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AIR SAFETY

HEARINGS

BEFORE THE

AVIATION SUBCOMMITTEE OF THE COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE UNITED STATES SENATE

EIGHTY-SEVENTH CONGRESS

FIRST SESSION

ON

AIR SAFETY

FEBRUARY 20, 21, 22, 23, 24, 27, 28, MARCH 3, 6, 8, 1961

Printed for the use of the Committee on Interstate and Foreign Commerce

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AIR SAFETY

MONDAY, FEBRUARY 20, 1961

U.S. SENATE,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
SUBCOMMITTEE ON AVIATION,
Washington, D.C.

The subcommittee met, pursuant to notice, in room 5110, New Senate Office Building, at 10:10 a.m., Hon. A. S. Mike Monroney (chairman of the subcommittee) presiding.

Senator MONRONEY. The Subcommittee on Aviation of the Committee on Interstate and Foreign Commerce will open its hearings.

Beginning this morning and for the balance of this week and part of next week, the Aviation Subcommittee will examine the subject of aviation safety which is vitally affected with the public interest. These hearings will supplement the air safety review conducted by us last year. We sincerely trust that we can develop a meaningful record from which valid, informed conclusions can be drawn as to the need for any corrective action whether within the Government itself or within the aviation community. We can then determine what steps should be taken to improve our record in this regard.

Specifically, the committee proposes to examine the following general areas:

(1) The status of air transportation in 1961—commercial, business, and private—in relation to air safety problems of today and tomorrow;

(2) The responsibility of various Government agencies for the promotion and advancement of air safety and the practices and procedures used to discharge it;

(3) The responsibility of the aviation community itself for self-imposed vigilance and discipline in achieving a maximum degree of air safety and the manner and method of fulfilling it;

(4) The areas of safety hazard disclosed by the 1960 accident record, considered in the light of the accident record of prior years—which include, among others, aircraft design, terminal area facilities, weather, and air traffic control;

(5) The present planning being conducted by both Government and the aviation industry, including research and development projects, for overcoming any existing weaknesses in our system of air safety or anticipated hazards of the near future.

The committee wishes to emphasize that this review is not being conducted for the purpose of assessing blame or determining the probable cause for any particular accident which may enter into our discussions here. Our essential objective is to provide a means for the free exchange of ideas to the end that all segments of the aviation

community, including our Goverment agencies, can acquire a sympathetic understanding of the problems confronting one another and proceed to take such action as the record might indicate so as to promote the highest degree of safety in all aspects of air travel.

It will be recalled that this committee conducted extensive hearings last year which included not only a review of the air safety record for 1959 but also a general examination of the regulatory processes of the Federal Aviation Agency involved in the determination and promulgation of air safety rules. As a result of those hearings, I believe that we have witnessed in recent months significant progress in the direction of a more sympathetic appreciation of the respective rights and responsibilities of both Government and industry and we do not, of course, intend to belabor any of the issues developed in that record. Rather, it is the desire of the committee to coordinate the energies of all having a vital interest in this important subject to meeting the challenge of today and preparing for tomorrow and, in so doing, profit by the lessons of the past. I think it is well to remember that each segment of the aviation community plays a vital role in insuring air safety. The full responsibility does not and cannot rest solely with the Government. This committee wishes to express its appreciation for the cooperative interest of all members of the aviation community and to express its confidence that all will continue to properly assume and discharge their respective responsibilities and act constructively and cooperatively with unity of purpose for the achievement of what the public demands and is entitled to have—the maximum degree of air safety possible within our human resources.

Now, we are all aware that most fatal accidents involve any number of factors—many times a chain of causes lies behind the fatality. But for purposes of better developing this record we suggest that the discussion of particular accidents be conducted under the following general categories, bearing in mind that all factors involved will be considered:

(1) Terminal area hazards;
(2) Weather;
(3) Structural or mechanical defects;
(4) Personnel factors including air traffic control.

It will be our objective in discussing these accidents to solicit from the witnesses suggestions as to what safety measures can be adopted or what practices can be employed to help reduce or to eliminate accidents.

Before we start the hearings, I would like to say that, on special invitation of the committee, we are pleased to have with us the new designee as the Federal Aviation Administrator, Mr. Najeeb Halaby, who is sitting on the bench with the committee at this time.

We are also proud to have our former chief counsel for the Aviation Subcommittee, the designee for membership on the Civil Aeronautics Board, Mr. Robert Murphy.

Gentlemen, we appreciate having you here. Fasten your seat belts, and we will be glad to start with the hearings.

The first witness will be the new Chairman of the Civil Aeronautics Board, Mr. Alan Boyd. Our congratulations go to him on assuming this very important post. He has accompanying him his associate General Counsel, Mr. Ross I. Newman, who has been before this com-

mittee many times; and other associates who I hope you will identify as they testify.

We are glad to have the CAB start this off for as you know, under the law, the Civil Aeronautics Board is charged with the final assessment of determining the probable cause of the accident.

Chairman Boyd, you may begin your testimony and present it in your own way.

STATEMENT OF HON. ALAN BOYD, CHAIRMAN, CIVIL AERONAUTICS BOARD, ACCOMPANIED BY MELVIN N. GOUGH, SR., DIRECTOR, BUREAU OF SAFETY; LEON TANGUAY, DEPUTY DIRECTOR, BUREAU OF SAFETY; ROSS T. NEWMAN, ASSOCIATE GENERAL COUNSEL; ROBERT FROMAN, ASSISTANT DIRECTOR, SAFETY BUREAU; GEORGE HALDERMAN, ASSISTANT TO THE DIRECTOR, SAFETY BUREAU; WILLIAM McNAMARA, CHIEF, SAFETY ANALYSIS DIVISION, SAFETY BUREAU; JOSEPH FLUET, CHIEF, OPERATIONS DIVISION, SAFETY BUREAU; JOHN F. PAHL, CHIEF, ENGINEERING DIVISION, SAFETY BUREAU; PHILIP GOLDSTEIN, CHIEF, INVESTIGATION DIVISION, SAFETY BUREAU; MARTIN CLARK, SAFETY SPECIALIST, SAFETY BUREAU; ARTHUR NEUMANN, SAFETY SPECIALIST, SAFETY BUREAU; C. E. STILLWAGON, SAFETY SPECIALIST, SAFETY BUREAU; AND JOSEPH ZACKO, SAFETY SPECIALIST, SAFETY BUREAU

Mr. BOYD. Thank you, Mr. Chairman and members of the committee. The Board appreciates this opportunity to appear before you in connection with your study of air safety. We wish to commend you, Mr. Chairman, and your committee, for the personal interest you have shown and for the contributions you have made to further the advance of air safety.

The proper discharge of the responsibilities assigned the Civil Aeronautics Board through the enactment of the Federal Aviation Act of 1958 are vital to the continued development and progress of the aviation industry. The Board has organized its staff, its accident investigation and accident prevention policies, plans, procedures and programs to discharge this assignment. The Board is proud of its Bureau of Safety and the excellent work collectively and individually performed by the members of its staff.

The Board appreciates the wholehearted cooperation of the various segments of the industry and the Government agencies in the discharge of our functions. They have made many valuable contributions to our accident investigation and accident prevention work.

We are pleased to report that during 1960, civil aviation flew more passenger-miles and expanded the number of active aircraft over last year. We have prepared for you the statistics which portray this growth as well as the statistical accident picture. A detailed presentation of this information will be made by the Bureau of Safety.

The industry and the Government are confronted with many technical problems which are only natural in a dynamic and growing aviation industry. We believe that the industry and the Government

must continue to cooperate in seeking the solutions to these problems in order to reduce the restrications and economic penalities levied on the industry to prevent them from becoming air safety problems.

The Board will present to the committee a comprehensive picture of its efforts to promote air safety. In presenting this we hope to accomplish two objectives. The first is to isolate areas and problems which require additional attention by the industry and interested agencies for their use in developing future policies, plans, and progress. The second objective is to acquaint the committee, the industry, and the public with a comprehensive picture of the Board's approach to and the problems connected with the discharge of its responsibilities.

The Director of the Bureau of Safety and his staff will make the detailed presentation to you; however, it does appear appropriate for us to highlight certain of our problems in advance so they can be kept in mind as this presentation progresses.

We wish to make it perfectly clear that the Board expects to discharge its responsibilities as set forth under the Federal Aviation Act of 1958, to the best of its ability within the resources which are made available to it.

Further, we have given and we will continue to give wholehearted support and cooperation to all agencies, particularly those with aviation responsibilities.

We are constantly striving to improve our organization and our procedural regulations, and the Board will appreciate any suggestions from this committee.

I pledge to the committee the wholehearted support of the Board and its staff in the promotion of air safety.

We, however, find ourselves in a position of wanting to do more to enhance safety than our resources will permit us to accomplish. During the past several years, the demands upon the Board and its staff in the field of accident investigation have been greater than at any time in the Board's history. During 1960 alone, Board personnel assigned to accident investigation work contributed approximately 20,000 hours of uncompensated overtime. The Bureau of the Budget has given its approval for 45 new safety positions for fiscal 1962. Thirty-six of these would be technical positions. If this increase is approved by the Congress, it will help to reduce the backlog of accident reports and greatly assist the Board in its safety functions.

Aside from the need for additional personnel, recent experience has shown that there are several amendments which can be made to the Federal Aviation Act which will help the Board in its accident investigation work.

We have prepared draft legislation for this purpose which has been included in the Board's legislative program. The Board's draft bill was introduced last week by Senator Magnuson as S. 962.

Certain activities of the Board in the field of accident investigation are now conducted under the authority of general and implied powers conferred by the Federal Aviation Act. The investigation of aircraft accidents would be facilitated if these activities were authorized by express statutory provisions.

S. 962 would expressly authorize the Board to request assistance of the Federal Bureau of Investigation and other investigatory agen-

cies, to request assistance of any medical agency of the United States, to examine and test to the extent necessary all component parts of the aircraft and property aboard the aircraft, and to conduct autopsies and such other post mortem tests as may be necessary.

This bill would also provide criminal penalties for removing, concealing, or withholding any part of a civil aircraft involved in an accident or any property aboard the aircraft.

During my tenure as Chairman of the Civil Aeronautics Board, I expect to devote a great deal of attention to air safety. Being a pilot, I am particularly concerned with the safety problems facing the industry today, and I can assure you that every effort will be made to develop policies and programs to improve our accident investigation work and to expedite the issuance of our reports.

In this connection, I cannot stress too strongly the importance of expanding our work in the field of accident prevention.

We have been somewhat handicapped in this area because our heavy workload has required the use of most of our technical personnel for accident investigations. In my opinion a great deal can be accomplished by a comprehensive accident prevention program, and it is my intention to concentrate on such a program to the greatest extent possible.

(Senator Hartke entered the room.)

Mr. BOYD. At this time, Mr. Chairman and members of the committee, I would like to present Mr. Melvin N. Gough, who is the Director of the Bureau of Safety. He is one of the outstanding men of civil aviation and, for many years past, a man who is well known throughout the industry and highly respected by all who know him, either personally or by reputation.

We are pleased and happy to have Mr. Gough as the Director of our Bureau of Safety. He will be the orchestra leader who plays the balance of this testimony through his various technical assistants.

Senator MONRONEY. Thank you very much, Chairman Boyd.

Before we go to Mr. Gough, I would like to ask if the 45 new safety positions that are authorized or approved by the Bureau of the Budget meet the needs requested by the Civil Aeronautics Board for additional staffing.

This committee has been very well aware of the overtime condition and the pressures within the Air Safety Section to more thoroughly and comprehensively search for the causes and to carry on independently an air safety program.

I wonder if the 45 new safety positions that appear in the budget meet the needs that the Board determined it had in this field?

Mr. BOYD. No, sir; not in the eyes of the Board.

Senator MONRONEY. This will probably be a subject that will come before Senator Magnuson's Subcommittee on Independent Offices' Appropriations. At that time we can perhaps take those up more fully.

The suggested legislation that you mentioned has been something that has been needed for some time. Your rights to recover the aircraft—there has been some doubt as to the legality of that.

There has also been some question as to whether we had the right to examine and make an autopsy on persons killed in accidents. Such a determination would have an important bearing on the probable

cause of the accident and certainly this committee will expedite hearings on Senator Magnuson's bill, S. 962.

I do not feel we should encumber the record of this safety investigation with these details. The committee will assure you we will go into that at the earliest possible time, for it is something that has been badly needed.

In connection with your additional safety positions, was there a request made or funds granted by the Budget Bureau to allow you or your safety people to recover or retrieve wreckage such as planes that might go down at sea or in waters surrounding airports?

As I recall, you had to rely on the good graces of other Government bureaus or on airline companies themselves sometimes to recover the most significant part on which the investigation would turn, namely, the recovery of the aircraft.

It would seem to me to be a practice that should not be left unattended.

Mr. BOYD. The answer, Senator, is "No," we have not been pleased with the approval for such a fund.

Senator MONRONEY. It would be very helpful, however, would it not, if you had some independent funds that could be used for the recovery of vital material that would be difficult to retrieve—if it were available to CAB and its investigators at the earliest possible time after an accident, so that all factors that might have contributed would be available before the start of the open hearings on these matters?

Mr. BOYD. We would deem it not only helpful, Senator, but essential.

Senator MONRONEY. Do you have any questions?

Senator COTTON. Yes. Before the Chairman turns the testimony over, it occurs to me—I would like to ask the Chairman's comments on the effectiveness of the act of 1958 in the matter of placing definitely and clearly outlining the responsibility and authority of the Board for investigations of accidents. It has seemed to me that it was a little nebulous; for instance, the act established the procedure in the case of some accidents and substantial loss of life—I have forgotten the exact phraseology—which involved substantial questions of public safety for the establishment of a special investigating board chairmaned by one member of the CAB and with two public members appointed by the President of the United States, and its goes on to establish the procedure.

Now, at the time that this act was adopted, it occurred to me that I could not see exactly the reason for it. One of the reasons given in the discussion was that the CAB was overburdened with investigations and having a lot of investigations going on at the same time, and this might take the pressure off and have a group that would address itself to just one accident, and go into it in great detail.

It has been my impression—I remember suggesting that be decided in the case of one accident—it has been my impression that the Board feels that would complicate and weaken investigation rather than strengthen it.

Is that correct?

Mr. BOYD. Yes, sir; that is essentially the feeling of the Board. The provisions of the statute, in our mind, are very clear and very definite as to the extent of our jurisdiction to investigate accidents and that extent is to investigate all civil aircraft accidents.

Now, of course, we do not investigate all civil aircraft accidents—getting back to the money aspect again. We have not yet been able to obtain the necessary funds to employ the personnel to investigate small aircraft accidents. However, on the special board of inquiry, it is my impression that the only reason the Civil Aeronautics Board would be at all interested in it, it would be very frankly, to use it in a situation to get the heat off the Board, and we have not seen any such situation.

Senator COTTON. It would not be for the public good to do that sort of thing?

Mr. BOYD. Sir?

Senator COTTON. It would hardly be for the public good to resort to that sort of expedient?

Mr. BOYD. That is right. I should say also, Senator, that we are absolutely sure that such a board of inquiry could not humanly give more detailed attention to the investigation of any one accident than does the Civil Aeronautics Board.

Senator COTTON. And would it be your opinion that it would clear away the underbrush and remove useless parts of the statute, parts that are an invitation sometimes to scatter the responsibility, if this feature in the 1959 act were repealed?

Mr. BOYD. I don't believe so, Senator. I would like to cast myself in the role of prophet to say there would be no circumstance under which this board of inquiry might not be helpful.

Frankly, I have difficulty conceiving of a situation, but I don't know what motivated the Congress specifically to adopt this section of the statute and conceivably there could be situations when such a special board of inquiry might be most helpful and where it would not be a question of the Civil Aeronautics Board as such shirking its responsibility.

Now, as far as the mechanics of the statute, we have encountered no difficulties in our function as accident investigators because that section is in the statute.

I don't think we would be any better off without it.

Senator COTTON. Well, it is either there for certain emergency for a useful purpose, or else it is a rather useless appendage which might be misused.

I cannot escape the conclusion that one or the other is the truth.

Now, would it be your feeling—I did not want to get you into the position of telling the Congress what to do, or of starting an argument about the act, but after all, we have to try out these acts and get the bugs out of them, and the clearer they are and the more definitely they fix responsibility, then the better they are going to be in the long run. It seemed to me from your testimony up until your last statement—and please understand, I am not trying to pick flaws or heckle you about it—up until your last statement, it seemed pretty clear to me that this might be an escape valve in dealing with public opinion and had the capacity, if misused, of doing more harm than good.

If that is true, it ought not be in the statute.

Now I understand you to say it ought to be kept, that there might be a set of circumstances under which the Board would see fit to do it. If the choice were left with the President, if the President of the

United States some day said, "Here is an accident which involves such deep principles of public safety that it calls for special investigation, and I am going to take it away from the Board as such, and have a Board member as Chairman of the investigation, but I am going to appoint some outside people to look into this," I could understand that, although I do not approve of it. But this sort of thing, someday the Board is going to say, "Here is a special accident; we are not going to investigate with our usual machinery and usual manner; we are going to appoint a Chairman of our Board, and have the President name a couple of people outside and go at it differently."

It seems to me the way it stands it serves no useful purpose.

Senator MONRONEY. Will the Senator yield?

Senator COTTON. Yes.

Senator MONRONEY. The theory behind the inclusion of that as a possible alternative was written in to cover the possibility of some accident of such catastrophic importance that could perhaps involve several agencies of Government, as well as private aircraft. We envisioned the time might come when a complete breakdown, perhaps, of the Government traffic control system becomes involved with other Government agencies, including, perhaps, military aircraft, which is generally beyond the control of the Civil Aeronautics Board. It was for this spectacular and catastrophic type of accident, where it might seem advisable, rather than summon a special congressional committee who would go into the accident because of the public demand, that we would have prepared and on the statute books an alternative that could be brought into play when the situation seemed of such magnitude to require it—particularly on the possible involvement of Government itself and the lack of jurisdiction of one Government agency to fully require the performance of other noncivilian branches of aviation as well as some of the civil branches of aviation that would be independent of the Civil Aeronautics Board.

Senator COTTON. I can understand that, and I am afraid Mr. Boyd is in a position of referring more or less to a general discussion which should perhaps take place when the committee is in executive session.

But I put this to Mr. Boyd, with due deference to the chairman of the subcommittee, if that is the function—and I am sure that the chairman knows what was behind the creation of it—if that is the purpose of it, of being invoked only in case of an accident of far-reaching dimensions and proportions, that involves the question between the military and civilian, and various agencies of Government, and that would put the CAB in an extremely difficult position because of lack of sufficient authority to handle a matter of that scope, should it be invoked by the President himself rather than be decided upon by the Civil Aeronautics Board.

Mr. BOYD. Senator, I really haven't given this matter any thought and would hesitate to express an opinion on that subject. I would say, however, with reference to the special board of inquiry, that should it be set up for any particular catastrophic accident by the mechanics to require the Board to initiate the action, I can assure you that the Board would see to it that highly responsible people were on the list to be submitted to the President for appointment as members of the Board.

Senator COTTON. I won't take any more of your time. I wish you would consider that question a little further. It seems to me it is a feature of the act that is a little nebulous, a little vague, and is open to some misuse. I had an example of it in which the Board was not to blame. It was rather belated. It opens a way for various things and I wish you would give that some consideration, and someday I would like to discuss it with you. It seems to me to be one of the things we ought to consider.

One other question, Mr. Chairman, and I won't take any time.

In the investigation of these accidents, I understand that it is clearly the policy of your Board to permit and invite the FAA to follow along with you so that they may have full knowledge insofar as it might be necessary, because of revelations concerning accidents, to consider new rules to be promulgated affecting aviation. Is that correct?

Mr. BOYD. Yes, sir.

Senator COTTON. Is that done merely—I haven't reviewed the statute lately. Is that done merely as a matter of courtesy and policy between the two agencies, or is that specifically written out in the statute?

Mr. BOYD. It is a matter of both, Senator.

As I stated in my testimony, we are certainly in a position of having cooperated with the FAA throughout its history. The section of the statute providing for accident investigation jurisdiction provides for FAA participation.

Now, we have an agreement with the FAA, which will be dwelt on a little later, which sets forth specifically how we go about this so that we don't have any problems of getting in each other's way, and the FAA has never at any time questioned the authority of the Civil Aeronautics Board in this field.

Senator COTTON. I am sure there has been perfect harmony and effective cooperation.

This agreement between the two agencies, is that touched upon in any way in the legislative draft that was presented and introduced by Senator Magnuson, the chairman of the committee?

Mr. BOYD. No, sir.

Senator COTTON. In your opinion, should it continue to be a matter of agreement between the two agencies, or should there be some statutory provision in regard to it that would be effective in the case—the very unlikely case, I am sure—of the situation arising where the personnel of the two agencies did not cooperate, perhaps, and found it difficult to cooperate?

Mr. BOYD. I don't believe there is any need for statutory changes to cover that point, Senator. Our authority is clearly specified in the statute and what we are discussing in terms of this memorandum is a modus operandi. And here I believe both the FAA and the Board would like to keep it on this basis because we may find that as the state of the art progresses we may want to approach this thing from different points of view than we do today.

Senator COTTON. I am sure we are all agreed that the authority for investigating these accidents is a function which is solely a part of public safety and should be clearly vested in one place, and your Board is the place. I am sure there is no question in my mind, and I doubt if there is in anybody's.

I note the statute says:

In order to assure proper discharge by the Administrator of his duties and responsibilities, the Board shall provide for the appropriate participation of the Administrator and his representatives—

referring, of course, to FAA—

in any investigations conducted by the Board under this title provided that the Administrator or his representatives shall not participate in the determination of probable cause by the Board under this title.

That, I take it—you feel that is a clear enough chart to be laid down as far as the statute goes?

Mr. BOYD. Yes, sir.

Senator COTTON. Thank you.

Senator MONRONEY. Senator Schoeppel?

Senator SCHOEPPEL. Mr. Chairman, thank you.

Mr. Boyd, since we are moving into this series of hearings on the safety feature, I was interested in what you had to say about certain activities of the Board in the field of accident investigation being conducted under the authority of the generally implied powers. I thought we might get at the opening of this some areas of activity or investigation, or handicaps, or whatever you might want to classify them.

Has your authority and has the conduct of any of your investigations ever been challenged by anybody?

Mr. BOYD. No, sir; to my knowledge, it never has.

We have had one occasion where we had some difficulty conducting what we felt was a proper autopsy.

Senator SCHOEPPEL. Did that come from a standpoint of another Government agency, or did it come from the aircraft owners, or officials, or anyone like that?

Mr. BOYD. No, sir.

Senator SCHOEPPEL. Was it from within your own governmental agency, or your governmental family?

Mr. BOYD. You mean the performance of an autopsy?

Senator SCHOEPPEL. You had some difficulty, you say?

Mr. BOYD. Yes, sir.

The difficulty was a question of State law, actually.

Senator SCHOEPPEL. Involved another division of the Government?

Mr. BOYD. That is right.

Senator SCHOEPPEL. It involved the State-Federal relationship, then; is that it?

Mr. BOYD. No, sir. A question of whether the Board had the authority in the existing law to accomplish this.

Senator SCHOEPPEL. Those are some of the things you think, in your humble opinion, ought to be completely and totally clarified so there couldn't be any mistake or delay or hindrance to any of the fullest possible investigations on the safety side?

Mr. BOYD. Absolutely.

Senator SCHOEPPEL. The thing we are trying to get out here on the top of the table is what is happening and what should we do to strengthen safety and so eliminate some of these accidents. I am interested in this objection that you had raised about some impediment that was thrown in your way. Did that come from private individuals, relatives or friends, or some high State officials?

Mr. BOYD. No, sir. It came from private individuals applying State law for which we had no definite law of our own to overcome.

I would say, Senator, that the primary need, so far as the Civil Aeronautics Board is concerned, is money and people. Well, Mr. Gough will go into our hopes and aspirations in the field of safety investigations where we feel we have not done an adequate job in the past purely and simply because we haven't been able to.

Senator SCHOEPPEL. It has been strictly a matter of lack of proper personnel; because you didn't have the finances to do it?

Mr. BOYD. That is right.

Senator SCHOEPPEL. Thank you.

Senator MONRONEY. At that point, Mr. Boyd, you are getting 45 new positions of which 36 will be technical positions.

Can you tell me how many you now have in these two categories?

Mr. BOYD. We have 91 people in our headquarters, of whom 50 are technicians. We have 48 in the field, of whom three-quarters, 37, are technicians.

Senator MONRONEY. This is the field offices you maintain?

Mr. BOYD. Yes, sir.

Senator MONRONEY. In how many States do you maintain field offices?

Mr. BOYD. We have New York, Chicago, Anchorage, Seattle, Denver, Los Angeles, Dallas, Miami.

Senator MONRONEY. These are small installations with two or three persons?

Mr. BOYD. Yes, sir.

Senator MONRONEY. I presume they work more in the area of promoting air safety than they do in investigations; is that correct?

Mr. BOYD. Senator, unfortunately, for the past 18 months or so these people have been scattered all over the domestic United States and other parts of the globe doing nothing but accident investigation work.

Senator MONRONEY. I see.

In other words, this shortage that you have requires you to pull the men off of the promotion of safety and the coaching of private pilots and other things of that kind, and require them to investigate accidents rather than the promotion on the other side of preventing accidents?

Mr. BOYD. They have never been able to devote a substantial amount of their time to safety promotion, Senator. We have tried to get into the general aviation accident to the extent we could, when our field men have not been involved in scheduled air carrier or other certificated air carrier accidents, but for the past 18 months, as I have said, due to the tremendous complexity of investigating an accident today, these people, some of them, haven't seen their wives for months on end, but have been completely away from home doing nothing but trying to figure out what happened to some of these tragic mishaps.

Senator HARTKE. Mr. Chairman, I want to congratulate you as chairman of this subcommittee for scheduling these hearings. I am vitally concerned on this subject.

I do have a couple of questions.

Senator MONRONEY. Go ahead.

Senator HARTKE. Mr. Boyd, in regard to the statement you mentioned last about the past 18 months, does this indicate that you have had heavier workloads in the past 18 months in regard to accident investigation?

Mr. BOYD. No, sir; I don't think it should take that meaning, Senator. I have been personally involved with the Civil Aeronautics Board for roughly that period of time and my knowledge is primarily on that basis. I haven't, of course, studied those figures; so I can't really give you a sound answer for prior periods.

Senator HARTKE. It is true that the accident rate has substantially increased, the fatality rate, in the last 2 years; is that right?

Mr. BOYD. No, sir. I didn't mean that either, but I do mean that when you have an accident of a four-engine aircraft, whether it be propeller or turboprop or jet, unless the accident is a completely obvious one—which is called completely obvious, which none of them really seem to be—the difficulties, the complexities of investigating that accident thoroughly, as we must do and as we will do, are much greater than they were when you were dealing with DC–3's, of which we still have quite a few, and the older four-engine aircraft.

Senator HARTKE. I didn't understand you. Do you mean to say the accident rate has not increased? Is that right?

Mr. BOYD. That is right, sir. This is a question that I can support my answer being right.

Now you can come up with another set of figures——

Senator HARTKE. I don't want to come up with any, sir. Let's get it clear.

Mr. BOYD. Another set of figures can be produced to show that the accident rate has increased. Mr. Gough here has detailed figures on exposure, on accident rate per passenger-miles, per aircraft-miles, and for landings and takeoffs, and he can give you the exact figures and will do so.

Senator HARTKE. In your opinion, then, is the safety record at the moment as good or better in the last 2 years than it has been before, or isn't it?

Mr. BOYD. In the last 2 years, I would say it is not as good as it has been, actually, except for 1959. It has been declining for the past 10 years; 1959 showed a slight increase.

Senator HARTKE. And 1960 was substantially the same?

Mr. BOYD. Yes, sir. The graph line would show that 1960 was on the gradual decline.

Senator HARTKE. Is this in regard to numbers? How do you figure this? I know you have these charts in here which go by hours and miles flown, and a lot of other things; but is there really a need for this committee to go into this question, then, of air safety, or are you making satisfactory progress?

Mr. BOYD. Senator, as long as there is an avoidable aircraft accident, I think there is a definite need for this subject to be studied thoroughly by the Congress, as well as by the agencies of the Congress and of the other branches of Government. Our aim is the ideal.

Senator HARTKE. In your charts, don't you indicate that the number of fatalities had substantially increased in 1958, 1959, and 1960 over the prior years?

Mr. BOYD. Yes, sir. The actual number. But one of the standards that has been used and accepted for years is the fatality rate per 100 million passenger-miles, and this has shown a decline since 1950, with the exception of 1959.

Senator HARTKE. It shows here that it was 0.008 in 1959. Is that right?

Mr. BOYD. Just a moment, sir. Would you mind indicating the chart which you are reading from?

Senator HARTKE. I am on chart J. Let's take fatal accidents in 1955. It was 0.008; right?

Mr. BOYD. 0.008, I believe, sir.

Senator HARTKE. Point what?

Mr. BOYD. 0.008.

Senator HARTKE. I am talking about fatal accidents.

Mr. BOYD. My book reads 0.080 for 1955.

Senator MONRONEY. Would the Senator identify the page and the document he is reading from?

Senator HARTKE. I am in the U.S. Civil Aeronautics Board Exhibit Material Book, No. 1, item J, I think. Is that right, Mr. Boyd?

Mr. BOYD. Yes, sir.

Now, I read for 1955, which I thought was the year we were referring to: "Fatal accidents per 100 million passenger-miles, 0.012."

Senator HARTKE. Yes; that is right. Fine.

Then it went down to 0.008 for 1956?

Mr. BOYD. Yes, sir.

Senator HARTKE. Down in 1957 to 0.006?

Mr. BOYD. Yes, sir.

Senator HARTKE. 1958 up to 0.008?

Mr. BOYD. Yes, sir.

Senator HARTKE. Up still again in 1959, up to 0.013?

Mr. BOYD. That is correct.

Senator HARTKE. Slightly decreased in 1960 to 0.01, which is still higher than 1956 or 1957 or 1958?

Mr. BOYD. That is right, sir.

Senator HARTKE. Is that a considerably reliable index on air safety?

Mr. BOYD. Yes, sir.

Senator HARTKE. Then we have to really say that the last 3 years, at least, were worse than the 2 preceding years of 1956 and 1957?

Mr. BOYD. Yes, sir; that is correct.

Senator HARTKE. That is what I thought you said was not so.

All right. There is a need, in your opinion, for a continued interest, anyway, in view of all the facts—you need continued safety.

Is there any reason—and I don't know if this is a proper question to you; and if it isn't you tell me. Is there any reason why foreign aircraft cannot be required to abide by all the standards and the requirements of domestic carriers when they either land or take off from the U.S. bases or airports?

Mr. BOYD. I believe, Senator, that is covered in the Chicago convention—one of the annexes of the Chicago convention of 1944. There may also be some reference to that matter in some of the ACAO agreements. I cannot answer you specifically.

Senator HARTKE. All right. Fine.

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Would that be a proper question for the FAA, do you think, in your opinion?

Mr. BOYD. Yes, sir.

Senator HARTKE. There have been some published reports or rumors concerning feuding between the CAB and FAA, and I wonder if you would comment on these.

Mr. BOYD. Yes, sir. I would be happy to.

We know nothing about it.

Senator HARTKE. Would you say that they do or do not exist, or that these reports are false or misleading?

Mr. BOYD. I think if there are such reports they are definitely misleading. I know of no such friction, Senator. To say there is no friction would be saying a great deal. But to my knowledge, sir, there is no such friction and I can assure you that so long as I am Chairman of the Board and Mr. Gough is Director of our Bureau of Safety, if it is within our power, we will see to it there is no friction in the future.

We feel that we have a very clear-cut complementary role—that each of us do, the FAA and CAB—and we don't intend to play in their backyard, and I don't think they will in ours.

Senator HARTKE. In other words, these reports of this feuding—as reported—in your opinion is false?

Mr. BOYD. I haven't heard such reports, and to my knowledge there is no such feuding.

Senator HARTKE. You have not heard or seen such reports?

Mr. BOYD. No, sir.

Senator HARTKE. You are not acquainted with any of the magazine or newspaper articles which have carried this?

Mr. BOYD. No, sir; I sure am not.

I will have to confess to you, Senator, I haven't been reading too many magazines lately.

I will assure you of this—if there has been any in the past, whether I knew of it or not, if it is within our power there will be none in the future.

Senator HARTKE. Do you have any knowledge of any pressures from lobbyists which have been applied from industry, either from the carriers or from the manufacturers, or those people who have the planes, which have impeded air safety in the United States in regard to your agency?

Mr. BOYD. No, sir. We have had the utmost cooperation from every Government agency and private individuals, private companies with whom we have dealt.

Senator HARTKE. Have any of the manufacturers or any of these people connected with aviation attempted to interfere with any recommendations you may have made with regard to air safety?

Mr. BOYD. Certainly not to my knowledge.

Now I should state, sir, that where the Board issues the finding of probable cause, it does not close its records, and there have been cases where interested parties have urged the Board to reopen an accident investigation record and on the basis of evidence presented by these parties, in the hope that the Board would change its finding of probable cause, and we have done so.

This is not a pressure in any sense, to my knowledge.

I think of two accidents, one of which we reopened at the instance of the Air Line Pilots Association, and one of which involved an executive aircraft, which we reopened at the instance of the company owning the aircraft.

Senator HARTKE. General Quesada in a statement in Harpers magazine indicated and stated that he didn't realize the number of pressures that would be placed upon him from the members of the industry and those people associated with it would be such as to prevent the operation of effective safety regulations.

You have not had any such pressure in the CAB, is that right?

Mr. BOYD. No, sir; we have not had any pressures that I would term "pressures" in that light at all.

Of course, it goes without saying that we have a completely different jurisdiction than the FAA and what pressures might be applied to the FAA and what efforts might be made, I would know nothing about them.

Senator HARTKE. That is all the questions I have.

Senator MONRONEY. Thank you very much.

If there are no further questions, we would like to hear from Mr. Gough.

Mr. BOYD. If you will excuse me, we will make room for his brain trust.

Thank you, Mr. Chairman.

Senator MONRONEY. You will be available, won't you, Mr. Boyd?

Mr. BOYD. Yes, sir.

Senator MONRONEY. Would you care to identify your associates at the table, Mr. Gough?

Mr. GOUGH. Yes, sir.

On my left is Mr. Robert Froman, and on my right Mr. Leon Tanguay from the CAB.

Senator MONRONEY. You may proceed in your own way, Mr. Gough. The committee has your statement, and if you care to give it in full, or if there are parts that are technical, reference to duties, that you might care to skip, why, you can do it as you wish.

Mr. GOUGH. Mr. Chairman and members of the committee, I do have a prepared statement which has been presented. I would much prefer to brief my remarks, and particularly in view of the discussions which have preceded.

Senator MONRONEY. The entire statement will appear in the record and then you may brief them following that.

(Mr. Gough's statement follows:)

Mr. Chairman and members of the committee, I appreciate the opportunity to appear before you and acquaint you with the work of the Bureau of Safety of the Civil Aeronautics Board. For those of you who may not be familiar with our activities I will include a short explanation of our functions, objectives, accomplishments in 1960 and our present problems. This report will cover the time that has elapsed since your last hearing and supplement the information which was presented at that time.

Title VII of the Federal Aviation Act states that it shall be the duty of the Civil Aeronautics Board to:

(1) Make rules and regulations governing notification and report of accidents involving civil aircraft;

(2) Investigate such accidents and report the facts, conditions, and circumstances relating to each accident and the probable causes thereof;

(3) Make such recommendations to the Administrator as, in its opinion, will tend to prevent similar accidents in the future;

(4) Make such reports public in such form and manner as may be deemed by it to be in the public interest; and

(5) Ascertain what will best tend to reduce or eliminate the possibility of, or recurrence of, accidents by conducting special studies and investigations on matters pertaining to safety in air navigation and the prevention of accidents.

The Bureau of Safety is responsible for developing the staff work required for the Board to discharge its air safety functions. At this time I will bring you up to date on some of the things the Bureau of Safety is doing now.

Beginning in early October and for a period of 4 months afterward, this Bureau has been practically overwhelmed by a series of six major and unique fatal accidents in air carrier operations unprecedented in the Bureau's history and which kept the technical staff on an emergency alert with practically all leave canceled except for Christmas Day and New Year's Day.

These six accidents I mentioned were major air disasters and some of them were distinguished by unique characteristics. First, early in October we had the Eastern Air Line's propjet Electra crash on the Boston airport, which involved the ingestion of birds in the engines, and took the lives of 60 passengers and 3 crew members. Then following we had the Northwest Airlines' DC–4 at Missoula, Mont., which struck a mountain range while inbound to the airport and resulted in the death of eight passengers and four crew members.

Shortly afterward we had the Arctic-Pacific C–46 carrying the football squad of California Tech, which crashed following a bad weather takeoff at Toledo, Ohio, which took the lives of 20 passengers and 2 crew members.

Then in December we had the terrible air collision between a United Air Lines DC–8 jet and a Trans World Airlines Constellation over New York, which took the lives of 128 passengers and crew, and killed 6 people on the ground. I might point out that the stricken DC–8 continued on from its point of collision and plunged into the heart of one of the most populous areas in the United States, Brooklyn, N.Y., but, fortunately, crashed into the only empty building in the area or we would have been faced with a far greater loss of lives on the ground.

In January we were confronted with the investigation of a takeoff accident involving Aeronaves de Mexico's DC–8 jet at Idlewild. The 96 passengers and 2 crew members were able to leave the aircraft before the plane exploded into flames.

Finally, American Airlines lost a Boeing 707 jet transport in a training flight, which crashed into the ocean off Montauk, Long Island, N.Y., killing all four crew members.

These accidents, as I said, happened in the short space of 4 months' time. The Bureau has completed enough investigative work to hold hearings on five of the six cases, although to do so we were forced to schedule certain technical employees from the investigative scene of one crash directly to the hearing room of another.

I should like to point out also that the flight equipment involved in these accidents included both a twin-engine and four-engine transport of World War II vintage, a turboprop jet transport of modern design, and two different models of the latest type pure jet transports. Obviously a wide variety of aeronautical technical skill and knowledge is required to investigate these diverse accidents and to reach an accurate finding as to the cause.

These six major cases are among the latest additions to the Bureau of Safety's accident investigative workload.

We are performing our investigation work and working on our reports and special studies, but we are not holding our own. Concurrently with this work we are studying our organizational structure in order to improve our capabilities and extend our area coverage. We are planning to expand our activities particularly in the field of accident prevention.

We must provide for increased cooperation and participation in air safety conferences and meetings with the Government and industry organizations such as FSF, AOC, AOPA, ALPA, NBAA, NASAO in order to exchange ideas on our mutual problems and promote air safety.

Unfortunately, during 1960 there were 4,540 general aviation accidents with 835 fatalities and 102 air carrier accidents with 500 fatalities.

During 1960 we had 806 accidents and incidents requiring investigation. These added to our workload. We have completed 574 investigations during the year. These accidents involved all types of aircraft—piston, jet, turboprop,

and helicopters. Our activities involved investigations on land, and in the water in practically all areas of the world, except the Arctic.

We held 10 formal hearings and took depositions on 8 other accidents. During 1960 we issued 17 reports on major aircraft accidents, 16 of which occurred prior to 1960. In addition, we made 52 recommendations to FAA of which 49 pertained to the accidents occurring in 1960 and on which we have not issued a report. As of July 1 we had a backlog of 354 accidents actively under investigation. That backlog as of December 31, 1960, was 299. We analyzed 4,680 accident reports and issued a probable cause thereon. We had a backlog of accidents awaiting analysis and determination of probable cause of 3,112 on July 1, 1960; that backlog is now approximately 3,800. We compiled and released statistics on 15 special reports. We have at the present time a backlog of 42 special projects and studies pertaining to and associated with our accident prevention work.

In addition we have studies underway which are designed to improve our organization, investigative methods, and accident prevention work. During the year we prepared for and participated in two congressional hearings and handled the usual routine correspondence, reports, and public requests for accident information.

Our present organization was expanded from 127 positions to 139 positions in 1960. We have 91 positions in the headquarters office and 48 positions in the field offices. At present we have 50 technicians in the headquarters who are specialists and augment the field staff. Several of these are undergoing on-the-job training. During fiscal year 1960 our personnel put in approximately 20,000 hours of uncompensated overtime, 13,263 hours in the field and 6,737 hours in the headquarters.

We have prepared for you two books of exhibits: book 1, containing accident statistical information and book 2, containing material pertinent to our operations.

Chairman Boyd stated that we would isolate areas and problems that require additional attention in developing future policies, plans, and programs. Information bearing on this is contained in book 1. This material will be of interest as it sets forth the comprehensive picture of civil aviation accident statistics.

Book 2 contains details on the following: The Bureau of Safety's organization functions and responsibilities; the CAB's regulations, investigation procedures, and techniques; overtime reports; recommendations; procedures for handling of recommendations; participation in FAA rulemaking; examples of typical reports issued by the CAB; five specific accident reports, and the history of the near-miss program.

I believe you will find this material covers the areas in which you requested information. I mentioned our future planning generally and will elaborate on it further.

I find that all of my people, Washington and field alike, have become completely engrossed trying to do a good job in their assigned task of investigating accidents. They are being forced to investigate these accidents at all hours of the day and night, so that they have insufficient time to think, plan, attend instruction courses, and otherwise improve themselves for their job.

I am also sure that they are not enjoying a reasonably relaxed homelife. I must, therefore, so plan and execute our future programs, so as to reduce the workload of the individual. I see no possibility of satisfactorily accomplishing this except to provide the numbers of qualified technicians for each activity with the proper grade, pay, and security so that the quality of the man's work will be the maximum to be expected.

It will be necessary, and we are formulating plans to rearrange the Bureau of Safety internal organization, so as to more efficiently direct the efforts of qualified specialists along specific lines of endeavor. This will mean devoting time and manpower into areas where we must be knowledgeable, such as the development of supersonic transports—and the future commercial use of VTOL/STDL and helicopters.

We plan to improve our investigation procedures to meet the challenge posed by such rapid changes as the introduction of turboprop, jet, and helicopters into air carrier service.

We will build on the existing system—refining, improving, and expanding it as necessary. For instance, investigation specialist categories will be expanded to provide more thorough coverage of fields such as air traffic control and others consistent with new developments and techniques. Our deployment of these

specialists will cover the field and headquarters both in accident and prevention investigations.

We are studying our public hearings and methods of introducing facts into public record.

Our purpose is to determine if the main objectives of cause determination and prevention are properly served and if any improvement can be suggested. This is presently a matter between the Board and our Bureau.

The many rapid improvements in design, construction, and operational techniques of the airplane and its components requires our technicians to keep knowledgeable of these improvements. To do this it is imperative that we have the time to attend and contribute to the free exchange of information at symposiums and regular meetings with NASA, FAA, Flight Safety Foundation, National Association of State Aviation Officers, etc., to name a few.

We must properly train newly assigned personnel and insist on recurrent training of all our specialists to assure that they are familiar investigation techniques and with the intricacies of any civil aircraft which becomes involved in an accident.

This demands regular and frequent exchange of information with experimental agencies, manufacturers, and operators as well as navigational and operational facilities provided by Federal and State Governments.

In directing our efforts to any area, when and where an accident occurs, I find that we are not able to take proper advantage and make maximum use of information, experiments, and knowledge which is available to use.

I believe it is imperative that our Bureau of Safety specialists establish and maintain the closest kind of relationship with the military, the USAF, NASA, and the FAA so that a free and unrestricted exchange of information is maintained with a minimum of duplication of effort.

We plan to expedite our accident reports to the public and to improve their quality.

This we hope to accomplish by applying the task force concept to the investigation and report preparation.

This involves keeping all Board investigators assigned to the investigation involved uninterrupted throughout the factfinding, analytical, and report completion phases.

This process also involves a thorough screening of the report by highly qualified experts in the various fields involved before final approval.

The act places the responsibility on the Civil Aeronautics Board for the investigation of accidents involving all civil aircraft. Because this dynamic aviation industry has increased with such astronomical leaps and bounds, we have not been able to carry out this assignment fully in the general aviation field, due to the lack of resources, primarily manpower.

The FAA has been asked and has been most cooperative in investigating and reporting their findings to us on all civil aircraft weighing less than 12,500 pounds where no fatality is involved. We do, however, still review these reports of conditions and circumstances and make a determination of the probable cause. (Public notice 13.)

While we are most grateful for this assistance, I would hope that our Bureau will be supplied with the necessary manpower, tools, and equipment in order to reassume our responsibilities in this field.

I have attempted to tell you something about what the Bureau has done in the immediate past, what it is doing now, and what it plans for the immediate future. Nothing I have reported is more important than what I have to say to you now in connection with a major change in the Bureau's objectives. Now it is our desire to devote equal time, skill, and effort to activities that will make it possible for us to prevent situations and conditions from developing that will result in an aircraft accident.

We need to know of every operational interruption to service that occurs to a U.S. air carrier as soon as possible after it occurs. We need to know of similar information involving private and corporate aircraft in the general aviation field. It is apparent that if minor mechanical or operational failures occur to individual or to diverse fields of general aviation, such occurrences might well be considered isolated and unimportant. It is only when all such occurrences are brought together for analysis that trends can be recognized and correctional action recommended to prevent such weaknesses from becoming accidents.

Mr. GOUGH. I should like to indicate to the committee, sir, that I am very proud of the privilege to appear before this group to represent and to be a part of the Bureau of Safety.

In the short period of time that I have been with it, I have learned a great deal and I should like to briefly tell you about that. I would like to tell you what we are doing now, what we have done in the past year, and what we are thinking about doing.

Now, the charge which is presented to us, as I see it, comes from title VII of the Federal Aviation Act, which states very clearly to me what the duty of the Bureau of Safety of the Civil Aeronautics Board is.

I would like to repeat those and quote from that act:

> First, to make rules and regulations governing the notification and report of accidents involving civil aircraft; second, to investigate such accidents and report the facts, conditions, and circumstances relating to each accident, and the probable cause thereof; third, to make such recommendations to the Administrator as, in the Board's opinion, will tend to prevent similar accidents in the future; fourth, to make such reports public in such form and manner as may be deemed by it to be in the public interest; and, fifth, to ascertain what will best tend to reduce or eliminate the possibility of, or the recurrence of accidents by conducting special studies and investigations on matters pertaining to safety in air navigation and the prevention of accidents.

And all this means to me is that our job is to learn the lessons and learn how to do things correctly and make recommendations to those who have the job of seeing that it is done.

This, I think, this spirit answers some of the questions which exist regarding the complementary duties of the Civil Aeronautics Board and the Federal Aviation Agency.

I think that—I am ad libbing for a second—but to me, in this free exchange, the important thing is, when an accident occurs, someone must make a decision as to how to proceed from that instant and this job is that of the FAA.

At the same time that the CAB then takes over the investigation, it needs the full cooperation of all the people who have been conducting the operation up to the time of the accident and from then on they proceed to determine truly and clearly and simply the facts that existed.

Senator MONRONEY. Mr. Gough, did you misspeak yourself? I think you said it was after an accident occurs it is the duty of the FAA to take over. Did you mean that, or did you mean it is the duty of the CAB?

Mr. GOUGH. I was hoping—that is what I was trying to explain. It is the FAA's duty to keep this streetcar running. It is the duty of the CAB, as I interpret it, to go in and find out what had happened and make a study of it and take over as far as the investigation direction is concerned.

Senator COTTON. I was impressed by the same wording that apparently caught the attention of the chairman, and I was about to ask, if you would permit, you said that the instant the accident happens, it is up to somebody from that instant to take over and then you—and that is the FAA—then you went on to say it is up to somebody to start investigating what happened, and that is the CAB.

Just what do you mean by "taking over"? Do you mean if an accident happens, and it should be obvious that it was caused by some

neglect or inadvertence on the part of the operator of an aircraft, that made it perfectly clear that the rules and regulations did not cover that, it is up to FAA the next day to promulgate a rule to remedy that situation pending the investigation by the CAB—is that what you meant?

Mr. GOUGH. I think so.

Senator COTTON. Is that what you had in mind?

Mr. GOUGH. Yes, sir.

Senator COTTON. Thank you.

Mr. GOUGH. This gives rise to a situation then, when there is an apparent probable cause publicized, simply because a decision had to be made as to how do you continue, and this does not conflict with the charge to the CAB that they make a precise study and determine what the cause was in their best estimate, and to get all the help possible from every source to determine truly what this cause was to the end point of everyone that we profit by this lesson and we keep this thing from happening again.

Senator MONRONEY. Would this be a case in point: the crashes of Eastern's Electras turn on the injection of starlings? I think the then Administrator of FAA was criticized in some quarters by giving an order to go out and get rid of those birds, and this was what you were talking about.

If the early indication was correct, some corrective action needs to be taken, that the safety of aviation cannot wait for the finding of a probable cause, but if there is a suspected cause it is up to the FAA Administrator to act immediately to try to correct that cause, while you are ascertaining, as you have done now, in the Logan Airport crash, a finding of fact later on.

But, in the meantime, they have been after those birds. Is that correct?

Mr. GOUGH. That is what I think and that is what I mean; yes, sir.

Senator COTTON. And nothing should be shocking or indicate to the public that there is any inefficiency if the FAA immediately after an accident on a reasonable assumption that there was a certain cause, promulgates a new rule, and then 2 or 3 months later after the CAB assistance and the assistance of all of the agencies, finds as best it can, the real cause of the accident, if it should not prove to be that cause, and the FAA revised its rule, revised its finding, that would indicate that the system was working, rather than it was not working? And it would indicate alertness rather than any hip-shooting inefficiency? Is that right?

Mr. GOUGH. I would say so.

Senator MONRONEY. You may continue.

Mr. GOUGH. Thank you, sir.

This gives rise toward another fact that seems to be overlooked quite often. In the process of investigating as the CAB continues with its investigation, it is constantly mindful of the necessity to make recommendations in keeping with part III of this charge to the Administrator of anything which somes to its attention that requires change short of the submisison of the final report.

Now, with that in mind, the investigation seems to become a big part of the work of the Bureau of Safety. But investigation leads only to

lessons and lessons which must be applied. And to do this intelligently, there are many other things that this Bureau of Safety must do.

It must continuously make recommendations to the FAA. It must monitor the work that is being done and indicate how it goes; even such decisions as were made at the time of the accident as to how to proceed may be studied, and further recommendations based on that particular decision.

Senator SCHOEPPEL. Mr. Chairman, I would like to ask the gentleman a question here.

With reference to the investigation of accidents, can we nail down this one thing, with reference to title VII? Do you think you have embodied there any impediments that would prevent you from going in and investigating each and every accident?

Mr. GOUGH. No impediments.

Senator SCHOEPPEL. Thank you.

Mr. GOUGH. To do this job the way it should be done and the way you would like to have it done and the way we would like to do it, has imposed a very severe workload on too few people and that has been mentioned, but I am going to touch on it quite a bit.

Since early October, we have had a rate of occurrance and a timing of accidents which has been a most difficult thing to cope with. We have had four major accidents, one of which was quite unique in that it was a collision of two major airplanes over a heavily populated area, and in the first 5 weeks of 1961 we have had four hearings. This meant that the investigators went from one hearing to another.

Now, that is one portion of the work and there were two other accidents that occurred during this time which I think puts to shame the statistics that we have.

For instance, one airplane struck a dyke and turned over and burned and no passengers were hurt. This was an incident of fate that was a pretty fortunate thing for our figures, if you wish, and also for a large number of people, but in the meantime, we have had another accident where a foreign airliner ran off the runway and 102 people got it.

If we put these 170 people into our figures, we would multiply them by 50 percent and our rates would appear vastly different.

The number of fatalities which have occurred is one thing. The numbers which might occur is something else very much more dear and very much more important to us because though we cannot retrieve those in the fatal accidents which we are investigating, we hope to get from them only lessons.

We do stand the chance from a great number of other areas of study to eliminate those which have not happened. And what I am saying to you gentlemen is our work has been devoted with too small a staff, entirely to investigation and recommendations, and not enough to the study of what is facing us because this is the area that is, I think, going to be a terriffic problem area.

In the meantime, we are trying to work on reports to satisfy the continuous demands, I say, and I think maybe I used the word "pressures"—it is not pressure, it is demand—of the public to know what went on in these accidents, so we are under this demand continuously

for these reports, and we are not able to hold our own, as I will show you.

We are not able to keep up with these accidents as they are occurring and produce reports because we are anxious from such as we see them, to keep up with the recommendations of the FAA and to keep the operations as safe as possible.

And keeping up with the recommendations means that we are continuously writing reports.

In addition to this, we must continuously study our organization to improve its capabilities, to prove the logic of the application of our talent, and to extend the area coverage of our operations.

The airplane of yesterday crashed in one piece. The airplane of today, with its increased performance, high altitude, high speed, covers many, many square counties and States.

An example of that was the dual crash in New York because of collision.

We must of necessity also in the Bureau of Safety extend our activities to conduct this charge. It is my observation that at the working level, the cooperation and understanding between the people engaged in this kind of aviation business is excellent. It is very good. We must increase this cooperation and we must do more to engage in conference meetings and technical society meetings, to sound the safety practices of other groups. We must continuously be with the FAA, with the airlines, with the military, with the flight safety foundation, who are continuously monitoring and prodding and pointing out the areas of safety work requirements and with such other organizations who are extremely interested and extremely helpful and cooperative, such as the ALPA, AOPA, and the NBAA, and all these people are in this picture, and we should do everything we can to be with them more and understand their problems in order for us to pass judgment on them.

This is a job we are trying to do with too small a staff. What I would like to tell you is what we did do in 1960 to give you an idea of the workload that is shown to you in great statistical form.

In 1960, there were 806 accidents and incidents requiring investigation. Of these we were able to investigate 574, but we are carrying over 232 into 1961.

It is necessary to study the data obtained from these accidents and incidents, and these accidents are covering a great variety of performance of piston engine, turbine prop, pure jets, helicopters, all in this year.

We have had a coverage of them, perfectly random, no one specific pattern. We have had it on land and sea, and, of course, we have been very, very fortunate to date that we have not had one in the Arctic.

In the meantime, the Bureau of Safety has conducted 10 public hearings in this past year, and have held 12 depositions to aid investigations. This in itself is quite a workload, and during 1960 we have made to the FAA 52 formal recommendations.

This is not a final completed report, but it is an indication of the cooperation along the line.

Forty-four of these recommendations had to do with the accidents which occurred in 1960, although I am sure later on these figures—

I am going to show you we wrote and released only one major report on the accidents which occurred in 1960.

I will say to you we made 44 recommendations regarding the accidents which occurred in 1960 to keep the streetcar on the tracks.

Now at the same time, we analyzed the probable cause of 4,680 accidents. This does not mean that they all occurred in 1960. I will give you that number later on.

But I am trying to divert your attention for a minute from the huge books of statistics to indicate to you that unless you go into it with the proper index, with the proper qualification, these numbers can become confusing.

So, I would repeat that we analyzed the probable cause of 4,680 accidents.

Now, during 1960, we had 4,540 accidents with 835 fatalities in the general aviation field. And in the air carrier field, we had 102 accidents with 500 fatalities, and this is an indication where increased safety depends on the statistics you use, and must be careful in looking at our exhibits to note whether you are talking about scheduled U.S. carriers, international carriers, general aviation, supplemental carriers, and so on, and I, too, find this point quite confusing.

But there is another point that is very clear to me, and that is that these are all people lost in aviation. Our job is not to count our blessings here, but to find these faults and put a magnifying glass on and to see how we can change it because if you are not careful, you find the figures for passengers, unsuspecting paid passengers who were killed, not to mention the many crews, or crews in training, or crews in training who had potential seats that were not filled, or the increasing mass density of the airplane, which means that each and every accident is going to cause more people to be lost, and this is the way I think we can view it.

Now, during the year 1960, we wrote and released 17 major formal reports. These had to do with accidents, all but one of which were previous to 1960. We produced 4,663 reports of probable causes in the general aviation field, and these figures are shown.

Another part of our workload, however, has to do with special projects which is pointed out in paragraph 5 of the act, that we should ascertain what will best tend to eliminate or reduce the number of accidents or occurrences by special studies and investigation. We shall see what is going on and make recommendations of what to do about it.

I would say in this case then, we have 42 projects underway in 1960 in the special category, in addition to the fact that we have had to prepare reports for committees, we have had to answer daily mail of inquiry. We have had to produce annual publications and we have had to work with the budget committee. These are part of our workload.

In spite of this, I would like to give you two other figures to show you that we are gaining a little bit because on July 1, 1960, we had under investigation division workload and accident investigations, we had 354 cases. On December 30, we had 299.

I would like to tell you a little about the organization which handles this. It is a great source of pride to me to be associated with it because of its smallness, its close-fitting structure, and its devotion to duty that works out of hours beyond anything I have ever seen.

It is on call 7 days a week, 24 hours a day, through Christmas and New Year, through the entire holiday season, entirely oblivious to the fact that they lost all their annual leave for last year.

In the field we had 48 people, as Mr. Boyd mentioned; 37 of them are technical, in 10 field offices. This means each field office of three to four field investigators has a huge territory where he can move in in a hurry, but in that territory, he must be in close contact with the FAA, with the industry, with the operational people in that area to keep knowledgeable and to know how to move fast and move in to the accident.

In our headquarters, we have 91 people of whom 50 are technical, spread through our various divisions. The organization chart will be given to you. And these people in fiscal year 1960 had in the field 13,000-some-odd hours of overtime and at headquarters 6,000-some hours of overtime. I have mentioned to you the leave that they have lost, and it seems to me that one of our problem areas to either obtain very high grade people or retain those that we do have, is to think of the human angle of this thing and arrange it so that there can be some compensatory time off. If we want a man to go out at 12:30 any Saturday night regardless of the parties that he would like to go to, to attend an accident at 2 o'clock on Sunday morning, then we must expect that when finished on Monday, he could sleep. The law doesn't provide for this without taking it off his annual leave and I think that is a point.

Now we have given you two exhibits, books of this kind [indicating], books 1 and 2 they are marked, and the major items that they contain are shown in the index.

Book 1 is all statistics from which you may extract such things as "Total, U.S. civil aviation—air carrier and general aviation"; "All U.S. air carriers—all operations"; "Certificated route air carriers: All operations, all scheduled service, passenger service, Alaskan carriers, helicopter carriers"; "Supplemental air carriers"; "Air carrier aircraft"; "Air carrier accident factors"; "General aviation: Accidents, aerial application accidents, executive aircraft accidents, causal factors"; "Midair collisions"; "Helicopter accidents."

Book 2 contains a great deal of background information about the Bureau of Safety which is good for the matter of record. It has the present organizational chart, map of field office location, such things as definition of an accident, statement of handling recommendations, and the recommendation summaries which have been made, that I mentioned; the overtime workload reports in detail, and so on.

Now, I would like to tell you what we plan to do and I gather that you can deduce that from the nature of the things I have said so far.

The first thing I would like to do in the Bureau of Safety is reduce the individual workload to the place where these people can think. I would like to increase the number of people, and I would like to increase the ratings of the people because there is a big job to be done, and it requires highly qualified people if this group is going to be on top of the whole coverage area of aviation commenting on how the rest of the world is doing.

I would like to continue to review the internal organization to assure the maximum utilization of the people we do have, but to be sure that I could more pointedly apply their efforts and keep them in their specializations.

I would like to study the possibility of improving the investigating procedure itself. This is a great area. This doesn't just require talent at the moment, it requires well qualified talent at the moment, which is abreast of the current state of the art.

I would like to improve the hearings, the hearings which have departed somewhat, I think, from simply getting scientific or technical facts or historical records into the public record. I would like to study this at great length and there is some indication that many others would like to have it done.

There are areas of specialization that require continuous improvement in overall structure of our organization such as the area of operations inspection and maintenance, which is the FAA's job to do, but we must be abreast of what they are doing in order to say to you that this job is being done properly. And this is a specialty.

Similarly, air traffic control and navigational aids is a specialty that is difficult to comment on or criticize unless one stays close to the picture and sees how those devoted, dedicated people who have the job of producing the air traffic control and navigational aids are doing all that is humanly possible and that is the kind of assessment we need to give them, I think, rather than criticize them at the moment of trouble.

Then there is the area of the helicopter, the VTOL/STOL, and supersonic airplanes, which are coming fast and which are different creatures from those for which our investigators had been trained in the past, and which really means that we have to stick close to research and what is going on and in which direction it is going, and operations, and what they are doing; and these things, in special applied fields.

I have mentioned to you that the airplane of the future and thinking, if you will for a minute, of supersonic airplanes, traveling at very high altitudes, very high speed, which could disintegrate into very, very small pieces and spread over a very large area, would by the very geometry multiply the task of investigation.

We have the necessity and desire in this spirit to increase the coordination and cooperation which exists between the people of the CAB and the other complementary organizations, and I think this becomes apparent to you, but it isn't quite so apparent it seems to me, as to how fine that is at the present time. I will call to your attention the very excellent spirit which prevails between research and operations and industry: In the case of the Lockheed Electra, as a result of the Carmelton and Buffalo accidents, all the resources of the FAA, of the great research centers of NASA, and of the military were all called in to this problem and participated.

In the case of human factors, that is an area of specialty which is increasing in interest and leaps and bounds in the attempt to go back to the very basic cause of accidents, and this is an area in which surely the CAB could not be expected to expand as an empire of knowledgeability in human factors and where we have had to call on the very fine organization of the FAA, but we do need a few people who understand this and who are in a position to affect this contact. This is what I call expanding in our capabilities.

We must improve our reports. We must improve the quantity, the quality, the timeliness and above all, we must be increasingly careful of our assessment of probable cause.

We must give increased emphasis to the area of general aviation because where I have talked to you so far, our attention has been devoted mainly to the main carrier accidents, which have occupied so much of the center of attention, but you will remember that the number of fatalities in general aviation was nearly doubled that of the air carrier.

We are charged to do this, of course, and what I am saying is, that we aren't as well equipped to do it as we should be.

Finally, I would like to say that we must give increased attention to the preventive side of this picture. I think we need to review the operational incident reporting and near-miss study situation because I think this is a very fertile field to find out how lucky you are, or how lucky we have been, and maybe cast our reflections on areas which if corrected soon enough, will prevent the future accidents.

In the case of investigation, we are always filling a void or trying to find out why we had these losses, but in the case of incidents, and near-miss studies, we have all the actors available to tell us many, many occasions on which we have just been lucky enough not to have the big accident.

Now in conclusion, Mr. Chairman, and members of the committee, in my opinion, the CAB has a basic structure of good, qualified people that can be expanded greatly. They are being overworked and they lack the capability for this reason to cover the areas that you want to get the kind of reports you would like to have. They lack the number of people to do the job that they themselves and we would like to do, that we think you want us to do.

I thank you.

Senator MONRONEY. Thank you very much.

At this point I think we should put in the record the various tables which have been chosen by the staff showing the historic accident record for all U.S. civil aviation for all carrier operations and for general aviation. These have been chosen by the staff to give a clear picture of the accident incidence measured by the historical reference and systems so that we will have a comparative base to determine the improvement or the deterioration of our accidents per million passenger miles flown and otherwise.

(The matter referred to is as follows:)

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February 14, 1961

FOREWORD

The purpose of this report is to present the accident record in U. S. civil aviation during 1960 and in relation to previous years. The majority of the tables contained herein deal with the period 1949 through 1960. In some cases the record goes back to 1938 to show the expanded growth in U. S. civil aviation.

Certain explanations are necessary to clarify the contents of the various tables.

1. The air carrier records are presented for the different classes of carriers and for the various types of service performed. Air carriers are classified into two main categories; the Certificated Route Carriers (commonly referred to as the Scheduled Airlines) and the Supplemental Carriers, formerly identified as the Noncertificated, or Large Irregular Carriers.

2. Effective 1959, the operations of the Alaskan Carriers are included in the figures shown for Domestic Operations. In the table dealing with the scheduled passenger service of the Domestic Carriers for the 1938-1960 period, the Intra-Alaskan operations are included in the 1959 and 1960 figures but not for the previous years.

   The table pertaining to scheduled passenger service of the Certificated Carriers for the 1949-1960 period includes the data for Intra-Alaskan operations.

3. Propeller Accidents to Persons.
   The various tables dealing with air carrier operations do not include this type of accident. A separate table is provided showing the number of these accidents during the 1949-1960 period. In addition, these accidents are included in the table showing the total number of accidents in U. S. civil aviation.

4. In several instances, the data shown for 1960 is based on preliminary information and on estimates of the number of passengers, passenger-miles, aircraft-miles and hours.

A

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U. S. CIVIL AVIATION ACCIDENT RECORD
1949 - 1960

ALL U. S. CIVIL AVIATION	Number Accidents Total	Fatal	Number Fatalities Total	Passengers	Crew	Others
1949	5555	584	1148	562	564	22
1950	4596	511	1077	557	507	13
1951	3933	466	1075	569	479	27
1952	3762	415	938	505	410	23
1953	3325	407	949	519	416	14
1954	3475	403	726	341	371	14
1955	3437	402	848	427	398	23
1956	3579	365	843	480	358	5
1957	4314	442	900	434	448	18
1958	4689	414	893	473	411	9
1959	4680	467	1161	646	502	13
1960	4638	453	1328	NA	NA	NA
AIR CARRIER OPERATIONS						
1949	96	22	252	204	35	13
1950	91	12	206	177	26	3
1951	109	25	325	264	58	3
1952	105	14	247	202	26	19
1953	93	20	314	255	54	5
1954	95	10	42	25	13	4
1955	94	18	229	185	37	7
1956	105	9	174	156	18	0
1957	112	14	99	72	20	7
1958	92	16	162	128	29	5
1959	102	18	340	271	61	8
1960	102	18	500	429	57	14
GENERAL AVIATION						
1949	5459	562	896	358	529	9
1950	4505	499	871	380	481	10
1951	3824	441	750	305	421	24
1952	3657	401	691	303	384	4
1953	3232	387	635	264	362	9
1954	3380	393	684	316	358	10
1955	3343	384	619	242	361	16
1956	3474	356	669	324	340	5
1957	4202	428	801	362	428	11
1958	4597	398	731	345	382	4
1959	4578	449	821	375	441	5
1960 (Preliminary)	4540	438	835	NA	NA	NA

Excludes: United Air Lines accident at Longmont, Colorado, 11/1/55 caused by dynamite explosion, 39 passenger and 5 crew fatalities. Western Airlines accident near Daggett, California, 7/25/57 caused by dynamite explosion in the suicide of 1 passenger.

Includes: Propeller accidents to persons.

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CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 1961

STATISTICAL SUMMARY
U. S. AIR CARRIER SAFETY RECORD
1956 - 1960

ALL U. S. AIR CARRIERS: (ALL OPERATIONS)

Accidents	1956	1957	1958	1959	1960
Total Accidents	103	110	90	102	101
Fatal Accidents	9	12	14	18	17[a/]
Nonfatal Accidents	94	98	76	84	84
Fatalities					
Total Fatalities	174	97	160	340	499
Passenger Fatalities	156	72	128	271	429
Crew Fatalities	18	20	29	61	57
Other Fatalities	0	5	3	8	13
Exposure					
Miles Flown (Million)	993.05	1089.73	1084.6	1151.3	1146.4*
Hours Flown (Million)	4.57	4.99	4.86	5.06	4.7*
Revenue Passengers (Million)	46.67	49.96	49.85	56.89	59.7*
Passenger Miles (Billion)	29.61	33.17	33.75	39.40	43.8*
Rates					
Total Accidents/Million Mi	0.100	0.100	0.082	0.088	0.088
Total Accidents/100,000 Hrs	2.253	2.204	1.851	2.015	2.148
Fatal Accidents/Million Mi	.009	.011	.012	.015	.012
Fatal Accidents/100,000 Hrs	.196	.240	.288	.355	.276
Passenger Fatality Rate/Per 100 Million Passenger Mi	.52	.21	.37	.68	.97

a/ Includes 3 midair collisions nonfatal to air carrier aircraft occupants. These 3 accidents excluded in computation of fatal accident rates.

* Estimated.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 25, 1961

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C

STATISTICAL SUMMARY
U. S. AIR CARRIER SAFETY RECORD
1956 - 1960

CERTIFICATED ROUTE AIR CARRIERS: (ALL OPERATIONS)

Accidents	1956	1957	1958	1959	1960
Total Accidents	94	103	84	94	89
Fatal Accidents	9	11	13	17	13[a]
Nonfatal Accidents	85	92	71	77	76
Fatalities					
Total Fatalities	174	95	158	337	393
Passenger Fatalities	156	72	128	270	336
Crew Fatalities	18	18	27	59	46
Other Fatalities	0	5	3	8	11
Exposure					
Miles Flown (Million)	948.18	1054.24	1045.43	1112.70	1100.0*
Hours Flown (Million)	4.34	4.81	4.68	4.87	4.5*
Rates					
Total Accidents/Million Mi	0.099	0.097	0.080	0.084	0.080
Fatal Accidents/Million Mi	.009	.010	.012	.015	.010
Total Accidents/100,000 Hrs	2.056	2.064	1.794	1.930	1.977
Fatal Accidents/100,000 Hrs	.207	.228	.277	.349	.244

a/ Includes 2 midair collisions nonfatal to air carrier aircraft occupants. These 2 accidents excluded in computation of fatal accident rates.

* Estimated.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 25, 1961

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STATISTICAL SUMMARY
U. S. AIR CARRIER SAFETY RECORD
1956 - 1960

CERTIFICATED ROUTE AIR CARRIERS: (SCHEDULED SERVICE - PASSENGER & CARGO)

Accidents	1956	1957	1958	1959	1960
Total Accidents	70	72	67	78	80
Fatal Accidents	6	6	8	14	12[a]
Nonfatal Accidents	63	66	59	64	68
Fatalities					
Total Fatalities	167	86	144	328	389
Passenger Fatalities	152	69	125	268	336
Crew Fatalities	15	13	16	52	42
Other Fatalities	0	4	3	8	11
Exposure					
Miles Flown (Million)	869.31	976.17	972.98	1030.25	991.50*
Hours Flown (Million)	4.03	4.44	4.34	4.50	4.00*
Departures (Million)	3.50	3.77	3.63	3.91	3.90*
Rates					
Total Accidents/Million Mi	0.080	0.073	0.068	.075	.080
Total Accidents/100,000 Hrs	1.736	1.620	1.544	1.732	2.000
Total Accidents/100,000 Departures	1.998	1.910	1.846	1.993	2.005
Fatal Accidents/Million Mi	.008	.006	.008	.013	.010
Fatal Accidents/100,000 Hrs	.173	.135	.184	.310	.250
Fatal Accidents/100,000 Departures	.199	.159	.220	.357	.256

a/ Includes 2 midair collisions nonfatal to occupants of air carrier aircraft. These 2 accidents excluded in computation of fatal accident rates.

* Estimated.

CIVIL AERONAUTICS BOARD
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January 25, 1961

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STATISTICAL SUMMARY
U. S. AIR CARRIER SAFETY RECORD
1956 - 1960

CERTIFICATED ROUTE AIR CARRIERS: (SCHEDULED PASSENGER SERVICE)

Accidents	1956	1957	1958	1959	1960
Total Accidents	61	57	61	69	75
Fatal Accidents	6	5	8	10	12[a]
Nonfatal Accidents	55	52	53	59	63
Fatalities					
Total Fatalities	167	82	144	310	389
Passenger Fatalities	152	69	125	268	336
Crew Fatalities	15	13	16	42	42
Other Fatalities	0	0	3	0	11
Exposure					
Miles Flown (Million)	821.47	929.23	932.32	984.48	N.A.
Revenue Passengers (Million)	46.00	49.42	49.16	56.00	58.6*
Passenger Miles (Billion)	28.61	32.39	32.59	37.7	41.2*
Rates					
Total Accidents/Million Mi	0.074	0.061	0.065	.070	N.A.
Fatal Accidents/Million Mi	0.007	.005	.008	.010	N.A.
Passenger Fatality Rate/Per 100 Million Passenger Miles	0.60	0.21	0.38	0.71	0.81

a/ Includes 2 midair collisions nonfatal to occupants of air carrier aircraft.

* Estimated

CIVIL AERONAUTICS BOARD
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January 25, 1961

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STATISTICAL SUMMARY
U. S. AIR CARRIER SAFETY RECORD
1956 - 1960

SUPPLEMENTAL AIR CARRIERS: (ALL OPERATIONS)

Accidents	1956	1957	1958	1959	1960
Total Accidents	9	8	6	8	12
Fatal Accidents	0	1	1	1	4[a/]
Nonfatal Accidents	9	7	5	7	8
Fatalities					
Total Fatalities	0	2	2	3	106
Passenger Fatalities	0	0	0	1	93
Crew Fatalities	0	2	2	2	11
Other Fatalities	0	0	0	0	2
Exposure					
Miles Flown (Million)	44.82	35.48	39.21	38.67	46.4*
Hours Flown (Million)	0.23	0.188	0.19	0.195	0.21*
Rates					
Total Accidents/Million Mi	0.201	0.225	0.153	.206	.258
Total Accidents/100,000 Hrs	3.913	4.255	3.181	4.096	5.71
Fatal Accidents/Million Mi	0	.028	.025	.025	.064
Fatal Accidents/100,000 Hrs	0	.531	.530	.512	1.42

a/ Includes 1 midair collision nonfatal to air carrier aircraft occupants. This accident excluded in computation of fatal accident rates.

* Estimated.

60-1-5

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 25, 1961

STATISTICAL SUMMARY
U. S. AIR CARRIER SAFETY RECORD
1956 - 1960

SUPPLEMENTAL AIR CARRIERS: (PASSENGER SERVICE)

Accidents	1956	1957	1958	1959	1960
Total Accidents	0	2	2	5	3
Fatal Accidents	0	0	0	1	2
Nonfatal Accidents	0	2	2	4	1
Fatalities					
Total Fatalities	0	0	0	3	102
Passenger Fatalities	0	0	0	1	93
Crew Fatalities	0	0	0	2	9
Other Fatalities	0	0	0	0	0
Exposure					
Revenue Passengers (Million)	.664	.535	.676	.895	1.100*
Passenger Miles (Billion)	1.003	.767	1.153	1.629	2.600*
Rates					
Passenger Fatality Rate/Per 100 Million Passenger Miles	0	0	0	.06	3.57

* Estimated.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 25, 1961

60-1-6

ACCIDENTS, ACCIDENT RATES AND FATALITIES
U. S. AIR CARRIERS
ALL OPERATIONS

1949 - 1960

Year	Number of Accidents		Aircraft Miles Flown	Accident Rate Per 1 Million Miles Flown		Fatalities			
	Total	Fatal		Total Accidents	Fatal Accidents	Passg.	Crew	Others	Total
1949.....	93	19	506,180,000	0.183	0.037	204	35	10	249
1950.....	90	11	535,891,000	.167	.020	177	26	2	205
1951.....	107	23	601,495,000	.170	.038	264	58	1	323
1952.....	104	13	670,720,000	.150	.019	202	26	18	246
1953.....	91	18	734,894,000	.123	.024	255	54	3	312
1954.....	93	8	758,654,000	.122	.010	26	13	2	41
1955.....	92	16	862,787,000	.106	.018	185	37	5	227
1956.....	103	9	993,055,000	.100	.009	156	18	0	174
1957.....	110	12	1,089,727,000	.100	.011	72	20	5	97
1958.....	90	14	1,084,652,000	.082	.012	128	29	3	160
1959.....	102	18	1,151,373,000	.088	.015	271	61	8	340
1960.....	101	17[a/]	1,146,400,000 est.	.088	.012	429	57	13	499

Excludes:
Fatal accident at Longmont, Colorado, 11/1/55, involving sabotage.
Accident at Daggett, California, 7/25/57, involving suicide of a passenger.

a/ Includes 3 midair collisions nonfatal to Air Carrier occupants. These 3 accidents excluded in computation of fatal accident rate.

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CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 25, 1961

U. S. AIR CARRIER ACCIDENTS
1960
(Preliminary)

		Accidents		Fatalities				Estimated Passenger Miles (Billions)	Passenger Fatality Rate Per 100 Million Passenger Miles
		Fatal	Total	Passengers	Crew	Other	Total		
A.	CERTIFICATED ROUTE AIR CARRIERS								
	1. Scheduled Passenger Service:								
	Domestic Carriers.....	10[a]	69	326	37	11	374	32.3	1.00
	International/Territorial.	2	6	10	5	0	15	8.9	0.11
	Subtotal.....	12	75	336	42	11	389	41.2	0.81
	2. Scheduled Cargo Service:								
	Domestic Carriers.....	0	4	-	-	-	-	-	-
	International/Territorial.	0	1	-	-	-	-	-	-
	All-Cargo.....	0	0	-	-	-	-	-	-
	Subtotal.....	0	5						
	Total Scheduled Service.....	12	80	336	42	11	389	41.2	0.81
	3. Nonscheduled Operations.....	1	9	0	4	0	4	-	-
	TOTAL - CERTIFICATED CARRIERS	13	89	336	46	11	393	-	-
B.	SUPPLEMENTAL CARRIERS								
	Passenger Service.....	2	3	93	9	0	102	2.6	3.57
	Cargo Service.....	2[b]	5	0	2	2	4	-	-
	Nonrevenue.....	0	4	-	-	-	-	-	-
	Subtotal.....	4	12	93	11	2	106	2.6	3.57
C.	TOTAL INDUSTRY.....	17[c]	101	429	57	13	499	43.8	0.97

Note: a/ Includes 2 mid-air collisions, nonfatal to air carrier.
b/ Includes 1 mid-air collision nonfatal to air carrier.
c/ Includes 3 mid-air collisions nonfatal to air carrier.
Excludes 1 propeller accident to person on ground.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 1961.

FATAL ACCIDENTS - FATALITIES

U. S. AIR CARRIERS
(ALL OPERATIONS)
1960

Date	Location	Operator	Type Service	Aircraft	Damage	Fatalities Crew	Passenger	Others	Total	Type of Accident
CERTIFICATED ROUTE CARRIERS										
1/6/60	Bolivia, N. C.	NAL	Passg.	DC-6B	Dest.	5	29		34	Explosion induced in-flight structural disintegration.
Weather 2/18/60	Holdcroft, Va.,	CAP	Passg.	Viscount	Dest.	4	46		50	Crashed during enroute cruise.
Mech 3/17/60	Cannelton, Ind.	MAA	Passg.	L-188	Dest.	6	57		63	In-flt. structural disintegration.
Ten. 4/20/60	Hickory, N. C.	PAI	Passg.	F-27 & Cessna	Subt.			4	4	Mid-air collision
5/23/60	Atlanta, Ga.	DAL	Trang.	CV-880	Dest.	4			4	Crashed during takeoff.
Wea. 6/14/60	Mt. Gilbert, Alaska	Pacific Northern	Passg.	L-749	Dest.	5	9		14	Collided with mountain.
7/14/60	Manila, P. I.	MAA	Passg.	DC-7C	Dest.		1		1	Prop. failure - ditched in ocean.
7/22/60	Houston, Tex.	TTA	Passg.	TC-3	Subt.	1			1	Ground collision with aircraft.
Mech 7/27/60	Forest Park, Ill.	Chi. Hell.	Passg.	S-58	Dest.	2	11		13	In-flight structural failure.
Ten. 10/1/60	Orlando, Fla.	EAL	Passg.	M-404 & Beechcraft	Subt.			1	1	Mid-air collision
Ten. 10/4/60	Boston, Mass.	EAL	Passg.	L-188	Dest.	3	59		62	Crashed on take-off.
Wea. 10/28/60	Missoula, Mont.	MAA	Passg.	DC-4	Dest.	4	8		12	Collided with mountain.
ATC 12/16/60	New York, N. Y.	UAL	Passg.	DC-8 &	Dest.	(7	77			Mid-air collision.
		TWA	Passg.	L-1049A	Dest.	(5	39	6	134	
	Subtotal					46	336	11	393	
SUPPLEMENTAL CARRIERS										
Ten. 9/18/60	Guam	World Airways	Mil. Cont.	DC-6AB	Dest.	7	73		80	Crashed on take-off.
10/4/60	Sacramento, Calif.	Capitol	Cargo	C-46F & Cessna	Minor Dest.			2	2	In-flight collision during landing.
10/15/60	Ogden, Utah	Capitol	Mil. Cont.	C-46	Dest.	2			2	Crashed during landing approach.
Wea 10/29/60	Toledo, Ohio	Arctic-Pacific	Passg.	C-46	Dest.	2	20		22	Crashed on take-off.
	Subtotal					11	93	2	106	
TOTAL - ALL CARRIERS						57	429	13	499	
PROPELLER ACCIDENT TO PERSON										
9/7/60	Accra Ghana, Africa	PAIA	Passg.	DC-7C				1	1	

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 25, 1961

NONFATAL ACCIDENTS
U. S. AIR CARRIERS
ALL OPERATIONS
1960

Date	Location	Operator	Type Service	Aircraft	Damage	Type of Accident
CERTIFICATED ROUTE CARRIERS						
1/3/60	Philadelphia, Pa.	Eastern	Passenger	L-749	Substantial	Right main gear collapsed on landing.
1/4/60	Washington, D. C.	Eastern	Passenger	L-749	Substantial	Right main gear collapsed on landing.
1/5/60	Frankfort, Ill.	Chicago - Helicopter	Cargo	Bell-47G2	Substantial	Collision - power line.
1/11/60	Gander, Newfoundland	Seaboard & Western	Cargo	L-1049	Substantial	Collided with tug.
1/13/60	Tampa, Florida	Delta	Cargo	C-46	Substantial	Engine exhaust ignited fuel on ramp.
1/17/60	Honolulu, Hawaii	PAWA	Passenger	DC-7	Substantial	Engine fire during take-off.
1/25/60	Boulder, Colo.	United	Passenger	DC-7	None	In-flight turbulence (personnel injury)
2/2/60	Houston, Texas	Braniff	Passenger	DC-7C	Substantial	Gear retracted prematurely.
2/3/60	Amarillo, Texas	Braniff	Passenger	L-188	Substantial	Collided with ground power unit.
2/3/60	Lawton, Okla.	Continental	Passenger	DC-3	Substantial	Taxied into an excavation.
2/4/60	New Orleans, La.	Eastern	Passenger	L-188	Substantial	Undershot runway during landing.
2/6/60	Chicago, Ill.	Delta	Cargo	C-46	Substantial	Overshot landing on icy runway.
2/7/60	Los Angeles, Calif.	PAWA	Passenger	B-707	Substantial	Landed on jet pods and left gear.
2/9/60	Tulsa, Okla.	Continental	Passenger	Viscount	Substantial	Veered off runway during landing.
2/11/60	Miami, Fla.	Eastern	Training	DC-7B	Substantial	Fire in nosewheel during landing.

Date	Location	Operator	Type Service	Aircraft	Damage	Type of Accident
2/13/60	Washington, D. C.	Eastern	Passenger	L-1049C	Substantial	Skidded off runway during landing.
2/15/60	San Antonio, Tex.	Braniff	Passenger	L-188A	Substantial	Lightning strike in flight.
2/19/60	Utica, N. Y.	Mohawk	Passenger	CV-440	Substantial	Skidded into a snow bank during landing.
2/22/60	Anchorage, Alaska	Alaska	Passenger	DC-6A	Substantial	Collided with trees during instrument approach.
2/25/60	Chicago, Ill.	American	Passenger	L-188	Substantial	Hard landing.
2/25/60	Chicago, Ill.	Delta	Passenger	CV-440	Substantial	Undershot runway during landing.
2/26/60	Erie, Pa.	Allegheny	Passenger	M-202	Substantial	Struck mound of snow during take-off.
2/28/60	Olathe, Kansas	TWA	Passenger	M-404	Substantial	Left main gear seperated from aircraft during takeoff.
2/29/60	Syracuse, N. Y.	American	Passenger	CV-240	Substantial	Veered into snowbank during landing.
2/29/60	Chicago, Ill.	TWA	Passenger	L-1049G	Substantial	Right main gear collapsed during taxi.
3/5/60	Detroit, Mich.	Flying Tiger	Cargo	L-1049H	Substantial	Landing gear collapsed during run-up.
3/5/60	Spokane, Wash.	Northwest	Passenger	DC-7C	Substantial	Engine fire in flight.
3/8/60	St. Louis, Mo.	Eastern	Passenger	DC-7B	Substantial	Collided with windrow of snow, during landing.
3/9/60	Chicago, Ill.	American	Passenger	L-188	Substantial	Veered off runway during landing.
3/9/60	New York, N. Y.	Eastern	Passenger	L-749	Substantial	Gear collapsed
3/9/60	Dominion Creek, Alaska	Alaska	Passenger	Cessna 180	Substantial	Nosed over during landing.
3/16/60	Baltimore, Md.	American	Passenger	DC-6	Substantial	Nose gear retracted during landing.
3/18/60	Lansing, Mich.	Northwest	Passenger	B-377	None	Evasive maneuver in flight (personnel injury)

Dat	Location	Operator	Type Service	Aircraft	Damage	Type of Accide
3/24/60	Syracuse, N. Y.	American	Passenger	DC-6B	Substantial	Veered off runway during landing.
3/29/60	Cape Pole, Alaska	Ellis	Passenger	G-21A	Destroyed	Nose up.
4/9/60	Fairbanks, Alaska	Wien	Test Flt.	F-27A	Substantial	Collision - ground.
5/9/60	Jamaica, N. Y.	TWA	Passenger	B-707	Substantial	Aircraft struck ground during attempted go-around.
5/12/60	Miami, Florida	Delta	Passenger	DC-8	Minor	Inflight turbulence (personnel injury)
5/13/60	Pittsburgh, Pa.	American	Passenger	DC-6	Substantial	Aircraft struck ground power unit.
5/21/60	Columbia, S. C.	Delta	Cargo	DC-3	Substantial	Collision - wires.
5/24/60	West of Denver, Colo.	United	Passenger	DC-8	None	Inflight turbulence. (personnel injury)
5/29/60	Dallas, Tex.	Trans Texas	Passenger	DC-3	None	Inflight turbulence (personnel injury)
6/1/60	Nr. Charlotte, N. C.	Capital	Passenger	DC-6B	None	Inflight turbulence (personnel injury)
6/14/60	Anaheim, Calif.	L. A. Airways	Passenger	S-55	Substantial	Main rotor blades struck drive shaft and tail cone.
6/14/60	Chicago, Ill.	United	Passenger	DC-8	Substantial	Nose gear collapsed during landing.
6/19/60	Dallas, Tex.	American	Passenger	B-707	Substantial	Scraped underside fuselage on landing.
6/23/60	Dallas, Tex.	Continental	Non-Rev.	DC-7B	Substantial	Gear retracted during landing.
7/17/60	Los Angeles, Calif.	L. S. Airways	Passenger	S-55	Substantial	Collided with truck
7/28/60	Avoca, Pa.	Allegheny	Training	CV-340	Substantial	Settled on runway.
8/13/60	Madison, Wisc.	N. Central	Passenger	DC-3	Substantial	Gear collapsed - landing.
8/15/60	Nome, Alaska	Munz	Charter	L-10A	Destroyed	Lost directional control during landing.
8/16/60	Northeast Cape, Alaska	Alaska	Passenger	C-18S	Substantial	Groundlooped during landing.
8/25/60	Chanute, Kansas	TWA	Passenger	L-049	None	Turbulence.

Date	Location	Operator	Type Service	Aircraft	Damage	Type of Accident
9/6/60	Phoenix, Ariz.	Frontier	Passenger	DC-3	Substantial	Struck light post with the left wingtip.
9/6/60	Des Moines, Iowa.	Ozark	Passenger	DC-3	Minor	Engine fire during take-off.
9/8/60	Texarkana, Ark.	American	Passenger	DC-6AC	None	Inflight turbulence
9/11/60	Birmingham, Ala.	Eastern	Passenger	CV-440	Substantial	Aircraft taxied into a light pole.
9/14/60	LaGuardia, N. Y.	American	Passenger	L-188	Destroyed	Undershot during landing.
10/7/60	Newark, N. J.	American	Passenger	DC-6	Substantial	Nose wheel collapsed during landing.
10/25/60	Fort Worth, Tex.	American	Passenger	B-707	Substantial	Nose gear retracted.
11/3/60	Eau Claire, Wisc.	Northwest & AF-B47	Passenger	L-188	None	Evasive action.
11/3/60	Wilmington, Dela.	Eastern	Passenger	M-404	Minor	Ran off runway on takeoff run.
11/17/70	Denver, Colo.	United	Passenger	DC-6 & Beech 35	Minor	Mid-air collision
11/28/60	Akiak, Alaska	Northern-Consolidated	Passenger	T-50	Substantial	Skis struck gravel bar.
12/3/60	Nichowak River, Alaska	Cordova	Charter	PA-18	Substantial	Landed on snow, aircraft flipped on its back.
12/5/60	Avoca, Pa.	Allegheny	Passenger	M-202	Substantial	Gear collapsed.
12/5/60	Atlanta, Ga.	TWA	Passenger	L-1049G	Substantial	Engine fire.
12/10/60	Golovin, Alaska	Munz	Passenger	Stinson	Substantial	Struck snowbank during landing approach.
12/12/60	Denver, Colo.	Continental	Training	DC-7	Substantial	Right inboard main gear tire blew out during takeoff.
12/18/60	Northeast Cape, Alaska	Wien	Passenger	Beech C-18	Substantial	Crashed into tundra on take-off.

Date	Location	Operator	Type Service	Aircraft	Damage	Type of Accident
12/19/60	Cortez, Colorado	Frontier	Passenger	DC-3	Substantial	Ran off runway damage to propeller.
12/19/60	Afgonak Village, Alaska	Kodiak	Passenger	G-21A	Substantial	Aircraft struck a log in water.
12/23/60	Chicago, Ill.	American	Passenger	L-188	Substantial	Prop. struck pipe covered by snow.
12/27/60	Philadelphia, Pa.	TWA	Passenger	L-749	Substantial	Fire on takeoff.
12/4/60	Wolbach, Neb.	United	Passenger	B-720	None	Inflight turbulence.
SUPPLEMENTAL AIR CARRIERS						
2/13/60	McGuire AFB, N. J.	Assoc. Air Transport	Contract Mil.	C-46	Substantial	Undershot runway during forced landing.
2/14/60	Providence, R. I.	U. S. - Overseas	Cargo	DC-4	Substantial	Collided with trees.
2/18/60 *	Mastic Pt. Andros Island, Bahamas	Assoc. Air Transport	Cargo	B-17	Substantial	Veered off runway during takeoff.
3/23/60	Mobile, Ala.	AAXICO	Charter	C-46	Substantial	Struck gr. antenna during go-around.
3/26/60	Burbank, Calif.	Twentieth Century	Training	L-1049E	Substantial	Propeller struck ground tow tug.
7/15/60	Nr. Raleigh, N. C.	Arctic Pacific		C-46	None	Inflight turbulence (personnel injury)
10/24/60	Miami, Fla.	Argonaut	Test	C-46F	Substantial	Left gr. failed on turn-off to taxi strip.
7/22/60	Hawthorne, Calif.	Stewart Air Service	Training	DC-4	Substantial	Nose gear collapsed.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 25, 1961

PROPELLER ACCIDENTS TO PERSONS

U. S. AIR CARRIER OPERATIONS

1949 - 1960

	CERTIFICATED CARRIERS		SUPPLEMENTAL CARRIERS		TOTAL INDUSTRY		
	FATAL	SERIOUS	FATAL	SERIOUS	FATAL	SERIOUS	TOTAL
1949	3	-	-	-	3	-	3
1950	1	-	-	-	1	-	1
1951	2	-	-	-	2	-	2
1952	1	-	-	-	1	-	1
1953	1	-	1	-	2	-	2
1954	1	-	1	-	2	-	2
1955	2	-	2	-	2	-	2
1956	-	2	-	-	-	2	2
1957	2	-	-	-	2	-	2
1958	2	-	-	-	2	-	2
1959	-	-	-	-	-	-	0
1960	1	1	-	-	1	1	2

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
JANUARY 25, 1961

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ACCIDENTS, ACCIDENT RATES AND FATALITIES
CERTIFICATED ROUTE AIR CARRIERS
ALL OPERATIONS
1949 - 1960

Year	Number of Accidents		Aircraft Miles Flown	Accident Rate Per 1 Million Miles Flown		Fatalities			
	Total	Fatal		Total Accidents	Fatal Accidents	Passg.	Crew	Others	Total
1949.....	73	10	482,707,000	0.151	0.020	100	19	4	123
1950.....	72	8	501,778,000	.143	.015	148	23	2	173
1951.....	83	18	556,763,000	.149	.032	186	46	1	233
1952.....	94	11	618,960,000	.151	.017	176	21	18	215
1953.....	70	11	685,957,000	.102	.016	113	27	3	143
1954.....	80	7	719,550,000	.111	.009	17	12	2	31
1955.....	79	13	819,581,000	.096	.015	158	32	4	194
1956.....	94	9	948,183,000	.099	.009	156	18	0	174
1957.....	103	11	1,054,241,000	.097	.010	72	18	5	95
1958.....	84	13	1,045,439,000	.080	.012	128	27	3	158
1959.....	94	17	1,112,703,000	.084	.015	270	59	8	337
1960.....	89	13[a/]	1,100,000,000 est.	.080	.010	336	46	11	393

Excludes:
Fatal accident at Longmont, Colorado, 11/1/55, involving sabotage.
Accident at Daggett, California, 7/25/57, involving suicide of a passenger.

a/ Includes 2 midair collisions nonfatal to Air Carrier occupants. These 2 accidents excluded in computation of fatal accident rate.

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CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 25, 1961

ACCIDENTS, ACCIDENT RATES
CERTIFICATED ROUTE AIR CARRIERS
SCHEDULED SERVICE

1949 - 1960

Year	No. Accidents Total	No. Accidents Fatal	Miles Flown	Hours Flown	Number of Departures	Accident Rates: Per 1 Million Miles Total Accidents	Per 1 Million Miles Fatal Accidents	Per 100,000 Hours Total Accidents	Per 100,000 Hours Fatal Accidents	Per 100,000 Departures Total Accidents	Per 100,000 Departures Fatal Accidents
1949.....	64	9	463,198,100	2,520,000	2,280,271	0.138	0.019	2.539	0.357	2.806	0.394
1950.....	59	6	477,463,000	2,561,900	2,481,928	.123	.012	2.302	.234	2.377	.241
1951.....	69	14	526,589,500	2,779,900	2,713,118	.131	.026	2.482	.503	2.543	.516
1952.....	77	9	589,430,300	3,030,800	2,847,157	.130	.015	2.540	.296	2.704	.316
1953.....	61	7	657,093,300	3,271,900	3,070,412	.092	.010	1.864	.213	1.986	.227
1954.....	67	6	689,782,700	3,294,100	3,093,672	.097	.008	2.033	.182	2.165	.193
1955.....	63	10	779,921,000	3,672,500	3,276,386	.080	.012	1.715	.272	1.922	.305
1956.....	70	7	869,315,000	4,031,000	3,502,790	.080	.008	1.736	.173	1.998	.199
1957.....	72	6	976,168,000	4,443,500	3,768,861	.073	.006	1.620	.135	1.910	.159
1958.....	67	8	972,988,000	4,338,900	3,633,348	.068	.008	1.544	.184	1.846	.220
1959.....	78	14	1,030,252,000	4,503,000	3,912,178	.075	.013	1.732	.310	1.993	.357
1960.....	80	12[a]	991,500,000*	4,000,000*	3,900,000*	.080	.010	2.000	.250	2.005	.256

Excludes:
Fatal accident at Longmont, Colorado 11/1/55 involving sabotage.
Accident at Daggett, California, 7/25/57 involving suicide of a passenger.

a/ Includes 2 midair collisions nonfatal to air carrier occupants. These 2 accidents excluded in computation of fatal accident rates.

* Estimated.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 25, 1961

60-16

RATE OF CHANGE 1949 - 1959
U. S. CERTIFICATED AIR CARRIERS
SCHEDULED SERVICE

ITEM	1949	1959	Increase	Percent of Increase
Passengers Carried	16,719,518	56,002,094	39,282,576	235%
Passenger-Miles Flown	9,256,345,000	37,765,609,000	28,509,264,000	308%
Aircraft Miles Flown	463,198,100	1,030,252,000	567,053,900	123%
Hours Flown	2,520,000	4,503,000	1,983,000	79%
Departures (Landings)	2,280,271	3,912,178	1,631,907	72%
			Decrease	Percent of Decrease
Passenger Fatality Rate:				
Per 100 Million Passenger Miles	1.04	.71	-.33	-32%
Total Accident Rate:				
Per 1 Million Miles Flown	0.138	0.075	-.063	-46%
Per 100,000 Hours Flown	2.539	1.732	-.807	-32%
Per 100,000 Departures (Landings)	2.806	1.993	-.813	-29%
Fatal Accident Rate*				
Per 1 Million Miles	0.019	0.013	-.006	-31%
Per 100,000 Hours	0.357	0.310	-.047	-13%
Per 100,000 Departures	0.394	0.357	-.037	- 9%

* During this period the fatal accident rate has shown a decreasing trend but with wide fluctuations from year to year.

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CIVIL AERONAUTICS BOARD
Bureau of Safety
November 10, 1960

ACCIDENTS, FATALITIES, FATALITY RATES
U. S. CERTIFICATED ROUTE AIR CARRIERS
SCHEDULED PASSENGER SERVICE

1949 - 1960

Year	Accidents		Fatalities			Passengers Carried	Passenger-Miles Flown	Passenger Fatality Rate Per 100 Million Passenger-Miles
	Total	Fatal	Passg.	Crew	Total			
1949.....	50	6	97	13	110	16,719,518	9,256,345,000	1.04
1950.....	48	6	144	21	165	19,220,086	10,725,642,000	1.34
1951.....	61	12	185	35	220	24,851,125	13,724,717,000	1.34
1952.....	61	8	140	15	155	27,569,902	16,251,243,000	0.86
1953.....	50	6	88	15	103	31,645,567	19,003,087,000	0.46
1954.....	58	5	17	7	24	35,447,523	21,388,518,000	0.07
1955.....	55	8	158	23	181	41,707,543	25,270,012,000	0.62
1956.....	61	6	152	15	167	46,004,528	28,608,285,000	0.60
1957.....	57	5	69	13	82	49,423,170	32,395,675,000	0.21
1958.....	61	8	125	16	141	49,165,720	32,598,629,000	0.38
1959.....	69	10	268	42	310	56,002,094	37,765,609,000	0.71
1960.....	75	12[a/]	336	42	378	58,600,000 est.	41,200,000,000 est.	0.81

Excludes:
Fatal occurrence at Longmont, Colo., 1955, involving 39 passengers and 5 crew fatalities.
Fatal occurrence near Daggett, Calif., 1957, involving suicide of 1 passenger.

a/ Includes 2 midair collisions nonfatal to Air Carrier occupants.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 25, 1961

60-15

ACCIDENTS, FATALITIES, FATALITY RATES
U. S. CERTIFICATED ROUTE AIR CARRIERS
SCHEDULED DOMESTIC PASSENGER SERVICE
1938-1960

Year	Total	Fatal	Fatalities Passenger	Fatalities Crew	Fatalities Total	Passengers Carried	Passenger-Miles Flown	Passenger Fatality Rate Per 100 Million Passenger-Miles Flown
1938.....	22	5	25	10	35	1,365,706	560,660,000	4.45
1939.....	27	2	9	3	12	1,895,793	755,118,000	1.19
1940.....	29	3	35	10	45	3,038,619	1,157,900,000	3.02
1941.....	26	4	35	9	44	4,141,748	1,506,303,000	2.32
1942.....	23	5	55	16	71	3,325,726	1,501,279,000	3.66
1943.....	14	2	22	8	30	3,115,972	1,670,935,000	1.31
1944.....	24	3	48	8	56	4,132,114	2,211,905,000	2.17
1945.....	33	7	76	11	87	6,687,968	3,408,290,000	2.22
1946.....	31	9	75	22	97	12,465,695	6,068,315,000	1.23
1947.....	36	5	199	17	216	12,890,208	6,313,312,000	3.15
1948.....	53	5	83	15	98	13,168,095	6,245,745,000	1.32
1949.....	29	4	93	11	104	15,120,015	7,071,042,000	1.31
1950.....	36	4	96	13	109	17,424,414	8,363,379,000	1.14
1951.....	37	8	142	24	166	22,652,179	10,949,903,000	1.29
1952.....	36	5	46	6	52	25,009,815	12,996,657,000	0.35
1953.....	32	4	86	15	101	28,722,743	15,337,760,000	0.56
1954.....	44	4	16	7	23	32,343,867	17,389,817,000	0.09
1955.....	40	7	156	21	177	38,027,120	20,550,940,000	0.75
1956.....	47	4	143	13	156	41,738,569	23,155,153,000	0.61
1957.....	43	3	31	2	33	44,972,334	26,252,338,000	0.11
1958.....	41	4	114	15	129	44,580,984	26,266,401,000	0.43
1959.....	62	9	209	33	242	51,002,218	30,435,495,000	0.68
1960.....	69	10 a/	326	37	363	53,000,000 est.	32,300,000,000 est.	1.00

Excludes - fatal occurrence at Longmont, Colo. involving 39 passenger and 5 crew fatalities.
Excludes - fatal occurrence at Daggett, Calif. involving suicide.
a/ Includes 2 mid-air collisions nonfatal to air carrier occupants.

ACCIDENTS, FATALITIES, FATALITY RATES
U. S. CERTIFICATED ROUTE AIR CARRIERS
SCHEDULED INTERNATIONAL PASSENGER SERVICE
1938-1960

Year	Accidents		Fatalities			Passengers Carried	Passenger-Miles Flown	Passenger Fatality Rate Per 100 Million Passenger-Miles Flown
	Total	Fatal	Passenger	Crew	Total			
1938.....	7	2	7	12	19	109,416	53,799,000	13.01
1939.....	6	1	10	4	14	136,090	78,271,000	12.77
1940.....	6	0	0	0	0	170,179	104,495,000	0
1941.....	4	1	2	0	2	235,802	165,950,000	1.20
1942.....	2	0	0	0	0	276,200	240,314,000	0
1943.....	2	1	10	4	14	292,888	254,374,000	3.93
1944.....	7	1	17	0	17	356,662	322,123,000	5.27
1945.....	5	2	17	10	27	493,498	462,180,000	3.67
1946.....	12	2	40	12	52	1,066,414	1,130,196,000	3.53
1947.....	9	3	20	13	33	1,359,712	1,863,268,000	1.07
1948.....	11	1	20	10	30	1,372,856	1,961,794,000	1.01
1949.....	8	0	0	0	0	1,520,067	2,168,780,000	0
1950.....	5	2	48	8	56	1,678,491	2,338,232,000	2.05
1951.....	10	1	31	9	40	2,041,833	2,734,846,000	1.13
1952.....	9	3	94	9	103	2,366,451	3,176,784,000	2.95
1953.....	5	2	2	0	2	2,702,678	3,565,420,000	0.05
1954.....	4	0	0	0	0	2,878,800	3,904,459,000	0
1955.....	5	1	2	2	4	3,416,652	4,601,273,000	0.04
1956.....	1	0	0	0	0	3,950,671	5,307,543,000	0
1957.....	7	1	36	8	44	4,147,937	5,981,841,000	0.60
1958.....	12	2	10	0	10	4,272,340	6,230,732,000	0.16
1959.....	7	1	59	9	68	4,999,876	7,330,114,000	0.80
1960.....	6	2	10	5	15	5,600,000 est.	8,900,000,000 est.	0.11

ACCIDENTS, FATALITIES, RATES
ALASKAN AIR CARRIERS
SCHEDULED PASSENGER SERVICE
1949 - 1960

Year	Accidents		Fatalities			Passengers Carried	Passg. Miles Flown	Passg. Fatality Rate Per 100 Million Passg. Miles Flown
	Total	Fatal	Passg.	Crew	Total			
1949.....	13	2	4	2	6	79,436	16,523,000	24.20
1950.....	7	0	0	0	0	117,181	24,031,000	0
1951.....	14	3	12	2	14	157,113	39,968,000	30.02
1952.....	16	0	0	0	0	193,636	77,802,000	0
1953.....	13	0	0	0	0	220,146	99,907,000	0
1954.....	10	1	1	0	1	224,856	94,242,000	1.00
1955.....	10	0	0	0	0	263,771	117,799,000	0
1956.....	13	2	9	2	11	315,288	145,589,000	6.18
1957.....	7	1	2	3	5	302,899	161,496,000	1.23
1958.....	8	2	1	1	0	312,396	174,715,000	0.57
1959 a/...	7	1	11	5	16	177,748	40,034,000	27.42
1960.....	6	0	0	0	0	N.A.	N. A.	0

a/ Effective 1959, Alaskan operations are also carried under Domestic operations. The 1959 figures shown above relate only to the intra-Alaska operations of those carriers operating exclusively in Alaska. Figures for the previous years include data relating to States-Alaska service, as well as intra-Alaska operations.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
JANUARY 25, 1961

HELICOPTER RECORD
U. S. AIR CARRIERS
SCHEDULED PASSENGER SERVICE
1953 - 1960

Items	1953	1954	1955	1956	1957	1958	1959	1960
Passengers carried	1,237	8,392	28,746	63,537	153,465	229,784	366,315	490,268
Passenger-miles flown ...	35,000	211,000	684,000	1,661,000	3,438,000	5,094,000	7,748,000	9,475,000
Revenue plane-miles flown	63,022	177,752	434,792	702,687	1,074,849	1,241,967	1,495,839	1,218,726
Fatal accidents.....	0	0	0	0	0	0	0	1
Total accidents.....	0	1	0	1	0	1	2	3
Passenger fatalities.....	0	0	0	0	0	0	0	11
Crew fatalities.....	0	0	0	0	0	0	0	2
Total fatalities.....	0	0	0	0	0	0	0	13
Accident Rate Per 1 Million Revenue Plane-Miles Flown:								
Fatal accident rate.....	0	0	0	0	0	0	0	0.821
Total accident rate.....	0	5.6	0	1.4	0	0.8	1.3	2.463

NOTE: Scheduled passenger service inaugurated 1953.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 25, 1961

ACCIDENTS, ACCIDENT RATES AND FATALITIES
SUPPLEMENTAL AIR CARRIERS
ALL OPERATIONS
1949 - 1960

Year	Number of Accidents		Aircraft Miles Flown	Accident Rate Per 1 Million Miles Flown		Fatalities			
	Total	Fatal		Total Accidents	Fatal Accidents	Passg.	Crew	Others	Total
1949.....	20	9	23,473,000	0.852	0.383	104	16	6	126
1950.....	18	3	34,113,000	.527	.087	29	1	0	30
1951.....	24	5	44,732,000	.536	.111	78	12	0	90
1952.....	10	2	51,700,000	.193	.038	26	5	0	31
1953.....	21	7	48,937,000	.429	.143	142	27	0	169
1954.....	13	1	39,103,800	.332	.025	9	1	0	10
1955.....	13	3	43,206,000	.301	.069	27	5	1	33
1956.....	9	0	44,822,000	.201	.0	0	0	0	0
1957.....	8	1	35,486,000	.225	.028	0	2	0	2
1958.....	6	1	39,213,000	.153	.025	0	2	0	2
1959.....	8	1	38,670,000	.206	.025	1	2	0	3
1960.....	12	4[a]	46,400,000 est.	.258	.064	93	11	2	106

a/ Includes 1 midair collision nonfatal to Air Carrier occupants. This accident excluded in computation of fatal accident rate.

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CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 25, 1961

U. S. AIRCRAFT FLEET
CERTIFICATED ROUTE AIR CARRIERS
SEPT. 30, 1960

	Number of Aircraft
PISTON-ENGINE AIRCRAFT	
Boeing 377	13
Convair 240/340/440	201
Douglas DC-3	288
Douglas DC-4	56
Douglas DC-6 Series	301
Douglas DC-7 Series	219
Lockheed 049/749 Series	76
Lockheed 1049/1649 Series	132
Curtiss C-46	44
Martin 202/404	90
Total	1420
TURBO-PROP AIRCRAFT	
Viscount	80
Convair 540	2
Fairchild F-27	42
Lockheed 188	108
Total	232
TURBO-JET AIRCRAFT	
Boeing 707	91
Boeing 720	16
Douglas DC-8	60
Convair 880	6
Total	173
TOTAL	1825
HELICOPTERS	
Bell B-47	5
Sikorsky S-58C	7
Sikorsky S-55	5
Sikorsky S-51	2
Vertol V-44B	5
Total No. Helicopters	24

NOTE: Excludes small aircraft used in Intra-Alaska Operations. Data based on report issued by FAA.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
JANUARY 25, 1961

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ACCIDENTS BY MAKE AND MODEL
CERTIFICATED ROUTE AIR CARRIERS
ALL OPERATIONS

1957 - 1959

	HOURS FLOWN			NUMBER ACCIDENTS						ACCIDENT RATE PER 100,000 HOURS FLOWN					
				1957		1958		1959		1957		1958		1959	
	1957	1958	1959	Fatal	Total	Fatal	Total	Fatal	Total	Fatal	Total	Fatal	Total	Fatal	Total
PISTON-ENGINE AIRCRAFT															
B-377	116,842	105,325	80,084	1	3	1	4	0	3	.85	2.56	.94	3.79	0.	3.74
CV-240/340/440	651,404	569,736	525,752	1	4	1	8	0	2	.15	.61	.17	1.40	0.	.38
DC-3	726,935	687,229	645,897	2	12	1	6	2	9	.27	1.65	.14	.87	.31	1.39
DC-4	288,420	198,522	196,492	1	8	0	1	2	2	.34	2.77	0.	.50	1.01	1.01
DC-6 Series	959,483	955,328	987,207	1	13	0	8	0	9	.10	1.35	0.	.83	0.	.91
DC-7 Series	587,395	808,133	759,165	0	10	2	12	1	12	0.	1.70	.24	1.48	.13	1.58
L-049/749 Series	335,274	256,553	245,705	1	9	0	1	1	1	.29	2.68	0.	.39	.40	.40
L-1049/1649 Series	398,231	394,384	420,226	0	2	1	8	2	5	0.	.50	.25	2.02	.47	1.19
L-18	5,855	2,899	422	0	0	0	2	0	0	0.	0.	0.	68.98	0.	0.
C-46	164,624	139,798	129,192	1	8	1	6	2	5	.60	4.86	.71	4.29	1.54	3.87
M-202/404	326,629	295,271	251,608	0	3	0	5	1	4	0.	.91	0.	1.69	.39	1.59
CV-28-5ACF	-	-	2,073	-	-	-	-	0	0	-	-	-	-	0.	0.
Total	4,561,092	4,411,178	4,243,823	8	72	7	61	11	52	.17	1.55	.15	1.38	.25	1.22
TURBO-PROP AIRCRAFT															
Viscount	178,625	188,868	257,504	0	5	2	5	1	8	0.	2.79	1.05	2.64	.38	3.10
CV-540	-	-	944	-	-	-	-	0	0	-	-	-	-	0.	0.
F-27	-	3,346	55,103	-	-	0	0	0	?	-	-	0.	0.	0.	3.63
L-188	-	1,395	134,023	-	-	0	0	2	10	-	-	0.	0.	1.49	7.46
Total	178,625	193,609	447,574	0	5	2	5	3	20	0.	2.79	1.03	2.58	.67	4.46
TURBO-JET AIRCRAFT															
B-707	-	1,874	97,045	-	-	0	0	1	9	-	-	0.	0.	1.03	9.27
DC-8	-	-	7,650	-	-	-	-	0	0	-	-	-	-	0.	0.
Total	-	1,874	104,695	-	-	-	-	1	9	-	-	0.	0.	.95	8.59
TOTAL	4,739,717	4,606,661	4,796,092	8	76	9	66	15	81	.17	1.60	.19	1.43	.31	1.69

NOTE - Excludes: Data relating to Helicopters and small aircraft (under 12,500 pounds gross weight).
Propeller accidents to persons.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
October 15, 1960

OPERATIONAL PHASE

U. S. Air Carrier Accidents
1954 - 1960

	1954-1959		1960	
Takeoff	Number	Percent	Number	Percent
Run	25	4%	9	9%
Climb	51	9	8	8
Discontinued	14	2	1	1
Subtotal, takeoff	90	15%	18	18%
Cruise	134	22%	19	19%
Landing				
Approach	71	12%	13	13%
Level off	19	3	1	1
Touchdown	31	5	9	9
Roll	154	25	20	20
Go-around	13	2	3	3
Subtotal, landing	288	47%	46	46%
Taxiing	80	13%	16	16%
Ground (Static)				
Starting engines, warm up, idle etc.	19	3%	3	3%
Total Accidents	611		102	

60-28

CAUSAL FACTORS
U. S. AIR CARRIER ACCIDENTS
ALL OPERATIONS
1957 - 1960

Causal Factors	1957	1958	1959	1960 a/
Personnel				
Pilot	48 (42.8)	42 (45.6)	30 (29.7)	14 (37.8)
Maintenance/Inspection	0	0	3 (2.7)	0
Airport	0	0	1 (0.9)	0
Other Personnel	39 (34.8)	31 (33.6)	15 (14.9)	8 (21.6)
Subtotal, Personnel	87 (77.6)	73 (79.3)	49 (48.2)	22 (59.4)
Other than Personnel				
Powerplant	9 (8.0)	18 (19.5)	5 (4.9)	4 (10.8)
Airframe	2 (1.0)	3 (3.3)	4 (4.0)	0
Landing Gear	17 (15.1)	8 (8.7)	14 (13.9)	2 (5.4)
Equipment & Accessories	4 (3.5)	6 (6.5)	1 (0.9)	0
Weather	24 (21.4)	17 (18.5)	13 (12.9)	11 (29.7)
Airport Terrain	15 (13.3)	14 (15.2)	3 (3.0)	3 (8.1)
Miscellaneous	2 (1.0)	6 (6.5)	5 (4.9)	0
Subtotal, Other	73 (65.1)	72 (78.2)	45 (44.5)	20 (54.5)
Undetermined	2 (1.0)	0	1 (0.9)	0
Subtotal	2 (1.0)	0	1 (0.9)	0
Total Accidents	112	92	101	37

a/ Based on 37 cases analyzed to date.

Excludes Daggett, California, 7/25/57, involving suicide.

In determining the cause of an accident, all contributing factors are considered. These factors are according to appropriate categories. For statistical purposes, where two or more causal factors exist in one accident, each is recorded and no attempt is made to establish a primary cause. The figures shown indicate the number of accidents in which each different category of causal factors was found to exist.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
JANUARY 25, 1961

60-41

ACCIDENTS, RATES
GENERAL AVIATION
1938 - 1960

Year	Accidents Total	Accidents Fatal	Fatalities	Hours* Flown (000)	Estimated* Plane-Miles Flown (000)	Accident Rates 100,000 Hours Total	100,000 Hours Fatal	Million Plane-Miles Total	Million Plane-Miles Fatal
1938.....	1,861	176	274	1,478	129,359	125.7	11.8	14.4	1.4
1939.....	2,222	203	315	1,922	177,868	117.0	10.7	12.5	1.1
1940.....	3,471	232	359	3,200	264,000	108.5	7.3	12.1	0.9
1941.....	4,252	217	312	4,460	346,303	94.5	4.8	12.3	0.6
1942.....	3,324	143	220	3,786	293,593	87.5	3.8	11.3	0.5
1943.....	3,871	167	257	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
1944.....	3,343	169	257	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
1945.....	4,652	322	508	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
1946.....	7,618	690	1,009	9,788	874,740	77.7	7.0	8.7	0.8
1947.....	9,253	882	1,352	16,334	1,502,420	56.7	5.4	6.2	0.6
1948.....	7,850	850	1,384	15,130	1,469,540	52.0	5.6	5.3	0.6
1949.....	5,459	562	896	11,031	1,128,992	49.6	5.1	4.8	0.5
1950.....	4,505	499	871	9,650	1,061,500	46.4	5.2	4.2	0.5
1951.....	3,824	441	750	8,451	975,480	45.0	5.2	4.0	0.5
1952.....	3,657	401	691	8,186	972,055	44.6	5.0	3.8	0.4
1953.....	3,232	387	635	8,527	1,045,346	38.0	4.6	3.1	0.4
1954.....	3,381	393	684	8,963	1,119,295	37.6	4.4	3.0	0.4
1955.....	3,343	384	619	9,500	1,216,000	35.2	4.0	2.7	0.3
1956.....	3,474	356	669	10,200	1,315,000	34.0	3.5	2.6	0.3
1957.....	4,200	438	800	10,938	1,426,285	38.5	4.0	2.9	0.3
1958.....	4,584	384	717	11,700	1,544,000	39.1	3.3	3.0	0.3
1959.....	4,578	449	821	12,400	1,649,000	36.9	3.6	2.8	0.2
1960**.....	4,540	438	835	13,100	1,749,000	34.6	3.3	2.6	0.2

* Source FAA
** Preliminary

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
JANUARY 25, 1961

60-55

ACCIDENTS, RATES
AERIAL APPLICATION ACTIVITIES
1951 - 1959

Year	ACCIDENTS Total	ACCIDENTS Fatal	HOURS FLOWN	ACCIDENT RATE PER 10,000 HRS. Total Accidents	ACCIDENT RATE PER 10,000 HRS. Fatal Accidents
1951	366	56	708,129	5.17	0.79
1952	376	49	707,277	5.32	0.69
1953	346	46	722,000	4.79	0.64
1954	313	43	678,000	4.68	0.80
1955	317	54	851,960	3.72	0.63
1956	277	45	802,500	3.45	0.56
1957	370	43	865,800	4.27	0.50
1958	346	51	875,000	3.95	0.58
1959	313	57	880,000	3.55	0.64

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
JANUARY 25, 1961

60-56

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ACCIDENTS, RATES
EXECUTIVE AIRCRAFT OPERATIONS
1951 - 1960

Year	Accidents Total	Accidents Fatal	Hours Flown	Fatalities Crew	Fatalities Passg.	Fatalities Other	Fatalities Total	ACCIDENT RATES PER 100,000 HOURS FLOWN Total Accidents	ACCIDENT RATES PER 100,000 HOURS FLOWN Fatal Accidents
1951.....	13	2	185,000	2	1	0	3	7.02	1.08
1952.....	7	1	206,000	2	2	0	4	3.39	.48
1953.....	9	0	265,800	0	0	0	0	3.39	0.0
1954.....	13	7	294,210	10	15	0	25	4.42	2.38
1955.....	11	3	312,300*	6	2	0	8	3.52	.96
1956.....	8	5	324,300*	12	13	0	25	2.46	1.54
1957.....	17	2	312,660**	4	8	0	12	5.44	.64
1958.....	16	4	325,000*	7	2	0	9	4.92	1.23
1959.....	16	1	N. A.	2	8	0	10	N. A.	N. A.
1960.....	11a/	2	N. A.	5	2	0	7	N. A.	N. A.

a/ Preliminary

*Estimated

**Based on partial analysis of C. A. A. Sample Survey.
Above data pertains to fixed-wing aircraft over 12,500 pounds.

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CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
JANUARY 25, 1961

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CAUSAL FACTORS
GENERAL AVIATION ACCIDENTS
1960

CATEGORY	NUMBER ACCIDENTS	PER CENT TOTAL ACCIDENTS*
PILOT FACTORS	1013	77%
OTHER PERSONNEL FACTORS	75	6
POWERPLANT	88	7
ROTOR ASSEMBLY	4	0.3
AIRFRAME	7	0.5
LANDING GEAR	75	6
EQUIPMENT & ACCESSORIES	13	1
WEATHER	210	16
AIRPORT-HELIPORT TERRAIN	303	23
MISCELLANEOUS:		
INCAPACITATION	12	1
OTHERS	52	4
UNDETERMINED	14	1

*Based on 1317 cases analyzed representing approximately 35% of total accidents.

In determining the cause of an accident all contributing factors are considered. These factors are classified according to appropriate categories. For statistical purposes, where two or more causal factors exist in one accident, each is recorded and no attempt is made to establish a primary cause. The figures shown above indicate the number of accidents in which each different category of causal factors was found to exist.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
JANUARY 25, 1961

V

CAUSAL FACTORS
GENERAL AVIATION ACCIDENTS
1959

CATEGORY	NUMBER ACCIDENTS	PER CENT TOTAL ACCIDENTS*
PILOT FACTORS	3598	79%
OTHER PERSONNEL FACTORS	279	6
POWERPLANT	406	9
MOTOR ASSEMBLY	6	0.1
AIRFRAME	36	0.8
LANDING GEAR	265	6
EQUIPMENT & ACCESSORIES	51	1
WEATHER	509	11
AIRPORT-HELIPORT TERRAIN	380	8
MISCELLANEOUS		
INCAPACITATION	12	0.2
OTHERS	73	1.6
UNDETERMINED	31	0.7

*Based on total of 4539 cases analyzed.

In determining the cause of an accident all contributing factors are considered. These factors are classified according to appropriate categories. For statistical purposes, where two or more causal factors exist in one accident, each is recorded and no attempt is made to establish a primary cause. The figures shown above indicate the number of accidents in which each different category of causal factors was found to exist.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
JANUARY 25, 1961

Table 1

MIDAIR COLLISIONS
IN
U. S. CIVIL AVIATION
1938 - 1960

Year	Number Accidents Total	Number Accidents Fatal	Number Fatalities	Class of Operation: Air Carrier Air Carrier	Air Carrier Gen. Aviation	Air Carrier Military	Gen. Aviation Military	Gen. Aviation Gen. Aviation
1938.....	3	1	2	0	0	0	0	3
1939.....	6	6	12	0	0	0	1	5
1940.....	14	13	26	0	0	0	1	13
1941.....	13	5	7	0	0	0	0	13
1942.....	12	10	21	0	0	2	0	10
1943.....	31	14	14	0	0	0	2	29
1944.....	11	6	6	0	1	0	0	10
1945.....	20	6	9	0	1	1	0	18
1946.....	38	15	25	1	0	0	4	33
1947.....	49	30	54	0	1	0	5	43
1948.....	30	15	47	0	0	0	3	27
1949.....	17	11	89	0	3	1	2	11
1950.....	7	3	11	0	0	0	0	7
1951.....	13	7	17	1	2	0	3	7
1952.....	14	6	14	0	3	0	3	8
1953.....	9	0	0	1	0	0	2	6
1954.....	16	10	18	0	0	1	1	14
1955.....	21	8	24	0	3	0	2	16
1956.....	17	11	161	1	1	0	1	14
1957.....	15	6	19[a]	0	0	1	4	10
1958.....	16	12	86	0	0	2	2	12
1959.....	13	10	20	0	0	0	3	10
1960.....	25	9	152[b]	1	4	0	3	17
Total....	410	214	834	5	19	8	42	336

a/ Includes 3 persons on ground.
b/ Includes 6 persons on ground.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 1961

Table 2

MIDAIR COLLISIONS AND FATALITIES
INVOLVING
AIR CARRIER AIRCRAFT
1938 - 1960

	Number of Midair Collisions			Fatalities						
				Air Carrier Aircraft			Other Aircraft			
	Total	Fatal	Fatal to Air Carrier*	Passengers	Crew	Total	Passengers	Crew	Persons On Ground	Total Fatalities
1938-1941 None										
1942.....	2	1	1	9	3	12	0	0	0	12
1943.....	0	0	0	0	0	0	0	0	0	0
1944.....	1	0	0	0	0	0	0	0	0	0
1945.....	2	2	1	1	0	1	1	3	0	5
1946.....	1	0	0	0	0	0	0	0	0	0
1947.....	1	1	1	7	1	8	0	1	0	9
1948.....	0	0	0	0	0	0	0	0	0	0
1949.....	4	4	2	63	7	70	1	3	0	74
1950.....	0	0	0	0	0	0	0	0	0	0
1951.....	3	2	1	0	3	3	0	1	0	4
1952.....	3	2	0	0	0	0	1	2	0	3
1953.....	1	0	0	0	0	0	0	0	0	0
1954.....	1	1	0	0	0	0	0	0	0	2
1955.....	3	2	1	10	3	13	0	4	0	17
1956.....	2	1	1	117	11	128	0	0	0	128
1957.....	1	0	0	0	0	0	0	0	0	0
1958.....	2	2	2	49	9	58	1	2	0	61
1959.....	0	0	0	0	0	0	0	0	0	0
1960.....	5	4	1	116	12	128	4	3	6	141
Total.....	32	22	11[a/]	372	49	421	8	21	6	456

* Number collisions resulting in fatalities to occupants of Air Carrier.
a/Nine of these occurred in scheduled passenger service; 2 in nonrevenue operations.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 1961

HELICOPTER ACCIDENTS
U. S. CIVIL OPERATIONS
1950 - 1960

Year	Total Accidents	Fatal Accidents	Number of Fatalities	No. Helicopters In Operation
AIR CARRIER-ALL OPERATIONS				
1950	4	0	0	11
1951	3	2	3	11
1952	1	0	0	9
1953	1	0	0	14
1954	4	0	0	17
1955	4	0	0	20
1956	11	0	0	19
1957	2	1	1	26
1958	4	1	2	22
1959	1	0	0	23
1960	4	1	13	24
Total	39	5	19	
GENERAL AVIATION				
1950	39	3	3	-
1951	26	2	5	93
1952	25	1	1	101
1953	15	1	1	123
1954	32	2	6	148
1955	34	3	5	236
1956	47	3	4	283
1957	55	9	12	344
1958	80	11	25	437
1959	88	9	15	520
1960	106	11	28	606 est.
Total	547	55	105	
TOTAL CIVIL OPERATIONS				
1950	43	3	3	NA
1951	29	4	8	104
1952	26	1	1	110
1953	16	1	1	137
1954	36	2	6	165
1955	38	3	5	256
1956	58	3	4	302
1957	57	10	13	370
1958	84	12	27	459
1959	89	9	15	543
1960	110	12	41	630 est.
Total	586	60	124	

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 25, 1961

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CIVIL AERONAUTICS BOARD

Statutory Responsibilities and Background Information Regarding the Safety Functions of the Civil Aeronautics Board

The Civil Aeronautics Act of 1938 was originally administered by three groups of officials. There was a five-member Civil Aeronautics Authority which exercised quasi-legislative and quasi-judicial functions; there was a three-member Air Safety Board which was responsible for investigating aircraft accidents, reporting the probable cause and making recommendations to eliminate future accidents; and there was an Administrator of Civil Aeronautics whose duties included the development of civil airways, landing areas, and other air navigation facilities. Under Reorganization Plans 3 and 4 of 1940, the Air Safety Board was abolished and its functions were transferred to the five-member "Authority" which was redesignated as the Civil Aeronautics Board. The Administrator of Civil Aeronautics and the Civil Aeronautics Board were placed under the Department of Commerce, although the Board continued to exercise its functions of rule-making, adjudication, and investigation independently of the Secretary of Commerce.

The next major change in the law came with the enactment of the Federal Aviation Act of 1958. The CAA was taken out of the Department

of Commerce, and together with the Airways Modernization Board, formed the new Federal Aviation Agency, otherwise known as the FAA.

The FAA, which is headed by a single Administrator, operates a national network of air navigation aids, and controls civil and military air traffic; it regulates the use of navigable air space; it certifies as to the competency of airmen and airworthiness of aircraft; it procures and installs aids to air navigation; it conducts research and development to improve and modernize aviation facilities and procedures; it administers a Federal aid program for a national system of airports; and it constructs and operates airports in the National Capital area and other special locations.

The Board also derives its authority from the Federal Aviation Act of 1958. It exercises its powers independently and its decisions are not subject to review by any executive department or agency except for the approval of The President which is required in Board decisions involving overseas or foreign air transportation.

Under the Civil Aeronautics Act of 1938, the Board had the responsibility of promulgating the air safety regulations, as well as the function of investigating aircraft accidents. With the enactment of the Federal Aviation Act of 1958, the safety rule-making function was transferred from the Board to the Federal Aviation Agency, but the accident investigation function remained with the Board.

Under the Federal Aviation Act, the Board investigates accidents involving civil aircraft and makes reports on the facts, conditions, circumstances, and probable cause thereof; it makes such recommendations to the Administrator as will tend to prevent similar accidents in the future; it makes such reports public as may be deemed by it to be in the public interest; and it conducts special studies and investigations of aeronautical hazards to reduce aircraft accidents and to prevent their recurrence.

The FAA has certain related but different responsibilities when an aircraft accident occurs. These responsibilities pertain to violations of the Civil Air Regulations; the performance of navigational facilities which FAA provides and operates; the conduct of any of its employees; the competency of the operator and personnel concerned with operating and maintaining the aircraft; the airworthiness, failure or malfunctioning of the aircraft or its components; and possible Government tort liability.

For many years the Board and the FAA (or its predecessor, the CAA) have worked closely together in accident investigations. At the present time, the two agencies coordinate their accident investigation work in accordance with a memorandum of understanding which was approved by the Board and the Administrator in February 1957. This agreement recognizes that the statutory responsibility for investigating accidents to determine the probable cause rests with the

Board. It also takes cognizance of the fact that the Administrator has certain duties to perform in connection with aircraft accidents, and makes provision for the Administrator to perform his functions within the framework of the Board's accident investigation procedures to the extent that this can be accomplished without interfering with the Board's statutory responsibilities.

This close working relationship between the Administrator and the Board is essential to the expeditious discharge of the separate responsibilities of each agency. Throughout the years, these two agencies have worked together in accident investigations and the objectives of both agencies have been well served by this cooperation. In many instances the Administrator takes corrective action as soon as he receives a recommendation from the Board; in other cases studies or further investigations are launched by the Administrator to obtain additional facts and technical information.

It is important to note that the Board is not required to and does not wait until the conclusion of an accident investigation to make recommendations to the Administrator. Sometimes it is possible to determine the probable cause of an accident almost immediately. But on many occasions this can be done only after a long and very thorough, intricate and painstaking investigation. But note again that this does not mean that the Board waits until the conclusion of the investigation to make its recommendations to the Administrator.

Frequently in the course of such investigations, facts are developed which, although not immediately conclusive as to the cause of the accident, do point immediately to the need for corrective action. Therefore our recommendations are made just as soon as facts are discovered which, in our opinion, require corrective action by the Administrator.

Under Sections 602 and 609 of the Federal Aviation Act, the Board has (1) review responsibility of deciding whether an airman meets the pertinent rules, regulations, and standards prescribed by the Administrator for an airman certificate, and (2) appeal responsibility of amending, modifying or reversing an Administrator's order which amends, modifies, suspends or revokes an air safety certificate, if the Board finds that safety in air commerce or air transportation and the public interest so require. The Board's responsibility arises upon the filing of a petition for review or appeal by any person who is affected by the Administrator's action or order, and such petition is disposed of in an adjudicatory proceeding held by the Board, in which case an independent determination is made by the Board.

Section 602 of the Act provides that any person whose application for issuance or renewal of an airman certificate is denied by the Administrator may file with the Board a petition for review of the Administrator's action, unless the applicant's certificate at

the time of denial is under order of suspension or his certificate has been revoked within one year of the date of denial. It further provides that in determining whether the airman meets the pertinent rules, regulations, or standards, the Board shall not be bound by findings of fact of the Administrator, and that the Board's decision shall be binding on the Administrator except that the Administrator may, in his discretion, prohibit or restrict the issuance of airman certificates to aliens, or make such issuance dependent on the terms of reciprocal agreements entered into with foreign governments.

Section 609 of the Act provides that any person whose certificate is affected by an order of the Administrator under this Section may appeal the Administrator's order to the Board and the Board may, after notice and hearing, amend, modify, or reverse the Administrator's order if it finds that safety in air commerce or air transportation and the public interest so require. Under this Section, the Administrator, after reinspection, reexamination, or as a result of any other investigation, may issue an order amending, modifying, suspending, or revoking any air safety certificate, including an airman certificate, if he determines that safety in air commerce or air transportation and the public interest require such an order. The Section further provides that the filing of an appeal with the Board shall stay the effectiveness of the Administrator's order unless the

Administrator advises the Board that an emergency exists and safety in air commerce or air transportation requires the immediate effectiveness of his order, in which event the order shall remain effective and the Board shall finally dispose of the appeal within sixty days after being so advised by the Administrator. Judicial review of the Board's order is available to any person substantially affected, in which case the Section provides that the Administrator shall be made a party to the proceeding.

With respect to Section 609, the provision that the Administrator may issue an order suspending or revoking an air safety certificate is new, as are all of the provisions in Section 609 which provide for appeal to the Board of orders of the Administrator which amend, modify, suspend or revoke air safety certificates. In order to implement the changes in the law, the Board, on December 31, 1958, issued a revised Part 301, Rules of Practice in Air Safety Proceedings.

A question has arisen as to whether the Board, in proceedings under Sections 602 and 609, may review the safety standards or regulations prescribed by the Administrator under the Act. For example, the Administrator may have refused to issue an airman certificate for failure to meet a standard or he may have suspended or revoked a certificate for non-compliance with a safety regulation. In such cases, the aggrieved party may appeal to the Board under

Section 602 or Section 609 as the case may be. The airman's defense in such a case might well include an attack upon the Administrator's regulation or standard. Indeed, there may be cases where there is no factual dispute and where his only defense is directed to the regulation or standard. Such an attack might take several forms. In its broadest form, it might consist of assertions that the regulation is unnecessary or undesirable, i.e., it may challenge the merits of the regulation. On the other hand, the charge may be that the regulation is invalid by reason of some technical defect in its promulgation or that it is invalid because it is arbitrary or is beyond the Administrator's authority.

It is the Board's position that the Board's power of review does not extend to determination either of the validity or wisdom of the rules, regulations, and standards promulgated by the Administrator, but is limited to a review of the Administrator's findings of fact and actions thereunder. Thus, if a regulation or standard of the Administrator's is challenged, whether it be a direct attack on the regulation itself or whether it be in connection with adjudicatory proceedings, the aggrieved party's relief lies in the courts and not in an appeal to the Civil Aeronautics Board.

As stated above, the Board has promulgated a revised Part 301 which consists of the Board's Rules of Practice in Air Safety

Proceedings under Sections 602 and 609. This regulation adjusts the Board's proceedings to conform to the new statutory provisions.

To accommodate the amendment of Section 602 denying the right of review to persons whose certificate is under suspension, or has been revoked within a year, Section 301.18(b) of the regulation provides for motions to dismiss petitions for review for lack of standing of the petitioner. The statutory changes in Section 609, authorizing the Administrator to issue orders amending and revoking air safety certificates but providing for appeal to the Board, are reflected in the provisions on pleadings (301.12 to 301.15), procedure on emergency orders (301.50), and other provisions. These provisions preserve the character of the proceeding before the Board under Section 609 as a de novo proceeding in which the Board is not bound by the Administrator's findings or order and in which the Administrator as complainant has the burden of proof.

Thus the revised procedure before the Board under Section 609 remains quasi-judicial in nature and based on pleadings, namely, the Administrator's complaint and the respondent's answer. However, in order to save time and avoid unnecessary duplication, it is provided that the Administrator's order may take the place of the complaint if it (1) complies with the requirements as to the contents of a complaint, (2) was served upon the respondent with a notice that, in case he wishes to appeal, it is also to be considered as the

Administrator's complaint before the Board requesting affirmation of his order, and (3) postpones its effective date until after expiration of the time for appeal provided in this Part. In such a case the respondent may combine his notice of appeal with his answer or, in proper cases, with some appropriate motion. Thus, where this procedure is followed one duplicative procedural step on each side may be avoided.

Section 609 of the Act provides that the "filing" of the appeal with the Board shall stay the effectiveness of the Administrator's order. However, with regard to emergency orders, Section 609 provides that the order shall remain effective if the Administrator advises the Board "that an emergency exists and safety in air commerce or air transportation requires the immediate effectiveness of his order." A hiatus during which the emergency order might be deemed stayed by an appeal is avoided because where the combination pleading method is used, the appeal and the Administrator's order, which contains the designation as an emergency order, will be docketed by the Board at the same time (301.14, 301.15(a)). Where combination pleading is not used, there is nothing to prevent the Administrator from advising the Board of the emergency character of his order on the very day the appeal is received by him and docketed by the Board under 301.15(a).

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The Board believes that these regulations fully carry out the Congressional intent in relation to proceedings under Sections 602 and 609, and that they have established satisfactory procedures for implementing those provisions of the law.

There is no requirement in the Federal Aviation Act of 1958, nor was there any requirement in the Civil Aeronautics Act of 1938, that a public hearing be held in connection with the investigation of an aircraft accident. However, in the past and under the Board's present operating procedures, a public hearing is held when it is deemed necessary in the public interest. The principal reason for holding a hearing is to make a public record of all known facts pertaining to the accident and surrounding circumstances and conditions from which the Board may determine the probable cause of the accident and recommend corrective action.

Public hearings are conducted in accordance with Part 303 of the Board's Rules of Practice in Aircraft Accident Investigation Hearings. The rules provide for an informal fact-finding proceeding in which the testimony of witnesses and exhibits which might be of aid in determining the cause of the accident are received in evidence. There are no pleadings, issues, or adverse parties, and matters dealing with the rights or liabilities of persons arising out of the accident are excluded from the proceeding.

In keeping with Board policy of constantly endeavoring to improve accident investigations, Part 303 was substantially revised in February 1957 to provide for participation by officially designated "Parties to the Investigation" who would be permitted to question witnesses at the public hearing. These would normally include those persons, Government agencies, companies, and associations whose employees, functions, activities or products were involved in the accident, or who participated in the accident investigation. The revision also provided for a prehearing conference and authorized the Office of the General Counsel to designate a Legal Officer to advise the Board of Inquiry on legal questions.

In 1959, in the light of two years' experience under the revised procedures, Part 303 was further revised to authorize a Member of the CAB to serve as Chairman of the Board of Inquiry and to provide for designation of a CAB "technical staff" to participate in the accident hearing by presenting factual material and questioning witnesses.

As a result of both the 1957 and 1959 revisions, a more complete factual record is developed in the course of a public hearing. Witnesses are first questioned by the Board's technical staff who has the responsibility of initially developing pertinent testimony. Following such questioning, the Parties to the Investigation are given the opportunity to ask questions of the witnesses for the purpose of

further developing or clarifying the record. All questioning is under control of the officer presiding, and matters which are not relevant to the accident but are concerned with the rights and liabilities of private persons arising out of the accident or other matters not pertinent to the accident are excluded from the proceeding.

Following the hearing, the rules provide that any person may submit his recommendations as to the proper conclusions to be drawn from the testimony and exhibits submitted at the hearing. After the investigation is completed and all the pertinent evidence is evaluated, the Board issues its report setting forth the probable cause of the accident.

February 17, 1961

CIVIL AERONAUTICS BOARD

BUREAU OF SAFETY

OFFICE OF DIRECTOR

The Office of the Director is responsible for:

1. The investigation of facts, conditions and circumstances surrounding aircraft accidents, their probable cause, the analysis and evaluation of information obtained and the preparation of accident reports for Board issuance.

2. The preparation of comments and recommendations, for transmission to the Administrator, Federal Aviation Agency, suggesting corrective action to improve safety in air commerce.

3. The preparation of comments and recommendations, for transmission to the Administrator, FAA, concerning proposed safety rules and standards.

4. Coordinating and directing the technical and administrative aspects of the Bureau's functions, and establishing basic policies and procedures for accident investigation and all other safety activities.

5. Initiating new or revised Safety Investigation Regulations.

6. Convening public inquiries to ascertain the cause of aircraft accidents when deemed necessary in the public interest, designating the presiding officer and technical members of the Board of Inquiry, and ordering the taking of depositions.

7. Recommending the convening of Special Boards of Inquiry in particular cases.

8. Consulting with and advising the Board Members on technical and safety matters, including matters in connection with the implementation of decisions of the International Civil Aviation Organization, and representing the Board on government, industry or public committees concerned with air safety.

OPERATIONS DIVISION

The Operations Division is responsible for providing specialist staff services in the area of aircraft operations (including transport, commercial, business, private or other types of aircraft), including meteorological factors, air traffic control procedures and airman characteristics. Within this area of specialization, the Division:

1. Participates in special safety studies and investigations of accidents, aeronautical hazards and safety incidents.

2. Participates in public inquiries by testifying and questioning witnesses, serves on Boards of Inquiry when designated.

3. Proposes to the Director the submission of recommendations for corrective actions to be forwarded to FAA and comments and recommendations on safety rules and standards proposed by FAA.

SAFETY INVESTIGATION DIVISION

The Safety Investigation Division is responsible for the coordination of all phases of accident investigation from the beginning of a field investigation through the preparation of the draft of the accident investigation report. It recommends to the Director that he order a public inquiry when required in the investigation of an aircraft accident, and is responsible for conducting such an inquiry. This Division also proposes, to the Director, the submission of recommendations to the FAA for corrective action to prevent the recurrence of accidents and promote safety in air commerce, and is responsible for keeping the Director currently advised of significant facts concerning aircraft accidents and for advising him of possible violations of Part 320 of the Board's Safety Investigation Regulations concerning the reporting of missing aircraft or of aircraft accidents.

ENGINEERING DIVISION

The Engineering Division is responsible for providing specialist staff service in the area of aircraft design and manufacture, including airframe, power plants, propellers, instruments, systems (hydraulics, electrical, etc.) radio and other electronic aids to navigation and traffic control. Within this area of specialization, the Division performs the following functions:

1. Participates in special safety studies and investigations of accidents, aeronautical hazards and safety incidents.

2. Participates in public inquiries by testifying and questioning witnesses, serves on Boards of Inquiry when designated.

3. Proposes to the Director the submission of recommendations for corrective actions to be forwarded to FAA and comments and recommendations on safety rules and standards proposed by FAA.

SAFETY ANALYSIS DIVISION

The Safety Analysis Division is responsible for:

1. Establishing and maintaining systems for the accumulation of basic air safety statistics.

2. Compiling safety statistics, analyzing them to determine causal factors and to identify potential aeronautical hazards and making recommendations for corrective action.

3. Making special statistical studies concerning safety in aviation and preparing safety bulletins for public distribution.

4. Establishing and maintaining a control index on sources of information related to air safety for use in accident investigation and promotion of safety in air commerce.

HEARING AND REPORTS

Hearing and Reports is responsible for:

1. Conducting aircraft accident investigation inquiries, the taking of depositions, including making arrangements for space and other facilities, issuing public notices, administering oaths, issuing subpenas, introducing evidence and providing the presiding officer.

2. Preparing and submitting to the Director accident investigation reports.

FIELD INVESTIGATION

Field Investigation is responsible for:

1. Investigating aircraft accidents, aeronautical hazards and safety incidents, coordinating and directing the activities of the accident investigation teams, consisting of specialists from the Bureau, FAA, and the operator and/or the manufacturer of the airframe, engine, propellers and/or accessories.

2. Participating in aircraft accident investigations by testifying and questioning witnesses.

USCOMM-DC-27206

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Approved: Melvin N. Gough 2/10/61
Director — Date prepared

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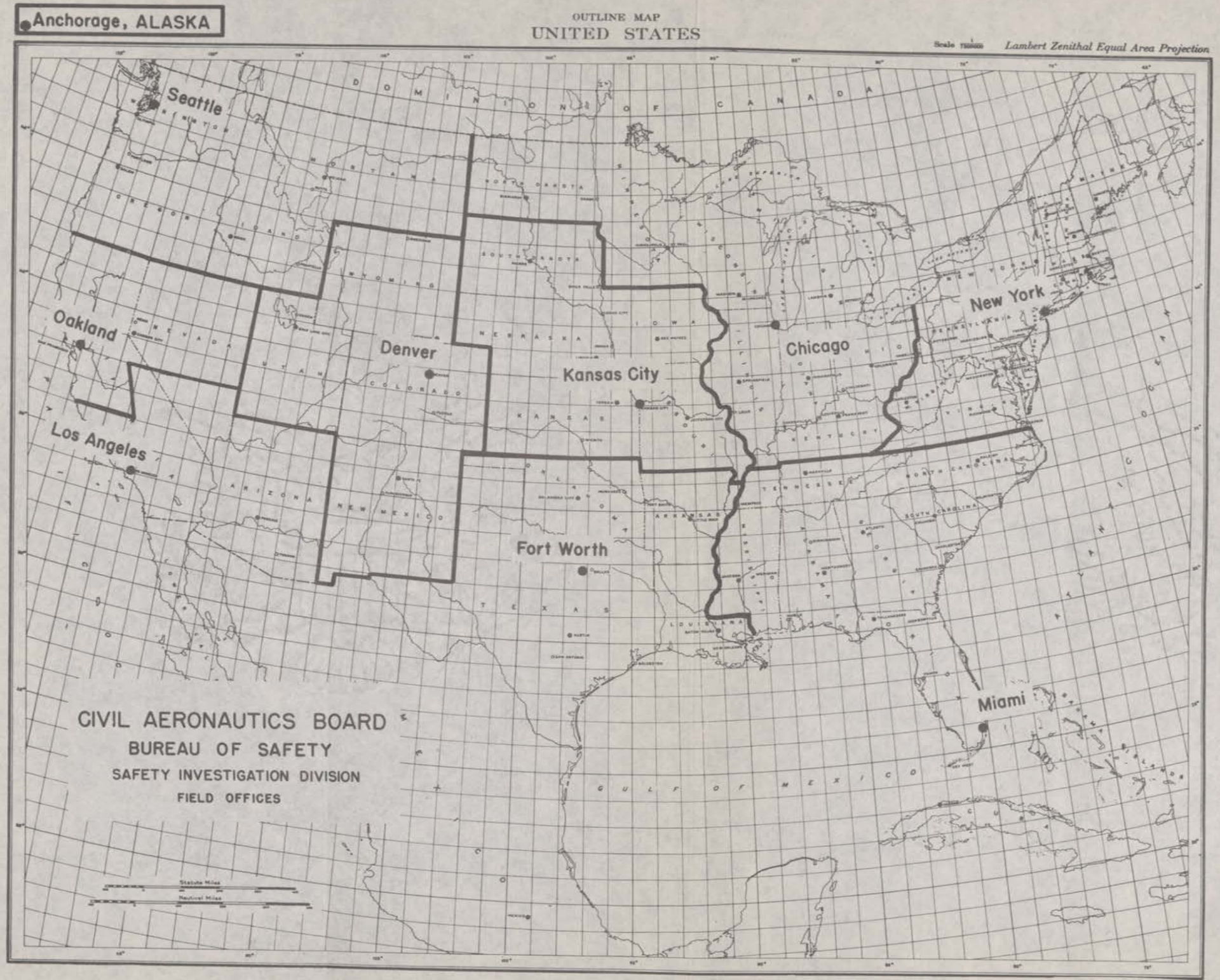

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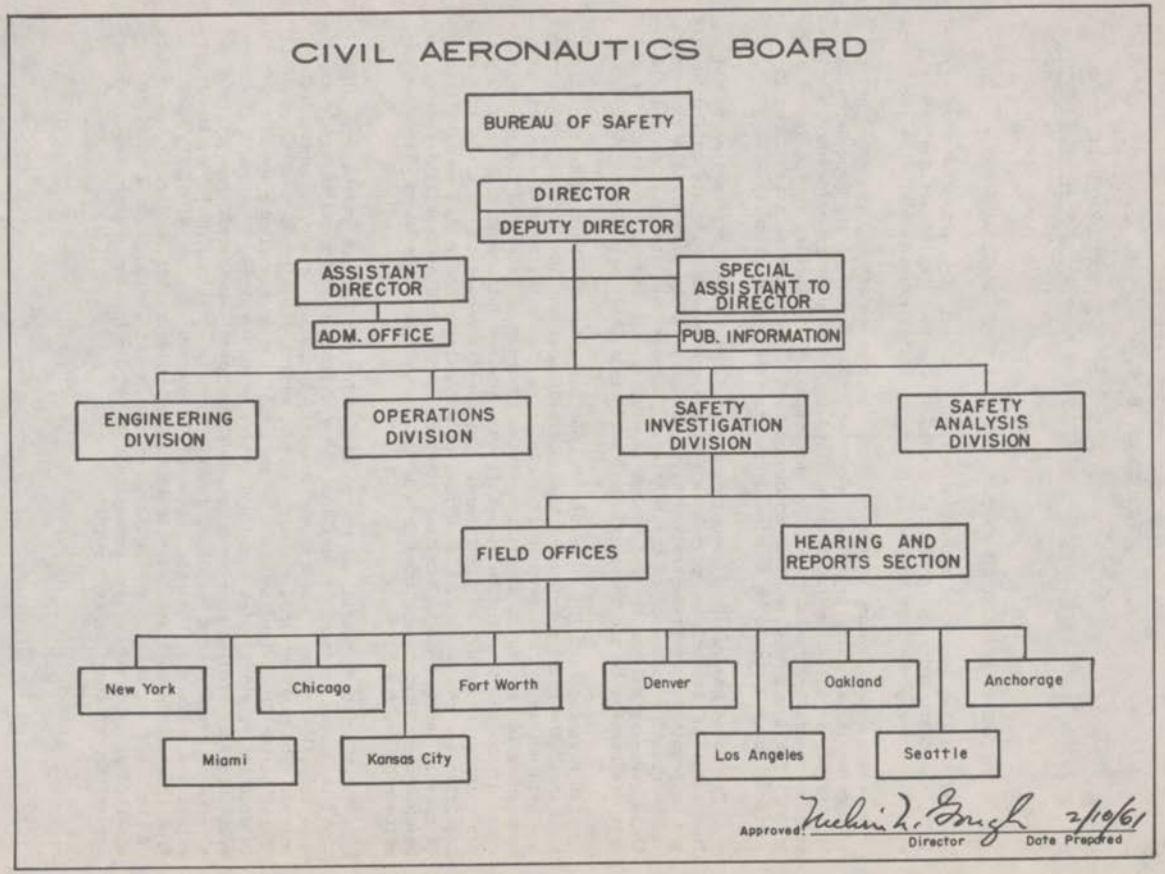

USCOMM-DC-27205

Regulation No. PR-35

UNITED STATES OF AMERICA
CIVIL AERONAUTICS BOARD
WASHINGTON, D. C.

PROCEDURAL REGULATIONS
Revision of Part 303
Adopted: March 19, 1959
Effective: March 21, 1959

RULES OF PRACTICE IN AIRCRAFT ACCIDENT INVESTIGATION HEARINGS

At the time the Board adopted a revision of Part 303, effective February 15, 1957, the Board indicated that it intended to re-evaluate its accident investigation hearing procedures in the light of experience gained under this regulation.

During the two years this regulation has been in effect, the Board has had an opportunity to fully appraise the revised procedures. These procedures have been highly satisfactory and have resulted in the development of a more complete factual record by providing for the participation of "Parties to the Investigation." The Board has therefore concluded that the procedures established in revised Part 303 should be continued with certain modifications.

The Board has received requests to expand the concept of "Parties to the Investigation" to include representatives of persons asserting claims for damages and to permit such representatives to participate in the prehearing conference and to question witnesses at the hearing. The Board has carefully considered these requests and has concluded that it would be undesirable to expand the concept of "Parties to the Investigation" to include these representatives.

In revising Part 303 to permit the participation of "Parties to the Investigation," the Board pointed out that aircraft accident investigation proceedings are held solely for the purpose of discovering the facts, conditions, and circumstances concerning an aircraft accident in order to determine the probable cause of the accident and to ascertain the measures which will best tend to prevent similar accidents in the future. The Board stressed the fact that these inquiries are not held for the purpose of determining the rights or liabilities of private parties and that matters dealing with rights or liabilities of private persons are therefore excluded from these proceedings. The Board wishes to reiterate this position.

The purpose of permitting the participation of "Parties to the Investigation" is not to enhance the position of these Parties or to confer any "rights" upon them, but rather to assist the Board in developing a more complete factual record. The manufacturer, the air carrier, or any other group designated as a "Party to the Investigation" must be in a position to contribute specific, factual information or skill which would not otherwise be supplied. Thus, all of the available fact-finding sources outside of the Board's own staff are utilized as a means of developing a complete, factual record. Section 701 (e) of the Federal Aviation Act clearly shows the intent of Congress to exclude liability questions from the Board's accident investigations in providing that no part of any report of the Board relating to any accident or the investigation thereof shall be admitted as evidence or used in any suit or action for damages growing out of any matter mentioned in such report.

C

During the period this regulation has been in effect, the Board has confined the issues strictly to matters relating to the probable cause of the accident and has excluded matters dealing solely with liability. On occasions the Board's objective has been made more difficult because some of the persons who have been designated by the Board as "Parties to the Investigation" have been represented by persons who also represent claimants or insurers. The Board intends to eliminate this practice in the future. We, of course, recognize the right of parties to designate their own representatives, but the Board cannot permit its statutory objective to be thwarted by the designation of persons whose interests lie beyond the legitimate scope of the accident investigation. Accordingly, no Party to the Investigation will be permitted to be represented by a person who also represents claimants or insurers, as prescribed in Sec. 303.16. Failure to comply with this provision shall result in loss of status as a "Party to the Investigation."

The Board has been requested to make available to persons other than "Parties to the Investigation" copies of exhibits for use during the public hearing. This appears to be a reasonable request and, to the extent possible the Board, in advance of the hearing, will make available at its office in Washington, D. C., or other appropriate designated location a separate set of exhibits for public inspection. A set of exhibits will also be made available for public use at the hearing.

While the Board intends to retain the concept of "Parties to the Investigation," we believe that certain modifications in these rules will further perfect and improve our hearing procedures. Sec. 303.9 will now provide that the Board of Inquiry may be composed of a Board Member, who shall serve as Chairman of the Board of Inquiry, the Director of the Bureau of Safety or his designee, and the General Counsel or his designee.

Sec. 303.8 provides for the designation of a "Technical Staff" of the Board who will participate in the public hearing by the presentation of factual material and by the examination of witnesses. Such an arrangement providing for the direct participation of the "Technical Staff" will thus eliminate the need for a member of the Board of Inquiry to testify in the proceeding. The Board believes this modification will enhance the ability of the Board of Inquiry to effectively appraise and evaluate the evidence of record.

A new Sec. 303.20 has been incorporated in the regulation to permit any person within 30 days after the close of the hearing to submit recommendations as to the proper conclusions to be drawn from the testimony and exhibits submitted at the hearing.

Since this Part is a rule of agency procedure and practice, notice and public procedure are not necessary.

In consideration of the foregoing, the Civil Aeronautics Board hereby amends Part 303 of the Procedural Regulations to read as follows, effective March 21, 1959.

PART 303 - RULES OF PRACTICE IN AIRCRAFT ACCIDENT INVESTIGATION HEARINGS

Sec.

303.1 Applicability of Part
303.2 Nature of hearing

INITIAL PROCEDURE

303.5 Determination to hold hearing
303.6 Hearing Officer
303.7 Notice of hearing
303.8 Technical Staff
303.9 Board of Inquiry

CONDUCT OF HEARING

303.15 Powers of Chairman of Board of Inquiry
303.16 Parties to the Investigation
303.17 Prehearing conference
303.18 Examination of witnesses
303.19 Evidence
303.20 Recommendations by interested persons
303.21 Stenographic transcript
303.22 Docket
303.23 Investigation to remain open
303.24 Request for withholding of information

§ 303.1 Applicability of Part. The provisions of this Part shall govern all aircraft accident investigation hearings conducted under the authority of Title VII of the Federal Aviation Act of 1958, unless otherwise specifically ordered by the Board.

§ 303.2 Nature of hearing. Aircraft accident hearings are held by the Board as a part of the investigation of accidents involving aircraft in order to determine the facts, conditions, and circumstances relating to each accident and the probable cause thereof and to ascertain measures which will best tend to prevent similar accidents in the future. It is purely a fact-finding procedure, and there are no formal pleadings or issues and no adverse parties. During the course of the hearing, no objections to any matter will be entertained from any party to the investigation or any other person. Aircraft accident hearings are not subject to the provisions of Sections 4, 5, 7, 8, or 10 of the Administrative Procedure Act.

INITIAL PROCEDURE

§ 303.5 Determination to hold hearing. The Director, Bureau of Safety, may, on behalf of the Board, order a hearing in any accident investigation whenever he deems it necessary in the public interest.

§ 303.6 Hearing Officer. The Director, Bureau of Safety, shall designate in writing a Hearing Officer who shall have the following powers:

(a) To give notice concerning the time and place of hearing;

(b) To issue subpoenas and to take or cause depositions to be taken in accordance with the provisions of Section 1004 of the Federal Aviation Act of 1958; and

(c) To designate parties to the investigation and to revoke such designations.

§ 303.7 Notice of hearing. The Hearing Officer shall designate a time and place for the hearing which meets the needs of the Board and gives due consideration to the convenience of the witnesses. The time and place of the hearing shall be published in the Notices Section of the Federal Register prior to the date of the hearing, unless such notice is impractical or unnecessary.1/

§ 303.8 Technical Staff. The Director, Bureau of Safety, shall designate members of the Board's Technical Staff who shall participate in the hearing and initially develop the testimony of the witnesses.

§ 303.9 Board of Inquiry. The Board of Inquiry shall consist of a Member of the Board, who, when present, will be chairman of the Board of Inquiry, the Hearing Officer, the Director of the Bureau of Safety or his designee, and where appropriate the General Counsel or his designee. It shall be the duty of the Board of Inquiry to examine witnesses and to secure in the form of a public record all known facts pertaining to the accident and surrounding circumstances and conditions from which probable cause may be determined or recommendations corrective action formulated.

CONDUCT OF HEARING

§ 303.15 Powers of Chairman of Board of Inquiry. The Board Member acting as chairman of the Board of Inquiry or, in the absence of a Board Member the Hearing Officer, shall have the following powers:

(a) To open, continue or adjourn the hearing;

(b) To administer oaths and affirmations;

(c) To determine the admissibility of and to receive evidence and to regulate the course of the hearing;

(d) To dispose of procedural requests or similar matters; and

(e) To take any other action necessary or incident to the orderly conduct of the hearing.

§ 303.16 Parties to the Investigation.

(a) The Hearing Officer may designate as Parties to the Investigation those persons, Government agencies, companies, and associations whose employees, functions, activities, or products were involved in the accident or who partic' pated in the accident investigation and whose special knowledge and aeronautic. skills contribute to the development of pertinent evidence.

1/ The Board ordinarily gives personal notice to all known interested persons and also publicizes the inquiry by a press release to aviation trade journals and local newspapers near the scene of the accident.

(b) No Party to the Investigation shall be represented by any person who also represents claimants or insurers. Failure to comply with this provision shall result in loss of status as a Party to the Investigation.

§ 303.17 Prehearing Conference. In their discretion, the chairman of the Board of Inquiry or the Hearing Officer may hold a prehearing conference with the Parties to the Investigation, the Technical Staff, and the representative of the Office of the General Counsel at a convenient time and place prior to the hearing. Copies of exhibits which are to be offered in evidence at the hearing will be furnished to the Parties to the Investigation prior to the prehearing conference if possible. There will also be furnished to the Parties copies of statements obtained from witnesses during the investigation or, if such statements are not available, a description of their anticipated testimony. At such prehearing conference, the Parties to the Investigation will indicate whether they desire to examine any such witnesses and the intended scope and area of such examination. They may also suggest additional witnesses, exhibits, or other evidence which in their opinion would be pertinent to the hearing.

§ 303.18 Examination of witnesses. (a) Witnesses will be examined by the Technical Staff. Following such examination, the Parties to the Investigation who have indicated at a prehearing conference their desire to examine such witnesses will be given an opportunity to do so. If a Party to the Investigation who has not indicated an intention to examine a witness desires to do so, he may submit a request to the officer presiding along with his justification as to why such examination is now deemed necessary. The officer presiding will then determine whether to permit the examination of the witness by the Party to the Investigation.

(b) Materiality, relevancy and competency of witnesses' testimony, exhibits or physical evidence will not be the subject of objections by a Party to the Investigation or any other person, but such matters will be controlled by rulings of the officer presiding on his own motion. If the examination of a witness by a Party to the Investigation is interrupted by a ruling of the officer presiding, opportunity will be given to show materiality, relevancy or competency of the testimony or evidence sought to be elicited from the witness.

§ 303.19 Evidence. The officer presiding shall receive all testimony and exhibits which might be of aid in determining the cause of the accident. He may exclude any testimony or exhibits which are not pertinent to the investigation or which are merely cumulative. He may withhold from public disclosure any evidence, pending a final determination by the Board as to whether it is in the public interest to release such evidence.

§ 303.20 Recommendations by interested persons. Any person may submit his recommendations as to the proper conclusions to be drawn from the testimony and exhibits submitted at the hearing. Fifteen (15) copies of such recommendations shall be submitted within 30 days after the close of the hearing, and shall be made a part of the docket.

§ 303.21 Stenographic transcript. A verbatim report of the hearing shall be taken. Copies of the transcript may be obtained by any interested person from the official reporter upon payment of the fees fixed therefor.

§ 303.22 Docket. The docket shall include the transcript, exhibits, brief and all other information concerning the accident which the Board has not ordered to be withheld from the public. A copy of the docket shall be made available to any person for review at the Washington office of the Board. Photostatic copies of exhibits may be obtained from the Chief, Docket Section, upon paying the cost of such copies.

§ 303.23 Investigation to remain open. Accident investigations are never officially closed but are kept open for the submission of new and pertinent evidence by any interested person. If the Director, Bureau of Safety, finds that such evidence is relevant and probative, it shall be made a part of the docket, and, where appropriate, Parties will be given an opportunity to examine such evidence and to comment thereon unless the Board orders it to be withheld from public disclosure.

§ 303.24 Request for withholding of information. Any person may make written objection to the public disclosure of information contained in any report or document filed pursuant to this Part or the provisions of the Federal Aviation Act of 1958, or of information obtained by the Board pursuant to the provisions of this Part or the Act, stating the grounds for such objection. Whenever such objection is made, the Board shall order such information withheld from public disclosure when, in its judgment, a disclosure of such information would adversely affect the interests of such person and is not required in the interest of the public.

(Section 204 (a), 72 Stat. 743; 49 U.S.C. 1324. Interpret or apply Sections 701, 702, 1001, 1004, 1104, 72 Stat. 781, 782, 788, 792, 797; 49 U.S.C. 1441, 1442, 1481, 1484, 1504.)

By the Civil Aeronautics Board:

/s/ Mabel McCart

Mabel McCart
Acting Secretary

(SEAL)

Regulation No. PR-8

UNITED STATES OF AMERICA
CIVIL AERONAUTICS BOARD
WASHINGTON, D. C.

Procedural Regulations
Promulgation of Part 311
Adopted: September 15, 1950
Effective: September 15, 1950

DISCLOSURE OF AIRCRAFT ACCIDENT INVESTIGATION INFORMATION

At the present time, the Procedural Regulations of the Board do not contain provisions regarding the disclosure by Board employees of information obtained during the course of an investigation of an accident involving aircraft. The purpose of this Part is to make provision therefor and to regulate the conduct of its employees in regard to the disclosure of aircraft accident investigation information.

The Board is required by section 702 of the Civil Aeronautics Act (49 U.S.C. 582) to investigate such accidents and report the facts, conditions, and circumstances relating to each accident and the probable cause thereof, and to make such recommendations as, in its opinion, will tend to prevent similar accidents in the future.

To perform this function, the Board has appointed air safety investigators who are assigned to the investigation of aircraft accidents. However, the Board's staff of accident investigators is very small in relation to the great number of accidents which must be investigated. In the fiscal year 1949 alone, more than 7,500 accidents involving aircraft were reported to the Board. Since the Board has less than 30 field employees assigned to accident investigation duties, "on the spot" investigations of such accidents have necessarily been limited to those kinds of accidents most likely to be productive of information leading to future improvements in air safety, even though valuable information as to aviation safety might have been obtained through such investigation of all accidents. Furthermore, the Board must employ specialists in aircraft design, metallurgy, aerodynamics, power plants, meteorology, electronics, and other technical phases of aviation. However, the Board is able to employ only one or two specialists in some of these technical fields. It cannot be predicted when a major crash will occur, and all Board investigators must be instantly ready to proceed to the scene of an accident immediately after it occurs. It would, therefore, substantially interfere with the performance of the Board's accident investigation duties if its employees were compelled to testify in all the cases of which they gain personal knowledge in the performance of their official duties with the Board.

The Board is not unmindful, however, of the possible hardships which confront private litigants, who often have great difficulty in establishing the facts relating to an aircraft accident. In order to preserve the wreckage, it is generally placed under guard and the public kept at a distance. However, air carriers and aircraft manufacturers are frequently invited to participate in the field investigation since their detailed technical and operating knowledge can contribute to the discovery of important evidence bearing upon the accident. Such participation in the public interest does, however, allow them a degree of

access to factual information regarding the accident not accorded to injured parties or the dependents of deceased persons who, not having the requisite technical background, are not permitted to take part in the investigation of the accident and, therefore, would not have equal access to such information. It would be an injustice in such cases for the Board to withhold from injured parties the only source of the facts in an accident investigation as to facts which are known only to those participating in an accident investigation. In light of the foregoing, the Board believes it to be in the interest of the public to release to all interested parties all factual information regarding an aircraft accident in its possession and to allow its employees to testify as to facts known to them when it is convinced that such facts cannot reasonably be established by any other witness or method.

Section 205 (b) of the Act authorizes the Board to cooperate with state and local authorities in connection with matters arising under the Act, and the Board believes it is in the public interest to cooperate with local authorities in investigations conducted by them in fulfillment of local governmental obligations. Therefore, the Board has decided to permit its employees to testify as to facts in coroners' investigations and grand jury proceedings conducted by a state or local government without regard to the availability of other witnesses.

The Board has consistently interpreted section 701 (e) thereof as forbidding the giving of opinion testimony by Board air safety investigators in civil suits between private litigants. The opinions of these experts, upon which the Board relies heavily in making its findings as to probable cause and recommendations in accident reports, are so inextricably entwined with the report that the basic purpose of section 701 (e) would be defeated were such opinion testimony permitted. Furthermore, apart from the provisions of 701 (e), the use of Board investigators as experts to give opinion testimony in civil suits between private parties would impose a serious burden on the Board's investigative staff, and would seriously interfere with the functioning of the Board's investigative processes. Consequently, the Board has prohibited its investigators from serving as expert witnesses or giving opinion testimony with regard to accidents investigated by them.

Since this regulation provides a rule of agency organization, procedure, and practice, notice and public procedure hereon are unnecessary.

In consideration of the foregoing, the Civil Aeronautics Board hereby amends the Procedural Regulations by adding a new Part 311 to read as follows, effective September 15, 1950:

PART 311 - DISCLOSURE OF AIRCRAFT ACCIDENT INVESTIGATION INFORMATION

§311.1 Finding as to the public interest. All accident reports and underlying papers in the office of the Bureau of Safety Investigation are in the custody of the Secretary of the Board subject to access by employees of the Board for purposes relating to their official duties. Employees have no control of such reports and papers, and no discretion with regard to permitting the use of them for any other purpose except as provided in this part. Employees are hereby prohibited from giving out any such reports, papers, or copies thereof to private parties or to local officers, or to testify in any court as to information in such reports or papers, or to produce such reports, papers, or copies thereof in

any court (whether in answer to subpoenas duces tecum or otherwise) except as provided in this part. Making such reports of underlying papers public other than as provided in this part is deemed to be contrary to the public interest and is hereby prohibited.

§311.2 Release of information concerning accidents. Information secured by the Board concerning accidents involving aircraft may be released only as follows:

(a) Regional Offices. Chiefs of Regions shall, upon request, release the following information concerning any accident at any time during or after the investigation of the accident:

(1) Place and date of the accident;

(2) Make, model, identification mark, and registered owner or operator of the aircraft involved;

(3) Names and addresses of the crew and other occupants of the aircraft or persons injured in the accident; and

(4) Information relating to any fatalities resulting from the accident and to the condition of injured persons (disclosure of this information must be qualified by the statement that such information is based on reports of physicians or hospitals).

(b) The Washington Office. The Director of the Bureau of Safety Investigation or such person in the Washington office as he may designate shall, upon request, release the information described in §311.2 (a) above. In addition, the Director or such designee shall, upon request:

(1) Release the names of witnesses and their addresses;

(2) Make replies as to facts in answer to specific inquiries, either verbal or written, concerning aircraft accidents, and shall furnish copies of documents in accident files, provided the expense of making such copies is borne by the recipient. In both instances, however, any suggestion, opinion, or recommendation made by any employee of the Board or any employee of the Civil Aeronautics Administration, when acting on behalf of the Board, shall be omitted; and

(3) Make available for inspection that portion of the file containing data pertinent to the accident but shall not make available that portion of the file containing any opinion, suggestion, or recommendation of any employee of the Board or any employee of the Civil Aeronautics Administration, when acting on behalf of the Board.

§311.3 Disclosure of information by testimony in court. No Board employee shall make public by testimony in court aircraft accident information obtained by him in the performance of his official duties, except in accordance with the following:

(a) Testimony of employees. Employees may serve as witnesses for the purpose of testifying to the facts observed by them in the course of accident

investigations in those cases in which an appropriate showing has been made tha the facts desired to be adduced are not reasonably available to the party seeking such evidence by any other method, including the use of discovery procedures against the opposing party. Employees shall testify only as to facts actually observed by them in the course of accident investigations and shall not give opinion evidence as expert witnesses.

(b) State and local investigations. Employees may testify in a coroner's inquest and a grand jury proceeding by a state or local government only as to facts actually observed by them in the course of accident investigations and shall not give opinion evidence as expert witnesses.

(c) Testimony by deposition. Insofar as possible, testimony of employees will be made available only through depositions taken at times and places reasonably fixed so as to avoid substantial interference with the performance of the duties of the employees concerned.

(d) Request for testimony of employees. A request for testimony of a Board employee relating to an aircraft accident shall be addressed to the General Counsel of the Board, who shall have power to approve or deny such a request. Such request shall set forth the reasons for desiring the testimony and facts showing that it conforms to the Board policies set forth above.

(e) Procedure in the event of a subpoena. If any employee receive a subpoena to produce accident reports or underlying papers or to testify in court as to accident information, the employee shall immediately notify the Director, Bureau of Safety Investigation by telegram. He shall give the title of the case, and identify the accident by name; the name of the judge, if available and the title and address of the court; the date on which he is directed to appear; the name, address and telephone number, if available, of the attorney representing the party initiating the request; the scope of the testimony, if known, and whether or not the evidence is available elsewhere. The Director will immediately, upon receipt of notice that an employee has been subpoenaed, inform the General Counsel of the Board. The General Counsel will either give the employee permission to testify or make arrangements with the court to have him excused from testifying. Until one of these actions is taken the employee shall appear in court in response to the subpoena and respectfully decline to testify or to produce the records called for, on the grounds that this part prohibits such conduct.

(Secs. 205, 701, 702; 52 Stat. 984, 1012, 1013; 49 U.S.C. 425, 581, 582)

By the Civil Aeronautics Board:

/s/ M. C. Mulligan

M. C. Mulligan
Secretary

(SEAL)

[Reprinted from FEDERAL REGISTER of February 28, 1959]

CIVIL AERONAUTICS BOARD, SAFETY INVESTIGATION REGULATIONS, EFFECTIVE FEBRUARY 28, 1959

Title 14—CIVIL AVIATION

Chapter I—Civil Aeronautics Board

SUBCHAPTER D—SAFETY INVESTIGATION REGULATIONS

[Reg. No. SIR-1]

PART 320—NOTIFICATION AND REPORTING OF AIRCRAFT ACCIDENTS AND OVERDUE AIRCRAFT

Adopted by the Civil Aeronautics Board at its office in Washington, D.C., on the 24th day of February 1959.

Under the Civil Aeronautics Act the Board could permit the Administrator, by delegation of authority, to investigate accidents and determine the probable cause thereof. Such a delegation was in fact made by the Board with respect to accidents of fixed-wing aircraft having a maximum take-off weight of 12,500 pounds, 18 F.R. 7499. Subpart A of Part 62 of the Civil Air Regulations reflected this delegation to the Administrator of Civil Aeronautics.

The Federal Aviation Act of 1958 repealed the Board's authority to delegate its accident investigation function to the Administrator, thereby rendering the outstanding delegation void. The new Act contemplates that the accident investigation function is to be performed by the Board itself. Therefore, in lieu of a power of delegation of the function, the new Act merely permits the Board to request the Administrator of the Federal Aviation Agency to investigate the facts and circumstances surrounding aircraft accidents and to report them to the Board, the function of determining probable cause being reserved to the Board in all cases.

The Board recently issued Public Notice PN-13, effective December 31, 1958, requesting the Administrator of the Federal Aviation Agency to investigate all civil aircraft accidents involving fixed-wing aircraft which have a maximum gross take-off weight of 12,500 pounds or less, except accidents involving aircraft operated by certificated Alaskan air carriers and accidents involving fatal injuries to any occupant of the aircraft, 23 F.R. 10492. This request to the Administrator is necessary because sufficient funds have not been made available to the Board to provide adequate facilities and personnel to handle the additional workload prescribed by the Act. Therefore, the request is temporary and may be rescinded by the Board through written notice to the Administrator.

This change in the law and arrangements necessitates changes in the existing reporting regulation which are not of a substantive nature. The substance of the regulation is being transferred to Subchapter D—Safety Investigation Regulations as new Part 320. Subpart A now contains the notifying and reporting requirements applicable to accidents investigated by the Board itself, while Subpart B contains those applicable to the accidents investigated by the Administrator pursuant to PN 13. Subpart B reflects the fact that under the present request of the Board as set forth in PN 13, accidents involving fatalities on board aircraft are excluded, as well as the fact that Subpart B is applicable only as long as the request remains outstanding in its present form.

As before, violations of either subpart of Part 320 will constitute violations of Board regulations which will be prosecuted by the Board's Office of Compliance under the provisions of the Act applicable to violations of Title VII and rules made thereunder.

Since there are no substantive changes made in this regulation and it does not impose any additional burdens on any person, public notice and proceedings hereon are not required and not in the public interest, and the new regulation may be made effective before the expiration of 30 days from the time of its publication.

Accordingly, the Board, effective upon publication in the FEDERAL REGISTER, i.e., February 28, 1959:

(1) Repeals Part 62 of the Civil Air Regulations (14 CFR, Chapter I, Subchapter A, Part 62);

(2) Changes the designation of Subchapters D and E of its regulations (14 CFR, Chapter I) to Subchapters E and F, respectively; and

(3) Promulgates a new subchapter of its regulations to read as follows:

APPLICABILITY AND DEFINITIONS

Sec.
320.1 Applicability of this part.
320.2 Definitions.

Subpart A—Notification and reporting to the Civil Aeronautics Board

320.4 Applicability of Subpart A of this part.

NOTIFICATION REQUIREMENTS

320.5 When notification is to be given.
320.6 Responsibility for giving notification.
320.7 To whom notification is directed.
320.8 Information to be given in notification.

REPORTING REQUIREMENTS

320.10 When a report is made.
320.11 Responsibility for making report.
320.12 Form of report and contents.
320.13 To whom the report is directed.

PRESERVATION OF AIRCRAFT WRECKAGE AND RECORDS

320.15 Preservation of wreckage and records.
320.16 Prohibition against removing or disturbing wreckage and records.
320.17 Recording of original position and condition of wreckage.
320.18 Release of wreckage.

NOTIFICATION OF OVERDUE AIRCRAFT

320.20 When notification is to be given.

Subpart B—Notification and reporting to the Administrator of the Federal Aviation Agency

Sec.
320.30 Applicability of Subpart B of this part.

NOTIFICATION REQUIREMENTS

320.31 When notification is to be given.
320.32 Responsibility for giving notification.
320.33 To whom notification is directed.
320.34 Information to be given in notification.

REPORTING REQUIREMENTS

320.38 When a report is made.
320.39 Responsibility for making report.
320.40 Form of report and contents.
320.41 To whom the report is directed.

PRESERVATION OF AIRCRAFT WRECKAGE AND RECORDS

320.45 Preservation of aircraft wreckage and records.
320.46 Prohibition against removing or disturbing aircraft wreckage and records.
320.47 Recording of original position and condition of wreckage.
320.48 Release of wreckage.

NOTIFICATION OF OVERDUE AIRCRAFT

320.50 When notification is to be given.

AUTHORITY: §§ 320.1 to 320.50 issued under sec. 204(a), 72 Stat. 743, 49 U.S.C. 1324. Interpret or apply sec. 701(a)(d)(f), 72 Stat. 781, 49 U.S.C. 1441.

APPLICABILITY AND DEFINITIONS

§ 320.1 Applicability of this part.

This part establishes requirements for the notification and reporting of accidents involving civil aircraft in the United States, its Territories and Possessions, and aircraft of United States registry wherever they occur. It further establishes requirements for the notification of overdue aircraft. Subpart A of this part covers the notification and reporting to be made to the Civil Aeronautics Board, while Subpart B covers the notification and reporting to be made to the Administrator of the Federal Aviation Agency concerning those aircraft the accidents of which are investigated by the Administrator pursuant to request by the Board under section 701(f) of the Federal Aviation Act of 1958.

§ 320.2 Definitions.

As used in this part the words listed below shall be defined as follows:

(a) *Act.* "Act" means the Federal Aviation Act of 1958, 72 Stat. 731, 49 U.S.C. 1301 et seq.

(b) *Administrator.* "Administrator" means the Administrator of the Federal Aviation Agency.

(c) *Board.* "Board" means the Civil Aeronautics Board.

(d) *Aircraft accident.* An aircraft accident is an accident which occurs during the starting or warming up of an engine or engines, or operation of an aircraft, which results in serious or fatal

injury to one or more persons or in substantial damage to any aircraft, or which involves a collision of two or more aircraft. Whenever serious or fatal injury results from contact with a rotating propeller which is installed on an aircraft, it shall be considered an aircraft accident.

(e) *Aircraft accident incident to flight.* An aircraft accident incident to flight is an aircraft accident which occurs between the time an engine or engines are started for the purpose of commencing flight until the aircraft comes to rest with all engines stopped for complete or partial deplaning or unloading. It excludes death or injuries to persons on board which result from illness, altercations, and other incidents not directly attributable to flight operation.

(f) *Aircraft accident not incident to flight.* An aircraft accident not incident to flight is an aircraft accident other than one defined in paragraph (e) of this section as incident to flight.

(g) *Operator.* An operator of aircraft is the person who causes or authorizes the operation of the aircraft, such as the owner or lessee of an aircraft.

(h) *Fatal injury.* A fatal injury is an injury which results in death within 30 days.

(i) *Serious injury.* A serious injury is an injury which requires hospitalization and medical treatment for a period of five or more days, or results in a fracture of any bone (except simple fractures of fingers, toes, or nose), lacerations which cause severe hemorrhages, or involve muscles, injury to any internal organ, or second or third degree burns or any burns involving more than five percent of the body surface: *Provided,* That the injury does not result in death within 30 days.

(j) *Substantial damage.* Substantial damage is damage which necessitates major overhaul of the aircraft or the replacement of or extensive repairs to any major component or combination of components of the aircraft. It does not include damage such as scraped wing tips, bent fairing or cowling, small punctured holes in the skin or fabric, dented skin or trailing edge, repairable damage to propeller blades, or damage to tires, engine accessories, or brakes.

(k) *Small fixed-wing aircraft.* Fixed-wing aircraft having a maximum certificated take-off weight of 12,500 pounds or less.

Subpart A—Notification and Reporting to the Civil Aeronautics Board

§ 320.4 Applicability of Subpart A of this part.

The provisions of this subpart apply to all aircraft except those investigated by the Administrator pursuant to an outstanding request by the Board under section 701(f) of the Act.

NOTE: By Public Notice PN 13, 23 F.R. 10492, effective December 31, 1958, the Board requested the Administrator to investigate all civil aircraft accidents involving fixed-wing aircraft which have a certificated maximum gross take-off weight of 12,500 pounds or less, except accidents involving aircraft operated by air carriers authorized by certificate of public convenience and necessity to engage in air transportation in the State of Alaska, and accidents in which fatal injuries have occurred to any occupants of such aircraft. Amendments to, or rescission of, this public Notice will be published in the FEDERAL REGISTER.

NOTIFICATION REQUIREMENTS

§ 320.5 When notification is to be given.

Immediate notification shall be given of any aircraft accident involving aircraft within the applicability of this subpart. Immediate notification also shall be given of any occurrence of fire involving any of the components or systems aboard the aircraft when incident to flight, regardless of the extent of injury to occupants or damage to the aircraft.

§ 320.6 Responsibility for giving notification.

The operator of the aircraft shall be responsible for giving notification as provided in § 320.5.

§ 320.7 To whom notification is directed.

The notification shall be directed to the Civil Aeronautics Board direct or through its nearest office. The notification shall be sent by the most expeditious means of communication available.

§ 320.8 Information to be given in notification.

The notification shall include the following information concerning the accident, if available: Location, date, time of day, number of persons involved, injuries to each, aircraft identification including registration number, aircraft make and model, names of crew members, operator, and briefly the nature of circumstances surrounding the accident.

REPORTING REQUIREMENTS

§ 320.10 When a report is made.

A written report shall be made of every aircraft accident incident to flight involving aircraft of United States registry wherever it may occur.[1] A written report will not be required on any aircraft accident not incident to flight, unless the operator has been requested to make such a report by an authorized representative of the Civil Aeronautics Board.

§ 320.11 Responsibility for making report.

The operator of the aircraft involved in the accident shall be responsible for making the written report required by § 320.10. The report shall be made as soon as practicable and good cause shown in writing for any delay over 10 days. Each member of the crew involved in the accident, if physically able at the time of the submission of the rep shall attach thereto a signed staten setting forth the facts, conditions, and circumstances pertinent to the accident. If incapacitated at the time of the submission of the report, each crew member shall submit a statement as soon as physically able.

§ 320.12 Form of report and contents.

The report shall be made in duplicate on an accident report form furnished by the Civil Aeronautics Board and shall contain all available information required therein.[2]

§ 320.13 To whom the report is directed.

The report shall be mailed or delivered to the office or representative of the Civil Aeronautics Board nearest the residence of the operator involved, or as otherwise directed by an authorized representative of the Civil Aeronautics Board.[3]

PRESERVATION OF AIRCRAFT WRECKAGE AND RECORDS

§ 320.15 Preservation of wreckage and records.

Aircraft wreckage and records thereof involved in or pertaining to an aircraft accident shall be preserved for the Board by the operator.[4]

§ 320.16 Prohibition against removing or disturbing wreckage and record[4]

Aircraft wreckage or records the involved in or pertaining to an aircraft accident shall not be disturbed or removed, unless specific permission is granted by an authorized representative of the Civil Aeronautics Board, except where necessary (a) to give assistance to persons injured or trapped therein, (b)

[1] Refer to definitions contained in paragraphs (d), (e), and (f) of § 320.2.

[2] Report Forms CAB 454 and, for small fixed-wing aircraft accidents, ACA 2400, are available from the Washington offices of the Civil Aeronautics Board, Universal Building, Washington 25, D.C., and from all field offices of the Board.

[3] The locations of the field offices of the Board are as follows:

New York Office: Room 101, Federal Building, New York International Airport, Jamaica, N.Y.

Miami Office: P.O. Box 931, Miami International Airport Branch, Miami 48, Fla.

Chicago Office: 6127 West Cermak Road, Cicero, Ill.

Kansas City Office: 4825 Troost Avenue, Kansas City 10, Mo.

Fort Worth Office: P.O. Box 105, Fort Worth 1, Tex.

Los Angeles Office: Pacific Building, 1725 Centinella Avenue, Inglewood, Calif.

Oakland Office: P.O. Box 2386, Oakland Airport Station, Oakland 14, Calif.

Seattle Office: Room 202, Administration Building, King County Airport, Seattle 8, Wash.

Anchorage Office: P.O. Box 2219, Anchorage, Alaska.

[4] Where accidents occur outside of United States, its Territories, or possessi the operator shall only be responsible for taking such measures for preserving aircraft wreckage or records as may legally be taken in the place where the accident occurs.

to protect such wreckage from further serious damage, or (c) to protect the public from injury.

§ 320.17 Recording of original position and condition of wreckage.

Whenever wreckage is moved in accordance with the provisions of § 320.16, prior to the removal, sketches or photographs shall be made of the original position and condition of the wreckage and marks on the ground, and any pertinent data which cannot be effectively photographed shall be recorded, unless the resultant delay would endanger the lives of persons injured or trapped, or unless essential public interests can be protected only by immediate movement. In any event, movement of the wreckage shall be so accomplished as to entail the minimum possible disturbance thereof, and shall be preserved in accordance with the provisions of § 320.15.

§ 320.18 Release of wreckage.

Aircraft wreckage or records thereof involved in or pertaining to an aircraft accident shall not be released for repair, salvage, disposal, or any other purpose until permission is granted by an authorized representative of the Civil Aeronautics Board.

NOTIFICATION OF OVERDUE AIRCRAFT

320.20 When notification is to be given.

When an aircraft is overdue and the operator believes that it has been involved in an accident, the operator shall immediately notify the Civil Aeronautics Board in accordance with the provisions of §§ 320.7 and 320.8. In addition, it shall be the responsibility of the operator to furnish such records pertinent to the flight as may be requested by the Civil Aeronautics Board.

NOTE: The reporting and record-keeping requirements contained herein have been approved by the Bureau of the Budget in accordance with the Federal Reports Act of 1942.

Subpart B—Notification and Reporting to the Administrator of the Federal Aviation Agency

§ 320.30 Applicability of Subpart B of this part.

The provisions of this subpart apply only to those aircraft which are investigated by the Administrator pursuant to an outstanding request by the Board under section 701(f) of the Act.

NOTE: See note under § 320.4.

NOTIFICATION REQUIREMENTS

§ 320.31 When notification is to be given.

In the case of aircraft within the applicability of this subpart, immediate notification shall be given when any aircraft accident incident to flight occurs which (a) is known or believed to have resulted from structural failure of an aircraft, aircraft engine, or propeller, (b) involves collision of two or more aircraft in the air, or (c) results in serious injury to any person, or fatal injury to any person not an occupant of the aircraft. Notification shall also be given of any occurrence of fire involving any of the components or systems on board the aircraft when incident to flight, regardless of the extent of injury to occupants or damage to the aircraft.

NOTE: Accidents involving fatal injury to occupants of the aircraft are investigated by the Board. See note under § 320.4.

§ 320.32 Responsibility for giving notification.

The pilot or pilots, or, if the pilots are incapacitated, the operator shall be responsible for giving such notification.

§ 320.33 To whom notification is directed.

The notification shall be directed to the nearest Federal Aviation Agency communications station, aviation safety district office, or aviation safety inspector.

§ 320.34 Information to be given in notification.

The notification shall include the following information concerning the accident, if available: Location, date, time of day, number of persons involved, injuries to each, aircraft identification including registration number, aircraft make and model, names of crew members, operator, and briefly the nature of circumstances surrounding the accident.

REPORTING REQUIREMENTS

§ 320.38 When a report is made.

A written report shall be made of every aircraft accident incident to flight involving aircraft of United States registry wherever it may occur, when there is serious injury or fatal injury to a nonoccupant of the aircraft, or where the reasonably estimated cost of repair is $100 or more. A written report may also be required for an aircraft accident not incident to flight, or for any accident involving minor injury or less than $100 estimated cost of repair if the pilot, owner, or operator is requested by an authorized representative of the Federal Aviation Agency to furnish it.

§ 320.39 Responsibility for making report.

The pilot or operator of the aircraft involved in the accident shall be responsible for making the written report required by § 320.38. The report shall be made as soon as possible and good cause shown in writing for any delay over seven days. If the operator is not the pilot, then each pilot involved in the accident, if physically able at the time of the submission of the report, shall sign the report or attach thereto a signed statement setting forth the facts, conditions, and circumstances pertinent to the accident. If incapacitated at the time of the submission of the report, each pilot shall submit such a statement as soon as he is physically able to do so.

§ 320.40 Form of report and conten

The report shall be made in triplica on an accident report form furnished the Federal Aviation Agency and sh contain all available information r quired therein.

§ 320.41 To whom the report is rected.

The report shall be mailed or deliver to the nearest aviation safety district regional office of the Federal Aviati Agency. However, where a State agreement with the Agency actively pa ticipates in the investigation of non-a carrier accidents and the accide occurred in that State, a State aviati official or investigator is authorized receive such report and exhibits in beha of the Agency.

NOTE: Where a State aviation authority r ceives such an accident report and exhibi or conducts the ... stigation in behalf the Agency, distribution of the copies of t report shall be in accordance with the agre ment with the Agency.

PRESERVATION OF AIRCRAFT WRECKAGE AN RECORDS

§ 320.45 Preservation of aircraft wrec age and records.

Aircraft wreckage and records there involved in or pertaining to an accide of which notification must be given u der the provisions of § 320.31 shall b preserved for the Agency by the pilo owner, or operator.[1] Wreckage of ai craft involved in accidents not requirin notification under § 320.31 need not b preserved, unless specifically ordered b an authorized representative of the Fed eral Aviation Agency.

§ 320.46 Prohibition against removin or disturbing aircraft wreckage an records.

Aircraft wreckage and records there involved in or pertaining to an accide of which notification must be given unde the provisions of § 320.31 shall not b disturbed or removed, unless specific per mission is granted by an authorized rep resentative of the Federal Aviatio Agency, except where necessary (a) t give assistance to persons injured o trapped therein, (b) to protect suc wreckage from further serious damag or (c) to protect the public from injury

§ 320.47 Recording of original positio and condition of wreckage.

Whenever wreckage is moved in ac cordance with the provisions of § 320.46 prior to the removal, sketches or photo graphs shall be made of the original posi tion and condition of the wreckage and marks on the ground, and any pertinen data which cannot be effectively photo graphed shall be recorded, unless the re sultant delay would endanger the lives o

[1] Where accidents occur outside of the United States, its Territories, or possessions the operator shall only be responsible for taking such measures for preserving aircraft wreckage or records as may legally be taken in the place where the accident occurs.

persons injured or trapped, or unless essential public interests can be protected only by immediate movement. In any event, movement of the wreckage shall be so accomplished as to entail the minimum possible disturbance thereof, and shall be preserved in accordance with the provisions of § 320.45.

§ 320.48 Release of wreckage.

Aircraft wreckage or records thereof involved in or pertaining to an accident of which notification must be given under the provisions of § 320.31 shall not be released for repair, salvage, disposal, or any other purpose until permission is granted by an authorized representative of the Federal Aviation Agency.

NOTIFICATION OF OVERDUE AIRCRAFT

§ 320.50 When notification is to be given.

When an aircraft is overdue and the operator or owner believes that it has been involved in an accident, the operator or owner shall immediately notify the Federal Aviation Agency in accordance with the provisions of §§ 320.32 through 320.34. In addition, it shall be the responsibility of the owner or operator to furnish such records pertinent to flight as may be requested by the Federal Aviation Agency. If the aircraft is still missing upon the expiration of seven days, the reporting provisions of §§ 320.38 through 320.41 shall be complied with.

By the Civil Aeronautics Board.

[SEAL] MABEL MCCART,
Acting Secretary.

[F.R. Doc. 59-1792; Filed, Feb. 27, 1959; 8:51 a.m.]

Regulation No. SIR-2

UNITED STATES OF AMERICA
CIVIL AERONAUTICS BOARD
WASHINGTON, D. C.

SAFETY INVESTIGATION REGULATIONS
Enactment of Part 321
Adopted: March 9, 1959
Effective: March 13, 1959

PART 321 - INSPECTION OF RECORDS, FACILITIES AND EQUIPMENT

Under Section 701 (a) of the Federal Aviation Act of 1958, it is the duty of the Board to investigate and determine the probable cause of accidents and, as a separate responsibility, to ascertain what will best tend to reduce the possibility of, or recurrence of, accidents by conducting special studies and investigations on matters pertaining to safety in air navigation and the prevention of accidents. In the performance of these duties under the Civil Aeronautics Act of 1938, as amended, the Board promulgated regulations implementing its inspection authority relative to its powers and duties under Title VII, and such provisions were set forth in detail in the various Civil Air Regulations. In addition, Part 240 of the Board's Economic Regulations construes the issuance of a prescribed identification card and credentials to an employee of the Board's Bureau of Safety Investigation as constituting an order and direction of the Board to such individual to inspect the equipment and records of an air carrier.

In connection with the transfer by the Federal Aviation Act of 1958 of the Board's safety regulatory functions to the new Federal Aviation Agency, certain changes in the Civil Air Regulations were deemed necessary by the Administrator of the Federal Aviation Agency in order to conform these regulations to the provisions of the new Act. The Administrator, therefore, issued an amendment, effective December 31, 1958 (24 FR 4), to the Civil Air Regulations which revised the references therein to the Administrator of Civil Aeronautics and deleted certain provisions pertaining to the safety inspection authority of the Board. The result is that the the full scope of the Board's inspection authority under Title VII of the Act is not presently completely set forth in regulatory form.

The Board presently has under preparation new regulations which will fully cover the Board's activities in the accident investigation and accident prevention fields, and it is expected that these regulations will be issued in the very near future. However, in order that the Board's powers of inspection and investigation be set forth in a form readily available to the public during the interim period, it is necessary that a regulation be promulgated spelling out the Board's authority to inspect or examine aircraft, equipment, facilities, personnel and records pertinent thereto or other matters relevant to the performance of the Board's duties under Title VII.

The provisions contained in this regulation are substantially those which were spelled out throughout the Civil Air Regulations and Part 240, and, in effect, continue those provisions. No person will be subjected to any additional requirements.

Therefore, and for the reasons stated above, the Board finds that a situation exists requiring immediate action in the interest of safety, that notice and public procedure hereon are unnecessary, and that good cause exists for making this regulation effective on less than 30 days' notice.

In consideration of the foregoing, the Civil Aeronautics Board hereby makes and promulgates the following Safety Investigation Regulation, effective March 13, 1959, to read as follows:

PART 321 - INSPECTION OF RECORDS, FACILITIES AND EQUIPMENT

Upon demand of an authorized representative of the Board and presentation of the credentials issued to such representative, any air carrier, airman, or person engaged in air commerce or in any phase of aeronautics, and any other person having possession or control of any aircraft, aircraft engine, propeller, appliance, air navigation facility, equipment, or any pertinent records and memoranda, including all documents, papers and correspondence now or hereafter existing and kept or required to be kept, shall forthwith permit inspection, photographing or copying thereof by such authorized representative for the purpose of the investigation of an accident or any special study or investigation pertaining to safety in air navigation or the prevention of accidents. Authorized representatives of the Board may interrogate any person having knowledge relevant to such study or investigation.

(Section 204 (a), 72 Stat. 743; 49 U.S.C. 1324 (a). Interpret or apply Sections 701, 702, 703, 1004, 72 Stat. 781, 782, 792; 49 U.S.C. 1441, 1442, 1443, 1484.)

By the Civil Aeronautics Board:
/s/ Mabel McCart

Mabel McCart
Acting Secretary

(SEAL)

DEFINITIONS OF AIRCRAFT ACCIDENT

Aircraft Accident

An aircraft accident is an accident which occurs during the starting or warming up of an engine or engines, or operation of an aircraft, which results in serious or fatal injury to one or more persons or in substantial damage to any aircraft, or which involves a collision of two or more aircraft. Whenever serious or fatal injury results from contact with a rotating propeller which is installed on an aircraft, it shall be considered an aircraft accident.

Aircraft Accident Incident to Flight

An aircraft accident incident to flight is an aircraft accident which occurs between the time an engine or engines are started for the purpose of commencing flight until the aircraft comes to rest with all engines stopped for complete or partial deplaning or unloading. It excludes death or injuries to persons on board which result from illness, altercations, and other incidents not directly attributable to flight operation.

Aircraft Accident not Incident to Flight

An aircraft accident not incident to flight is an aircraft accident other than one defined in paragraph two as incident to flight.

February 10, 1961

AIRCRAFT ACCIDENT INVESTIGATION PROCEDURES AND TECHNIQUES EMPLOYED BY THE CIVIL AERONAUTICS BOARD

Accident investigation is recognized today as one of the fundamental elements of a sound program for improved safety and accident prevention. The real purpose of accident investigation is to save lives by finding out exactly why an accident happened, how it happened, and any contributing causes so that preventive measures can be taken against the recurrence of similar accidents. Another objective of accident investigation - one that is extremely important by itself - is to lessen the economic impact of the accident by rapidly pinpointing the defect so that corrective measures can be quickly instituted to ensure the continued utility of like products that are in service. As an illustration, consider the economic impact on the aviation industry and on the country as a whole should there by one mysterious accident involving one of the new jet transport types.

In the civil aviation field the Civil Aeronautics Board is the government agency charged with the responsibility of investigating all aircraft accidents in the United States which involve civil aircraft. This includes accidents involving aircraft of both foreign and U. S. Registry. This responsibility was originally imposed on the Board by the Civil Aeronautics Act of 1938, and the Federal Aviation Act of 1958 continued the Board's authority in this area. Frequently, with the permission of foreign governments, Board investigators participate in investigations on foreign soil if the aircraft was of U. S. registry and, occasionally, our investigators are asked to assist in military accident investigations and investigations of accidents on foreign soil involving aircraft of foreign registry but of U. S. manufacture. The Federal Aviation Act of 1958 charged the Civil Aeronautics Board with the following duties relative to aircraft accident investigation:

"Sec. 701. (a) It shall be the duty of the Board to:

(1) Make rules and regulations governing notification and report of accidents involving civil aircraft;

(2) Investigate such accidents and report the facts, conditions, and circumstances relating to each accident and the probable cause thereof;

(3) Make such recommendations to the Administrator as, in its opinion, will tend to prevent similar accidents in the future;

(4) Make such reports public in such form and manner as may be deemed by it to be in the public interest; and

(5) Ascertain what will best tend to reduce or eliminate the possibility of, or recurrence of, accidents by conducting special studies and investigations on matters pertaining to safety in air navigation and the prevention of accidents."

Aircraft accidents occur at a never-ending variety of places - on rugged mountain peaks, in large bodies of water, dense jungles, deserts, swamps, farmland, forests, on airports, and even in the hearts of cities. These accidents involve aircraft of widely varying sizes and designs so that an infinite variety of accidents is possible. Because of the widely varying conditions surrounding aircraft accidents, no set pattern for investigation can be followed

and individual ingenuity is at a premium. However, a basic method of approach is feasible.

The general procedures used by the Civil Arronautics Board in the investigation of accidents involving large transport type aircraft will be explained briefly, followed by some of the fundamental techniques used, particularly those of an engineering nature with illustrations of these techniques as used in actual accidents.

GENERAL PROCEDURES

The problem of finding "2%" of a crashed aircraft which was defective prior to impact is frequently not too difficult. Witnesses, radio transmissions, and past service experience often point the way to these "possible causes." Demonstrating that the other "98%" of the aircraft was airworthy, thereby eliminating or pinpointing contributing factors, is difficult. This is particularly true when "100%" of the aircraft must be shown airworthy prior to the crash to put an accident in the operational class. To accomplish this more difficult task the Board maintains a staff of engineers in a central Washington office, in addition to the operational specialists located at strategic points throughout the country. These engineers are specialists in the fields of aircraft structures, powerplants, systems, maintenance, and electronics.

When an accident occurs the closest CAB field office is notified immediately by the owner or operator of the aircraft or by a local law enforcement agency near the scene of the accident. After relaying the preliminary information to the Washington office the investigators immediately make arrangements for the security of the crash scene and proceed there by the fastest available means. On arrival at the scene the investigator in charge makes a rapid appraisal of the situation and requests the type of specialists needed who are then dispatched immediately from the Washington office.

Next, the investigator in charge appoints several investigatory groups. Depending upon the nature of the accident there may be one such group to question witnesses, another to inspect the aircraft structure, another to examine the powerplants, etc.

In all major airline accidents, representatives of the Federal Aviation Agency and of the aviation industry and airman organizations, such as the Air Line Pilots Association, the manufacturers, and the airline involved are invited to, and normally do, participate in the investigation as members of the investigating groups. However, in all cases each group is headed by a CAB investigator or specialist. This policy of the Board's ensuring nongovernmental participation has been in effect for years, with extremely beneficial results. First, it has made available to the Board the highly specialized knowledge and practical experience of these individuals with respect to construction and operation of the aircraft involved in the accident. Second, it has ensured that no undue emphasis would be placed on any single aspect of the accident to the neglect of other aspects which might reveal the true case. Third, the natural desire of each of the various individuals involved to make sure that the responsibility is placed where it belongs has a very important "policing" effect. The checks and

counter checks of the conflicting interests represented on an investigation group virtually guarantee that all facts pertaining to the accident will be unveiled in their true light to the extent that information is obtainable. They further guarantee that the Board's analysis of these facts and the conclusions drawn from them will have that freedom from bias which a responsible body must always maintain.

At frequent intervals during the investigation, the investigator in charge holds meetings of all the various groups to review the progress of the work and to permit a free exchange of ideas and information among the groups. Very often one group will have uncovered some fact or facts which will serve as a valuable lead to another team in their work. In this manner, all the relevant facts, conditions,and circumstances relating to the accident are slowly developed.

Sometimes the work of the groups can be completed at the accident site but more frequently tests or continued study of parts or components are carried on at the manufacturer's plant or some testing facility. Often it is necessary to move the powerplants, instruments, and some of the system components immediately to more favorable locations for disassembly and study. The facilities of other Federal agencies such as the Federal Bureau of Investigation and the National Bureau of Standards are sometimes used for specific tests or studies of parts and materials.

When this first phase of the investigation is completed the Board holds a public hearing where all of the factual material collected in the investigation is made public. At the hearing the chairman of each of the investigative groups submits a report of his committee's work and then interested parties are given the opportunity to question him further. In addition to fulfilling an obligation to report publicly on the accident, the testimony of witnesses, investigators, and other people associated with the investigation presents an overall picture to the investigators which was not available prior to the hearing. Occasionally new avenues for investigation are opened at hearings which lead to intensive study or more tests to prove or disprove a theory.

At the completion of the investigation all of the factual data accumulated is analyzed and a final report is issued by the Civil Aeronautics Board which presents the circumstances surrounding the accident, an analysis of the facts determined in the investigation, findings, and conclusions by the Board, and a probable cause of the accident.

A case is never closed since occasionally new evidence is obtained which relates to a particular accident and it is necessary to reopen the investigation and possibly revise or reissue a final report.

Now that you have a general understanding of the operating procedures used by the Board in the investigation of accidents involving large transport-type aircraft some of the more important investigative techniques will be described in detail.

TECHNIQUES EMPLOYED IN ACCIDENT INVESTIGATION

Examination of the Airframe Wreckage

A thorough detailed study of the airframe wreckage by trained investigators yields an amazing amount of information about the aircraft at the instant of ground contact and will sometimes give the full story of the accident. When the wreckage is widely scattered only a small portion will be consumed by the ground fire which generally follows a crash but if an airplane contacts the ground at a steep angle with very little scattering of the wreckage, a large part of the aluminum, magnesium, and soft parts may be consumed by the fire making the study much less rewarding.

Generally, one of the first things to do is to identify as many of the airplane sections, components, and parts as possible and to plot their exact position on a wreckage distribution chart. Such a chart will often contain several hundred items since the location of small items, interior furnishings, etc., may give clues to the exact order of breakup if there is a lengthy ground slide. the wreckage distribution chart also should show ground impact marks and trees or objects struck or cleared just prior to the point of initial ground contact. Construction of the chart is most easily accomplished by laying out a baseline beginning at or near the point of initial ground contact and extending along the groundpath as far as necessary. Measurements can then be taken along the baseline and to the right or left with a minimum of equipment and trained personnel. If the wreckage is distributed over a small area polar coordinates are generally more practical if the proper equipment is available. In addition to giving the members of the structures group a preliminary look at the overall wreckage, the chart allows a continuity check to be made to ascertain whether or not the entire aircraft is accounted for at the crash site. Not enough pieces requires an extensive search back along the flightpath and too many pieces indicates either more than one aircraft or a cargo of aircraft parts.

Once the wreckage distribution chart is prepared the pieces can be moved as necessary to facilitate the study. It is frequently desirable to gather together all wing parts, fuselage parts, empennage parts, etc., so that related damage patterns can be identified and a complete or partial mockup is sometimes necessary.

The examination of the airframe wreckage is just exactly that: a careful study of each piece of the aircraft to learn anything from it that can be learned. The pieces are examined for evidence of ground contact, inflight fire (soot or molten metal deposits), ground fire damage, explosion, sabotage, corrosion, fatigue failures, inflight collision with foreign objects (birds, wires, trees, etc.), midair collision (paint marks, abrasions, propeller cuts, etc.), aerodynamic flutter, foreign substances, and many other considerations. The torn edges of structure are examined for plastic yielding and paint crasking or other evidence that identifies the fracture as a "single overload type failure" and for evidence of fatigue. If one of the rare inflight structural failures is suspected, the examination for fatigue must be very thorough. The direction in which mating pieces or sections of the aircraft break off relative to each other is determined insofar as is possible. This is necessary to separate inflight from ground impact damage and to analyze the sequence of breakup.

All hydraulic cylinders and mechanical actuators are examined to determine their positions at the time of breakup so that the position of the flaps, landing gears, flight controls, trim tabs, etc., can be determined. All elements of the control system, including the mechanical portion and its supports, the boost units, and surfaces, are traced and failures examined to determine that the flight controls were or were not functional at the time of impact. This examination accounts for all balance weights and includes a close look at the hinge bearings, tab linkages, and other areas susceptible to damage from aerodynamic flutter.

The heaters, air conditioning system, fire extinguishing system, cargo, and other sources of toxic gases are examined for damage or evidence of malfunction.

All external openings in the aircraft (doors, emergency exits, inspection openings, cargo hatches, cowl flaps, etc.) must be accounted for even though extensive burnout may make this task extremely difficult.

The angle at which the aircraft contacted the ground and the attitude that it was in at contact are established by the examination of the structure and by the relative location of gouges and ground impact marks shown on the wreckage distribution chart. In addition to the considerations previously listed, all areas of the aircraft having known records of service difficulty are closely examined. All detail findings are accurately documented in writing and thoroughly photographed. The importance of good detail photographic coverage cannot be overstressed.

An example of the way a wreckage distribution chart can be used in the analysis of an accident is the Braniff DC-7C accident at Miami in March 1958. In this accident the aircraft contacted the ground in a right bank while descending (returning to the airport after takeoff because of an engine fire). The initial ground contact point where the right wing tip cut into the soft marshy ground gave a rough angle of bank and descent. Trees cleared by the aircraft just prior to ground contact established a minimum angle of descent and the lateral distance between the engine contact marks verified the angle of bank. The distances between propeller cuts were used to calculate the speed of the aircraft at contact and the angle of the cuts with reference to the path established the angular acceleration caused by the gradual disintegration of the right wing. The location of a flash fire fed by the fuel in the right wing was established by grass burns near the initial impact point. Rudder fabric was burned by this fire as was fabric covering access holes inside the tail cone showing that the aft fuselage broke up early. Interior furnishings from the aft fuselage found only 500 feet from the initial impact point verified this finding. The trails of the four engines, which came off the aircraft at initial impact, were easily traced from the initial impact holes to the engines' final resting places one-half mile away. The gradual disintegration, sliding, and rolling of the fuselage, wing, and empennage was also obvious from the locations of parts, cargo, interior furnishings, and gouges in the ground.

Operations Group

The Operations Group is responsible for developing all facts relating to the history of the flight, the history of the crew and the probable flightpath.

The history of flight includes such items as flight planning and dispatching, weather en route (both forecast and as reported), previous stops en route, radio contacts, operational weight, and c. g. location at previous takeoff, and many other similar items. All of this evidence is carefully reviewed and evaluated to determine if any factor might have a bearing on the accident. Deviations by the crew from orderly routine flight procedures often suggest leads which open up new lines of investigation. The check on the crew usually covers their training and proficiency in their work, any recent illness, amount of duty or rest, mental attitude, freedom from worries, and previous accident records. As a standard procedure on air carrier accidents, the movements of the crew for the previous 24-hour period are investigated to the extent necessary to uncover any possible cause factors. In many ways, this phase of the investigation is the most difficult since it involves dealing with intangible psychological factors. These factors are becoming more and more important as our modern aircraft become more complex. The physical limitations of the pilot sometimes prevent him from following prescribed emergency procedures within the time available in some cases. Cockpit design and arrangements have a great effect on a pilot's speedy recognition of impending trouble and correction of the trouble before an accident occurs. In the investigation of an accident every attempt is made to get all contributing factors. Another important task handled by the Operations Group is the determination of the probable flightpath just prior to the crash. In this work they are assisted by the Witness Group. This work is done as early as possible in the investigation so that the other working groups can benefit by the facts developed from the evaluation of the flightpath. If the accident occurred on or near one of the large airports where radar advisory service is provided, valuable information relative to the flightpath can often be learned through interviews with the radar operators. Once the probable flightpath is established, it is reflown several times in the same or a similar type aircraft so that witness statements can be evaluated. Where navigational facilities are or may be involved, the FAA, as standard procedure, conducts an accurate check for evidence of discrepancies. For accidents occurring during takeoff or landing or in the immediate vicinity of an airport, it is standard practice to obtain statements from all pilots who took off or landed for a one-hour period before and after the accident. These are reviewed for information relative to turbulence, adequacy of approach lighting, instructions from tower personnel, functioning of navigational facilities, etc.

Another interesting phase which is normally handled by the Operations Group is radio transmission analysis. Since most communications between aircraft and FAA radio facilities are recorded the Operations Group carefully reviews these communications. Occasionally, a crew member of an aircraft which has met with an emergency gets off part of an emergency message which, because of his state of excitement and/or other crew members shouting in the background, is not readable. Sometimes the message may be too weak because of damaged equipment. In such a case the message is usually transcribed onto a tape and short groups of words are made into a continuous loop so that the message is repeated every few seconds. With this setup special sound equipment, capable of filtering out all static and certain frequency bands, will generally help listeners to hear some words and associate sound or syllable patterns on others so that some intelligence can be obtained from the message.

Witness Study

The manner in which the Witness Group works is fairly straightforward. Their main task, of course, is to contact and interrogate all witnesses to the accident in order to uncover facts which will assist the other committees in their work. The time of the accident, the local weather, the observed altitude, attitude, and direction of the aircraft, whether any unusual noise was heard or fire in flight was seen - these are some of the many points which can be developed from witness statements. Statements made by witnesses soon after the accident are very often more accurate than those obtained later; therefore, every attempt is made to secure witness statements as soon as possible. In collision accidents and in approach and climb-out accidents it is often extremely important to determine the aircraft altitude and heading as closely as possible. The technique used in such cases is to return the witnesses to the exact points from which they observed the aircraft and have them associate the aircraft's flightpath with adjacent or nearby buildings, mountains, trees, etc. Then by measuring the related angles and distances it is very often possible to determine very closely the aircraft's heading and altitude. In some cases it is necessary to fly an airplane of the same type as the one which crashed over several paths while being observed by the groundwitnesses before the flightpath of the crash airplane can be determined. The United Air Lines DC-6 accident at Mt. Carmel, Pennsylvania, in 1948 is an excellent example of an accident where thorough work by the Witness Group assisted materially in the determination of the probable cause. The Witness Group interrogated witnesses back along the flightpath for a distance of 31 miles and were able to establish clearly the erratic movements of the aircraft as it was slowly descending. Later, when it was established that the crew had become incapacitated by CO_2 in the cockpit, the witness testimony fitted into the picture perfectly.

Radio and Electrical Equipment Study

The extent of the work undertaken by the Radio and Electrical Group in any one accident is dependent to a large extent on the facts developed by the other committees. When it is indicated that the use or functioning of the radio equipment might have been a pertinent factor, the settings of all switches are carefully noted and checked against normal operating procedures. Depending upon the extent of damage to the radio navigation and communications equipment, various techniques may be employed to obtain the tuned frequencies of the units. The settings and indications of all instruments concerned with navigation of the aircraft are recorded and evaluated and whenever possible these instruments are given functional tests. An example of this phase of the work may be found in the investigation of the accident involving a Northeast Airlines DC-3 that crashed while making an approach to the New Bedford, Massachusetts, Airport under weather conditions that were near minimum. The airborne radio equipment used in connection with the ILS (Instrument Landing System) was immediately a prime suspect. However, damage to most of the pertinent units had been slight, and it was possible to determine the selected frequencies and to bench check all items. Finally, the recovered equipment was installed in a similar aircraft and was found to function properly during simulated ILS approaches. As another routine procedure following an accident, the maintenance records of the radio and electrical equipment are reviewed to uncover any previous difficulties

which might reflect on the degree of reliance placed on the equipment by the crew at the time of the accident. When it is suspected that the failure or malfunctioning of an electrical component may have contributed to an accident, the various units are segregated and inspected for evidence of malfunction or failure. One of the first steps taken is to determine whether electrical power was available prior to impact. A technique that is often employed in this regard is the disassembly of rotary electrical machines such as inverters and motors and the examination of their armatures for evidence of rotational scoring. In cases of inflight fire, particularly, suspicion is directed toward the electrical system until it can be eliminated as being a factor. Evidence of heat or burning in areas adjacent to electrical components or wiring are indications of electrical system trouble. When the wiring is suspected, the terminal connections, routing, clamping, protection against chafing, the capacity and condition of fuses and circuit breakers are all checked to determine whether they were contributing factors. Another technique used here is to lay out wire bundles and examine them for continuity of fire pattern in adjacent bundles.

Powerplant Study

In addition to the engine and propeller installations, the Powerplant Group is responsible for investigating all possible malfunctions or failures of related essential powerplant systems such as fuel, oil, and powerplant controls. A number of checks are made as soon as possible because they may direct attention to trouble areas. Propeller blade angle is one of the most important since it is indicative of the power being developed by the engine. Blade angles at impact can usually be determined within an accuracy of $\pm 2^{\circ}$ from a study of the impact marks found on blade shim plates, gears, or any part of the blade assembly that can be related to a nonmoving part.

The speed of the engine can be determined by study of the propeller speed control. Given the blade angle, speed of the aircraft, and propeller governor setting, the manufacturer of the engine can furnish a fairly reliable figure for the power being developed by the engine at impact. The speed of the aircraft can be calculated easily by applying the engine-propeller gear ratio to the governor setting to get propeller r. p. m. and then multiplying the distance between propeller slashes in the ground by the number of blades by the r. p. m.

Other items that are checked early include: all engine oil screens for free metal, spark plugs, and the interiors of the combustion chambers. This latter check is usually accomplished with a boroscope which is indispensable for this purpose. As a matter of course, samples of fuel are obtained when possible for later analysis. Following the initial examination at the scene, if circumstances permit, all powerplant parts are removed to a shop for more extensive disassembly and examination. Sometimes the engines are in operable condition, and test-stand runs are conducted to establish their integrity. Review of the powerplant maintenance records and the aircraft logs is another task accomplished by the Powerplant Group.

Powerplant fires present their own peculiar investigation problems expecially those which occur in flight prior to impact. In most instances of inflight powerplant fires partially burned material falls from the aircraft along the

flightpath. This necessitates the gathering up of this material and the building of a mockup in order to obtain a complete picture of the damage caused by the fire and to pinpoint the source of the fire. Mockups were usccessfully used in the recent investigation of a Convair 240 accident. This aircraft crashed a few hundred feet short of the runway when the wing burned off, and all aboard were killed. Investigation disclosed that the initiating cause was the fatigue-failure of a cylinder flange, releasing combustibles which were ignited by the exhaust. Ordinarily such a fire is contained by the fire seals and extinguished. In this instance, however, the fire seals were ineffective and the fire progressed rapidly into the wheel well and melted the main fuel line in that area releasing fuel in large quantities. The valve that could have stopped this flow of fuel was found open. The entire path of the fire rearward into the primary wing structure was revealed when all of the pieces were assembled in a mockup frame. Incidentally, this investigation resulted in a change in the cylinder handling procedures of the particular operator, a modification to the fire seals,and a change in the crew fire control procedures. This accident illustrates that seldom is the cause of an accident one pat thing but more often a series of events all adversely cumulative.

Structural Mockup

The use of a structural mockup of specific sections of an aircraft is frequently very effective in finding an accident cause or in demonstrating beyond any doubt that a specific occurrence did, in fact, happen. This is particularly true in the area of inflight fires, midair collisions, and explosions.

If the cause of an accident is not found during the preliminary work and the structure is still suspected of being the cause, a partial or complete reconstruction of the aircraft is undertaken and the study continued. This work is slow and tedious but various procedures can be used to speed up the identification of the broken, battered, and crumpled parts. Part numbers can be found on many pieces and these numbers can be checked against the parts catalog listing. The size, shape, thickness and/or similarity with parts already identified are points which can be used to assist in the identification. In many instances broken pieces or parts can be matched with other identified items. In the beginning, wing parts are separated into one pile, fuselage in another, tail in still another, etc., and then identification of parts and reconstruction of components is started. Control system parts and cable runs are generally laid out separatedly from the other reconstructions to facilitate study. Wooden frameworks or mockups are sometimes constructed and the parts are hung on or attached to framework in their correct positions. Detailed evaluation of the damage is reserved until the reconstruction is fairly complete in order to avoid drawing an erroneous conclusion from isolated pieces.

The UAL-TWA Grand Canyon collision accident in 1956 is a case where the Structures Group was faced with an extremely difficult and hazardous investigation job. Both aircraft sustained extensive damage during the inflight collision, and each broke up into countless relatively small pieces upon striking the rock walls of the canyon. Fire after impact destroyed a considerable portion of each aircraft, further complicating the task of examining the wreckage. In addition, the remote and relatively inaccessible location of the two wreckage sites presented numerous practical and technical problems. However, with

the cooperation of the U. S. Army, Board investigators traveled to each of the wreckage sites, examined the wreckage in detail, and brought out from the canyon sufficient evidence to establish conclusively that a collision had in fact occurred and to determine the relative attitude of the two aircraft at the instant of impact. The key wreckage pieces which fortunately survived the ground fire consisted of (1) a large section of the DC-7 left outer wing panel, (2) several pieces of DC-7 left wing structure, (3) several sections of the lower L-1049 fuselage containing propeller cut marks, and (4) several pieces of the L-1049 empennage structure. Technique-wise, two independent methods were used to establish the convergence angle between the two aircraft at impact. The first method involving relating scrape marks on one aircraft with scrape marks on the other aircraft to complete a relative velocity vector diagram. This method requires that no assumptions be made, and the derived convergence angle at impact is relatively precise. Incidentally, if the speed of one aircraft is known or assumed, the speed of the other aircraft and the closure speed between the two aircraft are easily determined. The second method makes use of the angularity of the propeller cuts and the spacing between them to arrive at the convergence angle. The cutting propeller tip helix path is determined using known or assumed values for r. p. m. and aircraft speed, and this path is oriented with respect to the cuts to arrive at the convergence angle. Usually a combined graphical-analytical procedure is used to accomplish this objective. When the pertinent parameters are not known, the procedure is completed for a range of the variables. Although the r. p. m. is the most sensitive variable, fortunately it is usually known with reasonable certainty in most instances. In the Grand Canyon accident, both methods were used and gave substantially the same convergence angle.

Inflight explosion of the primary structure such as the cabin from a bomb-type device, from fuel vapor ignition, or from a sudden depressurization is one of the numerous possibilities that must be considered during an investigation, and presents perhaps one of the greatest challenges to the Structures Group. In recent years, unfortunately, we have had several accidents which tested our detection methods. Fortunately, our routine procedure, supplemented with excellent laboratory testing, was sufficiently thorough to result in a successful determination of the cause in each case. In the Longmont, Colorado, UAL DC-6 bomb-explosion accident, our task was complicated by very extensive inflight disintegration as a result of the explosion compounded by the severe destruction of some components and parts during the subsequent ground impact. Nevertheless, through the extensive use of elaborate detailed mockups of the suspected areas, it was possible to not only confirm the explosion but it was possible to pinpoint the exact location in the aft baggage compartment where the bomb had been located. Reconstruction and examination of the aft fuselage wreckage proved that the forces which caused disintegration radiated in all directions from a point within the aft, or No. 4, cargo pit at approximately fuselage station No. 718. Very pronounced intensification in the severity of fragmentation, tearing, denting, piercing, and curling of the shattered structure forming the confines of the aft cargo compartment, indicated that the disintegrating forces emanated from an extremely violent explosion of very localized origin, which projected fragments of cargo through the walls and ceiling of the compartment. This is greatly in contrast to an explosion caused by the ignition of vapors from leaking fuel or other combustibles carried on and used used in the

operation of airplanes. Such explosions produce practically equal pressure on all surfaces of a pressure vessel, such as a cargo compartment, and cause failure at the weakest seams without pronounced localization and without fragmentation of either the pressure vessel walls or the contents of the vessel. The exact nature of the explosion source in the Longmont case was determined to be dynamite. This determination was made at the F.B.I. laboratory by testing of the sootlike deposits found on many of the cargo compartment wreckage pieces exposed to the source of the explosion.

In the Western Air lines CV-240 Daggett, California, explosion which occurred in July of 1957, the relatively small volume of the fuselage damage in the manner characteristic of a high-velocity explosion indicated that the explosion was of relatively small energy. In this case, recovery, reconstruction, and study of the bits and pieces from the hole in the sidewall of fuselage in the lavatory area pinpointed the origin of the explosion as being directly on top of the wash basin shelf at about fuselage station No. 658. Laboratory analysis of the grayish and dark deposits on numerous specimens from the lavatory area disclosed that these residues were characteristic of an incomplete detonation of dynamite. A fragment of copper found in the cabin insulation was similar in composition to the shell of an unexploded fuse-type blasting cap found in the toilet. This, plus some burned paper and burned matches found in the toilet, indicated that the dynamite was detonated by the application of heat to a blasting cap and that the first attempts were unsuccessful. Apparently, the dynamite was resting on the wash basin shelf while the fire was being applied to the blasting cap.

Another interesting explosion case technique-wise involved a converted executive A-26 aircraft that was making an approach for a landing at Oklahoma City, Oklahoma, in October 1955. When the pilot called the tower for landing instructions, a violent explosion occurred, and the aft fuselage and tail separated from the aircraft. Detailed examination of the aft fuselage wreckage disclosed no indications of heat damage or fatigue which could have permitted failure under loads less than design, or compression buckling of the skin and stringers which always accompanies failures due to overload. Instead, there were numerous indications of the aft fuselage having disintegrated due to excessive tensile stresses throughout the entire shell acting both longitudinally and peripherally at the same time. The only type of loading which can produce this combination is a much higher pressure inside the aft fuselage than outside. The manner in which the external skin bulged outward and separated from the horizontal stabilizer and bulged outward on the fin also could only result from very high internal pressures. From the type of damage it was evident that the pressures which caused the disintegration built up suddenly and that they originated in the aft fuselage. Only an explosion of an air-gasoline vapor mixture could have caused such a practically uniform pressure throughout the aft fuselage. Investigation indicated that the installation of a fuel tank and a radio rack in the aft fuselage without a vapor seal separating the two provided the possibility of an explosive air-fuel mixture resulting from a fuel leak and the necessary source of ignition. However, the severe fire damage after impact made it impossible to conclusively determine the condition of the fuel system components prior to the accident.

The Board is constantly striving to utilize the best available methods

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although our techniques are far from being truly scientific procedures. Accident investigation is still very much an art requiring the efforts of trained, experienced personnel with an inclination toward this work. Patience, perseverance, common sense, and logic remain, perhaps, the most effective tools available to the accident investigator. Without these qualities, most certainly, the investigator can accomplish little of value.

Over the years the aircraft accident investigator's task has become increasingly more difficult. Aircraft have increased tremendously in range and weight, and this growth has brough with it greater design complexity. The higher operating speeds of these newer aircraft have generally resulted in more extensive breakup of the aircraft when an accident does occur. These two factors - greater disintegration and greater amounts of more complicated components - present a terrific challenge to today's investigator.

February 10, 1961

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY

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HANDLING OF RECOMMENDATIONS

Under Title VII of the Act, it is the duty of the Board to investigate civil aircraft accidents and to make such recommendations to the Administrator of the Federal Aviation Agency as will tend to prevent similar accidents in the future. It is also the Board's duty to conduct special studies and investigations pertaining to safety in air navigation and the prevention of accidents. The results of these investigations and special studies must be directed to those organizations, both government and industry, which can take effective corrective action in order to be productive.

The Bureau of Safety is charged by the Board with carrying out these responsibilities.

Recommendations for precautionary, preventive or corrective action are initiated in the early stages of the Board's investigations and whenever thereafter the need for additional recommendations is developed during the continuing investigation. The Board's field investigation processes lend themselves especially well for the recognition, formulation, and proper dissemination of recommendations. In these investigations, particularly of air carrier accidents, we invite participation of the FAA, the air carriers, the various employee associations such as airline pilots, flight engineers, and dispatchers, the U. S. Weather Bureau, and the manufacturer of the aircraft and its important components. These organizations assign persons to work on the various investigatory teams under the supervision of Board investigators, and thus have privileged access to technical information as it is developed during the investigation. This system insures that interested parties, who may be in a position to take prompt and effective corrective action, will have the facts as they are developed. This means of expediting corrective action is in addition to the recommendations initiated by the Board during the early stages of investigation for action by the appropriate governmental or industry body.

Subsequent to the field investigation, the Board's public hearing makes an excellent vehicle for the dissemination of factual information upon which changes in methods, procedures, design, or operating practices can be based. Many facets of the industry and government concerned with aviation safety attend these hearings, both as participants and as observers, and are thus able to apply this information promptly and effectively to their organizations.

Finally, in the Board's formal evaluation of the facts, conditions, and circumstances surrounding an accident and determination of the probable cause, it frequently enphasizes recommendations previously made, and also sets forth other formal recommendations. As these reports receive wide distribution, the basis and objective of these recommendations are made known to the entire aviation community.

In the investigation of small airplane accidents by the Board, essentially the same procedures are followed, although the number of persons participating is usually not as great. The field investigators are in an excellent position to make direct recommendations to operators, manufacturers, and governmental aviation services at field level, when appropriate, or to forward these recommendations to the Board's Washington Safety Headquarters where they are processed for transmittal to the appropriate agency or organization. Recommendations also flow from the special studies and investigations conducted by the Bureau's technical staff.

During the past two years the Board has forwarded a number of recommendations to various organizations, primarily the FAA. These recommendations cover virtually the entire field of aeronautics: operations, training, traffic control, weather services, maintenance practices and procedures, aircraft design and structure, and aircraft component design and installation.

SAFETY RECOMMENDATIONS
CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
- 1961 -

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
2/14/61	Inadequacies in present method for determining and using ceiling and visibility.	To: Chairman, NACCAM. That the NACAAM study the current procedures for observing ceiling and prevailing visibility with a view to developing more suitable parameters for establishing operational meteorological minima. (B-93)	No reply to date.
2/2/61	Incident: Poughkeepsie, New York, 1/3/61, UAL, DC-8, N8006.	To FAA: That future aircraft be required to have seat belt signs which may easily be observed from all passenger seats. (B-96)	No reply to date.
1/24/61	Accident: Wilkes-Barre, Pa., 12/5/60, AL, Martin 202, N176A.	To FAA: Issue AD requiring one-time inspection for possible missing drag link bushings. (B-96)	No reply to date.
1/23/61	Incident: Chicago, Illinois, 10/2/60, Lufthansa German Airlines, Flight 431-02, ABOC.	Develop test technique which will enable ramp personnel to determine presence of fuel contamination under all climatic and light conditions. CAB Engineering to process recommendation as special project. (B-96)	No reply to date.

SAFETY RECOMMENDATIONS
CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
- 1960 -

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
1/ 4/60	Accident: Braniff Airways, L-188, Buffalo, Texas, 9/29/59.	To: FAA, Administrator; Recommended positive stop on all L-188 and other turbo-prop aircraft to prevent inadvertent movement of power lever to Beta range while in flight. (B-96)	No reply received.
1/12/60	Accident: American Airlines, L-188, New York, New York, 2/3/59.	To: FAA, Administrator; Recommended that simulators for flight crew training be required for all significently new type aircraft. (B-93)	FAA replied 1/20/60 recommending staff discussion which was held 2/19/60. FAA advised that appropriate rule making being developed.
1/12/60	Accident: American Airlines, L-188, New York, New York, 2/3/59.	To: FAA, Administrator; Recommended review of airport authorizations and limitations for pilots on new type transport aircraft. (B-93)	FAA replied 1/20/60 recommending staff discussion which was held 2/19/60. FAA advised that appropriate rule making being developed.
1/13/60	Accident: Johnson & Johnson, Learstar, Woonsocket, R.I., 12/15/58.	To: FAA, Director, Flight Standards; Recommended review of adequacy of standards re: flight manual information relative to anti- and de-icing procedures, and carburetor air inlet systems. (B-93)	FAA replied 5/27/60 outlining action being taken. AD issued 10/3/60, prohibiting Learstar operations in known icing conditions until carburetor preheat system modified.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
1/18/60	2 Accidents: Eastern Air Lines, L-749A, Philadelphia, Pa., 1/3/60, Eastern Air Lines, L-749A, Washington, D. C., 1/4/60.	To: FAA, Administrator; Recommended early and frequent reoccurring inspection of fillet radius CPTC series 8295 strut cylinders on L-749A aircraft and action to ensure reporting of serious defects as per CAR 40.508. (B-96)	Administrator, FAA replied 3/4/60 stating that action had been taken to ensure inspection of subject item and that a revision of CAR 40.508 was in process.
2/ 9/60	Letter from FAA 1/12/60 requesting comments on improving requirements for Flight Recorders. This item had a long history of previous CAB and CAA actions.	To: FAA, Director, Flight Standards; outlined detailed views in support of flight recorder requirements. (B-96)	No reply required: Civil Air Regulations have been revised and further revisions contemplated.
3/ 2/60	Accident: National Airlines, DC-6B, Bolivia, N. C., 1/6/60.	To: FAA, Administrator; Recommended review of engine overhaul and quality control procedures of National Airlines. (B-96)	No reply received.
3/ 2/60	Accident: Eastern Air Lines, L-1049C, Washington, D. C., 2/13/60.	To: FAA, Administrator; Recommended a re-evaluation of maintenance inspection procedures of all turbo-compound engine operators and issuance of an appropriate Airworthiness Directive requiring more frequent inspections of the exhaust system. (B-96)	Reply of 3/24/60 indicated under investigation by Regional Offices. Reply of 5/13/60 outlined corrective action to that date.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
3/21/60	2 Accidents: Lockheed PV-1, N3031, Hyannis, Massachusetts, 4/26/59 Lockheed PV-1, N33DT, Chicago, Illinois, 10/26/59.	To: FAA, Administrator; Recommended a study of the possibility of redesign of drag strut attach plate assembly on Lockheed PV-1. (B-96)	FAA concurred in reply of 4/27/60, study underway to determine corrective measures.
3/23/60	Accident: Johnson & Johnson, Learstar, Woonsocket, R. I., 12/15/58.	To: FAA, Director, Flight Standards; suggests that notes concerning runway visual range on ILS charts be clarified. (B-93)	Informal advice from FAA that appropriate action would be taken.
3/25/60	2 Accidents: Trans World Airlines, L-1049C, Chicago, Illinois, 2/29/60, Flying Tiger Line, L-1049H, Detroit, Michigan, 3/5/60.	To: FAA, Administrator; Recommended issuance of an Airworthiness Directive requiring inspection and modification of threaded areas lower drag strut cylinder assembly housings. (B-96)	No reply received; however, AD 60-10-6 issued on 5/16/60 in accordance with recommendation.
3/25/60	Accident: Capital Airlines, Viscount, Charles City, Va., 1/18/60.	To: FAA, Administrator; Recommended that the FAA require installation of filter between barge and fuel storage tanks at Washington National Airport; also internal filter housing and cover on top of storage tank be coated with rust proofer. (B-96)	FAA replied 7/5/60 outlining corrective action; states refueling to be monitored in future.
3/30/60	Accident: Eastern Air Lines, L-749, New York, New York, 3/9/60.	To FAA, Administrator; Suggested review of Lockheed's quality control procedures due to continued failures of L-749 aircraft landing gear. (B-96)	Reply received 7/5/60 stating that Lockheed initiated a service inspection program of L-749 aircraft; also that quality inspection procedures were considered satisfactory.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
3/30/60 6/ 6/60	Continuation of investigation of L-188 accident, 3/17/60 and fueling procedures - Electra aircraft.	To: FAA, Administrator; Recommended all Electras not equipped with overflow valves be fueled with overwing fuel caps open. AD be issued. (B-96)	Replied 4/29/60. AD issued. Additional reply 6/30/60.
4/ 4/60	Accident: Alouette Helicopter, N534, Butler's Peak, Calif., 3/3/60.	To: FAA, Administrator; Recommended issuance of Airworthiness Directive to require immediate inspection of diffuser vanes. (B-96)	FAA advised 6/22/60 that Airworthiness Directive being coordinated.
✓ 4/ 8/60	Accident: Piper PA24, N5286P, Springfield, Oregon, 1/20/60.	To: FAA, Administrator; Recommended issuance of Maintenance Alert Bulletin to PA-24 operators advising aileron rigging instructions in maintenance manual not clear as to prevent misrigging of flight controls. (B-96)	No reply to date.
4/ 8/60	2 Accidents: Braniff Airways, L-188, Buffalo, Texas, 9/29/59; Northwest Airlines, L-188, Cannelton, Indiana, 3/17/60.	To: FAA, Administrator; Recommending formulation of a Design Review Board to study Lockheed Electra aircraft. (B-96)	FAA advised 6/23/60 that the suggested review board was unnecessary.
4/11/60	Accident: Northwest Airlines, L-188, Cannelton, Indiana, 3/17/60.	To: Chief, U. S. Weather Bureau; Urged that increased emphasis be placed upon reporting and forecasting clear air turbulence and that appropriate research be accelerated. (B-93)	Close staff coordination with USWB regarding this problem has been effected. (See letter from USWB of 6/7/60.)

DATE OF ACTION	ACCCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
4/12/60	Accident: Northwest Airlines, L-188, Cannelton, Indiana, 3/17/60.	To: FAA, Administrator; Recommended that all Electra aircraft not already inspected be grounded until inspected. (B-96)	Reply received 4/14/60 outlining FAA's reasons for not complying with recommendation.
4/25/60	Accident: Cessna 195, N3002B, Elwood, Indiana, 4/7/60.	To: FAA, Administrator; Requested to issue an AD requiring immediate inspection of wing front spar fuselage carry through member of Cessna 190 and 195 series. (B-96)	Reply 6/9/60 outlining action. AD issued 5/17/60.
5/11/60	Accident: Piedmont Aviation Inc., F-27, Hickory, N. C., 4/20/60.	To: FAA, Administrator; Recommended communications procedures at uncontrolled airports, used by hi-speed or transport aircraft, to provide for exchange of known VFR traffic information; and development of traffic patterns for hi-speed or transport type aircraft. (B-93)	Reply received 6/9/60. Draft Release 60-17 issued by FAA.
5/13/60	Accident: Northwest Airlines, L-188, Cannelton, Indiana, 3/17/60.	To: FAA, Administrator; Recommended one time inspection for discrepancies in control surface booster assembly. (B-96)	FAA advised 7/16/60 that instructions forwarded to Regional Office to accomplish suggested inspection.
5/31/60	Accident: Ground Collision Northwest Airlines, DC-4, Frontier Airlines, DC-3, Billings, Montana, 3/8/60.	To: FAA, Director, Flight Standards; FAA attention directed to hazardous conditions at airport and on runways. (B-93)	FAA replied 7/19/60 stating appropriate action being taken to correct situation.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
6/ 2/60	Accident: Delta Air Lines, CV-880, Atlanta, Georgia, 5/23/60.	To: FAA, Administrator; Recommended extension of requirements for flight recorders to cover all flights of turbine-powered air carrier aircraft. (B-93)	FAA replied 6/22/60 concurring with our comments and recommendations. Action being taken to amend CAR's.
6/13/60	2 Mid-air Collisions: F-84F and Piper PA22, 11/6/59, Mansfield, Ohio; F-86 and Beechcraft, 12/15/59, Cheyenne, Wyoming.	To: FAA, Administrator, Transmitted information to FAA to avoid like mishaps in future. (B-93)	FAA replied 7/11/60 advising project under way to revise rules for operation on and in vicinity of airports.
6/17/60	Incident: Delta Air Lines, CV-880, "T" fittings.	To: FAA, Administrator, Recommended one-time inspection on "T" fittings in service and review manufacturer's quality control. (B-96)	FAA advised 8/12/60 that Convair had corrected situation.
6/27/60	Accident: Brantley B-2 Helicopter, Dilworth, Minnesota, 5/23/60.	To: FAA, Administrator; Recommended issuance of an AD for inspection of drive shaft, sleeve coupling, and attach bolt until appropriate modification is designed and installed. (B-96)	FAA advised 7/8/60 that proposed AD issuance was being evaluated.
6/27/60	2 Accidents: Trans World Airlines, B-707, New York, New York, 5/9/60; Eastern Air Lines, L-188, Nashville, Tennessee.	To: FAA, Director, Flight Standards; Pointed out need to stress emergency and evacuation procedures in the training of flight personnel. (B-93)	FAA replied 8/29/60 stating that appropriate action being taken.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
7/ 1/60	Accident: Delta Air Lines, DC-8, Miami, Florida, 5/12/60.	To: FAA, Administrator; Recommended issuance of AD requiring inspection and rework of passenger seat belt attachments. (B-96)	FAA advised 9/2/60 that Douglas Alert Service Bulletin A25-36 corrected deficiency and all operators are complying; consequently, AD not necessary.
7/14/60	Accident: Capital Airlines, Viscount, Charles City, Va., 1/18/60.	To: FAA, Director, Flight Standards; Recommended changes in the Capital Airlines Flight Manual and British Air Registration Board Manual re engine de-icing procedures. (B-93)	No reply received.
8/11/60	Accident: Chicago Helicopter Airways, Forest Park, Ill., 7/27/60.	To: FAA, Director, Flight Standards; Recommended that stressing the need for compliance with seat belt requirements in scheduled helicopter operations--particularly when flight attendants are not required. (B-93)	Reply received 9/23/60 stating that action being taken.
8/31/60	Accident: Grumman F-7-F, N7628C, Portland, Oregon, 8/29/59.	To: FAA, Chief, Engineering and Manufacturing Division; Recommended that improperly performed modification eliminating ADI be brought to attention of operators. (B-96)	FAA advised 9/12/60 that this matter was being brought to the attention of their Maintenance Division for appropriate correction.
9/14/60	Accident: Hiller, N5358V, Etna, Calif., 8/12/60.	To: FAA, Administrator, Recommended AD be issued requiring correction of a magneto distributor deficiency. (B-96)	FAA acknowledged recommendation 9/23/60 and advised Bureau of Flight Standards is considering problem.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
9/14/60	Accident: Bell, N988B, Gasquet, Calif., 7/25/60.	To: FAA, Administrator, Recommended reduction in inspection period of tail rotor pitch change rod bearing. (B-96)	FAA advised 10/19/60 that AD 58-23-1 was being revised as recommended to reduce the inspection period.
9/15/60	2 Accidents: Cessna 180, N7865A, Kipnuk, Alaska, 5/13/60; Bell, N123B, Mendenholt Glacier, Alaska, 7/2/60.	To: FAA, Administrator; Detailed fuel contamination problem, particularly Alaska, and recommended attention be given this problem and that the CAR establish fuel handling criteria equivalent to MIL-F-8508A. (B-96)	FAA acknowledged recommendation 9/27/60 and advised their Bureau of Flight Standards will consider this problem.
9/13/60	Accident: Aeronca 7AC, N81453, Beaver Falls, Pa., 10/28/59.	To: FAA, Chief, Engineering and Manufacturing Division; Recommended that operators be reminded of Continental Service Bulletin 51-5 which requires return of crank shafts to manufacturer for regrinding. (B-96)	FAA advised on 10/10/60 that their field inspectors were being reminded of this Service Bulletin and its provisions.
9/22/60	Accident: American Airlines, L-188, LaGuardia, N. Y., 9/14/60.	To: FAA, Director, Flight Standards; Suggested that the results of test and development work on visual glide slope systems be applied to some installation at LaGuardia Airport. (B-93)	FAA reply received 10/10/60 states LaGuardia has high priority in their installation program.
10/ 3/60	2 Accidents: Piper, N6036P, Wilson, Oklahoma, 12/16/59; Piper, N5083F, Sanger, Texas, 3/13/60.	To: FAA, Administrator; Recommended modification to accessory drive gear dowel. (B-96)	FAA replied 12/2/60. Two incidents investigated. Violation proceedings against manufacturer instituted by New York Office to forestall recurrence.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
10/ 6/60	Accident: Chicago Helicopter Airways, S-58, Chicago, Illinois, 7/27/60.	To: FAA, Administrator, Recommended consideration of more detailed inspections in service and re-evaluation of fatigue life substantiation of helicopter blades. (B-96)	FAA advised 10/14/60 the points raised will be considered by their Bureau of Flight Standards.
10/18/60	Accident: Piper Comanche, Nr. Palm Beach, Fla., 9/25/60.	To: Chief, U. S. Weather Bureau; Serious inadequacies in Florida aviation weather forecasts for 9/25/60 called to attention of WB with recommendation that quality control action would be appropriate. (B-93)	USWB replied 10/24/60 stating that our bringing matter to its attention is enabling them to improve their aviation weather services.
10/19/60	Accident: Piper Comanche, Nr. Tupelo, Miss., 8/28/60.	To: Chief, U. S. Weather Bureau; Inconsistencies between actual observational data and information supplied pilot by Birmingham station on 8/28/60 - recommended appropriate quality control action. (B-93)	USWB replied 10/24/60 stating that our bringing matter to its attention is enabling them to improve their aviation weather services.
10/21/60	3 Accidents: Piper PA24, N5972P, Nr. Chattanooga, Tenn, 6/20/60; Piper PA22, N9157D, disappeared on flight from Montpelier, Vt., to Manchester, N. H., 8/19/60; and Cessna 170, N4842K, Nr. Frederickstown, Mo., 9/27/60.	To: FAA, Administrator; Three accidents cited in which deficiencies in preflight or in-flight weather service provided by FAA were possible contributing factors. Appropriate quality control action recommended. (B-93)	FAA replied 11/10/60. Outlines steps it has taken during recent months which they believe will improve service.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
10/25/60	Accident: Capital Airlines, Viscount, Nr. Charles City, Va., 1/16/60.	To: FAA, Administrator; Recommended revisions to Operating Procedures Section of Grumman Gulfstream Airplane Flight Manual relating to use of ice protective system be made. (B-93)	Changes were accomplished in Revision 1. Cnanges also accomplished by Revision No. 12 to the Normal Procedure Section, F27/F27B Airplane Flight Manual.
10/26/60	Accident: Capitol Airways, C-46, Plain City, Utah, 10/15/60.	To: FAA, Administrator; Verbally on 10/21/60 and 10/24/60 recommending immediate and continued inspections of outer wing attach bolts and that military requirements for replacement of these bolts be considered as further corrective measures. (B-96)	A Telegraphic AD was issued 10/25/60 requiring bolt replacement within 500 hours and interim special inspections. AD was amended 10/26/60.
✓ 10/31/60	Accident: Capital Airlines, Viscount, Nr. Charles City, Va., 1/16/60.	To: FAA, Administrator; Same recommendation as 10/25/60, but pertaining to F-27.	No reply to date.
✓ 11/8/60	Accident: Arctic-Pacific, C 46F, N1124N, 10/29/60	Re maintenance and inspection procedures and policies of Arctic-Pacific Airlines be reviewed and that improvement be required where necessary to assure satisfactory airworthiness standards. (B-96)	No reply to date.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
11/14/60	Accident: EAL, L-188, N5533, 10/4/60	Re failure of lounge seat belts, failure of lounge partition, failure of passenger seat belts, seat tie down failures, service trays on rear of seats, and elimination of leg injuries. (B-96)	FAA replied 12/2/60. Matter under consideration by Regional Office (LAX). CAB held meeting on subject with Civil Air Surgeon; Director, Bureau of Flight Standards; Administrator, Federal Aviation Agency; Armed Forces Institute of Pathology.
12/5/60	Accident: Boston, Mass.,10/4/60, EAL Electra, N5533	Formulate a basic research program to improve tolerance of all turbine engines to bird ingestion.	No reply to date.
12/13/60	Accident: American Airlines, Lockheed Electra, La Guardia Airport, 9/14/60	To FAA: Recommended that present operating procedures for providing illumination of passenger emergency exit markings on air carrier aircraft be re-examined and such action taken as may be necessary to insure that they adequately provide for emergency illumination for evacuation following an accident.	No reply to date.
12/23/60	Accident: Washington Nat'l Airport, 9/11/60, NEA, Viscount 745D, N6579C.	To FAA: Take action to notify users of switch on Viscount 745D (fine pitch arming switch) and inspection to determine safety.	No reply to date.
12/23/60	Accident: Warrensburg, Mo., 7/16/60, Beechcraft A-45, N61288.	To FAA: Piston pin assembly - P/N 530845 for Beechcraft A-45 be included in AD 56-6-1 for replacement at appropriate time and/or operation.	No reply to date.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
12/23/60	Incident: Columbus, Ohio, 11/16/60, TWA, Martin 404 and 202.	To FAA: Recommend AD requiring one time inspection of torque arm assemblies and establish a time for future inspections.	No reply to date.

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DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
1/ 7/59	Accident: Johnson & Johnson, Learstar, Woonsocket, R. I., 12/15/58.	To: FAA, Director, Flight Standards; Recommended re-evaluate carburetor induction heating system on Learstars equipped with Wright engines. Also Lodestars. (B-96)	FAA advised 6/9/59 that PacAero will rewrite manual section dealing with anti-icing. Supplemental Type Certificate issued with alternate fuel source arrangement.
1/15/59	Accident: Alaska Coastal Airlines, Hiller, UH-12C, Juneau, Alaska, 8/28/58.	To: FAA, Director, Flight Standards; Recommended re-evaluate quality control procedures, Marvel Shebler Division, Borg-Warner Corporation. (B-96)	Copy of FAA letter of 1/26/59 to Region One Office outlining corrective procedures.
1/19/59	Accident: Seaboard & Western Airlines, L-1049D, Idlewild, N. Y., 11/10/58.	To: FAA, Director, Flight Standards; Recommended review inspection and overhaul procedure of propeller division Curtis Wright Corporation. (B-96)	FAA Memo of 3/12/59 outlines FAA action initiated to improve propeller overhaul quality.
1/20/59	Accident: Aerovias Sud Americans, C-46F, Guatemala City, Guatemala, 11/6/57.	To: FAA, Director, Flight Standards; Recommended corrective action to ensure meeting of airworthiness standards by Alaska Airlines in overhaul and inspection procedures. (B-96)	No reply to date.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
2/ 9/59	Accident: Bell 47-J Helicopter, Santa Rosa, New Mexico, 1/13/59.	To: FAA, Director, Flight Standards; Recommended distribution of Bell Service Bulletin #128 to all operators and issue an AD for mandatory daily inspection of all tail rotor blades. (B-96)	AD 59-5-1 issued. Article "A Word to the Wise (Keep Hands on Throttle)" being distributed.
2/ 9/59	2 Accidents: Eastern Airlines, Plattsburg, New York, 1/25/59, Capital Airlines, Lansing, Michigan, 1/27/59, and others.	To: FAA, Director, Flight Standards; Suggested FAA take appropriate action regarding inadequacy of snow removal at airports. (B-93)	No direct response. — 23
2/18/59	Accident: Air France, L-1049G, F-BGNE, New York, New York, 2/6/59.	To: FAA, Director, Flight Standards; Recommended review quality control procedures of Cleveland Pneumatic. (B-96)	FAA letter to Region 4 to investigate AD 59-7-3 issued, 9/14/59.
2/19/59	Accident: Eastern Airlines, L-1049G, Miami, Florida, 1/17/59.	To: FAA, Administrator; Recommended endorsement of NFPA standards for airport fire fighting equipment. (B-93)	Reply not required.
2/25/59	Accident: Trans World Airlines, L-1049, Olathe, Kansas, 1/17/59.	To: FAA, Director, Flight Standards; Recommended an AD requiring Constellation series aircraft be modified re Service Bulletin 707 and 2021, and perform immediate one time inspection of all downlock guide assemblies. (B-96)	AD 59-3-2 issued.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
3/ 9/59	Incident: Delta Air Lines, DC-6, Birmingham, Alabama, 9/8/58.	To: FAA, Director, Flight Standards; Recommended issuance of alert bulletin for DC-6 and DC-7 aircraft to prevent unintended feathering during the landing roll on application of reverse thrust. (B-96)	FAA issued Air Carrier Operations Alert Bulletin #19, 5/8/59.
3/11/59	2 Accidents: Wien Alaska Airlines, Point Barrow, Alaska, 11/23/57, Cape Thomaspon, Alaska, 8/17/58, Cessna 180.	To: FAA, Director, Flight Standards; Recommended utilizing optional landing gear strut on Cessna 180 aircraft operating on rough terrain at high gross weights. (B-96)	No reply to date.
3/23/59 3/27/59	Accident: Eastern Air Lines, L-1049G, Miami, Florida, 3/25/59.	To: FAA, Director, Flight Standards; Recommended corrective action to improve fire protection in Zone 3 and 3A, L-1049G series. (B-96)	AD 60-5-2 issued.
3/27/59	Accident: Pan American World Airways, B-707, Menil-Scelleur, France, 2/25/59.	To: FAA, Director, Flight Standards; Recommended modifying flight recorder on B-707 to cause actuation sufficiently in advance of take-off to be operating prior to wheels leaving the ground. (B-96)	FAA letter 4/28/59 referred recommendation to Region 4 for study. FAA letter 6/1/59 advised that LAS flight recorder in B-707 does not comply with CAR's. Boeing advised to modify. Proposed AD published in Federal Register 10/8/59.
3/27/59	Accident: Hiller UH-12C, N5321V, St. Paul, Minn., 8/27/58.	To: FAA, Director, Flight Standards; Recommended issuance of an Alert Bulletin for closer surveillance of Mercury clutch. (B-96)	FAA letter 5/12/59 and 9/14/59 advised that appropriate corrective action would be initiated.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
4/ 7/59	Accident: Hiller UH-12B, N8180H, Sitka, Alaska, 7/24/58.	To: FAA, Director, Flight Standards; Recommended issuance of an Alert Bulletin, revise Flight Manual, and amend appropriate CAR's. (B-96)	No reply to date.
4/ 8/59	Accident: American Airlines, Electra, LaGuardia, N. Y., 2/3/59.	To: FAA, Director, Flight Standards; Recommended initiation of study of air carrier policies etc., for employing autopilot for instrument approaches. (B-93)	FAA advised 10/30/59 that they were establishing operations specifications re use of autopilots.
5/ 1/59	Accident: Riddle Airlines, C-46, Alma, Georgia, 3/30/59.	To: FAA, Director, Flight Standards; Recommended irregularities found on C-46 aircraft be called to the attention of all operators. (B-96)	Alert Bulletin 59-5 (MOP 406) issued. AD 60-3-2 issued.
✓ 5/ 8/59	Accident: American Airlines, DC-7, Akron, Colorado, 4/12/59.	To: FAA, Director, Flight Standards; Recommended review inspection and quality control procedures American Airlines. (B-96)	No reply to date.
✓ 5/13/59	Incident: Delta Air Lines, DC-7B, Chicago, Ill., 2/26/59.	To: FAA, Director, Flight Standards; Recommended Delta Air Lines maintenance and flight personnel be required to comply with prescribed maintenance procedures. (B-96)	No reply to date.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
5/19/59	Incident: New York Airways, V-44B, Flushing Meadows, N.Y., 5/12/59.	To: FAA, Director, Flight Standards; Recommended issuance of AD re fatigue failure rotor balance weight strap. (B-96)	AD 59-11-2 issued. FAA replied 9/3/59 outlining preventive action to preclude future failures.
5/29/59	Accident: American Airlines, Electra, LaGuardia, N. Y., 2/3/59.	To: FAA, Director, Flight Standards; Recommended service test for primary safety items approved under the technical standard order system. (B-96)	No reply to date.
6/11/59	Accident: Capital Airlines, V700D, Detroit, Michigan, 4/3/59.	To: FAA, Director, Flight Standards; Recommended that Vickers-Armstrong be encouraged to redesign this part and change classification of the modification from desirable to mandatory. (B-96)	FAA letter 8/5/59 advised matter under consideration in Paris Office. FAA reply 1/19/60 advises that airworthiness directive being processed.
6/12/59	Accident: Riddle Airlines, C-46R, Alma, Georgia, 3/30/59.	To: FAA, Director, Flight Standards; Recommended issuance of an Alert Bulletin to call attention to cargo compartment lights and suggest corrective measures. (B-96)	No reply to date.
6/12/59	Accident: Helicopter Airways Service, Inc., Bell 47H, N2875B, Detroit, Michigan, 4/11/59.	To: FAA, Director, Flight Standards; Recommended mandatory compliance with Bell Service Inst. #335 S1 or a similar improved design. (B-96)	FAA reply of 7/17/59 advised present allowable service life adequate.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
6/22/59	Accident: Mooney M-20, N5276B, Syracuse, Indiana, 4/17/59.	To: FAA, Director, Flight Standards; Recommended reviewing Mooney quality control procedures. (B-96)	No reply to date.
7/10/59	Accident: Bell 47G, N67B, Hudson River, N.Y., 6/15/59.	To: FAA, Administrator; Recommended inspect all tail rotor blades prior to each flight on all Bell 47 helicopters equipped with floats and for blades previously used on float configured helicopters. (B-96)	FAA replied 8/18/59 advising AD being revised.
7/16/59	4 Accidents: Trans Canada Airlines, DC-4, Vancouver, B.C., 9/27/54, American Airlines, DC-6A, Los Angeles, Calif., 8/27/57, Pan American World Airways, DC-6B, Tehuantepec Peninsula, Mexico, 10/8/58, Pan American World Airways, DC-6B, Shannon, Ireland, 6/21/59.	To: FAA, Administrator; Recommended accelerated program to complete initial face alignment check of all surface treated aluminum alloy blades in service on DC-6, and require repeated checks at intervals not to exceed 1500 hours. (B-96)	AD 60-3-4 issued 2/5/60.
7/17/59	Accident: Grumman TBM 3E, N4039A, Simsbury Flying Service, Hartford, Conn., 5/24/58.	To: FAA, Administrator: Recommended installation of fire-resistant flexible hose or equivalent in place of aluminum tube on all TBM 3E aircraft. (B-96)	FAA replied 8/7/59 advising AD 58-19-1 believed adequate.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
7/20/59	Accident: Piper PA11, N78790, Anchorage, Alaska, 2/22/59.	To: FAA, Administrator; Recommended amend Part 3 of CAR's to require drainable fuel tank sumps. (B-96)	FAA replied 8/20/59 indicating fuel system design problem being studied. Fuel contamination problem called to attention of operators.
7/24/59 7/28/59	Accident: McCullock MC-4C, N4017K, Marineland, Calif., 7/17/58.	To: FAA, Administrator; Recommended test to determine if safety belt meets the TSO C-22 requirements; if not, remove from service. If requirements met, determine if TSO is adequate, or should be revised. (B-96)	AD 59-24-3 issued.
8/31/59	2 Accidents: Trans World Airlines, L-1649A, Milan, Italy, 6/29/59, Capital Airlines, Viscount, Chase, Maryland, 5/12/59.	To: FAA, Administrator; Recommended conduct review of airline operational practices re travel in areas of lightning with some fuel tanks empty. (B-96)	FAA replied 9/16/59 advising evaluation being conducted by NASA.
9/14/59	Incident: American Airlines, B-707, Los Angeles, Calif., 9/7/59.	To: FAA, Administrator; Recommended redesigning of fore flap to make fail-safe; issue AD requiring installation of new design. (B-96)	AD 60-4-2 issued 2/22/60.
9/18/59	Accident: Beech Bonanza, N3794N, Mason City, Iowa, 2/3/59.	To: FAA, Administrator; Recommended pilot in command and aircraft requirements for air taxi operations be made more stringent. (B-93)	FAA advised 11/2/59 revised Part 47 would cover recommendations.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
9/18/59	2 Accidents: Beech Bonanza, N3794N, Mason City, Iowa, 2/3/59, Capital Airlines, Viscount, Chase, Maryland, 5/12/59.	To: FAA, Administartor; Recommended that procedures, facilities and services for transmission of significant weather information to air crews be improved. (B-93)	Reply of 11/2/59 indicated inproved flight assistance program under development.
10/ 2/59	Mooney 18 & 20 series aircraft. Accidents at: Kerrville, Texas, Detroit, Michigan, Syracuse, Indiana, Culmerville, Pennsylvania, Structural failures.	To: FAA, Administrator; Recommended grounding of Mooney 18 and 20 series aircraft until improved control surface hinges, proper reinforcements of rib glue joints at hinge location are installed and high time aircraft static tested. (B-96)	FAA replied 12/7/59 outlining corrective action. Letter 6/20/60 forwarded report of investigation and corrective action.
10/27/59	Incident: Eastern Air Lines, L-188, Idlewild, N. Y., 10/22/59.	To: FAA, Administrator; Recommended all overwing fuel tank caps be removed when fueling and defueling L-188 aircraft. (B-96)	AD 60-10-5 issued.
10/29/59	Incident: Eastern Air Lines, L-188, Idlewild, N. Y., 10/22/59.	To: FAA, Administrator; Recommended all L-188 operators conduct inspection for foreign objects in fuel system. (B-96)	FAA advised 12/9/59 that priority telegraphic messages issued by FAA appraising the problem.
11/ 5/59	Recommendation: Flight recorders, Boeing 707 aircraft.	To: FAA, Administrator; Recommendations re inadequacy of proposed AD. (B-96)	No reply to date.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
11/12/59	Accident: Aeronca 65-AC, N39310, Hayti, Missouri, 3/25/59.	To: FAA, Administrator; Recommended corrective measures to require replacement of all safety belts other than TSO belts; establish research program to determine belt webbing deterioration caused by moisture. Require periodic retirement based on realistic service. (B-96)	FAA advised 12/28/59 that corrective procedures established for replacement of old type belts.
11/20/59	Accident: Trans World Airlines, L-1649A, Milan, Italy, 6/29/59.	To: FAA, Chief, Engineering Division; Recommended an AD requiring that one side of the No. 7 fuel tank be blocked off. (B-96)	No reply to date.
12/ 7/59	Accident: Piper PA22, N9530D Plum Boro, Pa., 4/23/59.	To: FAA, Administrator; Recommended conducting airworthiness determination tests of Piper PA22 autopilot, consider possible alert bulletin. (B-96)	
12/18/59	2 Accidents: Beech Bonanza, N3794N, Mason City, Iowa, 2/3/59, Capital Airlines, Viscount, Chase, Maryland, 5/12/59.	To: Chief, United States Weather Bureau and FAA, Director, Bureau of Air Traffic Management; Recommended initiation of interagency discussions to develop adequate flash advisory system for international and domestic air operations of all categories. (B-93)	Discussions held, plan being developed.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
12/21/59	Accident: Piedmont Aviation, DC-3, Charlottesville, Va., 10/30/59.	To: FAA, Administrator; Recommended same controls to assure accuracy and reliability be applied in development and checking of private facilities as are used for public facilities. (B-93)	No direct response by FAA.
12/28/59	Accident: Piper PA22, N3315A, Van Nuys, Calif., 3/29/59.	To: FAA, Administrator; Recommended issuance of an AD requiring mandatory compliance with Piper Service Bulletin No. 141. (B-96)	AD 60-10-8 issued.

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DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
1/ 6/58	Accident: Hiller UH-12, N8117H, Chino, California, 11/6/57.	To: CAA, Director, Flight Operations; Recommended issuance of AD requiring compliance with Hiller Service Bulletins. (B-96)	No reply received.
1/ 8/58	Propeller Failure: American Airlines, DC-6A, Los Angeles, Calif., 8/20/57.	To: Vice President Operations, American Airlines; Recommended inflight stress surveys to determine vibratory stresses of 43E60/6895-0 propeller. Hamilton Standard installation. (B-96)	Reply received 1/24/58. Tests were started 2/15/58.
1/17/58 2/10/58	Accident: Douglas DC-3, N19991, Pittsburgh, Pa., 12/10/57.	To: CAA, Director, Flight Operations; Recommended issuance of Maintenance Alert Bulletin calling operator attention to hazards of unorthodox condition of down latch mechanism. (B-96)	No reply received.
2/ 1/58	Accident: Humble Oil and Refining Co., S-58, N861, Grand Island, La., 2/1/58. Pontoon struck platform at night during take-off, crashed in water.	To: Humble Oil and Refining Company; Recommended life jackets be equipped with water proof flashlights and whistles for night use. (B-95)	Reply received stating that suggestion adopted.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
2/15/58	Accident: National Airlines, L-18-50, Key West, Florida, 2/15/58.	To: CAA, Director, Flight Operations; Examine emergency exits for proper operation, exits and doors for proper markings. (B-95)	CAA issued Alert Bulletin #13, Manual of Procedure 403.
2/19/58	Incident: Involving failure of tube assemblies in flight, DC-6 aircraft.	To: CAA, Director, Flight Operations; Recommended issuance of Airworthiness Directive requiring compliance with Douglas Service Bulletins 654 and 706. (B-96)	CAA advised AD not necessary as service experience did not justify it. All operators were in compliance with Service Bulletins 654 and 706.
3/12/58	Accident: Humble Oil and Refining Co., S-58, N861, Grand Island, La., 2/1/58.	To: CAA, Director, Flight Operations; called attention to lack of adequate strength of existing tail rotor drive shaft. (B-96)	CAA advised 4/9/58 that they were investigating the reported deficiencies in the subject shaft.
3/17/58	Accident: Eastern Airlines, DC-7B, Miami, Florida, 6/27/57.	To: CAA, Director, Flight Operations; Recommended establishing a mandatory service life for pump to firewall hydraulic pressure hose on DC-6, DC-6B, and DC-7 aircraft. (B-96)	Reply of 7/31/58 outlines reasons for not agreeing with recommendation.
3/19/58	Accident: Pan American World Airways, B-377, Pacific Ocean, 11/8/57.	To: CAA, Director, Flight Operations; Recommended PAA-PAD maintenance policies, particularly with regard to maintenance overhaul inspection, responsibility for day-to-day airworthiness and adherence to Maintenance Manual be re-assessed. (B-96)	No reply received.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
3/28/58	Accident: Lockheed PV-1, N99G, Pittsburgh, Pa., 12/10/57.	To: CAA, Director, Flight Operations; Recommended issuance of Alert Bulletin pointing out proper inspection procedures bolts and attach plate, drag strut. (B-96)	CAA advised 8/12/58 that maintenance note issued for General Maintenance Inspection Aids.
3/28/58	Accident: Hiller UH-12A, N8130H, Fresno, Calif., 8/12/57.	To: CAA, Director, Flight Operations; Recommended that a check be made of Pacific Helicopter Company to determine that their overhaul and inspection procedures meet standards of airworthiness. (B-96)	CAA transmitted letter 4/18/58, indicating action taken.
4/ 4/58	Incidents: Structural Failures--Main chassis ram foot fittings, V745 aircraft.	To: CAA, Director, Flight Operations; Recommended mandatory incorporation of sleeve modification main chassis ram foot fittings Viscount aircraft. (B-96)	Reply of 5/12/58 indicated AD 57-26-1 superseded by AD 58-8-6.
4/15/58	Improperly marked Shipments of Radium (alleged).	To: CAA, Director Flight Operations; Requested CAA investigate alleged shipment via Pan American World Airways by Lane-Wells and Loretz Company. (B-95)	CAA advised case returned to Department of Justice. Corrective action taken.
4/22/58	Accident: Bell 47J, N2894B, Detroit, Michigan, 3/24/58.	To: CAA, Director, Flight Operations; Recommended tank restraining strap be inspected daily until redesigned strap installed.	No reply received.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
4/24/58	Accident: Riddle Airlines, C-46R, Miami, Florida, 12/20/57.	To: CAA, Director, Flight Operations; Recommended inspection of all C-46R aircraft to determine if comply with CAR 4B fire requirements. (B-96)	FAA advised 5/7/59 that all C-46R aircraft comply with applicable fire prevention requirements.
5/23/58	Safety Investigation: Interference between radar installation and rudder pedals. Panagra DC-7 aircraft.	To: CAA, Director, Flight Operations; Recommended action to ensure positive clearance between radar scope and rudder pedals. (B-96)	Replied 7/24/58 advising Panagra modified all DC-7B aircraft.
6/16/58	Accident: Capital Airlines, V-745, Freeland, Michigan, 4/6/58.	To: CAA, Director, Flight Operations; Requested for flight stall tests to determine V-745 fitness under Part 4B or equivalent as required by part 10. (B-96)	Replied 9/18/58 advising results of tests, and that aircraft meets 4B as required.
6/19/58	Accident: North Central Airlines, DC-3, Jackson, Michigan, 6/19/58. Overshot runway and continued down embankment.	To: Vice President, North Central Airlines; Recommended re-emphasize be placed on emergency evacuation procedures. (B-95)	Acknowledged, indicating that corrective action taken.
8/ 6/58	Accident: Beechcraft 95-Travel Air, Little Rock, Arkansas, 7/22/58.	To: CAA, Director, Flight Operations; Recommended investigation of spin characteristics of Model 95. (B-95)	No reply received.
8/ 8/58	Fire extinguisher systems.	Recommended positive ground leads fire systems all aircraft. (B-96)	Alert Bulletin #6, MOP 406, issued.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
8/ 8/58	Accident: Continental Airlines, Viscount, North Platte, Neb., 7/11/58. Turbine wheel failure.	To: CAA, Director, Flight Standards; Recommended failure analysis of engine parts in relation to turbine disc failures and application of "single failure" philosophy in rule making. (B-96)	No reply to date.
8/22/58	Accident: Hiller UH-12C, N5314V, Voluntown, Conn., 6/14/58.	To: CAA, Director, Flight Operations; Suggested action to correct failure of tail rotor. (B-96)	Reply 9/12/58, Los Angeles Office investigating. AD 58-24-2 issued 12/1/58.
8/25/58	Daily Mechanical Reports: DC-7 anti-drag ring retention failures.	To: CAA, Director, Flight Operations; Suggested action to improve ring retention. (B-96)	AD 59-2-2 issued to comply.
9/10/58	Accident: Trans World Airlines, L-1649A, Cut Bank, Montana, 8/25/58.	To: CAA, Director, Flight Operations; Recommended requirement of means for feathering independently of low pressure relief and pilot valves of HS 5U21 Governor; cover in training programs and manuals. (B-96)	AD 59-10-5 issued.
9/2/558	Incident: Northwest Airlines, DC-7C, Seattle, Wash., 7/24/58.	To: CAA, Director, Flight Operations; Suggested re-evaluate maintenance and inspection procedures Northwest Orient Seattle Base. Rear packing nut for oil line not sufficiently tightened. (B-96)	Reply of 12/29/58 advising of inspection procedures being emphasized.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
9/29/58	Accident: L-188, N1881, Edwards AFB, Calif., 6/27/58.	To: CAA, Director, Flight Operations; Recommended action to provide adequate protection against inadvertent actuation into Beta range of power levers during flight. (B-96)	Reply 10/31/58 advising corrective action taken by imposing a spring force on power lever from stop position into Beta range.
10/20/58	Accident: United Air Lines, DC-7, Washington, D. C., 9/21/58.	To: CAA, Director, Flight Operations; Recommended issuance of an AD establishing inspection and cleaning period based on reasonable service period, incorporate improved bleed valve assembly--pitch lock bleed valve. (B-96)	Air Carrier Maintenance Alert Bulletin #58-18 issued.
19/24/58	Accident: L-18, N300E, Grants, N. M., 3/22/58.	To: CAA, Director, Flight Operations; Suggested review of CAA policy re installation and use of auxiliary fuel tanks which can result in dangerous over loading of aircraft. (B-96)	Letter from CAA indicates investigation and possible preventive action.
11/ 5/58	Accident: Trans World Airlines, L-1649A, Cut Bank, Montana, 8/25/58.	To: CAA, Director, Flight Operations; Suggested re-evaluation of quality control procedures at manufacturer's plant. (B-96)	AD being prepared, 4/17/59, requiring installation of prop governor incorporating bypass feathering valve. AD 59-10-5.
11/26/58	Accident: PacAero, CV-340, N340EL, Palm Springs, Calif., 10/16/58.	To: CAA, Director, Flight Operations; Suggested corrective action necessary re design provision for brake bleeding and brake maintenance procedures at PacAero. (B-96)	No reply received.

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DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
12/19/58	Accident: Seaboard & Western Airlines, L-1049D, Idlewild, N. Y., 11/10/58.	To: CAA, Director, Flight Operations; Recommended incorporation of new power unit with mechanical low pitch stop assembly and interim action regarding inspection periods. (B-96)	Replied to 2/20/59. AD 59-7-1 issued.
12/24/58	Accident: Alouette II, N526, Camron, La., 12/2/58.	To: CAA, Director, Flight Operations; Recommended grounding of all Alouette II helicopters until satisfactory fixes are incorporated in flight control systems. (B-96)	Telegraphic AD issued 1/9/59. Letter received 1/23/59 outlining action taken.

SAFETY RECOMMENDATIONS
CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
- 1957 -

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
4/26/57	Incident: Premature removal rate, 972TC18CA engines, American Airlines.	To: CAA, Director, Flight Operations; Recommended investigate high premature removal rate of 972TC18DA engines. (B-96)	CAA replied 5/2/57 advising problem being studied.
4/26/57	Accident: Westair Transport, C-46, Fairbanks, Alaska, 9/15/56.	To: CAA, Director, Flight Operations; Recommended correction of apparently inadequate inspection and maintenance procedures; Westair Transport. (B-96)	No reply to date.
5/ 8/57	Accident: Braniff Airways, CV-340, Dallas, Texas, 4/19/57.	To: CAA, Director, Flight Operations; Recommended AD to remove defective pivot shafts from service. (B-96)	AD 57-14-1 issued.
5/ 9/57	Accident: Continental Oil, S-55, N884 Empire, La., 11/19/56.	To: CAA, Director, Flight Operations; Recommended evaluation of quality control procedures re manufacture of failed hydraulic pump. (B-96)	No reply to date.
5/23/57	Incident: Capitol Airways, C-46, Travis AFB, Calif., 3/26/57.	To: CAA, Director, Flight Operations; Recommended AD for mandatory corrective procedures outlined for corrosion of propeller blade contacted by blade. (B-96)	AD 57-13-5 issued.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
6/10/57	Accident: Capital Airlines, V-745, LaGuardia, N. Y., 5/21/57.	To: CAA, Director, Flight Operations; Recommended determination if quality control procedures in maintenance and inspection departments are adequate. (B-96)	CAA replied 9/5/57 advising CAP taking corrective action and violation reports processed against those involved in incident.
6/19/57	Accident: Los Angeles Airways, S-55, Los Angeles, Calif., 11/10/56.	To: CAA, Director, Flight Operations; Recommended investigation of possible inadequacy in standards of overhaul and inspection at engine overhaul agency. (B-96)	No reply to date.
7/17/57 7/22/57	Recommendation: Uncontrolled engine/propeller overspeeds.	To: CAA, Director, Flight Operations; Recommended joint CAA-CAB effort to reduce high rate. (B-96)	AD 58-8-3 issued.
7/18/57	Accident: Flying Tiger Line, DC-6A, Jamaica Bay, N. Y., 6/21/57.	To: CAA, Director, Flight Operations; Recommended improvement of handling conditions and storage of aircraft fluids. (B-96)	CAA replied 10/9/57 advising corrective procedures initiated to insure proper handling of fluids.
8/ 9/57	Recommendation: Consideration of inflight refueling.	To: CAA, Chief, Air Carrier Division; Recommended consideration of requirement for inflight refueling capability and procedure for air carrier aircraft. (B-96)	No reply to date.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
9/17/57	Accident: Northeast Airlines, C-46, Boston, Mass., 8/30/57.	To: CAA, Director, Flight Operations; Recommended determining adequacy of cooling airflow to generator and engine accessory compartment; adequacy of number and location fire-warning thermocouples in Zone 2. (B-96)	CAA replied 10/22/57 advising that cooling problem being investigated by Fort Worth Office.
9/19/57	Accident: New York Airways, S-58C, New York, N. Y., 8/31/57.	To: CAA, Director, Flight Operations; Recommended AD for mandatory replacement of rollers in freewheeling unit. (B-96)	AD 57-19-2 issued.
11/21/57	Accident: Scandinavian Airlines, DC-7C, Nr. Boston, Mass., 10/29/57.	To: CAA, Director, Flight Operations; Recommended issuance of an AD for mandatory replacement of impeller gear with heavier gear. (B-96)	AD 57-24-1 issued.
11/21/57	Accident: Douglas B-26, N60Y, Roswell, N. M., 10/24/57.	To: CAA, Director, Flight Operations; Recommended AD be issued to correct fuel fitting failures. (B-96)	CAA advised 2/19/58 that an alert bulletin would be issued.
11/27/57	Accident: Northeast Airlines, DC-3, New Bedford, Mass., 9/15/57.	To: CAA, Director, Flight Operations; Recommended determining adequacy of test procedures of DC-3 operators relative to wing flap relief valve. (B-96)	Air Carrier Maintenance Alert Bulletin #58-2 issued.

DATE OF ACTION	ACCIDENT AND/OR SUBJECT OF RECOMMENDATION	RECOMMENDATION	CORRECTIVE ACTION
12/12/57	Recommendation: Protection prop feathering switches on DC-6 and DC-7 aircraft.	To: CAA, Director, Flight Operations; Recommended installation of insulation for protecting prop feathering switches on DC-6 and DC-7 aircraft to avoid inadvertent feathering. (B-96)	CAA replied 4/14/58 advising that Douglas instituting corrective measures.

ENGINEERING DIVISION

Project Status Report

Past compilations of this type have included a list of Engineering Division safety study projects already underway or programmed. The unusually heavy accident investigation workload of individual engineering specialists over the past year has precluded their being able to devote much, if any, time to these very important programmed projects. In addition, in the coming fiscal year it is expected that the increased technical complexity of our accident investigation workload alone will severely overtax the capabilities of our small engineering staff. Accordingly, faced with a large current backlog of accident investigation work and convinced that in the foreseeable future little time can be devoted to programmed safety study project work until additional specialists are authorized, hired and trained, this division is discontinuing a detailed listing of its safety study projects.

However, it should be pointed out that in the last year it has been necessary for the division to initiate numerous safety study projects directly connected with the investigation of specific accidents. Being part of specific accident investigations they are not listed as separate safety study projects. One example is that in connection with the TWA-UAL collision accident near New York on December 16, 1960, forty-five flight recorder records of jet flights approaching IDL through the Preston Intersection between December 8 and 16, are being analyzed. This project will yield much valuable information in regard to stability of range signals, holding speeds, compliance with holding patterns in regard to size and location, compliance with holding altitudes, collision hazards, etc. This project entails high enough man-hour requirements that automatic data processing by the Board's IBM machine has been planned to the maximum extent practical without the purchase or rental of additional units for attachment to the present equipment.

Division: Engineering

Date: February 1961

SPECIAL PROJECTS PENDING

Division Project No.	Project Description	Project Officer	Started	Percent Completed	Coordination
E-59-ST.-1	Structural Fatigue Failures in Civil Aircraft Accidents - This project involves a study of those accidents which were caused by the fatigue failure of structural components. The overall importance of structural fatigue will be assessed, and an attempt will be made to isolate significant factors such as design, maintenance, corrosion, loading, etc. This project should result in the identification of problem areas which can be studied further by separate projects.	Leak	1/27/59	16	
E-59-ST.-2	Review of Transport Landing Gear Accidents for the Period 1949-1958- An initial review of the accident record has disclosed that landing gear accidents constitute a significant percentage of the total in this period. The purpose of this project is to isolate and identify the problem areas in order that remedial action can be instituted.	Kennedy	1/27/59	0	

E-59-St.-3	(Reassigned as E-60-Syst.-4)				
E-59-St.-4	Review of Alaskan Air Carrier Accidents - To determine effect of overweight operations under SR No. 399A on landing gear failures.	Huyler	8-1-59	0	
E-59-PP-1	Powerplant Fatigue Failures in Civil Aircraft Accidents - This project involves a study of those accidents which were caused by the fatigue failure of engine components. The overall importance of structural fatigue will be assessed, and an attempt will be made to isolate significant factors such as design, maintenance, corrosion, loading, etc. This project should result in the identification of problem areas which can be studied further by separate projects.	Hallman	1-27-59	15	NBS
E-59-PP-2	Review of Transport Powerplant Accidents for the Period 1949-1958 - The accident record reveals that a significant percentage of accidents resulted from powerplant failures. The purpose of this project is to isolate and identify the problem areas in order that remedial action can be instituted.	Gonnoud	1-27-59	60	Analysis Division
E-59-PP-3	Multiple Engine Failures as a Factor in Transport Accidents - Since our performance requirements are based on as many as two engine failures in the case of four engine aircraft, it appears worthwhile to review the accident record to determine if the safety provided has been adequate.	Taylor	1-27-59	10	
E-59-PP-4	Carburetor Icing Study, Light planes - This study consolidates information on the carburetor icing problem and develops guide lines for use of accident investigators.	Hallman	7-2-59	85	Operations Division

E-57-Syst.-1	Emergency Radio Transmitters - This project involves evaluating the need for and the practicality of automatic distress signal devices for civil transport aircraft.	Cowan	12-15-57	85	USAF, ATA, FAA
E-57-Syst.-2	Reliability of Airborne Navigation Aids - This project involves evaluating numerous complaints relative to malfunctioning and failure of equipment in order to determine the need for corrective action.	Cowan	12-15-57	75	
E-57-Syst.-3	Potential Microwave Radiation Hazards - This project deals with the study of possible harmful effects to life and property from airborne and ground radar installations. Interim report completed May 1958. After project is completed periodic checks of developments will be made in the future.	Cowan	11-1-57	80	
E-59-Syst.-1	Review of Transport Accidents, Incidents, and DMR's Involving Hydraulic Systems Failures, and/or Malfunctions for the Period 1949-1958 - The records will be studied to determine the relative importance of hydraulics as a causal factor.	Collins	1-27-59	0	
E-59-Syst.-2	Review of Transport Accidents, Incidents, and DMR's Involving Failure and/or Malfunction of Electrical System Components for the period 1949-1958 - The records will be studied to determine the items of equipment most frequently involved and to attempt to point out units responsible for starting electrical fires or producing smoke in the cockpit.	Lowe	1-27-59	5	

E-60-Syst.-1	Instrument Power Failure Warning Indication - A study of the present situation relative to power failure warning indication systems in use in transport aircraft. To determine what has been done to improve the situation found to exist during the NEA Rikers Island accident investigation and to determine what further corrective action may be necessary.	Rawson	8-3-60	5	Analysis Division
E-60-Syst.-2	Hydraulic System Flexible Hose Failure (DC-6 and DC-7) - A study of the problem of continued failure of high pressure pump-to-firewall hydraulic hose on DC-6 and DC-7 aircraft. To determine the nature of the failures, the quality control procedures employed by the hose manufacturers and the current hose retirement policies of the carriers. The study will indicate whether a need exists for a mandatory retirement life for these hoses.	Lowe	8-3-60	0	Analysis Division
E-60-Syst.-3	Fire Detection System False Warnings - A study of the records of instances of false fire warning to determine which systems (by manufacturer and by type) exhibit the highest incidence of false alarm and, further, to identify the nature and source of the difficulties that precipitate false warnings so that recommendations may be made for corrective action that will serve to reduce such false warnings to a minimum without impairment of the systems' intended functions.	Rawson	8-3-60	0	Analysis Division
E-60-Syst.-4	Study of Flight Recorder Records from 707 Accidents - The foil records from the recorders installed on 707 aircraft involved in accidents will be studied to determine suitability of recording techniques and to assess the value of flight recorders as an assist in accident investigation.	Cowan	8-2-60	20	Boeing, LAS

E-58-TR.-1	Flight Attendant Seating - This project was initiated as a result of complaints received relative to the safety aspects of flight attendants seats and their location in the aircraft. B-95 was requested on 9-24-58 to conduct a field survey of all operators to collect necessary data for technical study. The field survey has been completed and data are undergoing analysis.	Doyle Hopper	10-1-58	45
E-58-TR.-2	Technical Analysis of L-18 Accidents - The alarming number of fatal executive accidents involving this model aircraft has prompted us to review the complete accident record of this aircraft to determine if there is any specific reason or reasons for these accidents. Since many of these accidents have involved engine failures, the single-engine performance of this model may be a factor; this aspect will be explored thoroughly.	Doyle	6-15-58	20
E-58-TR.-3	Visual Detection of Aircraft Through the Atmosphere - The objective of the project is to study the available technical data in order to determine the probability of visual detection of aircraft through the atmosphere. Preliminary project report completed on August 17, 1958. Interim report submitted December 24, 1958, for inclusion in B-91 "Speed Control Project."	Doyle	4-21-58	70

E-58-TR.-4	Development of Monitoring Procedures for New Jet Transports - This project involves the formulation of plans and procedures for the expeditious processing of mechanical, electrical, electronic, structural malfunctioning and failure reports involving new turbine powered aircraft. Our chief purpose is to devise ways and means to prevent serious accidents by initiating early corrective action on the basis of technical analysis of difficulty reports. Meeting held with CAA and ATA on December 9, 1958. Revised airline reporting system implemented. Study of processing methods continuing. Conference will be held on August 3, 4, and 5 by FAA to review maintenance requirements.	Sonner	7-1-58	81	ATA FAA
E-59-TR.-1	American Airlines L-188 East River Accident Crash Injury Study - This project involves the study of the crash survival aspects for the subject accident; field investigation activity completed and data being processed for factual report.	Doyle	2-4-59	77	
E-59-TR.-2	Review of Transport Accidents Involving Maintenance Procedures and Personnel for the Period 1949-1958 - The objective of this project is to determine the relative importance of maintenance as a causal factor in accidents and to identify and isolate problem areas.	Sonner	1-27-59	5	
E-59-TR.-3	Capital Airlines L-049, Accident at Charleston, West Virginia, Crash/Injury Study - This project involves a study of the crash survival aspects of the subject accident. Field investigation activity completed and data being processed for factual report.	Doyle	5-13-59	25	

SAFETY ANALYSIS DIVISION

PROJECTS COMPLETED
1960

1. Study on Midair Collisions in U. S. Civil Aircraft Operations, 1938 - 1960.

2. Statistical Review of Helicopter Accidents - Air Carrier and General Aviation.

3. Fatalities Attributable to Fire Following Impact as Compared with Those Resulting from Impact Forces.

4. Collisions with Wires on Take-offs and Landings - General Aviation, Fixed Wing and Helicopters.

5. Annual Resume of Accidents - Air Carrier, Rotorcraft and Large General Aviation Aircraft, 1959.

6. Annual Report to ICAO - Air Carrier Accident Record, 1959.

7. Recapitulation of U. S. Air Carrier Accidents Occurring in Foreign Countries.

8. Deaths and Injuries to Persons on the Ground, 1953 - 1959.

9. Fatal and Nonfatal Accidents Occurring in Forest Fire-Fighting Operations.

10. Collision with Obstruction - T. V. and Radio Towers, etc.

11. Accidents to Single-Engine Aircraft at Night during VFR Weather.

12. Accidents Involving Twin-Engine Aircraft and Resulting from Engine Failure on Take-off or Aborted Landings.

13. Structural Failures, Small General Aviation Aircraft.

14. Listing of Accidents Involving Structural Failures in Mooney M-20 Aircraft.

15. Listing of Accidents Involving Fuel System Contamination - General Aviation.

February 17, 1961

SAFETY ANALYSIS DIVISION
PROJECTS PENDING
1960

1. Annual Statistical Review, Air Carrier, Rotorcraft, and Large General Aviation Aircraft Accidents, 1959.

2. Annual Report of Aerial Application Accidents, 1959.

3. Statistical Review of Accidents in General Aviation, 1959, under 12,500 lbs.

4. Development of full scale system for automatic and/or electronic data processing of all civil aircraft accidents.

5. Study of Air Carrier Accidents involving instrument approaches.

6. Descriptions and details of all bomb explosions in aircraft, U. S. and foreign.

7. Study of accidents in General Aviation involving instrument pilots as compared with those involving noninstrument pilots.

8. Study of approach and landing accidents, Air Carrier and General Aviation aircraft over 12,500 lbs. gross take-off weight.

9. Study of a revised format for the reporting of General Aviation accidents by pilots, owners or operators.

10. Study of Air Carrier accidents involving training activities.

11. Resume of Air Carrier accidents involving turbulence in flight.

February 17, 1961

OPERATIONS DIVISION - STUDY PROJECTS
COMPLETED DURING CALENDAR YEAR 1960

1. An extensive study was completed of ice ingestion flameouts on certain turbine-powered aircraft. This study resulted in the transmittal of several recommendations to the FAA for review and revision, as necessary, of pertinent aircraft operating procedures. These procedures have been appropriately amended by the FAA.

2. In cooperation with the United States Weather Bureau and other offices of the Board, the Bureau's meteorological staff completed a study which showed the pressing need for the free carriage of USWB aviation forecasters by the air carriers under carefully controlled conditions. This transportation will assist forecasters in improving methods of forecasting and reporting weather data pertinent to the navigation and routing of aircraft. Furthermore, the inflight observation by these Weather Bureau personnel will increase their familiarity, and thus their effectiveness, with the peculiar problems inherent in the inflight reception and use of weather data. On October 13, 1960, the Board adopted appropriate regulations authorizing the free transportation of USWB aviation forecasters by air carriers.

3. An extensive analysis of the difficulties encountered in the air induction system of a twin-engine executive-type aircraft, particularly when operating in known icing conditions, was completed. As a result of the study, the Federal Aviation Agency issued an airworthiness directive restricting the operation of this aircraft in known icing conditions until modification to the carburetor air preheat system had been accomplished.

4. Several other projects were initiated during the year; however, the press of direct accident investigation and lack of personnel precluded final action on these matters. They covered diverse subjects such as weather services, jet training procedures, and inflight airframe failures of small personal aircraft.

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OPERATIONS DIVISION - STUDY PROJECTS
PENDING DURING CALENDAR YEAR 1960

1. Review of the Adequacy of the Meteorological Minima Prescribed in the Civil Air Regulations.

   A study has been made of accident cases during the last ten years in which low ceilings and/or visibilities have been involved. On the basis of this study, a discussion paper has been prepared and submitted to the National Advisory Committee for Aeronautical Meteorology (NACCAM) setting forth the findings and recommending several possible actions with respect to improved procedures for the measurement and operational use of cloud heights and visibility. This study is continuing.

2. Revision of Part 320 of the Board's Safety Investigation Regulations.

   The Bureau has under preparation the revision of Part 320, "Notification and Reporting of Aircraft Accidents, Certain Inflight Hazards, and Overdue Aircraft." This revision is designed to achieve the following objectives: 1) set forth unequivocally, insofar as the affected public is concerned, the Board's continuing and undiluted authority and responsibility for accident investigation and the determination of probable cause; 2) update the part to include, to the extent possible, previously developed recommendations; 3) simplify the part so that the user can readily determine his responsibilities by (a) eliminating all duplications, (b) presenting the requirements in the chronological order in which the pilot or operator is required to meet them, (c) eliminate to the extent possible footnotes and complex cross references, and (d) simplify and eliminate, when possible,definitions.

3. Evaluation of Training Procedures of Several Air Carriers and MATS for Boeing 707 and Other Jet Aircraft.

The Division has participated in the jet training programs of two air carriers and plans to cover several more. However, this project has been delayed because of insufficient personnel.

4. Cross-Wind Accidents and Accidents Involving Strong and/or Gusty Winds.

All accidents involving strong and/or gusty surface winds are being examined with a view to ascertaining whether the fault lay in the wind observing and reporting equipment, in the training of the pilot, or in an error in judgment. Recommendations are envisioned for improved methods of observing and recording winds.

5. Review of Adequacy of Weather Briefing in Connection with Aircraft Accidents.

All accidents on file for which weather analyses have been prepared are being re-examined in the interest of determining what weather briefing service had been provided in each instance and also the number of cases in which it was not possible to obtain a positive statement as to whether briefing had been provided or the nature of such briefing. From the study, it is hoped that specific recommendations will be forthcoming as to improved methods of briefing and recording of briefing.

6. Evaluation of Performance, Flight Characteristics, and Operations of Existing and New-type Transport Category Helicopters, including Single and Multiengine Turbine Types and Their Proposed Instrument Operation.

This study is being conducted to determine the operational performance standards necessary to enable twin-turbine helicopters to substantially

raise the safety and reliability of scheduled air carrier helicopter operation. It includes study to determine the best means of integrating large volume helicopter transportation into the already congested traffic complexes at major airports under both IFR and VFR conditions. This study is coordinated with the Board's economic responsibilities with respect to scheduled helicopter operations.

7. Bird Ingestion in Turbine-engine Aircraft.

A study is in progress relating to the effect of bird ingestion on engine performance in all flight configurations; e.g., takeoff, en route, and landing. Operational experience and bird ingestion incident information has been requested from the military and civil users of turbine-powered aircraft. Currently in effect is a request to all U. S. air carriers for immediate reports by telephone call direct to the Bureau of Safety on bird ingestion incidents, and for a written crew statement concerning the incident as soon as possible. This study is at present in the information collecting stage.

8. Criteria for the Separation of IFR and VFR Traffic in High Density Areas.

With the advent of jet-type, high-speed transport aircraft, IFR flights have become commonplace regardless of weather conditions. It is the belief of many pilots operating under Instrument Flight Rules that they are afforded a greater margin of safety and are provided separation from all aircraft, even those operating VFR. To date the FAA has no requirement or procedures which provide for mandatory separation or exchange of IFR and VFR traffic. We are studying the safety aspects of this situation, particularly with respect to high density areas.

9. Airframe Failures on All High-performance Personal-type Aircraft.

When the Civil Air Regulation pertaining to the certification of private and commercial pilots was promulgated many years ago, the speed of the privately-owned aircraft was in the general range of 120 m.p.h. In recent years, this type aircraft has grown greatly in speed. However, the pilot certificate standards with particular reference to type of aircraft have not advanced with the state of the art. Example: A private pilot with an airplane single engine land rating is certificated to fly and carry passengers in aircraft ranging from 65 HP Cubs up to 12,500 pounds certificated gross takeoff weight aircraft, without further showing of competency. It is believed that new pilot certificate standards are needed for high performance personal-type aircraft in order to insure that such persons are competent to fly such aircraft. An extensive study of accident records pertinent to this subject is being conducted.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY

FIELD INVESTIGATION SECTION
SAFETY INVESTIGATION DIVISION

SUMMARY OF OVERTIME

FISCAL YEAR 1960
JULY 1, 1959 - JUNE 30, 1960

MONTH	* NUMBER OF INVESTIGATORS		OVERTIME HOURS		
			WORK	TRAVEL	TOTAL
JULY	(23)	17	415.0	356.3	771.3
AUGUST	(23)	21	770.9	306.5	1,077.4
SEPTEMBER	(22)	19	615.0	401.5	1,016.5
OCTOBER	(22)	19	755.5	368.0	1,123.5
NOVEMBER	(27)	25	919.0	447.5	1,366.5
DECEMBER	(30)	28	648.0	403.3	1,051.3
JANUARY	(31)	31	876 0	593.0	1,469.0
FEBRUARY	(31)	27	588.5	475.0	1,063.5
MARCH	(32)	24	603.5	362.5	966.0
APRIL	(32)	28	590.0	339.5	929.5
MAY	(33)	30	849.5	450.0	1,299.5
JUNE	(33)	26	677.5	452.0	1,129.5
TOTAL			8,308.4	4,955.1	13,263.5

* The parenthesized figures are the actual total assigned investigators in the field offices. The second figures indicate the number of investigators per month with overtime hours.

February 3, 1961

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY

FIELD INVESTIGATION SECTION
SAFETY INVESTIGATION DIVISION

SUMMARY OF OVERTIME

FISCAL YEAR 1959
JULY 1, 1958 - JUNE 30, 1959

MONTH	* NUMBER OF INVESTIGATORS	OVERTIME HOURS		
		WORK	TRAVEL	TOTAL
JULY	(18) 14	199.5	240.5	440.0
AUGUST	(17) 14	166.5	326.5	493.0
SEPTEMBER	(17) 13	233.5	200.0	433.5
OCTOBER	(18) 15	215.5	132.0	347.5
NOVEMBER	(19) 14	130.0	171.5	301.5
DECEMBER	(19) 14	119.5	228.0	347.5
JANUARY	(20) 16	251.9	200.1	452.0
FEBRUARY	(21) 20	712.0	326.5	1,038.5
MARCH	(22) 19	497.6	273.8	771.4
APRIL	(22) 18	341.5	230.2	571.7
MAY	(24) 22	657.6	408.8	1,066.4
JUNE	(23) 20	397.4	296.1	693.5
TOTAL		3,922.5	3,034.0	6,956.5

* The parenthesized figures are the actual total assigned investigators in the field offices. The second figures indicate the number of investigators per month with overtime hours.

February 16, 1961

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
SAFETY INVESTIGATION DIVISION

SUMMARY OF OVERTIME
DURING THE INVESTIGATION AND PUBLIC HEARING CONCERNING THE UNITED AIR LINES - TRANS WORLD AIRLINES MIDAIR COLLISION OVER NEW YORK, NEW YORK, DECEMBER 16, 1960

NAME	OFFICE	HOURS
SAFETY INVESTIGATION DIVISION		
Philip N. Goldstein	Washington, D. C.	130
Helen H. Quinn	Washington, D. C.	51
FIELD INVESTIGATION SECTION		
George A. Van Epps	New York Office	139
Arnold E. Holstine	New York Office	102
George R. Baker	New York Office	97
William L. Lamb	New York Office	134
David L. Thompson	New York Office	115
Ralph E. Stokes	New York Office	42
Rita A. Pigulski	New York Office	16
Vivian B. Hipps	New York Office	16
George R. Clark	Fort Worth Office	140.5
Peggy B. Allen	Fort Worth Office	25
Frederick R. Beam	Los Angeles Office	77
HEARINGS AND REPORTS SECTION		
Van R. O'Brien	Washington, D. C.	72
Bill F. Buell	Washington, D. C.	52
William A. Buttlar	Washington, D. C.	72
TOTAL OVERTIME HOURS		1,280.5

February 3, 1961

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY

PARTICIPATION IN FAA RULE MAKING

The Board has participated in FAA rule making in the following manner since the Federal Aviation Act of 1958, as amended, became effective on December 31, 1958.

(a) Reviewed all FAA notices of proposed rule making and submitted comments to the FAA on certain proposals.

(b) Reviewed all Civil Air Regulations adopted by the FAA.

(c) Submitted a number of recommendations to the FAA for amendment of the Civil Air Regulations, review of manuals and procedures and issuance of Airworthiness Directives.

(d) Attended numerous public conferences convened by the FAA to discuss proposed rule making.

(e) Participated in frequent informal meetings, particularly concerning matters which were directly related to Board recommendations.

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BACKGROUND AND HISTORY OF THE BOARD'S NEAR-COLLISION PROGRAM

1. In 1953 an awareness of the problem of midair collision was manifested within the airline industry and this matter was discussed in several safety meetings. In 1954, at the meeting of the airlines' Chief Pilots at Dallas, Texas, special attention was focused on the subject of near collisions and discussion was directed to the establishing of a program for the reporting of these incidents so that corrective measure might be taken to reduce the potential.
2. The ALPA then requested the CAA to undertake such a program. One provision of the program stipulated by ALPA was that a pilot in making a report would be guaranteed immunity insofar as the filing of any violation might be involved.
3. The Administrator, after careful consideration, concluded that his safety enforcement responsibilities made it impossible to legally establish such a program within the CAA in view of the conditions imposed by ALPA; however, he felt that this type of program could be conducted by the Board under Title 7 of the Civil Aeronautics Act.
4. The Administrator then contacted the Board regarding the possibility of the Board instituting a near-collision reporting program.
5. On January 26, 1955, Chairman Chan Gurney held a meeting with staff members to discuss this request. He then instructed the Directors of the Bureau of Safety Investigation and Safety Regulation to investigate the problem further.

6. On May 4, 1955, the Directors of the Bureaus of Safety Investigation and Safety Regulation, in their report to the Board, recommended the establishment of a "Near-Miss" Program within the Bureau of Safety Investigation.

7. On May 9, 1955, the Board reviewed this recommendation, approved it in principle, and directed the Bureau of Safety Investigation to formulate a complete Program and submit it for approval.

8. Meetings were then held with the various industry groups (ALPA, AOPA, ATA, etc.), the military, and others to reach accord regarding the manner in which the Program would be handled, and on January 6, 1956, the Director, Bureau of Safety Investigation, submitted to the Board a complete and coordinated Program. This was approved on January 16, and the Bureau was instructed to put the Program into action.

9. Special Civil Air Regulation 416, Voluntary Pilot Report of Near Midair (Near-Miss) Collision, was adopted by the Board on February 23, 1956. The purpose of the regulation was to protect the information reported voluntarily by the pilot from any use in disciplinary or enforcement proceedings.

10. The Program was put into action during May 1956 with a widespread distribution of reporting forms, press releases, and descriptive literature. All segments of industry, including the military, participated and cooperated in this action.

11. The first reports from pilots began to flow in to the Board during May 1956. During the period from May 1956 to December 31, 1957, 3,000 reports were received, 1,511 of which came in during the first

four months. Out of these 3,000 reports, 167 dealt with incidents occurring outside the continental area or were considered as non-valid for various reasons. The remainder, a total of 2,833, were processed.

12. The initial statistical report was prepared and issued to the public March 25, 1957. This report dealt with 452 cases received in the 4-month period, September-December 1956. Subsequently, reports were prepared covering each of the quarterly periods of 1957; two of which were made available to the public. A number of special reports were prepared for various purposes, some of which were issued as a result of requests from Congress and the press; others were prepared for use of the Bureau and for discussion with those agencies which cooperated in the formulation of the Program. One of these reports deals with pilots' comments. On May 19, 1958, a final report was issued furnishing statistics on factors involved in the near collisions reported during January-December 1957. This report also contained a review of certain features inherent in the Near-Collision Program and a discussion on the general nature of the statistical results.

13. In submitting the above report to the Board prior to its release, the Bureau of Safety recognized that the Board's objective in collecting and assembling near-collision statistics and related information had been achieved and that no further benefit would result by the continuance of the Program in this form. Consequently, on July 23, 1958, Draft Release 58-14 was issued. This proposed the discontinuance

of the Near-Collision Program in its current form and the establishment of a different type of program which would cover the reporting of all kinds of flight hazards. Final action could not be taken on this matter prior to the transfer of the Board's regulatory function to the FAA under the new Act of 1958.

14. In April 1958, the Board requested the Administrator to take action to rescind SR-416 so as to terminate the Board's Program. Subsequently, both the Board and the Administrator adopted appropriate regulations which terminated the Board's Near-Collision Reporting Program effective July 15, 1959.

REPORT

OF

MIDAIR COLLISIONS

IN

U.S. CIVIL AIRCRAFT OPERATIONS

1938 - 1960

Prepared By

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
SAFETY ANALYSIS DIVISION

January 1961

FOREWORD

The purpose of this report is to present the record of midair collisions in U. S. Civil aircraft operations for the entire period from January 1938 through 1960.

The nature of the report is broad and general in scope. It describes the general operational aspects of those collisions in which air carrier aircraft were involved and deals with the general conditions attending the collisions involving non-Air Carrier aircraft. It also presents detailed information on the altitude and distance from airport factors involved in the non-Air Carrier collisions during a selected 10-year period. It does not, however, deal with causal factors or the specific detailed circumstances of individual accidents.

Section I furnishes a summary of all midair collisions during the 23 year period 1938-1960. It includes a table showing the annual frequency of these occurrences and a breakdown of the involvement by types of operations.

Section II deals with those collisions in which Air Carrier aircraft were involved and contains a list of all these occurrences.

Section III deals with the midair collisions in general aviation operations.

NOTE: 1960 data based on preliminary information and subject to revision.

SECTION I

Summary

MIDAIR COLLISIONS IN U. S. CIVIL AVIATION FLYING
1938 - 1960

In the 23-year period 1938-1960, a total of 410 midair collisions were recorded in U. S. Civil Aircraft Operations. Slightly over half (214) of these were fatal accidents, resulting in 834 fatalities.

The year-by-year record of these occurrences is shown in Table No. 1 on the next page.

Air Carrier Involvement

Air Carrier aircraft were involved in 32 (7.8%) of the total 410 midair collisions. Twenty-two of these were fatal accidents. However, only 11 (34%) of the total 32 collisions resulted in fatalities to the occupants of the air carrier aircraft.

More detailed information is presented in Section II concerning the collisions involving Air Carrier aircraft.

General Aviation Involvement

Aircraft engaged in General Aviation operations were involved in 397 (97%) of the 410 midair collisions. Two hundred and five (205) of these were fatal accidents, resulting in 475 fatalities.

The above figures include 19 cases in which Air Carrier aircraft were involved. Excluding these 19 cases, there were 378 midair collisions in General Aviation operations. Approximately 50% (192 cases) of these were fatal accidents in which 378 persons were killed.

Refer to Section III for additional details on General Aviation involvement.

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Table 1

MIDAIR COLLISIONS IN U. S. CIVIL AVIATION

1938 - 1960

Year	Number Accidents Total	Number Accidents Fatal	Number Fatalities	Class of Operation: Air Carrier Air Carrier	Air Carrier Gen. Aviation	Air Carrier Military	Gen. Aviation Military	Gen. Aviation Gen. Aviation
1938.....	3	1	2	0	0	0	0	3
1939.....	6	6	12	0	0	0	1	5
1940.....	14	13	26	0	0	0	1	13
1941.....	13	5	7	0	0	0	0	13
1942.....	12	10	21	0	0	2	0	10
1943.....	31	14	14	0	0	0	2	29
1944.....	11	6	6	0	1	0	0	10
1945.....	20	6	9	0	1	1	0	18
1946.....	38	15	25	1	0	0	4	33
1947.....	49	30	54	0	1	0	5	43
1948.....	30	15	47	0	0	0	3	27
1949.....	17	11	89	0	3	1	2	11
1950.....	7	3	11	0	0	0	0	7
1951.....	13	7	17	1	2	0	3	7
1952.....	14	6	14	0	3	0	3	8
1953.....	9	0	0	1	0	0	2	6
1954.....	16	10	18	0	0	1	1	14
1955.....	21	8	24	0	3	0	2	16
1956.....	17	11	161	1	1	0	1	14
1957.....	15	6	19[a]	0	0	1	4	10
1958.....	16	12	86	0	0	2	2	12
1959.....	13	10	20	0	0	0	3	10
1960.....	25	9	152[b]	1	4	0	3	17
Total....	410	214	834	5	19	8	42	336

a/ Includes 3 persons on ground.
b/ Includes 6 persons on ground.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 1961

SECTION II

MIDAIR COLLISIONS

IN

AIR CARRIER OPERATIONS

SUMMARY

During the 23-year period 1938 through December 20, 1960, Air Carrier aircraft were involved in 32 midair collisions. Twenty-two (22) were fatal accidents; however, only eleven (11) of the collisions resulted in fatalities aboard the Air Carrier aircraft. A total of 456 persons perished in these accidents:

421 were aboard the Air Carrier aircraft,
29 were aboard the other aircraft involved,
6 were persons on the ground.

Two hundred and fifty six of the 421 fatalities aboard Air Carrier aircraft occurred in two accidents.

The distribution of these 32 collisions in relation to the involvement of different classes of operators was as follows:

Between	No. Collisions Total	Fatal	Total Fatalities
Air Carrier and Air Carrier.....	5	3	265*
Air Carrier and Military.....	8	6	94
Air Carrier and General Aviation.	19	13	97
Total.....	32	22	456*

* Includes 6 persons on ground.

Scheduled Passenger Operations

In 24 of the 32 collisions, the Air Carrier aircraft were engaged in scheduled passenger operations. Seventeen (17) were fatal accidents, however, only nine (9) of these resulted in fatalities aboard the Air Carrier aircraft.

In 3 of these 24 collisions, both aircraft were Air Carrier aircraft, two of which were fatal accidents. These 3 cases are identified in the next paragraph.

Collisions Between 2 Air Carrier Aircraft

There have been 5 collisions between two Air Carrier aircraft.

In 3 cases, both aircraft were engaged in scheduled passenger service; two 1/ were fatal accidents and the other 2/ was non-fatal.

In another case 3/, a non-fatal accident, one aircraft was operating in scheduled passenger service and the other was a nonscheduled Air Carrier aircraft.

In the 5th case 4/, the collision occurred between two nonscheduled Air Carrier aircraft engaged in simulated instrument training operations. This resulted in fatalities to the occupants of one of the aircraft.

Operational Aspects

The 32 midair collisions involving Air Carrier aircraft were reviewed for the purpose of bringing out the general circumstances and conditions under which the collisions occurred. This information is presented in the following pages. As pointed out in the Foreword, the scope of this report is general. No attempt has been made, therefore to deal with the precise detailed causal factors of the individual accidents.

The general operational aspects and general conditions reviewed herein are as follows.

1. Weather Conditions
2. Occurrences in Airport Traffic Pattern Area
3. Air Traffic Control Aspects
4. Collisions in Instrument Training Operations
5. Other Operational Factors

In dealing with various operational conditions and circumstances, a reference is made to the date and location of the individual cases. Additional details as to the carrier and type of aircraft involved can be found in the list of accidents on pages 11 - 14.

1/ 6/30/56 Grand Canyon, Ariz. and 12/16/60 New York, N. Y.
2/ 8/26/53 Michigan City, Indiana.
3/ 12/19/46 Aberdeen, Maryland.
4/ 11/17/51 Oakland, California

OPERATIONAL ASPECTS OF MIDAIR COLLISIONS INVOLVING AIR CARRIER AIRCRAFT

1. Weather Conditions

In 27 of the 32 collisions in which Air Carrier aircraft were involved the atmospheric conditions were generally good, with no restriction to visibility, although hazy sky conditions may have limited visibility to 5 or 6 miles in 2 or 3 of these cases. In another instance, there was a possibility that a cloud formation at flight level limited forward visibility in certain quadrants.

In 4 cases, weather conditions constituted a definite factor. Excluding the recent collision over New York, on December 16, 1960 there were 2 accidents 1/ in which the collision occurred in the overcast or at the base of the clouds.

In the other case, 2/ there was a low ceiling of 500 feet with visibility of 5 miles and icing conditions existing in and below the clouds. The collision occurred below the clouds, a short distance above the ground as both aircraft were on final approach for landing. Although the surface visibility at the time of impact was adequate, the fact that icing conditions existed, and that one of the aircraft had made an instrument approach through the low overcast, constituted conditions attributable to weather.

1/ 11/4/42 Kansas City, Mo.
1/12/55 Covington, Ky.
2/ 12/15/52 Richmond, Ind.

2. Collisions Occurring in Airport Traffic Pattern Areas

There have been 11 collisions 1/ which occurred within the general airport traffic pattern area and while one or both aircraft were approaching prior to landing.

One of these occurred during the hours of darkness, 9 during daylight hours, and 1 at twilight.

Visibility conditions were good in 10 cases. In the other case, there was a low overcast at 500 feet with icing conditions existing below the clouds. In this instance, both aircraft were below the clouds and leveling off prior to touchdown.

One of the above cases occurred when one aircraft was conducting a simulated instrument approach and the other was on the downwind leg at approximately 1800 feet.

In addition to the above eleven cases, another collision 2/ occurred in the general proximity of an airport but above the traffic pattern level.

1/ 4/22/47 Columbus, Ga.
8/7/49 Milwaukee, Wisc.
11/1/49 Washington, D. C.
11/9/51 Eugene, Oregon
11/27/51 Ocala, Florida
6/28/52 Dallas, Texas
12/15/52 Richmond, Ind.
6/27/54 Columbus, Ohio
7/12/55 Kansas City, Kansas
8/29/55 Hobbs, New Mexico
4/10/57 Oklahoma City, Okla.

2/ 11/17/51 Oakland, California

3. Air Traffic Control Aspects

In dealing with the function of air traffic control, consideration has to be given to the complex of regulations and procedures governing the respective responsibilities of traffic control in providing separation and the pilot in avoiding collisions. Circumstances differ depending on whether the aircraft are operating in accordance with instrument flight rules, and the actual weather conditions. In each of the midair collisions that occurred, these and other factors differ in one or more significant respects.

As pointed out in the Foreword, it is not the purpose of this report to delve into causal factors or the specific details of individual accidents. Accordingly, the information presented below is for the purpose of indicating the number of collisions that occurred when one or the other aircraft had received a clearance or instructions from an air traffic control facility.

Air Route Traffic Control

There were 5 midair collisions that occurred when the function of enroute traffic control existed in respect to at least one aircraft. In two cases 1/ IFR conditions existed. In the other 3 cases 2/ VFR conditions existed.

Airport Traffic Control - Approach Control

There were 10 midair collisions 3/ that occurred when one or both aircraft had received a clearance or instructions from the appropriate airport control tower or approach control facility. This figure includes a case at Oakland, California, (11/17/51) wherein a clearance had been issued to one aircraft for a simulated instrument approach on the range station at a minimum of 1500 feet altitude. Neither aircraft had received any clearance to approach for a landing. The collisions occurred at 3000 feet above the airport.

1/ 11/4/42 Kansas City, Mo.
1/12/55 Covington, Ky.

2/ 6/30/56 Grand Canyon, Ariz.
4/21/58 Las Vegas, Nevada
5/20/58 Brunswick, Md.

3/ 11/1/49 Washington, D. C.
11/17/51 Oakland, Calif.
6/28/52 Dallas, Texas
6/27/54 Columbus, Ohio
7/12/55 Kansas City, Kansas
4/10/57 Oklahoma City, Okla.
10/1/60 Orlando, Florida
10/4/60 Sacramento, Calif.
11/17/60 Denver, Colo.
12/16/60 New York, N. Y.

4. Instrument Training Operations

In 3 of the midair collisions, one or both aircraft were engaged in instrument training operations.

In one case 1/ the Air Carrier aircraft was engaged in a training flight in actual instrument weather conditions. The collision occurred in the overcast.

In the second case 2/ two Air Carrier aircraft were involved and both aircraft were engaged in simulated instrument training operations. Weather was no factor.

In the third case 3/ one aircraft was making a simulated instrument approach while the air carrier aircraft was on a training flight for the purpose of making touch-and-go landing. Weather was no factor.

1/ 11/4/42, Kansas City, Mo.
2/ 11/17/51 Oakland, California
3/ 7/12/55 Kansas City, Mo.

5. Other Operational Factors

There were 3 collisions, 2 fatal, which involved certain particular factors not associated with normal flight:

One fatal collision 1/ occurred when the pilot of a military aircraft attempted to maneuver close to the Air Carrier aircraft. It was indicated that the military pilot had prearranged an "en route" rendezvous with the DC-3 copilot.

Another fatal collision 2/ occurred when a Navy aircraft, that had been buzzing a small private aircraft, pulled up in a climbing turn and collided with the Air Carrier.

In the third case 3/ one aircraft was taking moving pictures of the second aircraft, a DC-3. The flight had been made for this purpose. Both aircraft landed safely with no casualties.

1/ 10/23/42, Palm Springs, California
2/ 7/30/49, Chesterfield, New Jersey
3/ 10/17/52, Palmdale, California

Table 2

MIDAIR COLLISIONS AND FATALITIES
INVOLVING
AIR CARRIER AIRCRAFT
1938 - 1960

	Number of Midair Collisions			Fatalities						
				Air Carrier Aircraft			Other Aircraft		Persons On	Total
	Total	Fatal	Fatal to Air Carrier*	Passengers	Crew	Total	Passengers	Crew	Ground	Fatalities
1938-1941 None										
1942.....	2	1	1	9	3	12	0	0	0	12
1943.....	0	0	0	0	0	0	0	0	0	0
1944.....	1	0	0	0	0	0	0	0	0	0
1945.....	2	2	1	1	0	1	1	3	0	5
1946.....	1	0	0	0	0	0	0	0	0	0
1947.....	1	1	1	7	1	8	0	1	0	9
1948.....	0	0	0	0	0	0	0	0	0	0
1949.....	4	4	2	63	7	70	1	3	0	74
1950.....	0	0	0	0	0	0	0	0	0	0
1951.....	3	2	1	0	3	3	0	1	0	4
1952.....	3	2	0	0	0	0	1	2	0	3
1953.....	1	0	0	0	0	0	0	0	0	0
1954.....	1	1	0	0	0	0	0	0	0	2
1955.....	3	2	1	10	3	13	0	4	0	17
1956.....	2	1	1	117	11	128	0	0	0	128
1957.....	1	0	0	0	0	0	0	0	0	0
1958.....	2	2	2	49	9	58	1	2	0	61
1959.....	0	0	0	0	0	0	0	0	0	0
1960.....	5	4	1	116	12	128	4	3	6	141
Total.....	32	22	11[a]	372	49	421	8	21	6	456

* Number collisions resulting in fatalities to occupants of Air Carrier.
a/Nine of these occurred in scheduled passenger service; 2 in nonrevenue operations.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 1961

MIDAIR COLLISIONS INVOLVING U. S. AIR CARRIER AIRCRAFT

1938 - 1960

Date	Location	Operator	Fatalities						
			Aircraft	Air Carrier Passenger	Air Carrier Crew	Air Carrier Total	Other Aircraft	Persons On Ground	Total Fatalities
1938 None									
1939 None									
1940 None									
1941 None									
10/23/42	Palm Spgs, Calif.	American Military	DC-3 B-34	9	3	12			12
11/4/42	Kansas City, Mo.	TWA Military	DC-3 C-53						
1943 None									
12/24/44	Saline, Mich.	American Civil	DC-3 BL-65						
7/12/45	Florence, S. C.	Eastern Military	DC-3 A-26	1		1	2		1 2
9/26/45	Chicago, Ill.	TWA Civil	DC-3 A-75				2		2
12/19/46	Aberdeen, Md.	Eastern Universal	DC-4 DC-3						
4/22/47	Columbus, Ga.	Delta Civil	DC-3 BT-13	7	1	8	1		8 1

Date	Location	Operator	Aircraft	Fatalities: Air Carrier Passenger	Air Carrier Crew	Air Carrier Total	Other Aircraft	Persons On Ground	Total Fatalities
1948 None									
1/30/49	Port Washington, New York	Pan American Civil	L-749 Cessna 140				2		2
7/30/49	Chesterfield, New Jersey	Eastern Military	DC-3 P6F	12	3	15	1		15 1
8/7/49	Milwaukee, Wisconsin	Capital Civil	DC-3 Cessna				1		1
11/1/49	Washington, D. C.	Eastern Civil	DC-4 P-38	51	4	55			55
1950 None									
11/9/51	Eugene, Oregon	West Coast Civil	DC-3 PT-23						
11/17/51	Oakland, Calif.	Overseas National	DC-4		3	3			3
		Calif. Eastern	DC-4						
11/27/51	Ocala, Fla.	Eastern Civil	DC-3 Piper L-4				1		1
6/28/52	Dallas, Tex.	American Civil	DC-6 Swift				2		2

Date	Location	Operator	Aircraft	Fatalities					
				Air Carrier			Other Aircraft	Persons On Ground	Total Fatalities
				Passenger	Crew	Total			
10/17/52	Palmdale, Calif.	Calif. Air Charter	DC-3						
		Civil	L-12A						
12/15/52	Richmond, Ind.	Lake Central	DC-3						
		Civil	Cessna 170				1		1
8/26/53	Mich. City, Indiana	United	CV-340						
		American	CV-240						
6/27/54	Columbus, Ohio	American	CV-240						
		Military	SNB				2		2
1/12/55	Covington, Ky.	TWA	M-202	10	3	13			13
		Civil	DC-3				2		2
7/12/55	Kansas City, Kansas	TWA	DC-3						
		Civil	Cessna 140				2		2
8/29/55	Hobbs, N. M.	Continental	DC-3						
		Civil	PA-22						
6/30/56	Grand Canyon, Arizona	TWA	L-1049	64	6	70			70
		United	DC-7	53	5	58			58
9/9/56	Bartlesville, Oklahoma	Continental	DC-3						
		Civil	Cessna						
4/10/57	Oklahoma City, Oklahoma	AAXICO	C-46						
		Military	B-25						
4/21/58	Las Vegas, Nevada	United	DC-7	42	5	47			47
		Military	F-100				2		2

Date	Location	Operator	Aircraft	Fatalities: Air Carrier Passenger	Crew	Total	Other Aircraft	Persons On Ground	Total Fatalities
5/20/58	Brunswick, Md.	Capital	Viscount	7	4	11			11
		Military	T-33				1		1
1959 None									
4/20/60	Hickory, N. C.	Piedmont	F-27						
		Civil	Cessna 310				4		4
10/1/60	Orlando, Fla.	Eastern	M-404						
		Civil	Beechcraft				1		1
10/4/60	McClellan, AFB	Capitol	C-46						
		Civil	Cessna 172				2		2
11/17/60	Denver, Colo.	UAL	DC-6						
		Civil	Beechcraft						
12/16/60	New York, N. Y.	TWA	L-1049	39	5	44			44
		UAL	DC-8	77	7	84		6	90
				372	49	421	29	6	456

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
December 27, 1960

SECTION III

MIDAIR COLLISIONS IN GENERAL AVIATION OPERATIONS

SUMMARY

In the 23-year period 1938 through December 31, 1960, General Aviation aircraft were involved in a total of 397 midair collisions, 205 of which were fatal to one or both aircraft. These collisions resulted in a total of 475 fatalities including 3 persons on the ground.

The involvement of different classes of operators, was as follows:

Between	Collisions Total	Fatal
General Aviation and General Aviaton	336	170
General Aviation and Military.....	42	22
General Aviation and Air Carrier....	19	13
Total.....	397	205

In the 19 collisions between General Aviation aircraft and Air Carrier aircraft, 13 were fatal resulting in 97 fatalities. Of the 97 fatalities, 76 were aboard the Air Carrier aircraft and 21 aboard the General Aviation aircraft.

Excluding the 19 cases involving Air Carriers, there were 378 collisions in General Aviation operations. One hundred and ninety-two (192) were fatal accidents resulting in 378 fatalities. In 42 of these 378 cases a military aircraft was involved, twenty-two of which were fatal accidents.

In 336 cases, both aircraft were being operated in General Aviation flying. One hundred and seventy (170) of these were fatal accidents. One of these, a fatal accidents, involved two aircraft both of which were being flown in factory test operations, one was a DC-7B and the other was a military type aircraft F-89-J. Another case, non-fatal also involved factory test flight operations of military type aircraft.

General Conditions and Circumstances

The great majority of the General Aviation collision accidents occurred during daylight in conditions of good flight visibility, and in the landing approach phase or while in the traffic pattern.

A small number occurred in other than normal flying operations. In these cases the aircraft were engaged in acrobatics, racing, formation flying or in buzzing. A few occurred in special kinds of flying such as in aerial application and fish spotting activities. Two cases involved 2 gliders.

The element of traffic control was non-existent in practically all cases with the exception of the collisions involving Air Carrier aircraft and one or two others.

Altitude and Distances From Airport

For the purpose of establishing the altitude and distance from airport factors in the General Aviation collisions, a study was made of all cases occurring in a 10-year period (1948-1957). During this period there were 120 collisions that occurred between two General Aviation aircraft, 58 of which were fatal.

Table No. 3 on the following page presents the frequency distribution of these 120 accidents in respect to altitude and relationship to distance from airport.

Table 3

MIDAIR COLLISIONS IN RELATION TO AIRPORT PROXIMITY AND ALTITUDE
GENERAL AVIATION VS GENERAL AVIATION AIRCRAFT
(1948-1957)

Altitudes	On Airport	Within (Miles) from Airport								Beyond Five	Unknown	Total
		1/4	1/2	3/4	One	Two	Three	Four	Five			
6-10 (feet).....	10	0	0	0	0	0	0	0	0	0	0	10
11-25.....	5	0	0	0	0	0	0	0	0	0	0	5
26-35.....	6	1	0	0	0	0	0	0	0	0	0	7
51-60.....	3	1	0	1	0	0	0	0	0	0	1	6
76-100.....	4	3	0	0	0	0	0	0	0	0	0	7
101-125.....	0	1	0	0	0	0	0	0	0	0	0	1
126-150.....	4	0	1	0	0	0	0	0	0	0	0	5
176-200.....	1	7	2	0	0	0	0	0	0	0	0	10
351-400.....	1	0	1	1	1	1	1	0	0	0	0	6
451-500.....	0	0	1	0	0	1	0	0	0	0	0	2
501-550.....	0	0	0	0	2	1	0	1	1	1	0	6
601-650.....	0	3	1	0	0	0	0	0	0	0	0	4
701-750.....	0	2	0	0	0	1	0	0	0	0	0	3
751-800.....	0	1	0	0	0	0	0	0	0	1	0	2
801-850.....	0	0	0	1	0	0	0	0	0	0	0	1
851-1000.....	0	0	2	0	0	3	0	0	0	0	1	6
1001-1500.....	0	1	0	0	1	1	0	2	3	5	0	13
1501-1800.....	0	0	0	0	0	1	0	0	1	0	0	2
2001-2500.....	0	0	0	0	1	2	1	0	0	4	2	10
2601-3000.....	0	0	0	0	1	1	2	0	0	0	0	4
Over 3000.....	0	0	0	0	0	1	0	0	1	2	0	4
Unknown.....	1	1	0	0	0	1	0	0	3	0	0	6
Total.....	35	21	8	3	6	14	4	3	9	13	4	120

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Résumé of Accidents

U.S. Air Carriers

Rotorcraft and

Large General Aviation Aircraft

CALENDAR YEAR 1959

July 15, 1960

Civil Aeronautics Board

FOREWORD

The purpose of this report is to present a brief description of those aircraft accidents, incident to flight, which occurred during 1959 in the operations of Air Carriers, and in General Aviation operations involving fixed-wing aircraft having a certificated maximum take-off weight in excess of 12,500 pounds, and rotorcraft. Two statistical tables are included, one pertaining to Air Carrier accidents and the other to the General Aviation accidents dealt with in this report.

In certain cases included herein the information presented is based upon preliminary reports and is subject to addition and/or revision upon receipt of the completed report of investigation. Revisions made in respect to the 1958 Air Carrier accident record will be found in the addendum to this report.

Public reports have been issued by the Board on a number of the accidents included in this report, and are available upon request. In all cases, factual information obtained in the investigation can be released to inquirers at their expense when reproduction of records is involved.

Certain revisions have been made in the classification of air carriers, effective 1959, as a result of Alaska and Hawaii coming into the Union and the establishment of the supplemental air carriers. The terms used in this report to designate the various categories of carriers are defined in the "Glossary" on the next page.

GLOSSARY

Aircraft accident. An aircraft accident is an accident which occurs during the starting or warming up of an engine or engines, or operation of an aircraft, which results in serious or fatal injury to one or more persons or in substantial damage to any aircraft, or which involves a collision of two or more aircraft. Whenever serious or fatal injury results from contact with a rotating propeller which is installed on an aircraft, it shall be considered an aircraft accident.

Aircraft accident incident to flight. An aircraft accident incident to flight is an aircraft accident which occurs between the time an engine or engines are started for the purpose of commencing flight until the aircraft comes to rest with all engines stopped for complete or partial deplaning or unloading. It excludes death or injuries to persons on board which result from illness, altercations, and other incidents not directly attributable to flight operation.

All-cargo carriers. Certificated carriers primarily engaged in the transportation of freight and express. Does not include the all-cargo operations of the passenger/cargo carriers.

All-cargo service. Flights scheduled primarily for the transportation of freight and express. Could include mail.

Certificated route air carrier. An air carrier holding a certificate of public convenience and necessity issued by the Civil Aeronautics Board to conduct scheduled services over specified routes. Certain nonscheduled, or charter, operations may also be conducted by these carriers.

Domestic operations. In general, operations within the Continental Area of the United States. Includes operations of the certificated trunk carriers and the local service, helicopter, and domestic all-cargo carriers. In this report the intra-Alaska and intra-Hawaii operations of those carriers operating exclusively within the States of Alaska and Hawaii respectively are shown separately from domestic operations.

International and territorial operations. In general, operations to, from, or between points outside the territory of the United States and operations between United States points separated by foreign territory or major expanses of international waters. Includes both the combination passenger/cargo carriers and the all-cargo carriers engaged in international and territorial operations. Carriers operating between Alaska, or Hawaii, and the continental States are included in this category.

Supplemental Air Carrier. In general, the large irregular carriers, formerly designated as noncertificated air carriers, which have been awarded certificates of public convenience and necessity allowing limited scheduled service. Also includes those irregular carriers operating on a temporary authorization pending final decision on their application for certificate as supplemental air carrier.

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Part I

U.S. AIR CARRIER ACCIDENTS

RECAPITULATION OF U.S. AIR CARRIER ACCIDENTS
1959

CLASSIFICATION CARRIER/OPERATIONS	Accidents		Aircraft Damage Index			Fatalities				Serious Injuries				Total Aboard	Fire		
	Total	Fatal	Destroyed	Substantial	Minor None	Passengers	Crew	Others	Total	Passengers	Crew	Others	Total		In Air	After Impact	On Ground
CERTIFICATED ROUTE CARRIERS																	
DOMESTIC OPERATORS																	
1. Passenger/Cargo Carriers																	
Scheduled Passenger Service	55	8	7	34	14	198	28	0	226	21	12	1	34	2101	4	4	0
Scheduled Cargo Service	2	1	2	0	0	0	3	8	11	0	0	0	0	5	1	1	0
Nonrevenue Operations	7	1	1	6	0	0	5	0	5	0	0	0	0	38	0	1	0
2. All-Cargo Carriers																	
Scheduled Service	3	2	2	1	0	0	4	0	4	0	0	0	0	6	1	0	0
Total--Domestic Operators	67	12	12	41	14	198	40	8	246	21	12	1	34	2150	6	6	0
INTRA-ALASKA CARRIERS																	
Passenger/Cargo Carriers																	
Scheduled Passenger Service	7	1	2	5	0	11	5	0	16	0	0	0	0	39	0	1	0
Scheduled Cargo Service	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
Nonscheduled Revenue Operations	4	2	2	2	0	2	2	0	4	0	0	0	0	6	1	0	0
Nonrevenue Operations	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
Total--Intra-Alaska Carriers	13	3	4	9	0	13	7	0	20	0	0	0	0	47	1	1	0
INTRA-HAWAII CARRIERS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INTERNATIONAL/TERRITORIAL OPERATORS																	
1. Passenger/Cargo Carriers																	
Scheduled Passenger Service	7	1	2	5	0	59	9	0	68	2	0	0	2	475	0	2	0
Scheduled Cargo Service	2	1	2	0	0	0	3	0	3	0	0	0	0	11	1	1	0
Nonscheduled Revenue Operations	1	0	0	1	0	0	0	0	0	0	0	0	0	39	0	0	0
Nonrevenue Operations	3	0	1	2	0	0	0	0	0	0	0	0	0	11	0	1	0
2. All-Cargo Carriers																	
Scheduled Service	1	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0
Total--Int'l/Territorial Operators	14	2	5	9	0	59	12	0	71	2	0	0	2	538	1	4	0
RECAP--CERTIFICATED ROUTE CARRIERS																	
Scheduled Passenger Service	69	10	11	44	14	268	42	0	310	23	13	1	36	2615	4	7	0
Scheduled Cargo Service	9	4	6	3	0	0	10	8	18	0	0	0	0	25	3	2	0
Nonscheduled Revenue Operations	5	2	2	3	0	2	2	0	4	0	0	0	0	45	0	0	0
Nonrevenue Operations	11	1	2	9	0	0	5	0	5	0	0	0	0	50	1	2	0
Total--Certificated Route Carriers	94	17	21	59	14	270	59	8	337	23	12	1	36	2735	8	11	0
SUPPLEMENTAL CARRIERS																	
Passenger Service--Public	1	0	0	1	0	0	0	0	0	0	0	0	0	27	0	0	0
Passenger Service--Military Contract	4	1	1	3	0	1	2	0	3	4	1	0	5	180	1	1	0
Cargo Service--Military Contract	2	0	1	1	0	0	0	0	0	0	2	0	2	4	1	0	0
Nonrevenue Operations	1	0	0	1	0	0	0	0	0	0	0	0	0	3	0	0	0
Total--Supplemental Air Carriers	8	1	2	6	0	1	2	0	3	4	3	0	7	214	2	1	0
GRAND TOTAL	102	18	23	65	14	271	61	8	340	27	15	1	43	2949	10	12	0

DESCRIPTION OF AIR CARRIER ACCIDENTS

Domestic Operators - Certificated Passenger Carriers - Scheduled Passenger Service

Date	Time of Accident	Location	Airline	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury								
								Crew			Passengers			Others		
								F	S	M/N	F	S	M/N	F	S	M
1/15/59	0530 CST	New Orleans, La.	Eastern	DC-7B	Substantial	After Impact	55	0	0	5	0	0	50	0	0	0

An ILS approach, being made by the copilot, proceeded normally until the runway lights came into view and the crew changed to contact operation with flaps fully extended. As the flare for landing was started the aircraft entered a dense fog bank which obscured all visual references. The captain ordered a go-around and raised the landing gear. The aircraft settled to the runway, bounced and became airborne again but with severe roughness apparent in No. 1 and 2 engines. When the aircraft came out of the fog bank, the captain took over the controls and elected to make a wheels-up landing on the airport. A small fire near No. 2 engine was extinguished by emergency ground equipment.

1/17/59	1623 EST	Miami, Florida	Eastern	L-1049G	Substantial	In Air	17	0	0	5	0	0	12	0	0	0

After a ground traffic delay of approximately 20 minutes, the flight was cleared for takeoff. Local weather conditions were clear. At an altitude of 150 feet over the runway, the No. 3 engine showed a fluctuation in rpm and its propeller was feathered. The emergency firewall shutoff valve was not actuated as the flight engineer, at this time, had no indication of fire in the engine. Thereafter when the master fire warning bell sounded, two Freon bottles were discharged without extinguishing effect on the fire; however, the firewall shutoff was forgotten. On the landing the braking system "faded" and became ineffective. Reverse thrust was only partially effective as No. 4 engine had stopped during the roll. The runway was overrun about 75 feet and the right main gear collapsed as the aircraft stopped. The occupants were quickly evacuated but the fire was not extinguished for 30 minutes due principally to a lack of fire fighting equipment and equipment capability. Action was indicated by the Airport Authority to overcome this deficiency.

1/17/59	1638 CST	Olathe, Kansas	Trans World	L-1049	Substantial	None	33	0	0	5	0	0	28	0	0	0

Because the right main landing gear could not be extended a wheels-up landing was made on a foam-covered runway.

1/21/59	0817 CST	Emporia, Kansas	United	DC-7	None	None	53	0	0	5	0	1	47	0	0	0

The flight descended from 21,000 feet to 15,000 feet to bring the cabin pressure nearer sea level because a passenger was suffering from an apparent heart attack. The air was smooth and the seat belt sign was off. Sudden turbulence was encountered which threw passengers from their seats and scattered articles about the cabin. One passenger suffered a broken rib. The flight continued to Chicago.

1/22/59	1023 EST	Huntington, W. Va.	Allegheny	DC-3	Substantial	None	15	0	0	3	0	0	12	0	0	0
	During a normal landing a jarring sensation was experienced by the crew, and the left gear collapsed. Examination disclosed the center wing to drag strut attach fitting was broken at the lower attach bolt holes and permitted the drag strut to become detached, a condition which allowed the gear to collapse.															
1/27/59	0726 EST	Lansing, Michigan	Capital	V-700D	Substantial	None	27	0	0	3	0	0	24	0	0	0
	A normal approach was made to the snow-covered airport where runways had been cleared leaving banks of snow along the sides. The sun was just rising and a haze was present requiring occasional reference to instruments during the approach. As the aircraft was flared to land a thud was heard and upon landing, the aircraft veered to the left as the left gear collapsed. Directional control was lost and all four propellers were feathered. The airplane skidded to a stop in a deep snow bank beside the runway. Investigation disclosed the landing gear had struck a snowbank across the runway threshold which had not been called to the attention of the crew either by NOTAM or company dispatch or senior agent messages.															
1/27/59	1337 PST	Denver, Colorado	American	DC-7	None	None	52	0	0	5	0	1	46	0	0	0
	While cruising in clear smooth air at 16,000 feet severe turbulence was momentarily encountered. One passenger who was moving about in the lounge suffered a fractured ankle.															
2/3/59	2356 EST	LaGuardia, N. Y.	American	L-188	Destroyed	None	73	2	3	0	63	5	0	0	0	0
	During an ILS backcourse approach with the autopilot engaged, the aircraft descended until it struck the water at a location nearly 5,000 feet short of the runway threshold and 610 feet to the right of its extended centerline. Extensive investigation revealed a number of factors which together had the accumulative effect of causing the accident. These factors were: limited experience of the crew in the type aircraft involved; use of the autopilot throughout the approach; an error in the setting of the Captain's altimeter; marginal weather in the approach area; a possible misinterpretation of the altimeter and rate of descent indicators, both of which differed from those previously used by the crew; and a sensory illusion with respect to height resulting from visual reference to the few lights existing in the approach area.															
2/15/59	0258 EST	Miami, Florida	Capital	V-700D	None	None	37	0	0	3	0	1	33	0	0	0
	The flight was descending from 14,000 feet preparatory to landing. The seat belt sign was on. One passenger who had been in the lavatory was returning to her seat when the aircraft encountered moderate turbulence. The passenger lost her balance, fell, and fractured her ankle. The hostess was engaged in checking the passengers' seat belts at the time but had only partially completed her check. The passenger was given emergency treatment by a doctor on board and was hospitalized after landing at Miami.															

Scheduled Passenger Service

Date	Time of Accident	Location	Airline	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury								
								Crew			Passengers			Others		
								F	S	M/N	F	S	M/N	F	S	M
2/16/59	1236 EST	Nr. Chattanooga, Tenn.	Eastern	L-188	None	None	22	0	1	4	0	2	15	0	0	0
	While the flight was cruising in clear weather conditions at 23,000 feet, a B-47 jet bomber making a climbing right turn was observed near the same altitude. A rapid climb was made by the Electra captain and the bomber was observed to pass almost directly under the L-188 with an estimated separation between 400 and 500 feet. The L-188 was operating on an IFR clearance while the B-47 was on a VFR clearance. The rapid evasive maneuver resulted in injuries to one cabin attendant and three passengers.															
2/17/59	1548 CST	Mattoon, Illinois	Ozark	DC-3	Substantial	None	4	0	0	3	0	0	1	0	0	0
	The right landing gear tire blew out on touchdown. The aircraft veered off the runway and nosed up.															
3/5/59	0210 Z	Chicago, Illinois	Northwest	DC-6B	Minor	None	83	0	0	5	0	2	76	0	0	0
	During cruise, momentary turbulence was encountered. Although the fasten seat belt sign was on some passengers had loosened or unfastened their seat belts and were thrown about.															
3/8/59	2045 CST	Temple, Texas	Trans-Texas	DC-3	None	None		0	1	2						
	During normal cruise, sudden clear air turbulence was encountered. The hostess was thrown to the floor and suffered a fractured vertebra.															
3/13/59	2113 CST	St. Louis, Missouri	Ozark	DC-3	Minor	None	15	0	1	2	0	0	12	0	0	0
	While in normal cruise at an altitude of 3,300 feet, IAS 140 knots, the aircraft collided with a small duck which penetrated the sliding window located on the left side of the cockpit. The captain was seriously injured about his face and eyes. The flight returned to its point of take-off and landed safely.															
3/26/59	0934 CST	Chicago, Illinois	American	B-707	Substantial	None	114	0	0	9	0	0	105	0	0	0
	During a landing in a crosswind of between 35 and 40 knots, the approach was undershot. The gear struck sloping terrain short of the runway.															
4/3/59	1508 EST	Detroit, Michigan	Capital	V-700D	Substantial	None	11	0	0	3	0	0	8	0	0	0
	The crew was unable to extend the right main gear and circled for 2 hours and 38 minutes while attempts were made to extend it. The gear could not be lowered and a wheels-up landing was made on a foam-covered runway.															

4/9/59	2300 CST	Houston, Texas	Continental	V-812	Substantial	None	42	0	0	3	0	0	39	0	0	0

At touchdown, following a night ILS approach in heavy rain, the aircraft was not properly aligned with the runway and veered to the left. The left wheel went off the runway into soft terrain. The airplane continued parallel to the runway, struck two runway lights, and came to a stop 3,380 feet from the approach end with the left main landing gear and nose wheels mired in mud. Damage resulted to the No. 1 propeller, engine, cowl, and engine sub-mount, and to the inboard right landing flap, and wing structure.

4/12/59	1845 MST	Akron, Colorado	American	DC-7	Substantial	None	61	0	0	5	0	0	56	0	0	0

While cruising at 20,000 feet the No. 2 propeller suddenly oversped to 4,500 rpm. Efforts to feather it were ineffective whereupon the impeller disintegrated and broke through the supercharger case. Pieces struck No. 1 engine and broke open the front oil sump resulting in loss of oil. The No. 1 propeller was then feathered. The crew maintained control of the aircraft and successfully accomplished an emergency landing at the Akron, Colorado FAA emergency airport.

4/19/59	0845 MST	Albuquerque, New Mexico	Continental	V-812	Substantial	None	34	0	0	3	0	0	31	0	0	0

During take-off, both nose gear tires failed after V_1 speed had been reached. The nose gear failed before the aircraft could be brought to a full stop.

5/6/59	1809 EST	Washington, D. C.	Eastern	DC-7B	Substantial	None	69	0	0	6	0	0	63	0	0	0

The final approach in clear weather conditions was low. The captain failed to correct for this in time to prevent the right main gear from striking the ILS localizer shack which was located on the extended runway centerline about 175 feet from the runway threshold. Following impact the right main gear touched the ground about 80 feet short of the runway and the aircraft skipped touching the runway 105 feet past the threshold. The right wheel assembly and strut piston separated. The aircraft settled on the strut cylinder and collar, gradually veering off the runway onto a grass area. The right strut collapsed as the aircraft came to a stop.

5/12/59	1529 EST	Charleston, W. Va.	Capital	L-049	Destroyed	After Impact	44	1	3	2	1	2	35	0	0	0

During landing the aircraft touched down within the first third of the wet runway. Braking was ineffective and the Captain chose to ground loop the aircraft rather than continue down a sharp declivity at the end of the runway. The aircraft turned off the runway, slid over a steep embankment, where it came to a stop and burned.

Scheduled Passenger Service

Date	Time of Accident	Location	Airline	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury: Crew F	Crew S	Crew M/N	Passengers F	Passengers S	Passengers M/N	Others F	Others S	Others M
5/12/59	1845 EDT	New York, N. Y.	New York Airways	V-44B	Substantial	None	11	0	0	2	0	0	9	0	0	0

New York Airways' Flight 650, en route from Idlewild International Airport, N. Y., to LaGuardia Airport, N. Y., was cruising at 1,500 feet when a slight lateral oscillation began. This grew more pronounced and all efforts to damp it were unsuccessful. A precautionary landing was made in Flushing Park. The cause of the oscillation was a fatigue failure of the tuning weight strap in one of the forward rotor blades which allowed the 20-lb. tuning weight, located in the blade spar, to work its way to the blade tip. On landing, the weight was thrown from the blade and recovered by a police officer. Factors which produced fatigue in the strap were: (1) greater bending stresses than anticipated on the strap, (2) a layer of decarburization which reduced the strength and flexibility of the strap. Corrective measures were taken to overcome these factors.

5/12/59	1613 EST	Chase, Maryland	Capital	V-745D	Destroyed	None	31	4	0	0	27	0	0	0	0	0

While cruising at 14,000 feet at reduced airspeed the flight penetrated an area of extreme turbulence in the immediate vicinity of a severe thunderstorm. A loss of control occurred followed by an involuntary descent during which a high airspeed resulted. The aerodynamic load from high speed, recovery efforts and extreme turbulence resulted in stressing the aircraft structure beyond its design strength, causing inflight disintegration. The airborne radar was inoperable at the time. Also a flash advisory issued at 1415 EST delineating the position and movement of the line of thunderstorms along the route and indicating that their intensity was expected to increase was not passed to the captain by the carriers dispatch system while the flight was enroute.

5/14/59	1917 PST	Roseburg, Oregon	West Coast	F-27	Substantial	None	19	0	0	3	0	0	16	0	0	0

When the aircraft had attained a speed of 78 knots during the take-off roll, the first officer raised the landing gear. The aircraft settled to the runway.

5/20/59	1925 CST	Abilene, Texas	American	DC-6	None	None	18	0	1	4	0	0	13	0	0	0

While cruising in smooth air with the seat belt sign on, sudden rough air was encountered. A stewardess was thrown against the overhead rack and against an arm rest causing injury which required hospitalization.

5/29/59		Idlewild, N. Y.	Eastern	DC-7	None	None	48	0	1	5	0	0	42	0	0	0

While the flight was cruising above the clouds at 18,000 feet in the vicinity of Coyle, New Jersey, the aircraft radar revealed a large build-up of storm cells ahead. The area to the left appeared to be free of precipitation echos. The flight proceeded toward the clear area and the "Fasten Seat Belt" sign was turned on. Soon thereafter, severe turbulence was encountered and one of the flight attendants was thrown from her seat during which she sustained serious injury.

6/6/59	1925 EDT	Syracuse, N. Y.	Eastern		M-404	Substantial	None	12	0	0	3	0	0	9	0	0	0
	The first officer made a full flap approach during which touchdown occurred on the runway approximately 1,500 feet past the runway threshold. The captain completed the landing check list. Approximately 1,000 feet after touchdown, at approximate speed of 60 knots, the main gear collapsed. The aircraft slid to a stop on the fuselage and the extended nose gear.																
6/30/59	1940 EST	New York, N. Y.	Capital		V-700D	Minor	None	34	0	0	4	0	0	30	0	0	0
				Parked	DC-6	Substantial											
	During taxi for take-off the crew experienced a loss of hydraulic pressure, and a resultant loss of the brakes and nosewheel steering. The captain feathered all four engines and cut the master switch. However, before the aircraft stopped it contacted the tail section of a parked DC-6 with resultant damage. The hydraulic failure occurred as the result of failure to properly bleed the hydraulic system following replacement of a wheel and brake assembly.																
7/20/59	1711 EST	Boston, Mass.	American		DC-6	Substantial	None	68	0	0	5	0	0	63	0	0	0
	The flight made an ILS approach and landing in minimum weather conditions, (200 broken, 1,000 overcast, 1 mile visibility, light rain and fog). During the landing roll the First Officer inadvertently raised the gear handle when the captain ordered flaps up.																
7/22/59	1330 EDT	New York, N. Y.	Eastern		DC-7B	Substantial	None	59	0	0	6	0	0	53	0	0	0
	During a landing made by the copilot the touchdown occurred short of the runway and the left main gear struck an eight inch high exposed edge of the runway pavement at the approach end. The left main gear lower drag link spacer (P/N 4337530) was sheared, and allowed the gear to rotate rearward about its trunnion. The wing settled onto the trailing gear and the aircraft swerved off the runway into soft mud. The trunnion crucifix fittings then failed and the gear separated.																
7/25/59	1500 CST	Houston, Texas	Delta		DC-7	Substantial	None	71	0	0	5	0	0	66	0	0	0
	The aircraft touched down short of the threshold a crushed shell overrun area. A heavy jolt occurred as the wheels crossed the approach edge of the paved runway and the landing roll was completed. Later examination disclosed structural damage to the left wing.																
8/2/59	1432 EDT	Pittsburgh, Pa.	Northwest		B-377	Substantial	None	46	0	0	6	0	0	40	0	0	0
				Parked	DC-3	Substantial											
				Parked	M-202	Minor											
	The aircraft was being taxied to the ramp following landing. A DC-3 and a Martin 202, both facing south, were parked on the north edge of the loading apron. According to the captain as he taxied around the east end of the terminal finger and was moving toward the DC-3, nose wheel steering and brake failure occurred. The captain used full reversing but did not use the emergency braking. The B-377 struck the DC-3. The Martin 202, parked adjacent to the DC-3, was damaged by flying debris. Tests made following the accident failed to determine the definite cause of the brake and steering failure.																

Scheduled Passenger Service

Date	Time of Accident	Location	Airline	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury								
								Crew			Passengers			Others		
								F	S	M/N	F	S	M/N	F	S	M
8/11/59	1456 CST	Chicago, Illinois	American	B-707	Substantial	None	100	0	0	8	0	0	92	0	0	0
	The aircraft touched down on the runway and bounced twice during which the nose wheel assembly was separated. The aircraft came to a stop on the extended nose wheel strut, and main landing gear 6,238 feet from the approach end of the runway.															
8/26/59	2120 EST	Charleston, W. Va.	Capital	DC-3	Substantial	None	18	0	0	3	0	0	15	0	0	0
	During a landing made by the copilot, the aircraft bounced, continued straight for a short distance, and veered left off the runway. The captain applied corrective action including full throttle on the left engine. Recovery was not in sufficient time to prevent the aircraft from going over an embankment into a ravine 50 feet below the runway level. Tire marks were found on the runway indicating left braking prior to the location where the aircraft began to veer to the left.															
9/9/59	1201 EST	Palm Beach, Florida	Eastern	L-188	None	None	37	0	0	3	0	1	33	0	0	0
	Over a location approximately 50 miles north of West Palm Beach and while descending through 16,000 feet at an indicated 210 knots, the flight encountered a turbulent type bump in light precipitation, broken clouds and otherwise relatively smooth air. During this period a passenger returning to his seat from the lavatory lost his balance and sustained a broken leg. Although the aircraft's radar did not indicate returns commensurate with turbulent conditions at the time of the accident, the seat belt sign was reported to have been on 8 to 10 minutes prior to the occurrence.															
9/16/59		Nr. Vero Beach, Fla.	Eastern	L-188	None	None		0	0	5	0	1	-	0	0	0
	While cruising at 10,000 feet with the seat belt sign on, a sharp jolt of turbulence was encountered. One passenger who had unfastened his seat belt was thrown upward and his head struck the overhead rack causing severe lacerations.															
9/16/59	0125 EDT	Plattsburg Air Force Base, New York	Eastern	R-4Q4	Substantial	None	36	0	0	3	0	0	33	0	0	0
	The crew experienced an unsafe gear warning indication during the approach to Glens Falls. Emergency procedures were employed to obtain a safe gear indication. After these efforts were unsuccessful a wheels-up landing was made at Plattsburg Air Force Base on a foamed runway. There was no fire.															
9/18/59	1985 EDT	Westchester County Airport, New York	Mohawk	CV-240	Substantial	None	41	0	0	3	0	0	38	0	0	0
	An inadvertent wheels-up landing was made at Westchester County Airport, New York. The landing gear was lowered during the initial approach but retracted during the right turn from base leg to the final approach. The crew indicated their attention was diverted while watching other traffic. There was no fire.															

9/26/59	1735 EST	Nr. Macon, Georgia	Eastern	DC-7B	Substantial	None	50	0	0	5	0	0	45	0	0	0
	While cruising at 13,000 feet, a sudden explosive sound and violent vibration occurred in the No. 1 engine. Attempts to feather No. 1 propeller were unsuccessful until the aircraft speed was reduced. The propeller was then feathered and a landing was made at Atlanta. Investigation revealed the No. 2 PRT wheel shaft had failed and the No. 2 PRT wheel, cap and lower flight hood were missing. Investigation also indicated metal particles had moved forward and severed thirty-seven inches of one propeller blade of the No. 1 propeller. The retaining nut of the PRT shaft was found in the nacelle, its threads stripped.															
9/29/59	2309 CST	Nr. Buffalo, Texas	Braniff	L-188	Destroyed	In Air	34	7	0	0	27	0	0	0	0	0
	The flight departed Houston on an IFR flight plan and clearance. The last known radio contact was a routine report advising Dallas of an 2325 CST ETA. At 2309 CST an inflight disintegration of the aircraft occurred while it was on course and at its cruising altitude of 15,000 feet.															
10/3/59	1715 MST	Grants, New Mexico	American	DC-6	None	None	85	0	0	5	0	1	79	0	0	0
	The scheduled flight was cruising at 18,000 feet and was flying in and out of instrument weather conditions. Little turbulence was being encountered. When conditions appeared to be CAVU ahead, the seat belt sign was turned off. Shortly thereafter, a single, moderately severe bump was encountered and a passenger who was entering the lavatory with her small daughter, was thrown off balance. While attempting to steady her daughter the passenger fell and broke her right leg.															
10/6/59		Idlewild, New York	New York Airways	Vertol	Substantial	None	3	0	0	2	0	0	1	0	0	0
	During engine shutdown one main rotor blade drooped sufficiently to strike the passenger cabin in an area over the door. The excessive droop of the blade was caused by failure of an improperly adjusted blade droop stop.															
10/6/59	0036 EST	Jacksonville, Fla.	Northeast	DC-6B	None	None		0	0	5	0	0		0	1	0
	The Captain started to taxi out while the Company Station Agent was still in front of the nose wheel. The nose wheel rolled over the Agents foot and broke the heelbone.															
10/26/59	2018 PST	Santa Maria, Calif.	Pacific	DC-3	Substantial	In Air	19	1	1	1	0	1	15	0	0	0
	Shortly after the first power reduction following take-off and at an altitude of about 300 feet above the ground a loud explosion was heard and fire was observed in the left engine. Emergency procedures were immediately effected and the fire appeared to be out; however, a severe buffeting continued. The aircraft lost altitude and the captain was forced to make an emergency landing about 1½ miles from the airport. In an effort to avoid obstructions just before ground contact, the aircraft struck the ground in a left wing low attitude.															

68755 O—61——14

Scheduled Passenger Service

Date	Time of Accident	Location	Airline	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury: Crew F	Crew S	Crew M/N	Passengers F	Passengers S	Passengers M/N	Others F	Others S	Others M
10/30/59	2040 EST	Nr. Charlottesville, Virginia	Piedmont	DC-3	Destroyed	None	27	3	0	0	23	1	0	0	0	0

Evidence indicates the accident occurred during the inbound portion of the procedure turn, of an instrument approach, which was being flown 8 to 11 miles west of the maneuvering area prescribed by the instrument approach procedure. The aircraft crashed against the rocky slope of a 3,100-foot mountain, at an elevation of approximately 2,600 feet. No malfunction of the aircraft was found nor were discrepancies found during examination of the airborne and ground radio equipment and facilities.

11/4/59	1701 PST	Santa Maria, Calif.	Pacific	B-202	Substantial	None	26	0	0	3	0	0	23	0	0	0

After reaching about 100 feet after take-off, the left forward cargo door came open. The emergency escape chute attached to the door was pulled into left propeller which damaged the blades. The flight returned and landed safely.

11/7/59	1020 EST	LaGuardia, New York	Northeast	V-745D	Substantial	None	18	0	0	3	0	0	15	0	0	0

During the landing roll a failure of the ground fine pitch arm/disarm switch prevented the use of ground fine pitch. An accumulation of rain water on the runway made braking action poor. In order to prevent over running the runway the pilot intentionally veered the aircraft off the runway. The main landing gear sank into the soft sod, allowing the propellers to contact the ground.

11/14/59	1709 EST	Nashville, Tennessee	Eastern	L-188	Substantial	In Air	38	0	0	5	0	0	33	0	0	0

The flight was cruising at 20,000 feet on an IFR clearance, when it appeared to the crew that they were going to enter the clouds. Engine anti-icing and propellar deicing were selected but because of the lack of current indication on the propeller icing ammeter the alternate position was selected. The cockpit electrical system immediately became unstable and smoke appeared in the cabin. Fire warning for No. 1 engine came on and its propeller was feathered. Shortly thereafter the baggage door warning light, wing flap asymmetry light and fire warning lights for No. 2 and 3 engines activated. The captain immediately cancelled the IFR clearance, performed a rapid descent and made an emergency landing at Nashville. All occupants were promptly evacuated.

11/16/59	0144 CST	Nr. New Orleans, Louisiana	National	DC-7B	Destroyed	After Impact	42	6	0	0	36	0	0	0	0	0

Over the Gulf of Mexico, enroute from Miami to New Orleans, the flight was observed on radar to turn right and disappear from the scope. During search operations debris and bodies were recovered from the Gulf at a location about 90 nautical miles southeast of New Orleans; however, exhaustive efforts to locate the aircraft have thus far been unsuccessful. One passenger whose name was on the passenger list was later found in Phoenix, Arizona. He stated to the FBI that another man, whose car he was using when apprehended, had taken his place on the flight.

11/24/59	1850 EST	St. Petersburg, Fla.	Eastern	L-188	Substantial	None	34	0	0	5	0	0	29	0	0	0
	A hard touchdown occurred following what was believed to be a normal approach. After rolling a short distance the left wing dropped, the aircraft ground looped to the left, and came to a stop off the runway. Investigation revealed tire imprints in the soft earth leading to the 9 inch high approach edge of the runway. Matching tire marks were also found on the lip of the runway.															
11/26/59	1848 PST	Los Angeles, Calif.	American	B-707	Substantial	None	86	0	0	8	0	0	78	0	0	0
	Shortly after starting the take-off roll, the nose lifted off and could not be lowered. The captain quickly attempted to cut power on all engines, but missed No. 4 throttle. The nose of the aircraft slammed down hard on the runway. The thrust being produced from No. 4 caused a left yaw, during which failure of both nose wheel assemblies occurred. There was no fire and a normal evacuation was made. Investigation revealed that the rear cargo compartment was not loaded properly resulting in an improper weight distribution.															
12/1/59	0945 EST	Williamsport, Pa.	Allegheny	M-202	Destroyed	After Impact	26	4	0	0	21	1	0	0	0	0
	The flight was cleared for an IFR approach and was observed over the airport in a right circling approach to runway 27. However, the approach was high and the flight proceeded over the field, made a right turn to downwind leg, and another right turn which would again place the aircraft on a final approach to the runway. As this turn was completed the aircraft was observed to roll out of the right turn into a left turn, and disappear into snow showers and clouds toward the mountain where it crashed a few seconds later.															
12/7/59	2146 EST	Newark, New Jersey	American	DC-6	Substantial	None	37	0	0	5	0	0	32	0	0	0
	A landing was made on a wet snow-covered runway. Approximately 600 feet after touchdown reversing was used; however, the brakes and nose wheel steering were ineffective. When the aircraft started to slide toward the left of the runway reversing was deactivated and forward thrust was applied to No. 3 and 4 engines. The aircraft continued to skid and the nose wheel separated from the aircraft when it rolled off the runway.															
12/12/59	1610 PST	Nr. Ojai, Calif.	United	DC-6	None	None	50	0	0	4	0	1	45	0	0	0
	While the flight was descending in light turbulence with the seat belt sign on, a passenger leaving the lavatory tripped and fell. Her left ankle was fractured.															
12/23/59		Tyler, Texas	Trans-Texas	DC-3A	Substantial	None	16	0	0	3	0	0	13	0	0	0
	The right gear collapsed on landing and the aircraft swerved off the runway. The evidence indicated that failure of the right landing gear drag strut caused the gear to collapse.															

Domestic Operators

Date	Time of Accident	Location	Airline	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury: Crew F	Crew S	Crew M/N	Passengers F	Passengers S	Passengers M/N	Others F	Others S	Others M
Cargo Service																
3/15/59	0053 CST	Chicago, Illinois	American	CV-240	Destroyed	After Impact	2	0	0	2	0	0	0	0	0	0
An instrument approach was made using the backcourse of the ILS. The first approach was discontinued at 600 feet because the flight was not tuned to the correct frequency for the approach being made. On the second approach collision occurred with a steel tower 96 feet high. The crew was able to reduce the steepness of the dive which followed and the aircraft crashed in a railroad yard, skidded across tracks and came to rest 2,600 feet from the tower.																
11/24/59	0513 CST	Chicago, Illinois	TWA	L-1049H	Destroyed	In Air	3	3	0	0	0	0	0	8	0	0
About one minute after take-off, the crew reported to the tower that they received a fire warning for the No. 2 engine and were shutting the engine down. The flight was cleared to return to land. During a VFR approach below a low overcast, the tower controllers observed the aircraft strike the top of a house. Following this the aircraft struck four other buildings, crashed and burned.																
Nonrevenue Operations																
2/7/59	1145 EST	Miami, Florida	Eastern	L-188A	Substantial	None	6	0	0	6	0	0	0	0	0	0
Following take-off the nose gear would not retract. After burning off fuel a landing was made during which the aircraft veered off the runway. Investigation disclosed a failure of the nose gear centering cam.																
4/28/59	0714 EST	Greensboro, N. C.	Piedmont	F-27	Substantial	None	4	0	0	4	0	0	0	0	0	0
During the landing roll the captain inadvertently put the landing gear switch momentarily in the "up" position. The landing gear collapsed.																
6/15/59	1550 PDT	Ontario, Calif.	Western	L-188A	Substantial	None	7	0	0	7	0	0	0	0	0	0
On the final approach during a simulated circling approach, a sudden increase in sink rate was experienced. Added power failed to check the descent, and touchdown occurred short of the runway. A go-around was made; however, the hard touchdown caused substantial damage to the wings and fuselage.																
8/10/59	0949 CST	Ft. Worth, Texas	American	L-188	Substantial	None	5	0	0	5	0	0	0	0	0	0
During a local flight for the purpose of pilot and flight engineer training a take-off was made during which one engine was throttled to simulate engine failure. During the return the other engine on that side was throttled to simulate a two engine out approach. The landing was normal but when the remaining two engines were put into reverse thrust the aircraft veered to the right. The trainee captain applied left brake and blew out the left main tires. The airplane continued to the right and struck two runway lights after which it was brought back to the runway and stopped.																

8/13/59	1412 EST	Atlantic City, N. J.	Eastern	DC-7B	Substantial	None	5	0	0	5	0	0	0	0	0

The aircraft departed Newark Airport at 0820 EST for a local training flight. During an intended stall with gear and flaps down, the pilot noticed the left landing gear could not be extended. After all normal and emergency procedures failed to extend the gear, a wheels-up landing was made on a foamed runway. Investigation revealed left main restrictor check valve P/N 2230565-5-093 had become clogged, trapping hydraulic fluid in upside of gear actuating cylinder which prevented the gear from extending.

8/15/59	1640 EDT	Peconic Airport Calverton, L.I., N.Y.	American	B-707	Destroyed	After Impact	5	5	0	0	0	0	0	0	0

During a training flight the crew made a no-flap wave-off and continued around the traffic pattern with the gear extended. During the turn to the final approach with a simulated failure of the No. 3 and 4 engines, the aircraft entered a "scooping" type barrel roll to the right, accompanied by a severe yaw. The aircraft crashed and burned.

11/27/59	1730 PST	Ontario, Calif.	American	B-707	Substantial	None	6	0	0	6	0	0	0	0	0

During a training flight a series of take-offs and landings simulating one engine failure were made. The crew noted pieces of tire on the runway and found that No. 5 and 6 tires were missing. The aircraft was landed at Los Angeles using only reverse thrust for deceleration. Examination showed two main landing gear wheels and several remaining tires were heat damaged beyond repair.

All-Cargo Carriers

3/30/59	2346 EST	Alma, Georgia	Riddle	C-46R	Destroyed	In Air	2	2	0	0	0	0	0	0	0

Approximately one minute after the flight passed over Alma, Georgia Airport its crew radioed the aircraft was on fire and uncontrollable. There were no further communications. About this time several witnesses saw the aircraft in flames as it fell to the ground. The investigation of the accident indicated that the fire was ignited in aft lower cargo compartment when contact occurred between an unguarded light bulb and combustible cargo. The fire apparently penetrated the cargo compartment wall, burned through combustible fluid carrying lines and ignited the fluids. The resulting fire then destroyed the control system of the aircraft.

4/8/59	0710 PST	Portland, Oregon	Flying Tiger	C-46F	Substantial	None	2	0	0	2	0	0	0	0	0

Part of the through cargo consisted of two jet engines which combined weighed approximately 9,200 pounds. The engines were lashed together and were snubbed to prevent rearward motion by a single 4,000 pound strength cable. During take-off the cable broke and the engines slid rearward until stopped by the fuselage structure. Although the center of gravity moved rearward to unsafe limits and control of the aircraft became extremely difficult, the crew was successful in circling the field and landing safely.

Domestic Operators

Date	Time of Accident	Location	Airline	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury								
								Crew			Passengers			Others		
								F	S	M/N	F	S	M/N	F	S	M
9/2/59	1716 CST	Abilene, Texas	AAXICO	C-46	Destroyed	None	2	2	0	0	0	0	0	0	0	0

During flight the crew declared an emergency stating that they had lost elevator control and were on autopilot. Assisted by GCA, the captain attempted to land at Dyess Air Force Base using power and trim for pitch control. A landing on the main wheels was accomplished but during the roll the aircraft began to "porpoise" with increasing severity. Full power was then applied and the aircraft climbed steeply to between 150 and 200 feet. It then stalled, pitched down, and crashed on the runway at an angle in excess of 45 degrees. Investigation revealed that the aft link assembly became disconnected from the clevis in the elevator control horn assembly when an improperly secured bolt backed out.

Date	Time of Accident	Location	Airline	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury: Crew F	Crew S	Crew M/N	Passengers F	Passengers S	Passengers M/N	Others F	Others S	Others M
Scheduled Passenger Service																
3/24/59	0052 Z	Driftwood Bay, Alaska	Reeve Aleutian	DC-3	Substantial	None	10	0	0	3	0	0	7	0	0	0
From the air the runway appeared to be in useable condition; however, during landing, snowdrifts were encountered on the runway. The propellers struck the runway and separated from the engines.																
4/4/59	1108 AST	Kasigluk, Alaska	Northern Consolidated	Cessna T-50	Substantial	None	5	0	0	1	0	0	4	0	0	0
Enroute to Hooper Bay the pilot elected to return to Bethel because of unfavorable weather ahead. While in the turn, the manifold pressure on the right engine dropped. Power was increased at which time a loud snapping sound was heard and the right propeller separated from the engine. Single engine procedure was initiated and the pilot decided to land at the first available landing area. He selected a snow-covered frozen lake at Kasigluk. During the landing roll the tail wheel post was fractured. Examination showed that a fatigue failure of the crankshaft had occurred adjacent to the rear side of the propeller thrust nut. When the propeller and attached portion of the crankshaft separated additional damage occurred when the propeller contacted the right ski and engine cowling.																
4/28/59	1010 AST	Big Delta, Alaska	Wien Alaska	Beechcraft AT-11	Substantial	None	2	0	0	1	0	0	1	0	0	0
The landing gear collapsed following touchdown. Examination and tests failed to disclose mechanical failure or malfunction.																
6/16/59	1330 AST	Gilahina Buttes, Alaska	Cordova	Piper PA14	Destroyed	None	1	0	0	1	0	0	0	0	0	0
During normal cruise the aircraft suddenly veered to the left and entered a steep nose-down attitude. Efforts to control the aircraft were not successful; however, the pilot was able to slow the aircraft before it crashed into trees. Examination of the aircraft disclosed that the left aileron control cable had broken about 18 inches from the control stick where it had been previously weakened by electrical arcing during repairs made to the aircraft about three weeks previously.																
7/5/59	1720 AST	Kulik Lake, Alaska	Northern Consolidated	Cessna T-50	Substantial	None	3	0	0	1	0	0	2	0	0	0
An approach and landing was made on water where choppy waves and a cross swell were running. Before stopping the pontoons struck the swells causing failure of the upper strut fittings which attach the pontoons to the rear wing spar. This caused the pontoons to move forward and upward permitting the propeller tips to strike and cut holes in each pontoon.																

Intra-Alaska Carriers

Date	Time of Accident	Location	Airline	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury: Crew F	Crew S	Crew M/N	Passengers F	Passengers S	Passengers M/N	Others F	Others S	Others M
9/24/59	1615 BST	Great Sitkin Island, Alaska	Reeve Aleutian	DC-4	Destroyed	After Impact	16	5	0	0	11	0	0	0	0	0

Enroute to Sherya, Alaska, from Anchorage, the flight was scheduled to make two intermediate stops, one of which was an overnight stop at Adak. All enroute positions were reported to the company within 2 or 3 minutes of the estimates. About 300 miles northeast of Adak the flight reported it was 4,500 feet on top, in the clear, and gave an estimated time over the Adak low frequency range. It was then cleared to the Adak range to maintain VFR on top and to call Adak approach control, when 30 minutes out, for landing instructions. At 1715 AST the flight advised the company it was cancelling its IFR flight plan and was proceeding VFR. Two minutes later Adak control could not contact the flight. The aircraft crashed on Sitkin Island, at an elevation of 2,100 feet. Fire followed impact. The 1645 Adak surface weather was reported broken clouds, 8/10 coverage, based at 1,500 feet; broken deck above, 1/10 coverage based at 7,000 feet.

12/15/59	0107 Z	Kotzebue, Alaska	Wien Alaska	Beechcraft AT-11	Substantial	None	2	0	0	1	0	0	1	0	0	0

During the landing roll-out, the pilot inadvertently retracted the landing gear.

Scheduled Cargo Service

8/13/59	2245 BST	Kotzebue, Alaska	Wien Alaska	Cessna 180	Substantial	None	1	0	0	1	0	0	0	0	0	0

During take-off from the water of Kotzebue Sound, the pilot noticed that the aircraft was settling toward the right side and that an unusual amount of spray was being thrown by the propeller. He immediately closed the throttle and aborted the take-off. The aircraft then sank inverted in 10 feet of water. The pilot escaped through the left cockpit window and was uninjured. Examination revealed a small elongated hole in the underside of the right float, which appeared to have been caused by striking a sharp rock.

Nonscheduled Revenue Operations

1/20/59	1054 BST	Nome, Alaska	Wien Alaska	Beechcraft 18	Destroyed	In Air	1	1	0	0	0	0	0	0	0	0

Shortly after take-off smoke was observed from the aircraft and pilot radioed asking that maintenance personnel be on the runway. During the apparent attempt to return the aircraft lost altitude and struck a telephone pole which sheared part of the right wing. It then crashed inverted and burned. Investigation and study of the wreckage indicated an intense inflight fire in the cabin.

1/31/59	1720 AST	Dewline Site BAR "A", Barter Island, Alaska	Wien Alaska	Beechcraft C-18	Substantial	None	1	0	0	1	0	0	0	0	0	0

During an attempted visual approach the aircraft struck the ground. The ground was snow-covered and the only horizon reference were the headlights on a truck and six smudge pots used to bound the field. The visibility which was restricted by snow was below the minimum for VFR flight operations.

5/13/59	0842 AST	Point Barrow, Alaska	Wien Alaska	Cessna 180	Substantial	None	1	0	0	1	0	0	0	0	0	0

During the landing roll the right landing gear strut failed and allowed the right wheel-ski assembly to separate from its attachments.

7/3/59	1525 PST	Ketchikan, Alaska	Ellis	Cessna 180	Destroyed	None	3	1	0	0	2	0	0	0	0	0

During a return flight to Ketchikan a stop was made at Wrangell where a second passenger enplaned. At 1514 the pilot reported over Brounson Island. At 1525 a Mayday call from the flight was its last communication. Examination revealed no evidence of power plant or airframe failure; however, an autopsy of the pilot's body revealed a carbon monoxide hemoglobin--65% saturation. Although the heater and exhaust system was too badly damaged to determine the cause of exhaust leakage into cabin, it is believed that a defective exhaust gasket, stack, or clamp attachment could have permitted a small amount of CO to escape and enter the cabin which over a period of time could have caused the pilot to lose control of the airplane.

Nonrevenue Operations

11/22/59	0930 AST	Nr. Umiat, Alaska	Wien Alaska	Cessna 180A	Substantial	None	1	0	0	1	0	0	0	0	0	0

During the landing roll-out on skis the left ski leg failed and was followed by the failure of the right. This allowed the plane to slide on the underside of the fuselage causing damage to propeller, engine cowling and fuselage. Examination disclosed that the landing was on snow, covered with gravel which restricted the ski action and stressed the ski leg supports beyond design strength.

International/Territorial Operators

Date	Time of Accident	Location	Airline	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury								
								Crew			Passengers			Others		
								F	S	M/N	F	S	M/N	F	S	M
Scheduled Passenger Service																
2/3/59	2235 GMT	60 mi. London & Gander Atlantic Ocean	PAA	B-707	Substantial	None	129	0	0	10	0	2	117	0	0	0
While the flight was cruising at 35,000 feet on autopilot, the captain left the cockpit and entered the main cabin. During his absence, the autopilot became disengaged and the aircraft entered a steep descending spiral. The copilot who was engaged in flight computation failed to notice the maneuver until it reached serious proportions. The captain, becoming aware of the unusual attitude of the aircraft, returned to the cockpit and with the aid of the other crew members, was able to regain control of the aircraft after 29,000 feet of altitude had been lost. The airplane was flown to Gander, Newfoundland where a safe landing was made.																
4/13/59	1522 PST	Juneau, Alaska	PAA	B-377	Destroyed	After Impact	10	0	0	5	0	0	5	0	0	0
The final approach was undershot and the aircraft contacted an embankment at the approach end of the runway. Fire followed the impact.																
6/23/59	1300Z	Taipei, Taiwan Formosa	Northwest	DC-7C	Substantial	None	28	0	0	4	0	0	24	0	0	0
The flight, a scheduled passenger flight, departed Tokyo, Japan for Taipei, Taiwan. The flight was uneventful until landing at Taipei. There, the aircraft touched down on the centerline of the runway, with full flaps and at a speed of approximately 108 knots. Reverse thrust was used at 95 knots. With the propellar blades in the reverse thrust range the aircraft veered to the right and ran off of the side of the runway into a ditch. The Captain had applied full reverse thrust to No. 1 and 2 propellers in an attempt to maintain directional control and although the corrective action stopped the turning motion, the aircraft hydroplaned on the runway which was wet from recent rain showers. Investigation revealed no evidence of mechanical failure or malfunctioning.																
6/26/59	1632 Z	Milan, Italy	TWA	L-1649A	Destroyed	After Impact	68	9	0	0	59	0	0	0	0	0
Although weather conditions at the time the flight departed Milan were scattered thunderstorms, numerous pilot reports one hour before, throughout the period, and after, indicated none of the severity which would have caused concern to the flight. At 1632 Z, 12 minutes after leaving Milan, the flight reported at 10,000 feet climbing on course. At 1635 Z structural failure, followed by inflight disintegration of the aircraft occurred. Evidence indicated that the right wing initially separated in flight when the No. 6 and 7 fuel tanks exploded.																

7/9/59	1200 GMT	Tokyo, Japan	PAA	B-377	Substantial	None	59	0	0	6	0	0	53	0	0	0

During an approach the landing gear was extended and three green lights indicating the gear was safe were observed. However, as the power was reduced prior to touchdown, the gear unsafe warning horn sounded and a red gear unsafe light came on. The captain first called for a go-around but quickly decided the airspeed was too low. The gear switch was moved to the up position and a belly landing was made. The aircraft slid to a stop and the occupants were quickly evacuated.

7/12/59	0029 EST	New York, N. Y.	PAA	B-707	Substantial	None	113	0	0	10	0	0	103	0	0	0

On July 11, a Boeing 707 took off at approximately 2038 EDT for a flight from Idlewild, New York to London. As the aircraft became airborne the two front wheels of the left landing gear assembly separated from the landing gear truck. The captain remained airborne in the vicinity of the airport to dissipate fuel and to allow time for preparations to be made for the subsequent landing. A successful gear down landing was effected. There was no fire. Investigation disclosed that the wheels separated as the result of a fatigue failure which emanated from a peen mark made by contact between the landing gear truck beam and anti-rotation bolt. The contact probably occurred when the aircraft was operated without a snubber bar installed.

9/5/59	0832 HST	Honolulu, Hawaii	Northwest	DC-6B	Substantial	None	68	0	0	6	0	0	62	0	0	0

Following a normal approach and touchdown the nose gear failed during the landing roll. As a result the nose of the aircraft settled to the runway, and the No. 3 propeller and nose case separated from the engine. No fire occurred and all occupants were safely evacuated

Scheduled Cargo Service

6/21/59	0027 GMT	Shannon, Ireland	PAA	DC-6A	Destroyed	On Takeoff	8	0	0	6	0	0	2	0	0	0

Shortly after the throttles were advanced for take-off the crew heard a loud noise and the take-off was aborted. A visual check before the aircraft stopped revealed the No. 4 engine had separated from the aircraft and an intense fire engulfed the separation area. After the aircraft stopped all occupants were safely evacuated; however, the fire spread and destroyed the aircraft. The subsequent investigation disclosed that one blade of the No. 4 propeller had failed and the unbalanced loads on the engine mounts caused separation of the power plant.

9/12/59	2105 GCT	Nr. Village of Tegucigalpa, Honduras	PAA	DC-4	Destroyed	After Impact	3	3	0	0	0	0	0	0	0	0

The aircraft was observed at low altitude in clear weather conditions as it turned toward a circular shaped valley where it crashed into the side of a small ridge and burned.

International/Territorial Operators

Date	Time of Accident	Location	Airline	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury								
								Crew			Passengers			Others		
								F	S	M/N	F	S	M/N	F	S	M
Nonscheduled Revenue Operations																
3/30/59	0033 GMT	Kotzebue, Alaska	Alaska	C-46	Substantial	None	39	0	0	2	0	0	37	0	0	0
During an ADF instrument landing approach, the wheels of the aircraft contacted sloping terrain 15 feet short of the runway. A recovery and landing were made; however, examination disclosed that the aircraft was damaged by the initial ground contact.																
Nonrevenue Operations																
2/20/59	0756 PST	San Francisco, Calif.	PAWA	DC-7C	Destroyed	After Impact	3	0	0	3	0	0	0	0	0	0
A maximum glide angle approach to landing was being made as part of crew transitional training and check-out on the DC-7 aircraft. During the flare out a high rate of descent continued until the aircraft struck the runway with heavy impact. The impact caused structural damage and a fire which destroyed the aircraft.																
2/25/59	1140 GMT	Chartres, France	PAWA	B-707	Substantial	None	5	0	0	5	0	0	0	0	0	0
While practicing a two-engine minimum control condition during training flight the aircraft went into an abrupt spin to the right. Recovery was accomplished; however, the number 4 engine and strut assembly were separated from the right wing. A safe emergency landing was made at London, England.																
4/16/59	1410 EST	Peconic Airport, Riverhead, N. Y.	PAWA	B-707	Substantial	None	3	0	0	3	0	0	0	0	0	0
During a regular check-training flight, touchdown for landing was made on a sod area approximately 12 feet short of the runway. As the right main gear struck the end of the runway, the impact blew out two tires and separated the lower portion of the right gear from the gear strut.																
All-Cargo Carriers																
5/8/59		Munich, Germany	Seaboard & Western	C-46	Substantial	None	2	0	0	2	0	0	0	0	0	0
The left landing gear retracted during the landing roll and the aircraft groundlooped to the left.																

Supp. ental Air Carriers

Date	Time of Accident	Location	Airline	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury								
								Crew			Passengers			Others		
								F	S	M/N	F	S	M/N	F	S	M
Passenger Service - Public																
8/21/59	1500 PDT	Burbank, Calif.	Sourdough	C-46	Substantial	None	27	0	0	3	0	0	24	0	0	0
				Parked M-202	Substantial											
At 500 feet, immediately after take-off, the aileron boost seemed to be inoperative and both the system and the engine hydraulic pressure instruments indicated zero. The flight returned to Burbank and landed after extending the landing gear with the emergency system. The landing was made without flaps on a slightly downsloping runway. Brakes were applied without effect and the emergency hand pump for brake pressure did not help. The engines were cut and a left groundloop was attempted during which the aircraft struck a parked truck and a Martin aircraft; the latter in turn damaged a parked Stinson.																
Military Contract - Cargo																
5/28/59	1201 EDT	Middletown, Pa.	Capitol	C-46	Substantial	None	2	0	0	2	0	0	0	0	0	0
Following a normal approach and landing, the flaps were retracted and the brakes were applied. Before the landing roll was completed the left main landing gear collapsed and the aircraft swerved to the left and came to rest with only the tail section remaining on the runway. Investigation revealed the 5/16 inch forward retaining bolt of the down-lock cylinder had failed resulting in misalignment and insufficient travel of the down-lock spade to the locked position. As a result of the misalignment the micro switches were damaged and gave a false safe gear indication in the cockpit.																
10/15/59		Jacksonville, Fla.	U.S. Overseas	DC-5A	Destroyed	In Air	2	0	2	0	0	0	0	0	0	0
Between 1,300 and 1,400 feet during the climb following take-off, the No. 4 engine surged and its fuel pressure and fuel flow fluctuated. During a return to the airport the No. 2 and 3 engines lost power and an emergency gear up landing was attempted in a small lake. During the approach the aircraft struck trees, crashed and burned and the crew escaped through a cockpit window and swam ashore. Investigation showed that the fuel selectors were positioned on the auxilliary fuel tanks which were empty.																
Military Contract - Passenger																
2/1/59	2345 CST	Kerrville, Texas	General Airways	DC-3	Destroyed	After Impact	28	2	1	0	1	3	21	0	0	0
The flight was a civil air movement (CAM) of military personnel from Boise, Idaho to Lackland Air Force Base, San Antonio, Texas. During a stop at Pueblo, Colorado, a weather briefing was obtained from the U.S. Weather Bureau which indicated icing conditions existed over the route and were expected to continue. As the flight progressed, a series of radio communications indicated that ice accretion on the aircraft was becoming critical. During an attempt to reach Kerrville, Texas Airport the aircraft ran out of fuel and was crash landed in trees approximately 7 miles from the airport. Fire followed the impact.																

Supplemental Air Carriers

Date	Time of Accident	Location	Airline	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury								
								Crew			Passengers			Others		
								F	S	M/N	F	S	M/N	F	S	M
7/23/59	1438 MST	Denver, Colorado	Miami	C-46A	Substantial	None	43	0	0	3	0	1	39	0	0	0

When the landing gear was extended for landing at Denver an unsafe indication for the right gear occurred. After exhausting, without success, all known methods for locking the gear down a landing was made. After rolling 3,000 feet the right gear retracted. Examination disclosed that a failure of the main gear down lock actuating cylinder assembly had occurred as a result of damage incurred to it at a previous undetermined time.

8/6/59	1820 CST	San Antonio, Texas	California Hawaiian	DC-4	Substantial	In Air	71	0	0	4	0	0	67	0	0	0

Immediately after take-off the No. 2 engine fire warning light came on. After ascertaining that fire existed, emergency measures were taken, an emergency was declared, and a landing was made. Emergency ground equipment extinguished the remaining fire. Investigation disclosed evidence that the fire originated in Zone 2 and was caused by a rupture in the No. 2 engine vacumn pump discharge hose located immediately forward of the firewall. A restriction in the hose resulted from over tightening the hose clamp at the attachment to the firewall whereupon the pressure and generated heat ruptured the line and ignited the oil within it.

10/10/59	1359 EST	Winston-Salem, N. C.	Miami	C-46R5	Substantial	None	38	0	0	4	0	0	34	0	0	0

After one missed approach, the aircraft was cleared to land using runway 15. After a landing roll of about 5,000 feet the airplane veered left across a sod area and over an embankment, where it stopped in an upright attitude. Investigation, which included tests and disassembly of the brakes, revealed no evidence of failure or malfunction.

Nonrevenue Operations

7/27/59	1900 PDT	Ontario, Calif.	Great Lakes	DC-6	Substantial	None	3	0	0	3	0	0	0	0	0	0

As part of a pilot training and check flight, the crew made a touch-and-go landing with No. 4 engine throttled to simulate an engine failure. Shortly after touchdown the nose gear collapsed. The take-off unsafe warning horn indicating the propeller was not in high rpm apparently sounded which the check pilot mistook as the gear unsafe warning horn. In checking the landing gear handle position he may have actuated the gear.

#16 X

Part II

GENERAL AVIATION ACCIDENTS INVOLVING FIXED-WING AIRCRAFT HAVING A CERTIFICATED MAXIMUM TAKE-OFF WEIGHT IN EXCESS OF 12,500 POUNDS AND ROTORCRAFT

RECAPITULATION OF GENERAL AVIATION ACCIDENTS
INVOLVING FIXED-WING AIRCRAFT IN EXCESS OF 12,500 POUNDS GROSS WEIGHT AND ROTORCRAFT
1959

CLASSIFICATION OPERATOR/OPERATIONS	Accidents		Aircraft Damage Index			Fatalities				Serious Injuries				Total Aboard	Fire		
	Total	Fatal	Destroyed	Substantial	Minor None	Passengers	Crew	Others	Total	Passengers	Crew	Others	Total		In Air	After Impact	On Ground
FIXED-WING AIRCRAFT																	
Executive (Corporate)	16	1	2	12	2	8	2	0	10	0	0	0	0	70	1	1	0
Other Business	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
Intra-State	1	1	1	0	0	7	3	0	10	0	0	0	0	10	0	1	0
Air Taxi	1	0	1	0	0	0	0	0	0	0	0	0	0	4	0	0	0
Other Commercial	7	3	4	3	0	3	5	0	8	1	1	0	2	21	0	3	0
Fire Fighting	4	1	2	2	0	0	1	0	1	0	0	0	0	7	0	2	0
Test - Ferry - Demonstration	6	1	1	5	0	0	4	0	4	0	4	0	4	28	1	1	1
Public	2	0	0	2	0	0	0	0	0	0	0	0	0	6	1	0	0
Total--Fixed-Wing Aircraft	38	7	11	25	2	18	15	0	33	1	5	0	6	153	3	8	1
ROTORCRAFT																	
Executive	6	0	2	4	0	0	0	0	0	0	1	0	1	10	0	0	0
Aerial Application	12	1	1	10	1	0	0	1	1	1	0	0	1	13	0	1	0
Commercial	42	5	6	36	0	4	2	1	7	2	2	0	4	101	0	0	1
Pleasure	5	0	1	4	0	0	0	0	0	0	0	0	0	10	0	0	0
Instructional	3	0	0	3	0	0	0	0	0	0	0	0	0	5	0	0	0
Test - Ferry - Demonstration	10	3	3	7	0	4	3	0	7	0	0	0	0	20	0	2	0
Search/Rescue	1	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0
Public	2	0	1	1	0	0	0	0	0	0	0	0	0	4	0	0	0
Other	7	0	3	4	0	0	0	0	0	0	1	0	1	7	0	0	0
Total--Rotorcraft	88	9	17	70	1	8	5	2	15	3	4	0	7	172	0	3	1
GRAND TOTAL	126	16	28	95	3	26	20	2	48	4	9	0	13	325	3	11	2

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DESCRIPTION OF GENERAL AVIATION ACCIDENTS INVOLVING FIXED-WING AIRCRAFT IN EXCESS OF 12,500 POUNDS CERTIFICATED TAKEOFF WEIGHT

Date	Time of Accident	Location	Operator	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury								
								Crew			Passengers			Others		
								F	S	M/N	F	S	M/N	F	S	M
EXECUTIVE (CORPORATE) OPERATIONS																
1/20/59	2010 CST	St. Louis, Missouri	Miss. River Fuel Corporation	Lockheed 18	Substantial	None	2			2						
	Immediately after touchdown a severe tail wheel shimmy occurred. The runway was slippery because of ice and slush and the pilot was unable to get effective braking action or directional control. As a result the left gear and tail slid off the runway and the aircraft struck taxi and runway lights before it was brought back on the runway.															
3/11/59	1645 EST	Lancaster, Penna.	Jones Laughlin Steel Corp.	Lockheed 18	Substantial	None	6			2			4			
	The runway was snow covered and the pilot was advised that braking action was fair to poor. The aircraft touched down about 200-300 feet from approach end of the 5,500-foot runway and deceleration seemed normal until brakes were applied about halfway down the runway. Braking was not effective in stopping the aircraft in the remaining runway distance and the pilot attempted to groundloop. The aircraft ran off the runway and its tail struck the localizer monitor antennae.															
4/26/59	1905 EST	Hyannis, Mass.	Republic Steel Corporation	Lockheed PV1	Substantial	None	2			2						
	The left main gear retracted during landing allowing the wing to drop and aircraft swerved off the runway.															
5/13/59	1615 EST	Morristown, N. J.	Triangle Conduit & Cable Co.	Lockheed PV1	Substantial	None	2			2						
	The brakes failed during the landing roll and the aircraft rolled off the end of the runway into the bank of a shallow creek.															

5/15/59	1245 EDT	Connersville, Ind.	Beldex Corp.	Douglas DC3	Substantial	In Air	15		1		13	

During normal cruise a vibration occurred and fire was observed in the right engine. The propeller could not be feathered nor could the fire be completely extinguished. An emergency landing was made at the nearby Connersville Airport where emergency equipment had been summoned. The fire was extinguished within 3 to 5 minutes following evacuation of the airplane. Examination of the right engine disclosed that internal failure in the power section had occurred.

5/29/59	1227E	Atlanta, Georgia	Sears Roebuck & Company	Douglas DC3 Piper PA18	Minor Substantial	None	2		2			

While the DC-3 was taxiing to takeoff, the Piper engine was hand cranked with no one at the controls and without the wheels being chocked. When the engine started the Piper moved forward into the DC-3 left propeller.

6/27/59	0700 CST	Puerto Vallarta, Mex.	Homer R. Rich Mission Mfg. Co.	Douglas DC3	Substantial	None	11		2		9	

While taxiing on wet ground extra power was used to taxi up a rise. At the top of the rise, the airplane started to groundloop to the left. As the groundloop was being brought under control a jeep appeared just ahead of the aircraft. The groundloop was continued to avoid the jeep during which the aircraft slid into a fence and nosed up.

7/1/59	1852 EDT	Nr. Marion, Ohio	Continental Can Company	Martin B26	Destroyed	None	10	2		8		

The purpose of the flight was to transport company executives from Chicago, Illinois, to Baltimore, Maryland. The instrument flight progressed uneventfully until after its last position report made over Findlay, Ohio. Shortly after the report, the aircraft was observed flying below the overcast, enter a near vertical dive, and crash into the ground. No evidence was found of inflight structural or power plant failure. Thunderstorm activity occurred in the vicinity of the accident site about 30 minutes prior to the crash.

7/9/59	1225 EDT	Pittsburgh, Penna.	Island Creek Coal Company	Learstar 1D	Substantial	None	2		2			

A landing was made by the copilot at which time both pilots occupied their respective seating positions. Near the completion of the landing roll the left landing gear collapsed.

Date	Time of Accident	Location	Operator	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury: Crew F	Crew S	Crew M/N	Passengers F	Passengers S	Passengers M/N	Others F	Others S	Others M
EXECUTIVE CORPORATE (Cont'd.)																
8/9/59	2305 EST	Dravosburg, Penna.	Gulf Oil Corp.	Lockheed 18	Substantial	None	2			2						
	A wheels up landing occurred when the pilot forgot to lower the gear.															
9/5/59	214 EDT	New York, New York	Storer Broadcasting Company	Lockheed PV1	Substantial	None	4			2			2			
	While conducting the cockpit pretakeoff checklist, the pilot inadvertently fired one JATO bottle.															
10/8/59	1531 EST	Pittsburgh, Penna.	Nat'l Steel Co.	Lockheed PV1	Minor	None	2			2						
	The copilot made an ILS approach and landing during an instrument proficiency flight. The pilot said the approach and landing were fast and an intentional ground loop was made at the end of the runway during which the tail wheel collapsed.															
10/26/59	1647	Chicago, Illinois	Morton Salt Co.	Lockheed PV1	Substantial	None	2			2						
	While taxiing toward the parking area, in a gentle left turn, the right landing gear collapsed, causing the right wing tip and right propeller blades to strike the macadam surfacing. The pilot estimated the speed, at the time of the accident, to be approximately 2-3 miles per hour. Investigation revealed that the drag strut anchor fitting on which the drag strut is hinged and attached to the spar had failed.															
11/5/59	1600 EST	Cleveland, Ohio	Fontaine Truck Equipment	Douglas DC3	Destroyed	After Impact	2			2						
	The attempted flight was to be a demonstration flight for a prospective buyer. Upon reaching an altitude of approximately 15-20 feet, following a crosswind take off, the aircraft settled back onto the ground with severe impact and burned. Investigation revealed that the attempted take off was made with the rudder gust lock still attached to the tail section. The airport from which the take off was attempted does not have a control tower.															
12/8/59	1240 CST	St. Louis, Missouri	Monsanto Chemical Co.	Douglas DC3	Substantial	None	9			2			7			
	An ATR pilot, age 47, with 11,000 total hours, 5,000 hours in type, was making a takeoff when he realized that the elevators could not be actuated. He immediately cut the throttles and landed on the runway while the landing gear was retracting. Examination disclosed that the left elevator gust lock was still installed on the elevator.															

12/20/59	320 PST	Catalina, California	Shell Oil Co.	Vultee PBY5A	Substantial	None	3		3			

During a water landing the aircraft bounced and skipped several times. The next touchdown was smooth, however, the aircraft turned to the left, assumed a nose-down attitude and water entered the cockpit. The aircraft was towed onto the beach, where an inspection disclosed that both nose wheel doors had been torn off and the nose wheel well had been torn open by forces during landing.

OTHER BUSINESS

8/8/59	1630 C	Shreveport, La.	Rex Todd	Douglas B26	Substantial	None	1		1			

During a practice touch-and-go landing the aircraft stalled in a nose high attitude and a hard landing resulted in which the nose gear failed.

INTRA-STATE CARRIER

1/8/59	2032 EST	Nr. Bristol, Tenn.	Southeast Airlines	DC3	Destroyed	After Impact	10	3		7		

The evidence indicates that departure from Nashville was made with an inoperative radio compass, a defective item which was not entered in the aircraft log. An enroute stop was made at Knoxville and departure from there was 27 minutes behind schedule. Approaching Tri-City, the flight received clearance for an instrument approach to runway 27. The latest airport weather was given as 900 broken, 1700 overcast, visibility 3 miles, light snow, fog. The altimeter setting was 30.03. This was acknowledged by the flight. In a subsequent transmission the Captain reported malfunctioning of his ADF and that the outer marker had not been picked up visually or aurally. The wreckage was located the following day on the northwest side of the Holston mountain range. It was apparent from the evidence that the facilities available had not been used to definitely establish the position at Gray intersection and the aircraft consequently passed east of the outer marker. It continued beyond the normal procedure turn area and descended below surrounding terrain.

AIR TAXI

1/27/59	1526 PST	Catalina Island, California	Avalon Air Transport, Inc.	Sikorsky S43	Destroyed	None	4		2		2	

Pilot made a straight-in approach to a dead end harbor and touched down at an airspeed of between 70 and 75 knots. The aircraft became airborne after a short distance and after the second touchdown ballooned again. It then contacted the water hard and flat. The wings and engines failed downward and forward; the aircraft swerved to the left and submerged.

Date	Time of Accident	Location	Operator	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury: Crew F	Crew S	Crew M/N	Passengers F	Passengers S	Passengers M/N	Others F	Others S	Others M
OTHER COMMERCIAL																
1/13/59	0207 PST	Panther Peak, Calif.	Calif. Air Freight	Curtiss Wright C46F	Destroyed	After Impact	2	2								
	After takeoff, the crew filed a VFR flight plan Burbank to Seattle in which its cruising altitude and airway routing were proposed. No further communication was received from the flight. Investigation disclosed that the aircraft struck the side of a ridge at an altitude of approximately 8,600 feet MSL and burned. The crash site was located on a direct course to Seattle approximately 45 miles to the right of the airway. The minimum safe altitude on the direct route is 14,500 feet MSL as compared to 8,500 over the airway route.															
2/18/59	1447Z	Nr. Arica, Chile	Southern Cross Airways	Curtiss Wright C46	Destroyed	After Impact	5			5						
	Approximately 56 minutes after takeoff from Arica, Chile, for a flight over the Andes to Puerto Suarez, Bolivia, a power loss of the right engine occurred. The aircraft was overloaded by approximately 1,000 lbs. and it was impossible to maintain sufficient altitude to clear the terrain for a return to Arica. A forced landing was made on a comparatively open, uphill area where the aircraft slid through several rock retaining walls about three or four feet in height. Small fires which occurred around the right engine were extinguished by the crew using dirt and hand extinguishers. The initial cause of the engine malfunction was not established; however, as a result of it the exhaust valve of the #10 cylinder had failed from its piston beating against the spark plugs and cylinder head. This probably ruptured the intake port, and reduced manifold pressure to atmospheric pressure (22" in flight).															
7/7/59	1210P	La Grande, Oregon	Blue Mt. Air Service	No. American B25	Substantial	None	3			2			1			
	The aircraft was being ferried to its base after being used in a type rating test. The landing approach and touchdown were normal; however when brakes were applied, there was no effective deceleration even though the wheels were locked. The aircraft continued beyond the end of the runway approximately 100 feet where the nose gear collapsed. Investigation revealed that the runway had been treated with a "seal coat" which because it had been improperly applied, created a gummy and slick surface.															
8/4/59	1030 EST	Moose Creek, Idaho	Johnson Flying Service	Ford 5ACT	Destroyed	After Impact	5		1		3	1				
	In landing on a flight strip surrounded by mountainous terrain, a windshift occurred when the flight was committed to a landing. The aircraft overran the runway, crashed into trees, and burned.															

9/9/59	0905C	Dallas, Texas	Zantop Air Transport, Inc.	Curtiss C46F	Substantial	None	2		2		

The right landing gear front spar attachment fitting assembly failed during gear retraction on takeoff and a fire occurred in the right wheel well. The pilot made a landing during which the right gear collapsed.

12/7/59	1815 EST	Idlewild, New York	Zantop Air Transport	Curtiss C46	Substantial	None	1		1		

After landing the crew taxied the aircraft toward the hanger which required a long period of continuous taxiing in a direct crosswind of 18 knots with gusts to 40 knots. This required excessive use of the right brake to maintain the desired heading. The right brake expander tube fractured, and rendered the brake inoperative. The aircraft veered to the left and collided with a cement blast fence.

12/17/59	0230Z	Nr. Ketchikan, Alaska	Calif. Aircraft Engine Company	Convair PBY	Destroyed	None	3	3			

A commercial pilot, age 29, with 6,000 total hours, 75 hours in type, was engaged in a flight from Juneau to Annette, Alaska. At 1959Z, the flight contacted Annette, estimated arrival on the hour and requested an instrument approach clearance. At 0153Z, the flight advised that it was experiencing trouble with the right engine and requested an immediate descent. The aircraft was cleared for an unrestricted approach to the Annette Airport. The flight declared an emergency and the Coast Guard was notified. The last report from the flight was at 0218Z in which the pilot stated the flight was at 2,000 feet and could see fuzzy lights below. An extensive search was conducted without success by the Coast Guard, CAP and civilians until December 31, 1959 when it was necessary to discontinue and wait for spring weather conditions.

FIRE FIGHTING

6/20/59	10:31 MT	Prescott, Arizona	Internat'l Air Applicators	Convair PBY2	Destroyed	After Impact	2		2		

The flight had been engaged in borate bombing of forest fires and was approaching the airport after its third such flight of the day. All four engines lost power due to fuel exhaustion and a forced landing, with gear partially retracted, was made on hilly terrain. The aircraft broke up as it slid along the ground. Gear retraction was initiated when the emergency landing appeared imminent but the gear had not fully retracted before touchdown. A misunderstanding between the flight crew and the crew chief over the amount of fuel aboard resulted in insufficient fuel for the three flights as planned.

Date	Time of Accident	Location	Operator	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury: Crew F	Crew S	Crew M/N	Passengers F	Passengers S	Passengers M/N	Others F	Others S	Others M
FIRE FIGHTING (Cont'd.)																
7/5/59	318 PDT	Yucaipa, California	Hemet Valley Service	Grumman TBM3E	Destroyed	After Impact	1	1								
The pilot made an approach to drop borate downhill and crosswind with the flaps extended and the landing gear retracted. At a point near where the borate solution should have been released, the aircraft struck the ridge, disintegrated and burned. The reason for the borate not being released could not be ascertained because of extensive impact and fire damage.																
7/19/59	1630 PDT	Long Beach, Calif.	James N. Routh	Vultee PBY	Substantial	None	2			2						
The pilot, commercial rating, age 39, with 4,100 total hours landed the aircraft on the keel with the gear in the retracted position.																
10/19/59	0935 PDT	Palmade, California	Internat'l Air Applicators, Inc	Vultee PBY2	Substantial	None	2			2						
The ATR pilot, age 48, with 4,984 total hours, 148 in type, was taking off with a load of chemical to be used in fighting a forest fire. The takeoff was made in the wake of a departing PBY-2, under calm wind conditions, and as the gear was being retracted, the aircraft began to settle. The chemical belly tanks were jettisoned; however, the aircraft touched down on the runway on the extended and locked right gear, and the partially retracted left gear. The aircraft skid to a stop with the right gear down and the left up.																
TEST FERRY DEMONSTRATION																
3/14/59	1700 P	LaGrande, Oregon	Blue Mt. Air Service	No. American B25	Substantial	None	2			2						
The aircraft was being converted to a fire control spray aircraft and the flight was to test the operating efficiency of a newly installed spray facility. In preparation for landing, all hydraulic pressure was lost and the crew was unable to extend the gear and a wheels-up landing was made. A piece of flexible hose, installed as a temporary line connecting the original bomb bay door operating strut into the hydraulic system had been cut through where it was routed over the sharp edge of the tank mounting bracket.																
3/25/59	1046 PST	Laguna Beach, Calif.	General Dynamics Corp.	Convair 880	Substantial	None	5			5						
The purpose of the flight was to make flutter vibration and flight characteristic tests at supersonic speed. The dampeners had been removed prior to this test. A vertical empennage surface flutter was encountered which caused major structural deformation and/or destruction of the subject areas. Approximately two-thirds of the vertical stabilizer and 80% of the rudder surface was lost. Aircraft was landed safely.																

4/22/59	0700 EST	Miami, Florida	Homer R. Rich	Douglas TB26B	Substantial	Ground	2		2		

The engines were started normally and the aircraft was taxied to the runup ramp where a pre-takeoff engine runup was accomplished. Shortly thereafter the left engine nacelle area burst into flames causing considerable fire damage before the fire was extinguished by airport fire equipment.

5/7/59	1425 CST	San Antonio, Texas	Howard Aero, Inc.	Lockheed PV1	Substantial	After Impact	3		3		

The copilc., being checked out in this aircraft, was making the approach for landing. The approach was low and aircraft touched down short of the runway collapsing the left gear. Power was applied and a go-around effected. The subsequent landing was made with the right gear extended.

5/14/59	0916 PDT	Edwards AFB, Calif.	Douglas Aircraft Co.	Douglas DC8	Substantial	None	8		8		

The flight was for tests in connection with type certification of the aircraft. FAA and Douglas flight test personnel were aboard for this purpose and a FAA pilot flew the aircraft. It was agreed that in conjunction with the flight a landing using minimum landing distance techniques would be made. Although the pilot precisely followed the recommended procedures and techn.ques, the rate of descent near the ground was higher than expected by the manufacturer. The aircraft contacted the ground with such force that the fuselage was broken and No. 1 engine pod was torn off.

10/19/59	1700 PST	Arlington, Washington	Boeing Aircraft Company	Boeing 707-220	Destroyed	In Air	8	4	4		

The flight was scheduled as a customer guarantee and acceptance training flight prior to delivery of the aircraft to Braniff International Airways. The aircraft was being flown by a Braniff captain and a Boeing test pilot as instructor. Other Braniff and Boeing flight crew personnel were aboard as crew members and observers. During one of a series of Dutch Rolls being executed beyond maximum bank restrictions, control of the aircraft was lost. During the loss of control and recovery numbers 1, 2 and 4 jet pods were torn off by loads in excess of design strength. An intense fire occurred in the number 2 jet pod attach area. During the emergency descent and attempt to land the fire burned away portions of the controls and the aircraft was crash landed along a river.

Date	Time of Accident	Location	Operator	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury: Crew F	Crew S	Crew M/N	Passengers F	Passengers S	Passengers M/N	Others F	Others S	Others M
PUBLIC																
11/18/59	405 PST	Los Angeles, Calif.	Federal Aviation Agency	CV440	Substantial	In Air	3			3						
	During a pilot check and standardization flight, a simulated ILS approach was being conducted with a simulated right engine failure. While on the final approach the fire warning bell was heard, however, no fire warning lights came on. Shortly thereafter the tower advised the crew that a fire had been observed in the right engine by ground personnel. The crew initiated emergency procedures but forgot to feather the propeller. The fire continued to burn until extinguished by ground personnel after the aircraft landed and came to a stop.															
12/11/59	1120 EST	Worcester, Mass.	Federal Aviation Agency	Douglas DC3	Substantial	None	3			3						
	During the approach for landing the final portion was made too low to clear obstructions located at the approach end of a short, downhill runway. The main gear struck and passed through a ridge of dirt. The aircraft bounced onto the runway where it came to rest.															

DESCRIPTION OF GENERAL AVIATION ROTORCRAFT ACCIDENTS

DESCRIPTION OF GENERAL AVIATION ACCIDENTS INVOLVING ROTORCRAFT

Date	Time of Accident	Location	Operator	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury: Crew F	Crew S	Crew M/N	Passengers F	Passengers S	Passengers M/N	Others F	Others S	Others M
EXECUTIVE CORPORATE																
1/6/59	1920 EST	Clearwater, Florida	Publix Super Markets, Inc.	Bell 47J	Destroyed	None	1		1							
After 8 minutes of flight, the engine backfired and lost power. The pilot attempted to land on a highway. On the approach, the main and tail rotors contacted powerline wires, tearing off the main rotor. The fuselage struck the highway, breaking into two parts, one of which was struck by an automobile. Examination of the engine disclosed an excessive heat condition of both plugs in No. 1 cylinder and an oily aft plug in No. 3 cylinder. A compression check showed a wide variation between cylinders, with Nos. 1 and 3 being under 100 pounds.																
3/11/59	1107 PST	Venice, California	Douglas Aircraft Company, Inc.	Bell 47G	Substantial	None	2			1			1			
Pilot was attempting a zero forward speed autorotative water landing in a slight cross-wind. The helicopter touched down on the heel of the right float, and tilted sufficiently to permit the rotors to strike the water, the aircraft then capsized.																
9/25/59	0015	Timmins, Canada	Texas Gulf Sulphur Co.	Bell 47J	Substantial	None	1			1						
In landing clipped tail rotor on fence damaging tail rotor and one main blade.																
10/13/59	11:30 PM	Kingman, Arizona	Blakely Oil Co.	Bell 47M	Substantial	None	2			1			1			
While conducting a drilling rig operation the wind caused the helicopter to move to the right. The tail rotor struck a large rock.																
12/1/59	1340 PST	Fullerton, California	Ralph E. Phillips, Jr.	Piper PA22	Substantial	None	2			2						
				Bell 47J	Substantial	None	2			2						
A Piper approached from the northwest for entry into a right hand traffic pattern for runway 24, and the helicopter was cleared to cross the airport by control tower. The Piper pilot was not in radio contact with the tower and while descending on the downwind leg overtook, and collided with, the helicopter. Both pilots maintained control of their respective aircraft and landed successfully.																
12/1/59	1905 CST	Grand Isle, La.	Humble Oil & Refining Co.	Sikorsky S55	Destroyed	None	2			2						
During a night landing on an off shore drilling platform, pilot misjudged the distance to the tower. A rotor blade struck the tower and the aircraft rolled left and fell to a lower platform. There was no indication of mechanical failure or malfunction.																

AERIAL APPLICATION

3/6/59	0800 PST	Satsop, Washington	Chem.-Air Inc.	Bell 47G	Substantial	None	1	1		

After refueling the aircraft, the pilot neglected to notice the fuel hose and was unaware that it was draped over the left skid. During a vertical takeoff the hose restricted movement of the helicopter and caused it to go out of control. Although the pilot initiated corrective action, it did not prevent the helicopter from touching down hard with substantial damage.

4/18/59	0630 EST	Dartmouth, Mass.	East Coast Aviation Corp.	Hiller UH12B	Destroyed	After Impact	2	1	1	

During a spray run at a low altitude over trees, a partial power loss was experienced and the helicopter was landed in a small clearing. After touchdown, throttle was applied and the rpm came up. The pilot therefore attempted to take off and land in a more suitable area. At an altitude of approximately 50 feet, the engine again lost power causing an unwanted descent. The tail rotor blades struck telephone wires and the helicopter crashed out of control and burned.

6/5/59	1420 CST	Boerne, Texas	General Air Transport Inc.	Bell 47G	Substantial	None	1	1		

While returning to the established loading base, the helicopter was flown under a powerline. Telephone wires, lower on the poles were not observed by the pilot before the helicopter struck them. The aircraft became uncontrollable, fell off to the right and struck the ground causing substantial damage.

6/10/59	1040 EDT	Center Hall, Penna.	Agrotors Inc.	Bell 47D1	Substantial	None	1	1		

A commercial pilot, with 3,050 total hours, 2,500 hours in the type aircraft involved was conducting agricultural spray operations. Before starting a field, he circled it to observe any wires but saw none. During a spray run, made about two feet above the ground, the pilot suddenly saw wires in his flight path but too late to avoid them. The wires contacted the main rotor mast. The pilot was able to avoid a tree by a successful partially controlled rearward autorotative descent and landing.

Date	Time of Accident	Location	Operator	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury: Crew F	Crew S	Crew M/N	Passengers F	Passengers S	Passengers M/N	Others F	Others S	Others M
AERIAL APPLICATION (Cont'd.)																
6/21/59	0600 PST	Stockton, California	Stockton Heli. Inc.	Bell 47G	Substantial	None	1			1						
The pilot was making a takeoff to ferry the aircraft a short distance. He had not made an adequate preflight check or hover check and was not aware that there was a full load in the spray tanks, put there to neutralize the previous chemical load. A jump take-off was made, which, because of the maximum gross load, resulted in a loss of rotor RPM. Altitude was lost and the aircraft contacted an eight foot boundary fence. It then struck the ground just beyond the fence in an upright attitude.																
6/24/59	0615 PST	Fresno, California	Amco Helicopters	Bell 47D1	Substantial	None	1			1						
A commercial pilot, age 36, with 11,000 total hours, and 2,000 hours of aerial application work in the type helicopter involved approached a field for the first spray run. One of the landing skids struck and broke a high tension wire. The end of the broken wire struck the tail rotor blades causing them to disintegrate. The pilot effected an emergency landing during which the main rotor struck the tail boom.																
6/29/59	0550 CST	Stuttgart, Arkansas	Allied Heli. Service, Inc.	Bell 47D1	Substantial	None	1			1						
While rolling out of a procedure turn during aerial application, the helicopter began to shudder and the nose pitched upward and to the left. Full power was applied when thereafter, the aircraft began a rapid descent which was stopped only about 3 feet above a rice field. The tailrotor, however, contacted an irrigation canal embankment throwing the helicopter into a violent spin during which the left skid struck the ground and collapsed, allowing the main rotor to contact the ground.																
7/4/59	0800 PDT	Clovis, California	Fresno Heli. Inc.	Hiller 12A	Substantial	None	1			1						
The pilot had just taken off to ferry the helicopter from one spray area to another. An altitude of 100 feet was reached when the forward tail rotor drive slip assembly failed, resulting in a loss of tail rotor control. During an autorotative landing in a fig orchard, the main rotor blades contacted trees, splintered the blades and caused major damage to the airframe. Examination disclosed that the failed part, P/N 24565, had been improperly assembled during rebuilding.																
7/19/59	1725 CST	Stuttgart, Arkansas	Allied Heli. Service Inc.	Bell 47D1	Substantial	None	1			1						
The helicopter was engaged in spraying operations. During a tight turnaround at the end of a spray run, a small drop in engine R. P. M. occurred. The pilot attempted an autorotative landing, but touched down very hard causing the main rotor blades to be deflected downward and to strike the tail boom, shearing it off. The drop in R. P. M. was the result of spark plug fouling, but its effect would not have prevented continued flight.																

8/11/59	0705 EDT	Avenue, Maryland	Agrotors, Inc.	Bell 47D1	Substantial	None	1		1			
	Before starting to spray a tobacco field, the pilot circled the field looking for obstacles but failed to detect the wires running across it. About midway through the first spray run, he saw the wires and attempted to go beneath them; however, the main rotor contacted and broke the lower strand. After continuing for a short distance, a complete loss of tail rotor control was experienced and the helicopter spun violently before a successful autorotation landing was made.											
9/24/59	1410 EST	Lovington, Virginia	Central Virginia Electric Corp.	Bell 47G2	Minor	None	1		1		1	
	The helicopter was being used for agricultural spray demonstrations and tests. One crewman was on the ground while the pilot flew until the chemical tank was exhausted. The pilot returned to the field from which he was operating to refill the chemical and fuel tanks. The engine was shut down and the pilot deplaned, but as the rotor brake had been removed some time previously, the main rotor continued to revolve. The crewman, meanwhile, climbed to a catwalk on the chemical truck, which was positioned near the helicopter. As he stood up to place the hose nozzle into the chemical tank, he was struck on the right side of the head by a main rotor blade, which inflicted fatal injury.											
10/16/59	1:15 PM PST	Hanford, California	Amco Helicopters	Bell 47D1	Substantial	None	1		1			
	During the pull-up from a spray swath, the right skid struck a telephone line and the helicopter crashed out of control.											
COMMERCIAL												
1/20/59	1530 PST	Santa Monica, Calif.	Helicopter Corp. of America	Bell 47G	Substantial	None	2		1	1		
	During the landing flare, the pilot applied rear cyclic control and the tail rotor struck a rock that was obscured by tall grass.											
1/30/59	09:10 EST	Lexington, Virginia	Helicopter Patrol, Inc.	Bell 47G2	Substantial	None	2	2				
	During pipeline patrol, over mountainous terrain, the engine became rough and lost power. The pilot was able to reach the upslope of a mountain, but in the attempted landing the main rotor struck a tree. The helicopter settled in hard resulting in substantial damage.											
2/9/59	1355 AST	W. Broad Pass, Alaska	Polar Helicopter Inc.	Bell 47G2	Substantial	None	3		1	2		
	The engine failed because of fuel exhaustion while over rough terrain. During an autorotative landing the rotor blades struck trees. The helicopter crashed on its side in deep snow.											

Date	Time of Accident	Location	Operator	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury								
								Crew			Passengers			Others		
								F	S	M/N	F	S	M/N	F	S	M
COMMERCIAL (Cont'd.)																
3/2/59	1028 EST	Era River, New Guinea	World Wide Air Service Ltd.	Sikorsky S58	Substantial	None	4			1			3			
	At an altitude of 2,000 feet, a sudden engine failure occurred. The pilot immediately established autorotation and turned toward a clearing; however, when the pilot actuated the external cargo release button the cargo did not drop and a rapid loss of altitude occurred, necessitating a landing in a river. The helicopter settled to the river bottom in an upright attitude during which time a main rotor blade struck the tail cone.															
3/9/59	1042	S. Coast Netherlands, New Guinea	World Wide Air Service Ltd.	Bell 47D	Substantial	None	1			1						
	The helicopter was taking off from a jungle clearing with a 300-pound load. Downdrafts and severe turbulence from surrounding trees resulted in a loss of main rotor rpm, and the aircraft settled back to the ground. The tail rotor struck tree stumps, breaking the rotor and driveshaft. The helicopter came to rest on its side.															
3/12/59	1330 PST	Duarte, California	Calicopters, Inc.	Bell 47G2	Substantial	None	1			1						
	While hovering in a confined area, the tail rotor struck a tree.															
4/11/59	1400 EST	Detroit, Michigan	Helicopter Airways Service	Bell 47J	Substantial	None	2			2						
	Immediately after takeoff, and while hovering at two or three feet above the ramp, a sideways lurch of the helicopter occurred followed by vertical vibration. The helicopter remained controllable and pilot landed. One counterweight bracket had separated and struck the following rotor blade damaging it. The bracket was hurled 300 feet away.															
5/23/59	0830	Port Moller, Alaska	Sud Aviation	Alouette II	Substantial	None	4			2			2			
	After normal preparations for a flight to transport supplies, a commercial pilot, age unknown, with 1,495 total hours, 45 in type, experienced what he believed was "ground resonance" as the rotor RPM was increased for take-off. This was felt through the cylic control stick. During hover, just after the aircraft became airborne, the pilot heard a loud snap and although the aircraft operated normally the pilot decided to make a precautionary landing. Just as the aircraft was about to touchdown, a violent vibration occurred during which the main rotor blade struck the tail rotor and cabin area.															
4/28/59	1400 MST	Nr. Payson, Arizona	Blakely Oil, Inc.	Bell 47J	Substantial	None	1			1						
	On approach for landing in a mountainous area, the main rotor contacted tree branches. A normal landing was made but inspection revealed damage to the main and tail rotors.															

5/4/59	09 PDT	Red Box, California	Cal. Rotors Calicopters	Bell 47G2	Substantial	None	1		1			

The helicopter was being landed on a cleared area on top of a ridge at an elevation of 5000 feet MSL. Near the ground gusty air was encountered causing the aircraft to settle abruptly and contact the ground with sufficient force to result in major damage.

5/5/59	1308 CST	Grand Isle, Louisiana	Rotor-Aids, Inc.	Bell 47G	Substantial	None	1		1			

A landing was made on a platform which was not approved for helicopters. The area was limited and was confined by a guard rail. After the passenger had gotten out the pilot attempted to reposition the helicopter. The tail rotor struck the guard rail causing loss of anti-torque control. The aircraft then pitched upward and over and came to rest inverted in the water.

5/14/59	1945 YST	Haines Junction, Yukon Territory	Robert L. Augstin	Hiller UH12	Substantial	None	1		1			

During approach for landing the helicopter struck an electric wire and nosed down allowing the rotor to strike the ground. Prior to the accident, local authority had insisted that the pilot move the helicopter to a ball park area. Since the area was surrounded by trees it was the pilot's intent to take off and land in an adjacent area before continuing takeoff and departure. The downwash from the rotors disturbed the silt-like dust covering the park, causing dust-restricted visibility. In this condition wires were struck and the main rotor blades struck the ground. This was followed by complete loss of control.

5/18/59	1600	Srinayal, E. Pakistan	World Wide Heli. Ltd.	Bell 47D1	Destroyed	None	1	1				

The pilot apparently took off immediately after discharging two passengers and at an altitude of 150 feet lost control. The helicopter struck the ground in a tail low attitude and rolled to a near inverted position. There was no evidence to indicate that the pilot had moved the battery from its rearward position before the takeoff, as is required when the aircraft is operated without ballast or passengers.

6/2/59	1330 AST	Kattalla, Alaska	Nat'l Helicopter Service Eng. Co.	Bell 47G2	Substantial	None	3		1	2		

Following takeoff the pilot decided to land and recheck the aircraft loading. The helicopter contacted the ground with a slight forward motion. The pilot applied aft cyclic correction but was too late to prevent the aircraft from nosing forward on the toes of the floats. As a result the main rotor struck the ground, the helicopter turned 180 degrees, and rolled over on its right side.

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Date	Time of Accident	Location	Operator	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury								
								Crew			Passengers			Others		
								F	S	M/N	F	S	M/N	F	S	M
COMMERICAL (Cont'd.)																
6/2/59	15 AST	Nr. Eagle, Alaska	Southwest Heli. Inc.	Bell 47G2	Substantial	None	3			1			2			
	Pilot was attempting to land two geologists near outcroppings on a river bank. He was not satisfied that the tail rotor would clear the water as he partially settled on the beach and decided to take off and look for a better landing area. As the helicopter rose, a gust of wind drifted it toward the steep river bank. Back cyclic control was applied but, as a turn was started, the main rotor struck the bank and was splintered. The helicopter continued to turn through 180 degrees and struck the water. It came to rest upright enabling the occupants to evacuate safely.															
6/12/59	1500 CST	Ponca City, Oklahoma	Allied Heli. Co., Inc.	Bell 47B	Substantial	None	2			1			1			
	A commercial pilot, age 31, with 500 total hours, 48 in type, was hovering the helicopter about 30 feet above the ground. A partial loss of R. P. M. from high temperature and ground effect of a nearby obstacle, was experienced. In an attempt to move forward, additional R. P. M. were lost and the helicopter struck the ground. Impact caused the main rotor blades to deflect downward and strike the tail boom, which was severed.															
6/19/59	1315 CST	Little Rock, Arkansas	Allied Helicopter Service	Bell 47D1	Substantial	None	1			1						
	During a cross-country ferry flight, the pilot became concerned about the remaining fuel supply and made a precautionary landing to check it visually. According to his statement, he could see gasoline in the bottom of the tank and assumed it was sufficient to reach his destination. Within sight of the Little Rock Municipal Airport, the engine failed as the result of fuel exhaustion and an autorotative landing was attempted on a street in a residential area. One skid contacted an automobile, causing a hard landing and substantial damage to the helicopter.															
6/22/59	1430 EST	Clarksburg, West Va.	Heli. Patrol, Inc.	Bell 47D	Substantial	None	3			2			1			
	At an altitude of 200 feet during a cross country flight the pilot lost tail rotor control. During a hard landing the aircraft turned over and the main rotor blades were torn off.															
6/29/59	1035 PDT	Jean, Nevada	Las Vegas Airways	Bell 47G	Substantial	None	3			1			2			
	A helicopter pilot, while approaching for a landing in an open clearing on the side of a mountain, experienced a wind velocity change from 15-20 mph to calm. The change caused the helicopter to fall the last 3 feet of the approach. The helicopter bounced back into the air, and then landed hard on its right skid, causing substantial damage.															

6/30/59	1350 MST	Richfield, Utah	Roberts Aircraft Company	Bell 47G2	Destroyed	None	3	1	2	

Shortly after becoming airborne during a takeoff into the wind from rugged and mountainous terrain a windshift occurred and the helicopter started to settle. The pilot was unable to arrest the settling and attempted to make a landing between trees; the helicopter coming to rest on its side against a rock.

7/8/59	1740 EST	White Sulphur Springs, West Virginia	Inland Airlines Inc.	Bell 47G2	Substantial	None	2	1	1	

At an altitude of 100 feet immediately after takeoff the engine backfired twice, stopped, fired again with another backfire, then stopped running. An autorotative descent and landing was effected on a golf course, with damage occurring as the result of a hard impact with the ground. Evidence was found indicating that the engine had failed because of an exceedingly rich fuel mixture. Because fuel spillage was observed by one of the passengers, it is possible that fuel escaped from around an improperly secured fuel tank cap into the carburetor air inlet, thus producing the excessively rich mixture.

7/10/59	1130Z	Cape Yakataga, Alaska	Economy Rotor Aids, Inc.	Sikorsky S55	Substantial	None	6	1	5	

Following a gradual descent with reduced power, the pilot applied collective pitch and added throttle to resume level flight. The engine failed to respond. An autorotative forced landing followed during which a flat, rather hard contact with the ground occurred. The rotor blades struck some small brush. At the moment of contact the engine began developing power, causing the helicopter to turn left and roll on its side. The occupants quickly evacuated, with only minor injuries. No physical cause of the engine malfunction was found; however it may have been caused by carburetor icing. The freezing level was at 400 feet at the time.

7/13/59	1540 CST	Leeville, Louisiana	Petroleum Heli. Inc.	Bell 47G	Substantial	None	2	1	1	

An approach was being made from an altitude of 600 feet for a landing on a small platform atop an offshore oil storage tank. An autorotation descent was made to 250 feet. During the transition from autorotation to powered flight the helicopter continued to settle rapidly to a position from which a landing could not be made on the platform or could a go-around be attempted. A landing was attempted on the storage tank at a level below the platform. During the attempt the helicopter collided with a handrail and the main rotor struck the tail boom. The pilot knew that the rotor tachometer was inoperative prior to flight.

Date	Time of Accident	Location	Operator	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury: Crew F	Crew S	Crew M/N	Passengers F	Passengers S	Passengers M/N	Others F	Others S	Others M
COMMERCIAL (Cont'd.)																
7/14/59	11:50 PDT	Chilao, California	Southwest Helicopters	Bell 47G2	Substantial	None	3			1			2			
	About 2½ minutes after takeoff, a substantial power loss occurred and an autorotative landing was made on very rough terrain. During the landing, the main rotor struck rocks and other damage occurred to the skids and tail rotor guard. Tests failed to disclose an apparent reason for the power loss, but carburetor icing is a possibility.															
7/22/59	1715 Z	Annette Island, Alaska		Hiller UH12B	Substantial	None	3			1			2			
	The pilot took off from a parking area located between the hangar and terminal building and proceeded to the south taxiway at a height of between 10-15 feet. The aircraft was observed to porpoise slightly and then drop to the ground in an upright position.															
7/25/59	1600 AST	Becharof Lake, Alaskan Peninsula	Gay Airways Inc.	Bell 47J	Destroyed	On ground	3			1	1		1			
	A commercial pilot, age 38, with 4,385 total hours, 100 hours in type recent experience intended to make an enroute stop at a fuel cache. The flight was being conducted in a gusty wind of about 50 mph. While in a downwind turn, the airspeed dropped off to between 0 and 20 mph, it then increased to 45 mph as the turn continued into the wind. A sudden loss of altitude was experienced and just prior to ground contact the pilot dropped collective pitch, applied more throttle, and brought collective pitch up again with the engine over-revved. Touchdown occurred on the right skid, about 1,000 feet from the intended landing area; the rotor blades struck the ground and the helicopter rolled over on its side and caught fire. One of the passengers, thrown partially out of the right side and pinned underneath the fuselage, received fatal injuries. The helicopter was overloaded approximately 70 pounds.															
7/26/59	1300 PST	Pelican, Alaska	Petroleum Heli.	Bell 47G2	Destroyed	None	3		1		1	1				
	The flight was for the purpose of exploration (mineral prospecting). A landing was being attempted on a large rock outcropping at the 5800 level of a mountain. When about 20 feet off the ground, a severe downdraft was encountered and in spite of full power, the helicopter descended rapidly and contacted the ground short of the selected landing area. As the area was on a steep slope covered with loose rock, the aircraft slid backward over a cliff, striking various levels before coming to rest on glacier ice below. The two survivors were rescued after 7 days on the glacier.															
8/10/59	1530 CDT	Wisconsin Dells, Wisconsin	Helicopter Service Corp.	Bell 47G2	Substantial	None	3			1			2			
	The flight was for the purpose of transporting revenue passengers on a local sightseeing flight which was the eighth since the aircraft had been refueled. Five to six minutes after becoming airborne, the engine failed because of fuel exhaustion and a successful autorotative landing was made in the Wisconsin River where the water was about 3 feet deep. Pilot and passengers evacuated the helicopter and waded ashore. The main rotor blades were damaged when they struck the water.															

8/14/59	1035 PDT	Kernville, California	Whirl-Wide Helicopters	Hiller UH12E	Substantial	None	3	1	2	

Approximately 15 feet above the ground during an approach for landing on a mountain meadow, a windshift was encountered. The aircraft struck the ground before the pilot could effect a recovery. The tail boom was severed by the main rotor and the aircraft came to rest on its right side. The wind was gusty and variable, 20-25 knots.

8/16/59	2040 EDT	Plymouth, Penna.	Philadelphia Heli. Airways	Bell 47H1	Destroyed	None	1	1		

The pilot was engaged in broadcasting reports of auto traffic conditions during which more time than usual was consumed because of strong headwinds encountered on some of the segments of the pattern. While returning to the home base the engine quit because of fuel exhaustion. The pilot was aware that the fuel gauge was inoperative, and estimated fuel consumption based on elapsed time. During 180 degrees autorotative approach to an open area, the helicopter struck powerlines and crashed out of control.

8/18/59	1015 MST	Clearfield, Utah	Hiller Aircraft Company	Hiller UH12E	Substantial	None	3	1	2	

The helicopter, being used to service a fire-fighting crew was landed on a small prepared spot on a hillside. On the uphill side, the disk of the rotating main rotor blades was lower than the height of a member of the fire-fighting crew who walked into the blades and received fatal injuries.

8/22/59	1403 EST	Miami, Florida	Sunline Heli. Inc.	Bell 47B	Substantial	None	3	1	2	

Power failure occurred at low altitude. During an autorotation landing the main rotor blades cut off the tail boom.

8/31/59	1305 PST	Wheeler Peak, Nevada	Roberts Aircraft	Hiller UH12E	Destroyed	None	2	1	1	

An attempt was made to land the helicopter on a ridge 12,550 feet MSL an altitude which is near the service ceiling of the aircraft. Approximately 4 or 5 feet above the ground, turbulence was encountered which resulted in a sudden descent and contact of the forward part of the landing skids on rock-covered ground. The pilot was unable to regain control as the helicopter rocked backward and to the right and the main rotor blades struck the rocks. The aircraft then rolled and came to rest inverted.

Date	Time of Accident	Location	Operator	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury: Crew F	Crew S	Crew M/N	Passengers F	Passengers S	Passengers M/N	Others F	Others S	Others M
COMMERCIAL (Cont'd.)																
9/5/59	1445 CDT	St. Louis, Missouri	Hempel Air Taxi Inc.	Bell 47G2	Substantial	None	2			1			1			
	A commercial pilot, age 39, with 4,272 total hours, 851 in type, was conducting a contract flight for the General Electric Corporation for the purpose of checking signal strength of a TV Channel at various angles, altitudes, and distances from the transmitting towers. Following a takeoff at an altitude of between 75 and 125 feet, sudden engine failure occurred. An autorotational landing was attempted but, in order to avoid a power cable, rotor rpm was depleted and a very hard landing resulted. Investigation disclosed no apparent cause for engine failure, however it is considered possible that a vapor lock occurred in the fuel system. The air temperature at the time was 89° F, and the helicopter had been hovered for a time after takeoff which afforded less engine cooling.															
9/10/59	1100 AST	Nr. Chitina, Alaska	Gay Airways Inc.	Bell 47G2	Substantial	None	3			1			2			
	While in cruising flight, 1,000 feet above the terrain, the pilot depressed the collective pitch for descent. The response to the control made it apparent that a failure had occurred. As rotor rpm decreased, a steep dive was made with a flare-out at treetop level. The helicopter settled into the trees. Examination disclosed that a bolt, P/N AN174-20, which connects the bell crank, P/N 47-727-050-1, to the support in the collective control linkage, P/N 47-729-071, was missing.															
9/11/59	0645 AST	Yukon River, Alaska	Petroleum Heli. Inc.	Bell 47G2	Substantial	None	3			1			2			
	During a normal flight at 2,200 feet ASL, a loud sound was heard and was immediately followed by severe vibration in the tail rotor pedals. A hard autorotational landing was made which caused the main rotor blades to flex downward, and strike the tail boom and tail rotor. The cause of the vibration was found to be a 5-gallon can which had broken from its mooring on the right float and struck the tail rotor blades.															
9/21/59	1525 AST	Homer, Alaska	Risk Heli. Inc.	Bell 47G2	Substantial	None	3			1			2			
	About one foot above the ground during an attempt to land at the 3,100-foot level of Saddle Mountain, a strong gust or wind shift occurred. The pilot was unable to effectively correct for this, and the aircraft rolled to the right, bringing the main rotor blades in contact with the ground.															

10/20/59	0902 PST	Grayland, Washington	Columbia Heli. Inc.	Bell 47G2	Substantial	None	2		1		1	
	The helicopter was being utilized in a salvage operation in which a grounded freighter was being refloated. Its purpose was to fly lines, personnel, and equipment between the ships in the area. The helicopter was being hovered next to a lifeboat which had been swung out on its davits, to permit a passenger to step into it. The ship rolled sufficiently to cause a davit to come into contact with the main rotor blades. The helicopter fell 25 feet into the water. The pilot and passenger were immediately rescued and the aircraft was also brought on board within 20 minutes of the accident.											
11/17/59	1605 E	Loudon, Tennessee	S. P. Cole	Bell 47D1	Substantial	None	2		1		1	
	Hard landing following autorotation due loss of power.											
11/30/59	1147 CST	Leeville, Louisiana	Petroleum Heli. Inc.	Alouette II	Substantial	None	3	1		2		
	The pilot radioed a company dispatcher that he was experiencing a malfunction of the tail rotor control and was returning to base. A few seconds later without additional information the aircraft crashed in the Gulf of Mexico.											
12/15/59	1045 AM PST	Los Angeles, Calif.	Renco Helicopter	Hiller UH12B	Substantial		1		1			
	During the flare for landing the tail rotor guard and rotor blades struck the ground failing both blades and causing a partial loss of control. The helicopter then made a hard landing with damage to the tail boom and landing gear cross tubes.											
12/23/59	550 CST	Chicago, Illinois	Heli. Airlift	Bell 47H1	Substantial	None	3		1		2	
	During a landing on a skating rink a piece of canvas, laid to protect the ice, was sucked into the main rotor blades. The helicopter fell from 10 feet.											
PLEASURE												
5/14/59	1100 CDT	Blue Island, Illinois	W. T. Howell	Bell 47G	Substantial	None	2		1		1	
	During downwind taxi the pilot shifted the cyclic control which he normally operated with his right hand to his left. The tail skid struck the ground and pilot applied rearward movement on the cyclic control causing the main rotors to strike the tail.											

Date	Time of Accident	Location	Operator	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury								
								Crew			Passengers			Others		
								F	S	M/N	F	S	M/N	F	S	M
PLEASURE (Cont'd.)																
7/9/59	1331 EDT	Windsor, Connecticut	Richard Delafield	Hiller UH12A	Substantial	None	2			1			1			
	After lift-off and as the helicopter was entering translational flight, a crosswind drifted it toward rising terrain. A shallow, left turn was attempted but the low altitude prevented reducing collective pitch to increase rotor rpm. As the drift continued toward a hedgerow, the pilot decided to land. Just prior to touchdown, full collective pitch was applied but according to the pilot's statement with the collective pitch in full up position there was no power available for left rudder control. Contact with the terrain was abrupt and the aircraft rolled over on its left side.															
7/25/59	1400 CST	Delhi, Iowa	Gerald J. Pasker	Bell 47G2	Substantial	None	2			1			1			
	A float-equipped helicopter was landed 150 feet from a sandy beach and taxied to shore. Because the aircraft was blowing debris on cabin sites, it was taxied away from the shoreline. A wave created by a passing motorboat submerged the right float at which time the main rotor contacted the water. One blade was broken which struck and caused additonal damage to the helicopter.															
9/6/59	1300 MST	Glen Canyon City, Utah	Roberts Aircraft Co.	Bell 47G2	Substantial	None	2			1			1			
	A helicopter being flown near a ridge encountered a downdraft. The pilot immediately turned away from the ridge but the helicopter settled and its tail rotor struck rocks on the side of the ridge. The pilot maintained control and returned to the airport where he made a safe landing.															
10/6/59	1820 AST	Karluk, Alaska	Alaska Aeromarine	Bell 47D1	Destroyed	None	2			1			1			
	The pilot was making a low altitude, nonrevenue sightseeing flight, in partial darkness, and over an area of rolling terrain. The helicopter contacted a high point in the terrain, nosed down, descended rapidly, and crashed on lower terrain.															
INSTRUCTIONAL																
1/26/59	1530 CST	Nr. Sheeveport, La.	Cambell Air Service	Bell 47G	Substantial	None	2			2						
	The student pilot was being checked out on autorotation landings. During one, the helicopter was landed on what appeared to be solid ground, but was in fact a swamp area covered with a thin layer of soil. As the skids began to dig in the pilot applied full back cyclic control to prevent the helicopter from nosing over. In doing so the main rotor blade severed the tail boom.															

4/20/59	4010 CST	Lafayette, Louisiana	Petroleum Heli. Inc.	Bell 47G	Substantial	None	2		2			
	During a supervised training flight several autorotation landings were made on water. During one, the student made a long flare at a low altitude. Recovery from the flare was not made in time and the tail rotor struck the water.											
12/30/59	1355 PST	Las Vegas, Nevada	Las Vegas Airways	Bell 47G2	Substantial	None	1		1			
	During a practice autorotation landing in a smooth field, the tail rotor struck a small mound of loose dirt. The impact failed the tail rotor and caused the main rotors to strike the tail boom.											
TEST FERRY DEMONSTRATION												
1/13/59	0945 MST	Santa Rosa, New Mexico	Bell Helicopter Corp.	Bell 47J	Destroyed	After Impact	1	1				
	A tail rotor blade failed while the helicopter was in cruise configuration at an altitude of approximately 200 feet. The aircraft went out of control and struck the ground in a nearly vertical attitude and burned.											
2/27/59	1714 EST	Conowingo, Maryland	Delaware Valley Heli. Division	Bell 47J	Destroyed	After Impact	4	1		3		
	During a demonstration flight, the helicopter was observed to start a climbing turn from low altitude and strike a powerline. It burst into flames and crashed on the ice of a cove. The direction of the approach was toward the setting sun, and a wooded background which reduced the visibility of the wires.											
4/13/59	5:26 PM	Las Vegas, Nevada	Hughes Tool Co.	Hughes 269A	Substantial	None	1		1			
	On a "zero" speed autorotative landing, 95% of the collective pitch, and considerable aft cyclic pitch were used. This resulted in the slower moving main rotor being excessively flexed by gusts which were present. The main rotor struck the tail rotor boom, causing immediate loss of control.											
4/26/59	0900 AST	Anchorage, Alaska	Alaska Heli. Inc.	Bell 47G2	Substantial	None	3		1		2	
	The pilot was demonstrating a difficult autorotative water landing in shallow water while using minimum, near zero, forward speed. Contact with the water was slightly tail low and resulted in the main rotor blades, striking the tail boom.											

Date	Time of Accident	Location	Operator	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury								
								Crew			Passengers			Others		
								F	S	M/N	F	S	M/N	F	S	M
TEST FERRY DEMONSTRATION (Cont'd.)																
6/30/59		Mammoth Lakes, Calif.	Hiller Aircraft Company	Hiller UH12	Substantial	None	1			1						
A commercial pilot, age 36, with 4,000 total hours, 2,000 hours in type was engaged in a helicopter flight test. While practicing height-velocity autorotation landing tests, a hard landing was made which caused substantial damage.																
7/11/59	0730 CST	Osage Beach, Missouri	Thomas H. Berry	Bell 47G	Substantial	None	2			1			1			
The helicopter was being flown for an engine test following repair work. A noise in the engine was heard and the pilot returned to the airport. On the approach the engine stopped completely and an autorotative landing was made, in which the landing gear was damaged. Examination disclosed crankshaft failure of the engine.																
8/19/59	0930 CST	Austin, Texas	Great Southwest Helicopter Corp.	Brantley B2	Destroyed	None	2	1			1					
A commercial pilot, age 32, with 1,784 total hours, 80 in type, was on a cross-country flight with his wife as a passenger. The helicopter was observed flying straight and level between 800 to 1,000 feet when a popping sound was heard and the main rotor RPM rapidly decreased. The helicopter descended in a rotating motion resembling the spin of a fixed-wing aircraft. Complete disassembly and examination of the wreckage failed to reveal any indication of failure of the powerplant, airframe or control system. An autopsy performed on the pilot indicated that he was probably dead, or incapacitated, prior to impact with the ground.																
8/27/59	1415 EST	Lake Wales, Florida	Hughes Tool Co.	Hughes 269A	Substantial	None	2			1			1			
While cruising at an indicated airspeed of 65 knots at 1,000 feet, a sudden loud report was heard following which the helicopter rotated to the right through 720 degrees. Unable to regain antitorque control, the pilot made an autorotative landing without damage. Examination disclosed that the fibreglass sleeve had been lost from one tail rotor blade. The vibration resulting from the unbalanced condition had caused secondary damage to horizontal and vertical stabilizers, tail rotor gear box pinion shaft, and the tail boom at the tail rotor gear box attachment. The initial failure was the result of an adhesive bonding agent with a lower peel strength than that required.																
9/4/59	1445 EDT	Hagerstown, Maryland	Umbaugh Aircraft Company	Umbaugh Autogiro U18	Substantial	None	1			1						
During takeoff for a test flight, the experimental type autogiro drifted to the left of the runway and the left gear struck a runway light. The pilot, unaware of damage to the gear, completed the necessary air work. During landing, the left gear collapsed and the autogiro rolled onto its left side. The data obtained on this flight was considered sufficient to correct the control problem experienced during the takeoff.																

11/23/59	1355	Stratford, Connecticut Sikorsky Acft.	Sikorsky S62	Substantial	None	3	3			

A commerical pilot, age 37, with 3,373 total hours, 64 hours in type helicopter involved, was checking out an Air Force pilot who was at the controls. General water handling characteristics of the aircraft were being demonstrated. A full autorotative approach was planned. At 15 feet, a shallow flare was made and the helicopter settled into the water and nosed down. The instructor-pilot applied full up collective pitch but the aircraft continued on over until on its back. The crew evacuated without difficulty. The landing gear was in the extended position during the water landing but normally would have little effect on the nose down tendency.

SEARCH/RESCUE

8/7/59	0925 PST	Nr. Quincy, Calif.	Christler & Avery Aviation	Bell 47G2	Substantial	None	2	1	1	

A landing was made on an improvised emergency area to pick up a snakebite victim. On takeoff, an extreme lateral "beat" or vibration was felt and lateral cyclic control was lost. An autorotational landing was attempted during which the helicopter lurched from side to side. On contact with the ground the dynamic stop cables broke and the main rotor struck the tail boom causing extensive damage. It is probable that an object picked up during the takeoff, struck the main rotor.

PUBLIC

6/15/59	1645 EDT	Hoboken, New Jersey	Port of New York Authority	Bell 47G	Destroyed	None	2	1	1	

A commercial pilot, age 35, with 1,700 total hours, 600 hours in type, took off with a photographer to take pictures of the New Jersey entrance of the Lincoln Tunnel. At 600 feet altitude, during left turns the helicopter began to shudder. The pilot established autorotation and landed in the Hudson River. The aircraft touched down in a crosswind with a right sideward motion which capsized the aircraft. The occupants were taken aboard a tugboat. Investigation disclosed that a tail rotor blade failed at the No. 4 rivet causing the blade to separate and pass through the horizontal stabilizer.

11/18/59	1150 CST	Frederick, Oklahoma	Commonwealth of Kentucky	Brantley	Substantial	None	2	1	1	

While practicing autorotational landings the right skid collapsed allowing the main rotor blades to strike ground.

Date	Time of Accident	Location	Operator	Aircraft	Aircraft Damage	Fire	Total Aboard	Division of Injury: Crew F	Crew S	Crew M/N	Passengers F	Passengers S	Passengers M/N	Others F	Others S	Others M
GYROCOPTERS																
5/31/59	1300 CST	Lansing, Illinois	Charles B. Roloff	Gyroplane	Substantial	None	1			1						
The pilot, with over 3,800 hours in fixed-wing aircraft was making his first flight as the pilot of a helicopter. While in a turn at 50 feet altitude, speed was lost and a fast and hard downwind landing resulted. One main rotor blade was damaged.																
6/20/59	1500 EDT	Hartford, Connecticut	John L. Swigert, Jr.	Benson B7MC	Substantial	None	1			1						
A commercial pilot, age 27, with 1,985 total hours, 187 hours in helicopters, was practicing taxiing a gyrocopter. The overhead tiller bar produced opposite control response compared to that of a normal airplane. On the final run, the aircraft became airborne and a gust of wind banked it to the left. In the attempt to recover, the pilot moved the control to the right, causing the gyrocopter to bank more to the left and the rotor blade to contact the ground.																
7/2/59	1845 CST	Waukegan, Illinois	Dale Preston	Benson	Substantial	None	1			1						
A private pilot, age 31, with 400 total hours, 20 hours in type, was conducting an experimental flight of the home-assembled gyrocopter. Flight was kept within the confines of the airport. During the landing approach the engine failed and the gyrocopter touched down in a soft, rough area and came to rest on its side.																
8/18/59	1030 CST	Garrison, Iowa	C. J. Gahring & E. J. Pickart	Benson Al	Destroyed	None	1			1						
On the first test flight of a home-built gyroplane, the pilot lost partial control during a left turn at 200 feet. The aircraft contacted the ground with a skidding motion which caused it to roll to the right breaking the rotor and propeller.																
9/7/59	1400 CST	Lansing, Illinois	C. B. Roloff	Gyroplane	Destroyed	None	1			1						
During climb following takeoff, the engine overheated because of a lean fuel mixture, resulting from a defective fuel pump. An autorotative landing was at slow speed. Impact with the ground was hard enough to cause considerable damage to the aircraft.																
9/20/59	1215 CDT	Osceola, Wisconsin	Harry Bruce Hoch	Benson B7MC-404	Substantial	None	1			1						
The gyrocopter had been converted from a glider to a powered aircraft by the installation of a 72-hp engine. Although it had been flown 12 hours as a towed glider, this was the first flight as a powered aircraft. The pilot, as far as is known, had never had previous experience with a powered gyrocopter. On the takeoff, the aircraft veered to the left, made a 180-degree turn, struck the ground and came to rest on its right side.																

12/10/59	1230 CST	Rockford, Illinois	C. J. Cole	Benson Gyrocopter	Destroyed	None	1	1			

On the first takeoff of the home assembled gyrocopter, the pilot lost control, with the aircraft diving into the ground.

ADDENDUM

REVISIONS - 1958 AIR CARRIER ACCIDENT RECORD

The information presented in the annual "Resume" is based on the data available at the time the publication goes to press. Information subsequently received may alter the basis for the classification of certain occurrences. In this respect, the following changes have occurred relative to the air carrier accident record for calendar year 1958 as it appeared in the Resume dated July 15, 1959.

DELETIONS:

1. Under Scheduled Domestic Operators - Scheduled Passenger Service; the accident shown as occurring on 12/2/58 at Lewiston, Idaho, involving West Coast Airlines, F-27. This has been reclassified as an incident.

ADDITIONS:

1. Under Scheduled Domestic Operators - Scheduled Passenger Service; accident occurring at Charleston, W. Va. on 10/23/58, Eastern Air Lines, M-404; total aboard 20; aircraft damage substantial; 3 crew minor/no injury; 17 passengers minor/no injury. As ground fog was present on the airport, the flight was advised by the control tower to use runway 5 which had one mile visibility. Although the runway lights were visible during the approach, the aircraft hit very hard on the nose wheel and a bounce resulted. As the fog was becoming thicker the landing was abandoned and the trip proceeded to Huntington where the landing was made with a flat nosewheel tire. The flight was continued after replacement of the tire, but a routine 50 hour inspection of the aircraft at Miami on 10/28/58 revealed substantial structural damage.

2. Under Scheduled Domestic Operators - Nonrevenue Operations; accident occurring at Atlanta, Ga. on 12/18/58, Eastern Air Lines, L-749; total aboard 4; aircraft damage substantial; 4 crew minor/no injury. On a normal landing roll, a fatigue failure occurred to the lower drag strut terminal for P/N 299284 of the right main gear. This allowed the main strut and wheel assembly to retract forward, and damage resulted to the airframe structure. The failure was primarily due to the inadequate design of a company alteration.

3. Under Scheduled International Operators - Scheduled Passenger Service; accident occurring at Brussels, Belgium on 5/23/58; Pan American World Airways; DC-6B; aircraft damage substantial; 4 crew minor/no injury. On the take-off run No. 2 propeller assembly sheared off. The take-off was aborted successfully. Examination and disassembly of the engine showed initial failure to have been in the master rod.

REVISIONS:

1. Under Certificated All-Cargo Carriers - Scheduled Domestic Operators - Military Contract; accident at Atsugi, Honshu, Japan on 9/9/58; Flying Tiger Line, L-1049H; changed to 6 crew fatal; 2 passengers fatal.

2. Under Scheduled Domestic Nonrevenue Operations; accident at Martinsburg, W. Va. on 6/4/58; Capital Airlines, DC-3; changed to 1 crew fatal; 2 crew serious injury.

3. Under Alaskan Air Carriers - Scheduled Passenger Service; accident at Haines, Alaska on 8/20/58; Alaska Coastal Airlines, G-21. The flight was cruising at an altitude of about 200 feet over a large expanse of smooth glassy water, below a low overcast, and in light drizzle with patches of fog and haze. With only a small island to the left as a reference the pilot apparently entered a gradual turning descent until the aircraft struck the water. Changed to 1 crew serious; 1 passenger fatal; 5 passengers serious and 2 passengers minor injury.

USCONN---DC

GENERAL INFORMATION

Number of U. S. Helicopter Manufacturers..... 13
Estimated Production Figures - 1960-for commercial use..... 170

Number of Helicopter Operators in the U. S. - 1960:
- Commercial Operators..... 163
- Scheduled Helicopter Operators - Air Carrier 3
- Executive - Business - Industrial..... 83
- Government Agencies..... 20

Number of Helicopter Flight Schools..... 46

Scheduled Air Carrier Service Inaugurated:
- Cargo Service - 1947
- Passenger Service - 1953

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HELICOPTER ACCIDENTS

U. S. CIVIL OPERATIONS
1950 - 1960

Year	Total Accidents	Fatal Accidents	Number of Fatalities	No. Helicopters In Operation
AIR CARRIER-ALL OPERATIONS				
1950	4	0	0	11
1951	3	2	3	11
1952	1	0	0	9
1953	1	0	0	14
1954	4	0	0	17
1955	4	0	0	20
1956	11	0	0	19
1957	2	1	1	26
1958	4	1	2	22
1959	1	0	0	23
1960	4	1	13	24
Total	39	5	19	
GENERAL AVIATION				
1950	39	3	3	-
1951	26	2	5	93
1952	25	1	1	101
1953	15	1	1	123
1954	32	2	6	148
1955	34	3	5	236
1956	47	3	4	283
1957	55	9	12	344
1958	80	11	25	437
1959	88	9	15	520
1960	106	11	28	606 est.
Total	547	55	105	
TOTAL CIVIL OPERATIONS				
1950	43	3	3	NA
1951	29	4	8	104
1952	26	1	1	110
1953	16	1	1	137
1954	36	2	6	165
1955	38	3	5	256
1956	58	3	4	302
1957	57	10	13	370
1958	84	12	27	459
1959	89	9	15	543
1960	110	12	41	630 est.
Total	586	60	124	

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 25, 1961

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HELICOPTER DATA
U. S. CIVIL OPERATIONS

1. Air Carrier - Accident Rates:

   a. All Operations - 7-year Period 1953-1959

Total Accidents (1953-1959)	27
Fatal Accidents (1953-1959)	2
Hours Flown (1953-1959)	150,000
Accident Rates per 100,000 Hours:	
Total Accidents	18.0
Fatal Accidents	1.3

   b. Scheduled Passenger Service - 7 year Period 1953-1959

Total Accidents (1953-1959)	5
Fatal Accidents (1953-1959)	0
Hours Flown (1953-1959) Estimated	57,000
Accident Rates Per 100,000 Hours:	
Total Accidents	8.8
Fatal Accidents	0

2. General Aviation - Accident Rates:

There are no figures available on the actual number of hours flown per year in general aviation helicopter operations.

The Civil Aeronautics Administration, however, made a survey for calendar year 1957. This survey disclosed the following information relating to operations within the continental United States.

No. of helicopters - total	320
No. of helicopters in active usage	290
No. of helicopters inactive	30
Estimated total hours flown	105,000
Estimated total miles flown	8,800,000
Estimated occupants per flight includes pilot	2.7
Estimated occupant- miles flown	23,936,000

During 1957 there were 55 helicopter accidents in general aviation flying, 9 of which were fatal. Four of these (1 fatal) occurred outside of the continental United States, leaving a total of 51 accidents (8 fatal) which occurred within the United States.

On the basis of hours flown in the Continental United States the accident rate per 100,000 hours was:

Total Accidents	48.6
Fatal Accidents	7.6

HELICOPTER RECORD
U. S. AIR CARRIERS
SCHEDULED PASSENGER SERVICE
1953 - 1960

Items	1953	1954	1955	1956	1957	1958	1959	1960
Passengers carried	1,237	8,392	28,746	63,537	153,465	229,784	366,315	490,268
Passenger-miles flown ...	35,000	211,000	684,000	1,661,000	3,438,000	5,094,000	7,748,000	9,475,000
Revenue plane-miles flown	63,022	177,752	434,792	702,687	1,074,849	1,241,967	1,495,839	1,218,726
Fatal accidents.....	0	0	0	0	0	0	0	1
Total accidents.....	0	1	0	1	0	1	2	3
Passenger fatalities.....	0	0	0	0	0	0	0	11
Crew fatalities.....	0	0	0	0	0	0	0	2
Total fatalities.....	0	0	0	0	0	0	0	13
Accident Rate Per 1 Million Revenue Plane-Miles Flown:								
Fatal accident rate.....	0	0	0	0	0	0	0	0.821
Total accident rate.....	0	5.6	0	1.4	0	0.8	1.3	2.463

NOTE: Scheduled passenger service inaugurated 1953.

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
January 25, 1961

60-8

REPORT

ACCIDENTS IN WHICH FATALITIES RESULTED FROM FIRE FOLLOWING IMPACT

AIR CARRIER OPERATIONS

1940 - 1959

Prepared By

CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
SAFETY ANALYSIS DIVISION

January 1961

FOREWORD

Purpose

The purpose of this report is to furnish information pertaining to the question of the frequency and proportion of fatalities resulting from fire following impact in air carrier aircraft accidents as compared with fatalities attributable to impact forces.

Method

The information contained herein was obtained from a review of the reports of air carrier accidents that occurred during the 20-year period, 1940 - 1959. All of the fatal accidents which involved fire occurring after impact were studied. These included all revenue and nonrevenue operations of both the Certificated Carriers and the Supplemental Carriers. At the outset it was realized that the reports of investigation did not contain the kind of data necessary to provide an objective basis for distinguishing between "impact force" fatalities and those that might have resulted from fire. In view of this, it was decided to approach the problem by attempting to ascertain the frequency of accidents in relation to the probability of fire deaths. On the basis of the type of accident and the general description thereof as contained in the report of investigations, the accidents were classified into the following three groups:

Group 1 - Accidents in which there was some evidence of death attributable to fire following impact.

Group 2 - Accidents in which some deaths might possibly be attributed to fire following impact.

Group 3 - Accidents in which it was unlikely that death could be attributed to fire following impact.

SUMMARY

During the 20 year period, 1940 - 1959, there were 86 fatal air carrier accidents in which fire occurred after impact. The probability of death occurring as a result of the aspect of fire, rather than of impact forces, in these 86 accidents was found to be as follows:

5 accidents in which some evidence was indicated,
20 accidents in which the possibility existed,
61 accidents in which it was unlikely.

Additional details on the number of fatalities, survivors, and total persons aboard in each of the above 3 groups are presented in Table 1. A brief description of each accident in the first 2 groups is also given in the following pages.

Cases Occurring in the 1949 - 1959 Period

It was considered advisable to look at the subject problem as it existed from 1949 through 1959 because of the increasing use of 4 - engine aircraft with greater seating capacity. Also, more complete and accurate accident statistics and exposure data are available for this period than for the years prior to 1949.

Accordingly, in Table 2, the picture is presented of fatal accidents during 1949-1959 which involved fire after impact. In this 11-year period, there were 3 cases in which fire deaths were likely, 8 cases in which the possibility existed and 39 cases in which fire deaths were unlikely.

During this same 11-year period the air carrier industry flew approximately 9 billion aircraft miles with a total of 161 fatal accidents. When these figures are related to the preceding data the following is disclosed:

Items	Number	Rate Per 1 Million Aircraft Miles
Total Fatal Accidents.....	161	0.0178
Number Involving Fire After Impact.....	50	.0055
Number in Which Fire Deaths Likely.....	3	.0003
Number in Which Fire Deaths Possible...	8	.0008
Total Number in Which Fire Deaths Were Likely or Possible.....	11	.0012

Table 1

STATISTICAL TABULATION

Fatal Air Carrier Accidents in Which Fire Occurred After Impact

1940 - 1959

	Group 1	Group 2	Group 3	Total
Number Accidents.....	5	20	61	86
Percent of Total Grouping.....	6%	23%	71%	100%
Total Personnel Aboard Aircraft...	226	499	1,806	2,531
Number Fatalities.....	92	337	1,516	1,945
Percent Fatalities/Persons Aboard	41%	67%	84%	77%
Number Survivors.....	134	162	290	586
Percent Survivors/Persons Aboard.	59%	33%	16%	23%

Group 1 - Accidents In Which There Was Some Evidence of Death Attributable to Fire Following Impact.

Group 2 - Accidents In Which Some Deaths Might Possibly be Attributed to Fire Following Impact.

Group 3 - Accidents In Which It Was Unlikely That Death Could be Attributed to Fire Following Impact.

Table 2

STATISTICAL TABULATION

Fatal Air Carrier Accidents in Which Fire Occurred After Impact

1949 - 1959

	Group 1	Group 2	Group 3	Total
Number Accidents.....	3	8	39	50
Percent of Total Grouping.....	6%	16%	78%	100%
Total Personnel Aboard Aircraft...	156	266	1249	1671
Number Fatalities.....	29	172	1022	1223
Percent Fatalities/Persons Aboard.	19%	65%	82%	74%
Number Survivors.....	127	94	227	448
Percent Survivors/Persons Aboard..	81%	35%	18%	26%

Group 1 - Accidents In Which There Was Some Evidence of Death Attributable to Fire Following Impact.

Group 2 - Accidents In Which Some Deaths Might Possibly be Attributed to Fire Following Impact.

Group 3 - Accidents In Which It Was Unlikely That Death Could be Attributed to Fire Following Impact.

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ACCIDENTS IN WHICH THERE WAS SOME EVIDENCE OF DEATH ATTRIBUTABLE TO FIRE FOLLOWING IMPACT.

Date	Location	Carrier	Aircraft	Total Aboard	Number Fatalities	Number Survivors	Brief Resume
2/1/57	Rickers Island, New York	Northeast Airlines	DC-6A	101	20	81	Aircraft crashed during take-off under instrument conditions. Aircraft struck the ground while descending in a slightly left wing low attitude. The entire left wing and outer right wing separated from the aircraft as it skidded along the ground. Fire,after the wreckage stopped,completely burned out the right inboard wing and the fuselage from the cockpit windshield to the aft pressure bulkhead.
10/19/53	New York Int'l Airport, Jamaica, New York	Eastern Air Lines, Inc.	Lockheed 749	27	2	25	Aircraft crashed during take-off under instrument conditions. The aircraft was approximately eight degrees nose up, and two degrees left wing down upon initial impact. Fire burned and melted the left side of the fuselage about two-thirds of its length, as well as gutting the cockpit and passenger cabins.
1/14/51	Philadelphia Int'l Airport, Philadelphia, Pa.	National Airlines, Inc.	DC-4	28	7	21	Aircraft crashed during a landing approach under instrument conditions. Aircraft overshot during landing, ran off the end of the runway, and struck a ditch. It came to rest with the rear section of the fuselage remaining suspended and with the sill of the main cabin door six to eight feet above the east bank of the ditch. Fire originated in the vicinity of the No. 2 and No. 3 engine nacelles and rapidly spread rearward.

GROUP (Cont'd)

Date	Location	Carrier	Aircraft	Total Aboard	Number Fatalities	Number Survivors	Brief Resume
5/29/47	La Guardia Field, New York, New York	United Air Lines, Inc.	C-54	48	43	5	Aircraft crashed following an aborted take-off run which was attempted under adverse weather conditions. Aircraft ran off the end of the runway, crashed through a fence, and half-bounced, half-flew across a highway. It came to rest east of a school of aeronautics and was almost immediately enveloped in flames.
7/28/43	Trammel, Kentucky	American Airlines, Inc.	DC-3	22	20	2	Aircraft crashed during severe thunderstorm activity while attempting a landing. It crashed under power into trees on practically level terrain. There was evidence that most of the occupants of the cabin were victims of suffocation or fire.

Total Accidents	5
Total Aboard	226
Total Number Fatalities	92
Total Number Survivors	134

ACCIDENTS IN WHICH SOME DEATHS MIGHT POSSIBLY BE ATTRIBUTED TO FIRE FOLLOWING IMPACT.

Date	Location	Carrier	Aircraft	Total Aboard	Number Fatalities	Number Survivors	Brief Resume
3/15/58	Nantucket, Massachusetts	Northeast Airlines, Inc.	CV-240	34	24	10	While attempting an instrument landing approach, the aircraft flew into the ground in an almost level attitude, struck a rise in the terrain, and catapulted into the air. It then settled to the ground and cartwheeled before coming to rest.
12/21/55	Jacksonville, Florida	Eastern Air Lines, Inc.	Lockheed 749A	17	17	0	Aircraft crashed through trees and onto the ground while attempting an instrument landing approach. Explosion and fire occurred immediately upon impact.
7/17/55	Chicago Midway Airport, Chicago, Illinois	Braniff Airways, Inc.	CV-340	43	22	21	Aircraft struck an advertising sign and crashed onto the airport inverted, while attempting an instrument landing approac
3/2/51	Sioux City, Iowa	Mid-Continent Airlines, Inc.	DC-3	25	16	9	Aircraft crashed into the ground in a left-wing-low attitude while attempting a landing approach under instrument conditions.
9/4/50	Utica, New York	Robinson Airlines	DC-3	23	16	7	Aircraft crashed into trees while attempting a take-off. It had gained approximately 50 feet of altitude and leveled off prior to settling into trees
11/29/49	Dallas, Texas	American Airlines, Inc.	DC-6	46	28	18	Aircraft stalled during landing approach and crashed into a hanger and other buildings within the boundary of the airport.

GROUP (Cont'd)

Date	Location	Carrier	Aircraft	Total Aboard	Number Fatalities	Number Survivors	Brief Resume
7/12/49	Chatsworth, California	Standard Airlines, Inc.	C-46E	48	35	13	Aircraft struck a mountain at a point 430 feet lower than its crest. Fire occurred immediately after the aircraft wreckage came to rest.
1/2/49	Seattle, Washington	Seattle Air Charter	DC-3	30	14	16	Aircraft settled back to the ground in a landing attitude and crashed into a revetment hanger while attempting a tak off under instrument conditions.
4/15/48	Shannon, Eire	Pan American Airways, Inc.	Lockheed 049	31	30	1	Aircraft struck the ground while attempting a landing approach under instr ment conditions. The empennage, broken into three sections, was scattered around the fuselage and wings. The fou engines separated from the aircraft during the crash progression.
3/10/48	Chicago, Ill.	Delta Air Lines, Inc.	DC-4	13	12	1	Aircraft stalled during take-off at an altitude between 500 and 800 feet and crashed into the ground after affecting partial recovery from the stall.
1/7/48	Savannah, Georgia	Coastal Air Lines, Inc.	DC-3C	27	18	9	Aircraft crashed into a marsh and burst into flames while attempting an emergency landing with both engines inoperativ
11/30/47	Seattle, Washington	Alaska Airlines	C-54	28	8	20	Aircraft ran off the end of the runway during landing under instrument conditions, rolled down an embankment, struck a ditch and collided with a movi automobile before coming to rest.

GROUP (Cont'd)

Date	Location	Carrier	Aircraft	Total Aboard	Number Fatalities	Number Survivors	Brief Resume
11/27/47	Yakutat, Alaska	Columbia Air Cargo, Inc.	DC-3	13	13	0	Aircraft crashed into a densely wooded area while attempting a landing approach under instrument conditions.
6/19/47	Mayadine, Syria	Pan American	Lockheed 049	36	14	22	The pilot experienced an engine fire in flight. The aircraft ground looped and skidded backwards during an emergency landing on the desert.
12/31/46	Charleston, South Carolina	Intercontinental Air Transport Company	DC-3C	5	5	0	Aircraft struck trees and crashed into the ground while the pilot was attempting his second instrument landing approach.
12/28/46	Shannon, Eire	Transcontinental and Western Air	Lockheed 049	23	13	10	Aircraft struck the ground while attempting a landing under instrument conditions. The aircraft structure disintegrated and burned upon impact.
9/5/46	Elko, Nevada	Trans-Luxury Airlines	DC-3	21	20	1	Aircraft crashed into a hillside in almost level flight attitude while attempting a landing approach under instrument conditions.
8/9/46	Lakehurst, New Jersey	Atlantic Central Airlines	Lockheed 1856	6	4	2	The pilot overshot the runway during an emergency landing approach and crashed into the ground while attempting a go-around.
1/22/43	Arequipa, Peru, S. A.	Pan American Airways, Inc.	DC-3A	15	14	1	Aircraft, while flying under instrument conditions, flew into a mountain peak at an elevation of approximately 13,000 feet msl.

GROUP 2 (Cont'd)

Date	Location	Carrier	Aircraft	Total Aboard	Number Fatalities	Number Survivors	Brief Resume
10/30/41	Moorhead, Minnesota	Northwest Airlines	DC-3A	15	14	1	Aircraft crashed onto the ground in an almost level attitude while attempting a landing approach under instrument conditions. Forward speed was estimated to be 90 mph.

Total Accidents	20
Total Aboard	499
Total Fatalities	337
Total Number Survivors	162

CIVIL AERONAUTICS BOARD

ACCIDENT REPORTS ANALYZED DURING THE PERIOD
JANUARY 1 THROUGH JANUARY 15, 1961

GENERAL AVIATION

Docket	Location	Date	Aircraft		Injury[2] F	S	M	N	Probable Cause
2-1217	Logan, Utah	4/6/60	Bellanca 1212	CR	0	0	0	1	1. Failure of both pilots to see the other's aircraft in time to avoid collision. 2. Failure to fix the wind tee to the active runway. 3. Judgment of the instructor in not requiring a full stop landing and taxi back after the first solo landing.
			N-86850 (S)[1]	PX	0	0	0	2	
			Aeronca 7AC, N-85645	*					

(BUSINESS/STUDENT SOLO) A ground collision occurred between two aircraft at the intersection of two bisecting runways. The accident occurred in good weather.

At the time of the collision N-86850, flown by a private pilot, age 28, with 140 total hours, 15 in type, was decelerating in the after landing roll on runway 10. The landing terminated a cross-country flight.

The second aircraft, N-85645, flown by a student pilot, age 23, with 10 total hours, all in type, was in the take-off roll using runway 25. The take-off was being made after the student's first solo landing. It was the take-off portion of a touch-and-go-type landing.

Investigation revealed the wind tee was free to swing with the surface wind and, at the time of the accident, it indicated a direction between the two runways. Runway 25 had been active most of the day.

The instructor of the student was standing near the runway intersection and saw the collision situation developing. He attempted to signal the pilot of N-86850 to try to stop before reaching the intersection. Neither pilot saw the other's aircraft before it was too late to avoid the collision.*(Aeronca 7AC, (S), N-85645, 1 crew - no injury).

1/ Aircraft Damage: (D) Destroyed; (S) Substantial; (M) Minor; (N) None.
2/ Degree of Injury: (F) Fatal; (S) Serious; (M) Minor; (N) None.

GENERAL AVIATION

Docket	Location	Date	Aircraft		Injury F	S	M	N	Probable Cause
2-1218	Union, Oregon	4/6/60	Piper PA18	CR	0	0	1	0	Pilot failed to observe wires in time to avoid a collision during flight at a low unsafe altitude.
			N-7576D (S)	PX	0	0	1	0	

(PLEASURE) The private pilot, age 45, with 400 total hours, 1½ in type, stated that while making a low pass over a farm field to attract the attention of persons on the ground he failed to observe electric wires until it was too late to avoid striking them. He stated that he attempted to fly under the wires; however, the aircraft struck the lowest strand. The aircraft contacted the ground on its wheels, skipped a short distance and then touched down the second time. After the plane slid about 180 feet with the brakes locked, it nosed over.

2-1219	Fort Morgan, Ala.	4/6/60	Piper PA22	CR	0	0	0	1	Failed to maintain adequate flying speed during a landing approach in gusty wind conditions.
			N-7136B (S)	PX	0	0	0	1	

(PLEASURE) The private pilot, age 65, with 350 total hours, 200 in type, was making an approach for landing in a gusty 25-mph wind. The aircraft was stalled during the approach and touched down short of the runway.

2-1220	Celesville, Misc.	4/6/60	Piper PA22	CR	0	0	0	1	Pilot became lost during a VFR cross-country flight.
			N-6136D (S)	PX	0	0	0	0	

(BUSINESS) A private pilot, age 35, with 55 total hours, all in type, initiated a cross-country flight from LaCrosse, Wisc., to Eau Claire, Misc. At the time of departure, 0915 cst, the aircraft had about three hours of fuel. The pilot stated that because of a strong cross wind en route he became confused and uncertain of his position and decided to land. The landing was made about 1000 cst on a soft cornfield during which the aircraft nosed up.

Investigation showed the wind at flight altitude was across the pilot's course with a velocity of between 30 and 35 mph.

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GENERAL AVIATION

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1221	Oklahoma City, Okla.	4/6/60	Piper PA24	CR	0	0	0	1	Pilot undershot the landing approach in a strong, gusty surface wind.
			N-5896P (S)	PX	0	0	0	2	

(BUSINESS) During the landing approach the aircraft, flown by a private pilot, age 32, with 450 total hours, 300 in type, touched down short of the runway. The aircraft rolled onto the runway and thereafter swerved to the left off the runway where it struck a parked aircraft.

The accident occurred in a gusty 25-knot surface wind. (Parked aircraft, Piper PA24, N-5498P (S).)

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1222	Des Moines, Iowa	4/6/60	Piper PA22	CR	0	0	0	1	1. Judgment in initiating the flight in adverse surface wind. 2. Strong, gusty surface wind.
			N-2941Z (S)	PX	0	0	0	0	

(BUSINESS) The private pilot, age 55, with 5,200 total hours, 3,100 in type, stated he had completed the pretake-off engine runup and was awaiting tower clearance to take off when a severe gust caused the aircraft to nose over into an inverted position. The surface wind was reported as 27 mph with gusts to 38 at the time of the accident.

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1223	Winter Haven, Fla.	4/3/60	Cessna 182	CR	0	1	0	0	Overload failure of the nose gear.
			N-4974D (S)	PX	0	0	1	0	

(PLEASURE) A private pilot, age 51, with 70 total hours, all in type, arrived over the destination airport after avoiding adverse weather during a cross-country flight. He stated that because of approaching thunderstorms he was anxious to land as quickly as possible.

The first approach was overshot because of excessive airspeed and the second was made with a quartering tail wind and, again, with excessive speed. The aircraft ballooned after touchdown. The nose gear failed under the impact force of the second touchdown.

GENERAL AVIATION

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1224	Naples, Florida	4/3/60	Beechcraft C18S N-68Y (D)	CR PX	0 0	0 0	1 2	0 4	Loss of directional control during the take-off roll.

(PLEASURE) A private pilot, age 40, with 1,148 total hours, 16 in type, was making a take-off in a slight cross wind of between 10 and 15 mph. During the early portion of the ground roll the aircraft began to swerve. As the plane swerved off the left side of the runway it became airborne at minimum airspeed for a short distance. It then stalled and struck the ground. Fire broke out after the crash and destroyed the aircraft.

2-1225	Norman, Oklahoma	4/4/60	Champion 7FC N-9013B (S)	CR PX	0 0	0 0	0 0	1 0	1. Student pilot lost control of the aircraft while taxiing onto the runway in a strong gusty wind. 2. Judgment of the instructor in releasing the student for a solo flight under existing wind conditions.

(STUDENT SOLO) After completing a check flight with an instructor, the student pilot, age 31, with 21 total hours, all in type, was cleared to make a solo flight at which time the surface wind was 15 knots with gusts to 25. As the student was making a turn on the runway for take-off he lost control of the aircraft and it nosed over.

2-1226	Pearland, Texas	4/4/60	Howard DGA15P N-5572N (S)	CR PX	0 0	0 0	0 0	1 0	1. Downdraft. 2. Pilot failed to maintain sufficient airspeed for the landing approach in a strong gusty surface wind.

(BUSINESS) During the landing approach in a gusty, variable 30-mph wind, the private pilot, age 38, with 552 total hours, 77 in type, experienced a downdraft as the aircraft passed the leeward side of hangars. The aircraft settled rapidly and contacted the ground with damaging force before the pilot could arrest the descent.

2-1227	Lehighton, Penna.	4/4/60	Piper PA22 N-4825A (S)	CR PX	0 0	0 0	0 0	2 0	Failure of the instructor to adequately supervise the actions of the student.

(DUAL INSTRUCTION) When cautioned of wires in the landing approach path, the student reacted by raising the nose of the aircraft in an abrupt manner

(see next page)

GENERAL AVIATION

Docket	Location	Date	Aircraft	Injury F S M N	Probable Cause
2-1227 (Cont'd)	which caused the aircraft to stall. The instructor, with commercial and instructor ratings, age 26, 300 total hours, 20 in type, took control of the aircraft but was unable to stop the descent resulting from the stall before the aircraft struck the ground with force that failed the nose gear.				
2-1228	Nr. Vail, Arizona	4/5/60	Ercoupe 415D N-3737H (S)	CR 0 0 0 1 PX 0 0 0 1	Loss of engine oil caused by failure of the oil sump attaching flange and resulting in engine failure.
	(BUSINESS) The private pilot, age 38, with 106 total hours, 60 in type, stated throughout the cross-country flight the engine had operated normally until shortly after he reduced power to make a gradual descent to the destination airport which was then still some distance away. He said that at this time the engine became rough and he noted the oil pressure instrument showed a loss of oil pressure. As the descent continued the engine roughness increased to the extent it was necessary to land on a strip short of the destination airport. The engine froze during final approach which necessitated continuing the landing although there was a cow on the strip. The left wing struck the cow and the aircraft ground looped. During removal of the oil sump it was learned that the attaching flange was cracked about one-half way around its circumference and there was about one-half pint of oil remaining in the engine. Disassembly of the engine revealed a connecting rod failure that resulted from extreme engine temperature.				
2-1229	San Diego, Calif.	4/5/60	Beechcraft C45 N-9048Z (S)	CR 0 0 0 1 PX 0 0 0 0	Misuse of brakes during landing.
	(BUSINESS) During the landing roll the private pilot, age 43, with 321 total hours, 20 in type, used excessively hard braking which resulted in forces on the nose gear that caused it to collapse.				

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1230	Kansas City, Mo.	4/5/60	Cessna 310 N-3009D (S)	CR PX	0 0	0 0	0 0	2 1	Check pilot failed to adequately supervise the landing approach and level-off.

(SALES DEMONSTRATION) During the course of a sales demonstration of the aircraft to a customer, the commercial pilot, age 40, with 3,000 total hours, 100 in type, followed through on the controls while the passenger made the approach for landing. The final approach speed was low and as the aircraft was leveled off at a height of about 10 feet above the runway, it stalled. A hard landing which damaged the aircraft occurred before the pilot could effect a recovery.

2-1231	Mt. Trumble, Ariz.	4/5/60	Cessna 150 N-5942E (D)	CR PX	0 0	0 0	0 0	1 1	Unsuitable take-off area under the existing terrain and elevation conditions.

(PLEASURE) The private pilot, age 28, with 92 total hours, 2½ in type, (time in type was the pilot's total flight experience in the past 90-day period) attempted to take off in a fully loaded aircraft from a small, soft field located at an elevation of 5,500 feet msl. The aircraft failed to gain sufficient altitude to clear a fence at the end of the field. The aircraft struck the fence, crashed and came to rest inverted. The head wind velocity was 5 mph.

2-1232	Nathalie, Va.	4/5/60	Navion N-4082K (S)	CR PX	0 0	0 0	0 0	1 1	Power plant: Failure of No. 2 piston. Contributing Factor: Overdue annual inspection of the aircraft.

(PLEASURE) While cruising at an altitude of 2,500 feet the private pilot, age 43, with over 3,000 total hours, 25 in type, stated the engine operation became rough and lost power. The pilot said the aircraft was unable to maintain altitude and he attempted to make a forced landing on a farm field. Unable to maintain sufficient altitude, the aircraft collided with a telephone line and crashed. Inspection of the engine disclosed the No. 2 piston had disintegrated and passed out of the cylinder leaving no trace in the cylinder. The last annual inspection of the aircraft was conducted on May, 15, 1958, more than two years before the accident.

GENERAL AVIATION

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1233	Loma Alta, Texas	4/5/60	Cessna 182	CR	0	0	0	1	The execution of a landing too far down the runway to permit a safe stop.
			N-2588G (D)	PX	0	0	0	1	

(BUSINESS) During the approach for landing on a ranch strip the commercial pilot, age 42, with 4,000 total hours, 1,000 in type, intentionally landed the aircraft long to avoid cattle which were on the approach end of the strip. As a result the pilot was unable to stop the plane on the remaining runway and it rolled into large rocks located off the end of the strip, shearing the nose gear. The carburetor was broken off the engine which released fuel onto the engine causing a fire which consumed the aircraft.

2-1234	Manorville, Penna.	4/6/60	Piper PA12	CR	0	0	0	1	Power failure resulting from an undetermined cause.
			N-7584H (D)	PX	0	0	0	1	

(BUSINESS) The weather conditions had been forecasted to remain satisfactory for VFR flight; however, the commercial pilot, age 31, with 1,500 total hours, 25 in type, was forced to deviate from his planned course because of snow showers. The flight was continued after dark and while flying over the river the aircraft encountered a heavy cloud that had not been visible to the pilot in the darkness. The pilot stated that he immediately applied carburetor heat and reversed course. He said that although the aircraft quickly emerged from the cloud the engine became rough and lost power. The aircraft was unable to maintain altitude and the pilot ditched it in the river. Grappling operations to recover the aircraft were unsuccessful.

2-1235	Andrews, Texas	4/6/60	Piper J3C	CR	0	1	0	1	Failure of the instructor to adequately supervise the student's landing approach.
			N-1582N (S)	PX	0	0	0	0	

(DUAL INSTRUCTION) During the approach for landing the instructor, commercial and instructor ratings, age 52, with 6,000 total hours, 2,000 in type, cautioned the student to be more attentive to maintaining adequate airspeed. About 250 feet from the runway the aircraft became too slow and settled rapidly. The instructor took control and applied full power; however, before his action was effective the aircraft struck a billboard located 150 feet from the runway.

GENERAL AVIATION

Docket	Location	Date	Aircraft		Injury F	S	M	N	Probable Cause
2-1236	Spearfish, S. D.	4/6/60	Piper PA20	CR	0	0	0	1	1. Failure of the pilot to discontinue the landing after a wind shift occurred and land on an available runway into the wind. 2. Gusty, shifting wind conditions.
			N-7635K (S)	PX	0	0	0	4	

(PLEASURE) The private pilot, age 35, with 83 total hours, all in type, stated the surface wind (velocity of 30 mph) shifted to a cross wind during the approach for landing and,as the aircraft was leveled off, a gust caused one wing to drop resulting in touchdown on the left gear. The impact force collapsed the gear. The pilot wisely analyzed his own accident by stating it could have been avoided had he aborted the landing and made a new approach for landing on a runway more directly into the wind.

2-1237	Albuquerque, N. M.	4/6/60	Beechcraft 35	CR	0	0	0	1	Failure of the nose gear actuating assembly.
			N-3072V (S)	PX	0	0	0	3	

(PLEASURE) During the approach for landing the cockpit landing gear position indicator showed the landing gear was down; however, when power was reduced the gear unsafe warning horn sounded. The pilot, commercial rating, age 41, with 6,200 total hours, 2,800 in type, executed a go-around after which it was discovered the nose gear was hanging free. All efforts to extend and lock the gear were unsuccessful and the gear collapsed on landing.

Investigation showed the nose gear actuating arm was failed allowing the gear to swing free. It also showed that the actuating tubes had failed in bending; however, the cause of the bending loads was not discovered. The aircraft had been involved in a prior wheels-up landing.

2-1238	Dallas, Texas	4/3/60	Stinson 108-3	CR	0	0	0	1	Failure of the No. 5 cylinder.
			N-6279M (D)	PX	0	0	0	2	

(PLEASURE) While returning to the airport the pilot, age 31, private rating, with 240 total hours, 50 in type, experienced a power failure and made an emergency landing on an undeveloped field. During the landing the aircraft struck a ditch and cartwheeled. Investigation disclosed the No. 5 cylinder had failed in the area above the mounting flange.

GENERAL AVIATION

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1239	Vacaville, Calif.	4/3/60	Bellanca 1419 N-7650B (S)	CR PX	0 0	0 0	0 0	1 1	Pilot failed to extend the gear for landing.

(PLEASURE) The commercial pilot, age 34, with 3,800 total hours, 274 in type, landed the aircraft with the gear retracted. He explained that his attention was diverted to parachutists who were being dropped on a target a safe distance from the runway during which he inadvertently retracted the gear while deciding whether to complete the landing approach.

2-1240	Palm Desert, Calif.	4/3/60	Piper PA17 N-4483H (S)	CR PX	0 0	0 0	0 0	1 1	Pilot failed to maintain sufficient airspeed during landing under high temperature conditions.

(PLEASURE) The private pilot, age 34, with 83 total hours, 4 in type, was making a landing at a desert airport under a high temperature condition. The pilot had no previous experience in landing under high temperature conditions. The aircraft stalled before the pilot anticipated resulting in a hard landing. The impact force of landing collapsed the left landing gear.

2-1241	Champaign, Ill.	4/3/60	Champion 7FC N-7693E (S)	CR PX	0 0	0 0	0 0	1 0	Pilot made an improper flare-out for landing.

(STUDENT SOLO) A student pilot, age 21, with a total of 9 hours, all in type, made the landing approach with the elevator trim tab set in the full nose-up position. When he applied power to avoid undershooting the runway the aircraft assumed an excessive nose-high attitude. The action took the pilot by surprise and before he could correct the condition the aircraft stalled resulting in a hard landing. Impact force damaged the landing gear.

2-1242	Fort Worth, Texas	4/3/60	Piper PA20 N-7823B (S)	CR PX	0 0	0 0	0 0	1 0	Inability of the pilot to regain directional control because of ineffective braking.

(PLEASURE) A private pilot, age 37, with 222 total hours, 13 in type,

(see next page)

Docket	Location	Date	Aircraft	Injury					Probable Cause
					F	S	M	N	
2-1242 (Cont'd)	stated that during the after landing roll of the fourth touch-and-go landing the aircraft deviated slightly to the right. He said that he immediately applied left brake to compensate for the deviation; however, the left brake was ineffective. The aircraft ground looped with force that broke the left wheel assembly from the landing gear strut. Because of the damage to the left wheel and brake assembly it was not possible to determine the condition of the brake prior to the accident.								
2-1243	Merritt Island, Fla.	4/3/60	Cessna 150 N-5976E (S)	CR PX	0 0	0 0	0 0	2 0	Failure of the instructor to adequately supervise the student's landing and prevent touchdown at an unsuitable position.
	(DUAL INSTRUCTION) The instructor-pilot, commercial rating, age 46, with 2,500 total hours, 350 in type, stated he gave the student a simulated engine failure during the landing approach. As the aircraft was being flared out for landing the right gear struck an automobile tire which was positioned around a runway light. The tire was thrown into the air in such a manner that it struck the tail of the plane.								
2-1244	Bend, Oregon	4/3/60	Cessna 182A N-9928B (S)	CR PX	0 0	0 0	0 0	1 0	Pilot misjudged and undershot the landing approach.
	(PLEASURE) A private pilot, age 19, with 26 total hours, all in type, was making an approach to land on a small field. The aircraft struck a fence bordering the field and nosed over.								
2-1245	Nr. Graford, Texas	4/3/60	Beechcraft 35B N-5035C (S)	CR PX	0 0	0 0	0 0	1 1	Pilot failed to see and observe wires.
	(PLEASURE) The private pilot, age 34, with 3,500 total hours, 40 in type, made a low pass over the water to signal ground personnel to meet him at the nearby landing strip. During the low pass he failed to observe an electric line approximately 40 feet above the surface of the water. The								

(see next page)

GENERAL AVIATION

Docket	Location	Date	Aircraft	Injury				Probable Cause
				F	S	M	N	
2-1245 (Cont'd)	aircraft struck and broke the wire, one piece of which went over the top of the fuselage and damaged the empennage. Despite the damage the pilot was able to control the aircraft and make a safe landing.							
2-1246	Lake Elmo, Minn.	4/3/60	Cessna 140 N-1822V (S) Stinson 108-3 N-6388M (S)	CR PX *	0 0	0 0	0 0	1 1	Pilot lost directional control during landing.
	(PLEASURE) During the landing roll the Cessna, operated by a private pilot, age 31, with 142 total hours, 20 in type, turned to the left and struck a Stinson which was stopped on the taxiway. The Stinson was stopped because its engine stalled while its pilot was taxiing after landing. The pilot was attempting to restart the engine when the collision occurred. *(Other Aircraft: 2 Crew, (N); 1 Passenger, (N).)							
2-1247	Excelsior Springs, Mo.	4/3/60	Luscombe 8A N-71572 (S)	CR PX	0 0	0 0	0 0	1 1	1. Loss of directional control and misuse of brakes during the landing roll in an adverse cross wind. 2. Strong, gusty cross wind.
	(PLEASURE) During the landing roll in a gusty surface wind of between 18 and 25 mph the private pilot, age 35, with 155 total hours, 146 in type, applied braking in an effort to keep the aircraft from veering off the runway. During the effort the aircraft nosed up.							
2-1248	Salida, Colo.	4/3/60	Piper PA12 N-2973M (S)	CR PX	0 0	0 0	0 0	1 0	Failure of the right landing gear "tie strap" during taxi.
	(PLEASURE) The right landing gear collapsed while the private pilot, age 40, with 120 total hours, all in type, was taxiing the aircraft prior to take-off. Investigation showed the gear collapsed when the right landing gear "tie strap" failed. It also revealed evidence of an old crack in the "tie strap". The history of the aircraft showed it had been extensively operated on rough terrain.							

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1249	Nelson Lagoon, Alaska	4/3/60	Piper PA22	CR	0	0	0	1	A loss of power caused by fuel starvation resulting from mismanagement of the fuel supply.
			N-1699P (S)	PX	0	0	0	1	

(PLEASURE) The private pilot, age 23, with 4,600 total hours, 550 in type, stated that it was his intention to warm the engine and taxi the aircraft for take-off while using fuel from a tank which was nearly empty. He said that he intended to switch to the other fuel tank which was full before take-off but forgot to do so. The engine stopped because of fuel starvation immediately after take-off and the aircraft was substantially damaged during a forced landing on rough terrain.

2-1250	Toledo, Ohio	4/3/60	Beechcraft B50	CR	0	0	0	1	Pilot failed to secure the cabin door which opened in flight causing a distraction during which he allowed the aircraft to descend and strike the runway with damaging force.
			N-3694B (S)	PX	0	0	0	0	

(TRANSPORTATION) When the cabin door opened as the aircraft became airborne during take-off, the pilot, private rating, age 56, with 3,014 total hours, 440 in type, diverted his attention to the door and to an attempt to grab a map being sucked through the door. During the diversion the aircraft was allowed to descend and strike the runway with severe impact on the landing gear. Resultant damage to the landing gear retract mechanism caused the right gear to collapse in the subsequent landing.

2-1251	Nr. Magalang, Pampanga, P. I.	4/3/60	Aeronca 7FC	CR	0	1	0	0	Lost control of the aircraft during an emergency landing.
			N-9037B (D)	PX	0	0	0	0	

(STUDENT SOLO) The student pilot, with 13 total hours, all in type, made a prolonged glide to lose altitude. When he applied power to terminate the descent the engine failed to respond. The pilot stated that as "he was ready to land" during the forced landing, the engine suddenly resumed operation and caused him to lose control of the aircraft.

GENERAL AVIATION

Docket	Location	Date	Aircraft		Injury F	S	M	N	Probable Cause
2-1252	Salton City, Calif.	4/3/60	Cessna 172 N-8745B (S)	CR	0	0	0	1	Failure to remove rudder gust lock before take-off.
				PX	0	0	0	3	

(BUSINESS) The private pilot, age 43, with 500 total hours, 1:25 in type, forgot to remove the rudder gust batten before take-off. After the aircraft became airborne the rudder jammed to the left. The pilot was able to circle the airport and land but was unable to keep the aircraft on the runway after landing. The plane ran off the runway and struck a ditch.

2-1253	Nr. York, Penn.	4/24/60	Cessna 172 N-5048A (D)	CR	1	0	0	0	1. Noninstrument pilot attempted VFR flight at very low altitude and struck ground obstructions. 2. Judgment of the pilot in attempting to continue the flight in known adverse weather conditions which precluded safe continuance of the planned flight.
				PX	1	2	0	0	

(PLEASURE) The private pilot, age 50, with 540 total hours, 345 in type, and with no recorded night or actual instrument experience, departed Harrisburg, Pa., at 0305 for a night VFR flight to Lancaster, Pa., to enplane passengers and continue to Washington, D. C.

About 0325 the pilot radioed Harrisburg that he had encountered adverse weather, was alarmed, and did not wish to continue to Lancaster. With assistance he returned to Harrisburg and landed safely about 0400.

About 0506 the pilot again departed Harrisburg and flew to Lancaster where he enplaned the passengers. According to one of the passengers, shortly after take-off the flight encountered poor weather in haze and fog. The passenger said that while the pilot was attempting to follow a highway the right wing struck a tree. The aircraft then hit a house and crashed inverted.

Investigation revealed weather conditions at Middletown, between Harrisburg and Lancaster, were: measured ceiling, 700 feet overcast; visibility, 3 miles in fog. At the time and place of the accident conditions were: estimated ceiling, 800 feet; visibility, 2½ miles in rain and fog. The pilot was informed by Harrisburg Tower personnel of the Middletown weather prior to his departure.

Docket	Location	Date	Aircraft		Injury F	S	M	N	Probable Cause
2-1254	New Hudson, Mich.	9/21/60	Aeronca 7AC	CR	1	0	0	0	Pilot made a downwind take-off and failed to maintain adequate airspeed in an attempt to clear power lines.
			N-3310E (D)	PX	1	0	0	0	

(PLEASURE) The aircraft, flown by a student pilot, age 30, with 86 total hours, 9 in type, was observed to stall as it approached power lines located at the end of the runway following a downwind take-off. The aircraft was entering a spin when it struck the ground.

2-1255	Nr. Eureka, Utah	10/13/60	Cessna 170A	CR	1	0	0	0	Noninstrument pilot lost control of the aircraft in instrument weather conditions.
			N-3145A (D)	PX	3	0	0	0	

(BUSINESS) A private pilot, age 25, with 137 total hours, 47 in type, and without instrument experience initiated an intended flight from Salt Lake City, Utah, to Las Vegas, Nevada, with an intended refueling stop at Cedar City, Utah. The aircraft was unreported after take-off from Salt Lake City.

Three days later the wreckage of the plane was found at the bottom of a ravine near the confluence of two canyons. The crash site was approximately 40 miles from Salt Lake City and according to an impact-stopped watch the accident happened about one hour after the Salt Lake City departure.

Examination of the wreckage showed the plane crashed in a near vertical descent. There were no witnesses to the crash; however, persons in the area said that at the estimated time of the crash there were low ceilings and it was raining with high surface winds.

2-1256	Nr. Williamsport, Pa.	4/22/60	Cessna 180	CR	1	0	0	0	The aircraft descended for unknown reasons and struck ground obstructions in a near level attitude at a high rate of speed.
			N-7874A (D)	PX	2	0	0	0	

(BUSINESS) About 1955 the private pilot, age 52, with more than 5,650 total hours, 500 in type, reported he was airborne over the Williamsport Omni. He requested that his previously filed night VFR cross-country flight plan to the Buffalo, N. Y. Air Park be activated. When informed this was done the pilot acknowledged; there were no further radio communications with the pilot. The pilot failed to reach the destination.

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GENERAL AVIATION

Docket	Location	Date	Aircraft	Injury				Probable Cause
				F	S	M	N	
2-1256 (Cont'd)	The next morning the wreckage of the aircraft was found where the aircraft had crashed and burned on a hilltop about 21 miles from the Williamsport Omni. The accident, according to an impact-stopped watch, occurred about 15 minutes after the pilot's radio call over the Williamsport VOR. Examination of the wreckage indicated the aircraft had struck the tops of trees while flying in a near level attitude at a relatively high rate of speed. Examination of the engine indicated it was operating normally and developing appreciable power at impact. The speed of the aircraft suggested it had accelerated in a descent prior to the crash. There was no evidence of malfunction or failure of the aircraft and weather conditions were good.							
2-1257	Concord, Calif.	4/7/60	Cessna 120 N-1879N (S)	CR PX	0 0	0 0	0 0	1 1	Pilot exceeded stress limits of aircraft by turning at an excessive taxi speed.
	(PLEASURE) The private pilot, age 57, with 15,000 total hours, 75 in type, completed the pretake-off check and taxied the aircraft at a rapid speed toward take-off position. He made a left turn during which the speed and a cross wind from the left caused the aircraft to slide to the right resulting in severe side loads which damaged the aircraft.							
2-1258	Nr. Gurdon, Ark.	4/7/60	Champion 7FC N-4872E (S)	CR PX	0 0	0 0	1 0	0 0	Failure of the pilot to apply carburetor heat in time to restore a loss of power from carburetor icing.
	(BUSINESS) The private pilot, age 38, with 68 total hours, 27 in type, stated that after approximately one hour of a cross-country flight the engine lost partial power and, although he applied full throttle, the aircraft was unable to maintain altitude. He further stated that he applied carburetor heat without effect. An emergency landing was made on a farm field during which the landing gear was sheared when the aircraft rolled over a terraced area. A subsequent inspection disclosed no evidence of failure or mechanical malfunction of the engine.							

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1259	Alderwood Manor, Wash.	4/7/60	Cessna 172 N-8597B (S)	CR PX	0 0	0 0	0 0	1 0	Pilot landed the aircraft on unsuitable terrain.

(PLEASURE) The private pilot, age 38, with 220 total hours, 50 in type, landed the aircraft on a 1,400-foot private sod strip and during the roll-out the nose wheel struck a soft spot in the runway. Resultant forces sheared the nose gear. The pilot stated that he was aware of the soft spot but did not believe the condition was as bad or the area was as large as it was.

2-1260	Nr. Tyonek, Alaska	4/7/60	Piper PA20 N-1848A (D)	CR PX	0 0	0 0	0 0	1 3	Improperly secured lock plates allowed the cam shaft bolts to work loose.

(TRANSPORTATION) During the cruising portion of a cross-country flight a commercial pilot, with 28,000 total hours, 1,500 in type, experienced a complete power failure. The pilot made the forced landing on a field covered with soft snow during which the aircraft nosed over.

Disassembly of the engine showed four cam shaft bolts had become unscrewed allowing the cam shaft to disengage. This occurred because the lock plates which normally secure the bolts were not properly locked.

2-1261	Tehran, Iran	3/10/60	Beechcraft AT-11 N-57TA (D)	CR PX	0 0	0 0	0 0	2 1	Loss of directional control during landing.

(BUSINESS) The aircraft, operated by a commercial pilot, age 30, with 800 total hours, 20 in type, was making a landing under normal conditions when the aircraft swerved and ground looped.

2-1262	Cedar River, Mich.	2/27/60	Taylorcraft BC12D N-43273 (S)	CR PX	0 0	0 0	0 0	1 1	The engine had been allowed to cool during letdown and it failed to respond when throttle was rapidly applied.

(PLEASURE) During the approach for landing on the ice the private pilot, age 40, with 3,000 total hours, 100 in type, realized he was undershooting

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GENERAL AVIATION

Docket	Location	Date	Aircraft	Injury				Probable Cause
				F	S	M	N	
2-1262 (Cont'd)	the intended landing area and he applied throttle; however, the engine failed to respond. The aircraft touched down on an area of rough ice and forces collapsed the left landing gear. It was disclosed that the pilot had cleared the engine once during the letdown which was made in an outside temperature of 18°F.							
2-1263	Laredo, Texas	4/10/60	Bellanca 1419 N-6556N (S)	CR 0 PX 0	0 0	0 0	1 3	1. A malfunction of the hydraulic pressure relief valve. 2. A malfunction of the landing gear down limit switch.
	(PLEASURE) A private pilot, age 44, with 800 total hours, 30 in type, landed the aircraft with the landing gear extended and the landing gear warning lights indicating the gear was down and locked. The gear, however, collapsed during the landing roll. Investigation revealed a faulty hydraulic pressure relief valve which relieved the hydraulic pressure at an amount insufficient to fully lower and lock the landing gear. Investigation also revealed that the landing gear down limit switch was out of adjustment and the landing gear warning lights indicated down and locked with the gear in an unsafe position.							
2-1264	Heasho, Missouri	4/10/60	Mooney MK20A N-6586B (S)	CR 0 PX 0	0 0	0 0	2 2	Inadequate actuation of the landing gear control from the locked position during landing.
	(PLEASURE) A certificated private pilot flying with the student pilot, age 37, with 600 total hours, 15 in type, observed the student pilot actuate the landing gear control to the gear-down position. During the landing roll, however, the landing gear collapsed. At this time the private pilot observed the gear control was out of the locked down position. Investigation failed to disclose any evidence of malfunction or failure of the landing gear system.							

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1265	Macon, Georgia	4/10/60	Piper PA23 N-2162P (S)	CR	0	0	0	1	Pilot inadvertently actuated the landing gear switch during landing.
				PX	0	0	0	4	

(BUSINESS) A private pilot, age 38, with 750 total hours, 225 in type, stated that the right landing gear retracted during the roll-out portion of a cross wind landing. Investigation revealed that the right main gear warning light operated intermittently. This discrepancy, the only one discovered during inspection, was caused by a very slight out-of-adjustment condition of the right main landing gear light micro-switch.

2-1266	Kern County, Calif.	3/30/60	Piper PA18 N-8772C (S)	CR	0	0	0	1	Loss of directional control during a cross wind landing on a limited landing area.
				PX	0	0	0	0	

(PIPELINE PATROL) A commercial pilot, age 33, with 10,000 total hours, 8,000 in type, was making a cross wind landing on a strip confined in an area of equipment associated with the oil pumping stations at the strip. During the landing the aircraft deviated in the 20-mph cross wind and struck manifold pressure vents associated with the equipment and located next to the strip.

2-1267	San Carlos, Calif.	3/30/60	Beech G35 N-173B (S)	CR	0	0	0	1	Landing gear retracted during the landing roll for reasons undetermined.
				PX	0	0	0	0	

(FERRY) According to qualified witnesses the commercial pilot, age 24, with 670 total hours, 55 in type, landed the aircraft with the landing gear in the extended position. Before the weight of the aircraft was firmly on the gear, during the landing roll, the landing gear was observed to retract.

Investigation failed to reveal the reason for the gear retraction.

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Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1268	Natchez, Miss.	3/30/60	Piper PA24 N-6154P (S)	CR	0	0	0	1	Pilot made a high, fast approach which, coupled with poor braking action, resulted in overrunning the end of the landing area.
				PX	0	0	0	3	

(BUSINESS) A commercial pilot, age 27, with 1,014 total hours, 30 in type, landed the aircraft on a sod landing area which was principally covered by clover. The aircraft overran the landing area and struck a fence.

Qualified witnesses stated that the landing approach was high and fast. It was also learned that braking action was poor because the clover was wet from a recent rain.

2-1269	Lewiston, Idaho	4/10/60	Boeing NI N-49255 (S)	CR	0	0	0	1	The landing gear struck a hidden hazard.
				PX	0	0	0	0	

(CROP CONTROL) A commercial pilot, age 35, with 8,300 total hours, 4,300 in type, was engaged in spraying a field which required him to fly below power lines strung across the area. During a swath run, in which the aircraft was flown about two feet above the terrain, the right landing gear struck a large rock which was obscured by a growth of wheat around the rock.

2-1270	Lake Bend Orielle, Idaho	4/8/60	Luscombe 8A N-1079K (D)	CR	0	0	1	0	A loss of control for an undetermined reason immediately after the pilot completed a series of unwarranted low altitude passes.
				PX	0	0	0	0	

(PLEASURE) A private pilot, age 40, with 660 total hours, 8 in type, made several low passes, which varied from 30 to 100 feet, over boats on a lake. He stated that following the last pass he was completing a turn when the aircraft yawed abruptly to the left and was unable to maintain altitude. The pilot said he could not regain control or stop the yaw to the left and, therefore, ditched the plane in the lake. The aircraft sank where the lake was about 1,000 feet deep and was not recovered.

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1271	Moriarty, N. M.	4/8/60	Piper PA24 N-6614P (S)	CR PX	0 0	0 0	0 0	1 2	1. Pilot failed to align the aircraft with the runway of intended landing. 2. Restricted forward visibility caused by oil on the windshield. 3. Failure to determine the oil leak was stopped prior to undertaking a night flight.

(PLEASURE) Following a test flight for engine replacement a slight film of oil was noted on the windshield. It was assumed the oil came from the propeller governor oil pressure line and the fitting was tightened one-quarter turn.

The same day the ATR pilot, age 39, with 6,160 total hours, 250 in type, departed for a night VFR flight to the Otto Airport near Moriarty, N. M. About 45 minutes after departure the oil film reappeared on the windshield. The pilot stated there was a clear spot on the pilot's side of the windshield and the film did not concern him. He therefore continued the flight to the destination.

On arrival the pilot executed a pattern to land on runway 17. During the final turn he was momentarily engaged in extending the flaps and then aligned the aircraft for final approach. Immediately after touchdown the pilot realized he had landed off the runway. Investigation showed the plane had been landed on the right side of runway 21.

In the subsequent work to determine the source of the oil leak the leak was stopped when the crankshaft oil seal was replaced.

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1272	Delano, Calif.	4/8/60	Beechcraft C35 N-607D (S)	CR PX	0 0	0 0	0 0	1 3	Pilot failed to see the gas pit cover during taxi.

(BUSINESS) Shortly after the commercial pilot, age 47, with 5,000 total hours, 1,500 in type, started to taxi the aircraft from the parking area it struck a yellow painted gas pit cover. Impact force failed the nose gear. The pilot said he did not see the cover before the aircraft struck it.

GENERAL AVIATION

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1273	Nr. Firebaugh, Calif.	4/8/60	Cessna 182C	CR	0	0	0	1	Impact with an unobserved depression located in the landing area.
			N-8840T (S)	PX	0	0	0	0	

(BUSINESS) Prior to landing on the private landing strip the private pilot, age 25, with 155 total hours, all in type, made a low pass over it to look for ground obstructions. Seeing none, the pilot landed. During the roll-out the aircraft struck a depression orientated perpendicular to the direction of the landing roll. Impact failed the nose gear and the aircraft nosed over.

2-1274	Richmond, Virginia	4/8/60	Helio 391	CR	0	0	0	1	1. Loss of directional control during cross wind landing. 2. Judgment of the pilot in electing to practice a cross wind landing under the existing surface wind velocity.
			N-4120D (S)	PX	0	0	0	2	

(BUSINESS) The private pilot, age 52, with 1,150 total hours, 450 in type, stated he wanted some cross wind landing practice and landed on a runway the direction of which resulted in a cross wind condition. The velocity of the surface wind was 18 mph with gusts to 25 mph. During the landing roll the aircraft ground looped with force that failed the left landing gear.

2-1275	Santa Susana, Calif.	4/8/60	Piper PA22	CR	0	0	1	1	Failure of the instructor to take control of the aircraft more promptly and correct the student's faulty landing technique.
			N-3420A (D)	PX	0	0	0	1	

(DUAL INSTRUCTION) During the flare-out for landing the student left the aircraft in a "crab" attitude. The instructor-pilot, commercial rating, age 25, with 700 total hours, 75 in type, took control but not in time to correct the student's mistake or to keep the right wing from contacting the ground and cartwheeling the plane.

2-1276	Butte Valley, Calif.	4/8/60	Piper PA12	CR	0	0	0	1	Pilot attempted to force the aircraft into the air during take-off before it reached sufficient airspeed for the existing conditions.
			N-7589H (S)	PX	0	0	0	1	

(BUSINESS) During a take-off from a 2,300-foot runway located at an

(see next page)

Docket	Location	Date	Aircraft	Injury F S M N	Probable Cause
2-1276 (Cont'd)	elevation of 4,237 feet msl the private pilot, age 34, with 184 total hours, 153 in type, attempted to force the heavily loaded aircraft into the air before it attained adequate flying speed for the conditions. The aircraft became airborne momentarily and settled back to the runway. After using about three-fourths of the runway distance the pilot aborted the take-off; however, he could not stop the aircraft before it overran the end of the runway and struck sage brush with force that failed the left landing gear.				
2-1277	Chino, Calif.	4/8/60	Piper PA23 N-1028P (S)	CR 0 0 0 2 PX 0 0 0 0	1. Failure of the trainee pilot to extend the gear for landing. 2. Inadequate supervision of the instructor-pilot.
	(PILOT CHECK) The flight was for the purpose of training the pilot trainee for a multiengine rating. On the seventh landing the aircraft was landed with the wheels up. An operations check list had been used prior to each of the first four landings; however, it was not used on the last three landings and both the trainee and instructor, commercial rating, age 32, with 2,900 total hours, 22 in type, failed to check extension of the gear for landing. The gear warning horn operated normally but failed to sound during the subject approach because the power settings used were higher than the setting at which the horn would sound.				
2-1278	Core, West Va.	4/8/60	Globe GC1B N-3707K (S)	CR 0 0 0 1 PX 0 0 0 0	Pilot failed to detect carburetor icing and apply carburetor heat in time to prevent a loss of power which required a forced landing.
	(BUSINESS) An appreciable loss of power was experienced during a cross-country flight. The commercial pilot, age 42, with 6,000 total hours, 5 in type, applied carburetor heat; however, the action was ineffective. Because of the extent of the power loss the pilot was unable to maintain altitude and made a wheels-up landing on an open field. An inspection disclosed no malfunction of the power plant or its related components. The pilot was most probably correct when he stated it was his belief that carburetor icing had occurred and there was inadequate carburetor heat, because of the power loss, to eliminate the ice.				

GENERAL AVIATION

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1279	Chicago, Illinois	4/7/60	Cessna 180	CR	0	0	0	1	A loss of control of the aircraft during a cross wind landing.
			N-3208D (S)	PX	0	0	0	0	

(BUSINESS) The private pilot, age 43, with 202 total hours, 52 in type, made a landing in a 12-mph cross wind. Shortly after touchdown the aircraft swerved and the right wing tip struck the runway. It then rolled to the left and the left tip struck the runway.

2-1280	South Bend, Ind.	4/6/60	Cessna 182	CR	0	0	0	1	Power plant: Failure of the exhaust valve, No. 3 cylinder.
			N-6474A (S)	PX	0	0	0	1	

(BUSINESS) A power failure occurred shortly after take-off and the private pilot, age 49, with 700 total hours, 500 in type, made an emergency landing in a sod field. The right wing tip struck the ground and the aircraft nosed up. The engine failure occurred as the result of the failure of the No. 3 cylinder exhaust valve.

2-1281	Huron, South Dakota	4/7/60	Piper PA22	CR	0	0	0	1	1. Lost directional control during landing in a strong, gusty cross wind. 2. Strong, gusty cross wind.
			N-3453Z (S)	PX	0	0	0	2	

(PLEASURE) During landing in a gusty 19-mph cross wind the aircraft turned into the wind. The private pilot, age 34, with 430 total hours, 15 in type, attempted to recover; however, before he was successful side loads failed the nose gear and the aircraft nosed up.

2-1282	New Smyrna Beach, Florida	4/7/60	Cessna 140	CR	0	0	0	1	1. Loss of directional control during landing in a strong, gusty cross wind. 2. Strong, gusty cross wind.
			N-2649N (S)	PX	0	0	0	1	

(PLEASURE) The commercial pilot, age 28, with 700 total hours, 121 in type, reported that during the last part of the landing roll a cross wind from the left, with a reported velocity of between 20 and 30 mph, caused the aircraft to ground loop and nose up.

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1283	Helena, Montana	4/7/60	Cessna 190	CR	0	0	0	1	Loss of directional control during the landing roll.
			N-9385A (S)	PX	0	0	0	4	

(BUSINESS) The commercial pilot, age 30, with 727 total hours, 11 in type, lost directional control during landing. The aircraft ground looped with force that failed the right landing gear.

2-1284	Moses Lake, Wash.	4/7/60	Callair A5	CR	0	0	1	0	Pilot made procedure turnaround too tight causing the aircraft to stall at low altitude.
			N-9962C (S)	PX	0	0	0	0	

(CROP CONTROL) During a procedure turnaround for his second spraying run the commercial pilot, age 43, with 3,450 total hours, 3 in type, made the turn too tight. The heavily loaded aircraft stalled at low altitude and crashed before a recovery could be effected.

2-1285	San Jose, Calif.	4/7/60	Cessna 140	CR	0	0	0	1	Lost directional control during landing.
			N-3007N (S)	PX	0	0	0	0	

(STUDENT SOLO) The student pilot, age 25, with 12 total hours, all in type, overcontrolled when he attempted to maintain directional alignment on the runway during the landing roll. The aircraft veered and ground looped off the runway. It came to rest inverted.

2-1286	Phoenix, Arizona	4/7/60	Superior Satellite V2	CR	0	0	0	2	1. Student failed to execute the instructor's corrective instruction. 2. Failure of the instructor to take control of the aircraft and correct the student's faulty technique before it was too late.
			N-6544C (S)	PX	0	0	0	0	

(CHECK FLIGHT) The student had previously soloed the aircraft but because he had not flown it for several months he was being checked out by a commercial pilot, age 32, with 687 total hours, 81 in type. During the landing in which the accident occurred the student leveled off too high, and instead of executing a go-around as ordered by the instructor, he closed the throttle. The aircraft settled quickly, and before the instructor could effect a recovery, struck the ground on the right landing gear with impact force that failed the component.

GENERAL AVIATION

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1287	Long Beach, Calif.	4/7/60	Grumman G21 N-324 (S)	CR PX	0 0	0 0	0 0	1 0	Gear retracted for reasons undetermined.

(AIR TAXI) The ATR pilot, age 39, with 11,980 total hours, 2,000 in type, made a normal landing; however, during the roll-out the gear retracted. During subsequent inspection both retracting shafts were found to have sheared as a result of abnormal loads imposed after the gear started to collapse. When the broken retracting shafts were replaced the gear operation was normal.

2-1288	Indianapolis, Ind.	4/7/60	Ercoupe 415C N-37117 (N)	CR PX	0 0	0 1	0 0	1 0	Passenger stepped off the leading edge of the wing into the rotating propeller.

(PLEASURE) The passenger of the aircraft operated by a private pilot, age 32, with 160 total hours, 20 in type, deplaned to guide the pilot into a parking space. Although he was briefed to the contrary, the passenger stepped off the leading edge of the wing and was struck by the propeller. The passenger was severely lacerated.

2-1289	Bonham, Texas	4/7/60	Callair A4 N-6148C (S)	CR PX	0 0	0 0	1 0	0 0	Pilot initiated flight with insufficient fuel resulting in a power loss because of fuel starvation.

(CALIBRATING SPRAY EQUIPMENT) The commercial pilot, age 25, with 320 total hours, 15 in type, pulled the aircraft up into a steep climb after take-off during which the engine stopped because of fuel starvation. He turned the aircraft toward an open area and the engine resumed operation momentarily. It then stopped the second time while the pilot was still making the turn at low altitude. The left wing struck the ground causing the aircraft to cartwheel.

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1290	Millington, Md.	9/5/60	Champion 7FC N-8526E (S)	CR PX	0 0	0 0	0 0	1 0	1. Inaccurate flight planning and estimate of fuel for the flight. 2. Failure of student to monitor remaining fuel en route and land at available airport. 3. Lack of supervision over the inexperienced student's activities relative to the flight.

(STUDENT SOLO) A student pilot, age 21, with 11 total hours, all in type, initiated a triangular course cross-country flight which he planned would take one hour and ten minutes. After one hour and 55 minutes, over a course shorter than planned, the pilot realized the fuel gauge showed nearly empty. He therefore made a landing on a road during which the aircraft ground looped and was damaged.

The pilot stated the fuel gauge showed three-quarters of a tank at departure or an amount he believed was enough for four hours of flight.

Investigation showed the fuel gauge was accurate as the fuel tank was progressively filled with fuel. It also showed that during the flight the student twice passed over suitable airfields.

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1291	Basking Ridge, N. J.	8/15/60	Beech 35 N-3352V (D)	CR PX	0 0	0 0	1 1	0 0	1. Pilot attempted to force the aircraft into the air prematurely resulting in an extended ground roll and reduced climb performance with marginal control. 2. Adverse terrain conditions for take-off.

(FERRY) The aircraft, flown by a private pilot, age 34, with 496 total hours, 25 in type, collided with wires shortly after take-off and crashed into a private residence.

Investigation revealed that the pilot attempted to take off from a 2,400-foot long sod strip which was rough as a result of constant traffic. During the take-off run the aircraft was twice observed to rotate to a nose-high attitude while the main gear remained on the ground. Another witness, a commercial pilot, well qualified in light plane operations, stated that as the aircraft became airborne it seemed to partially stall, recover slightly and then start a nose-high left climb out of the field. In this attitude at low altitude the right main gear struck wires and then trees. Thereafter the aircraft was observed to continue in the left turn until it collided with the private residence.

During the course of the investigation the pilot stated that he "did not suspect any type of malfunction of engine or airplane".

GENERAL AVIATION

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1292	Olalla, Washington	5/15/60	Cessna 140 N-73057 (D)	CR PX	0 0	0 1	1 0	0 0	Power failure resulting from failure of the armature shaft.

(PLEASURE) During a cross-country flight from Spanaway to Bremerton, Wash., the private pilot, age 22, with 148 total hours, 122 in type, experienced a complete power failure over rugged terrain which afforded no suitable landing area. The pilot made the emergency landing on the best available area, a small clearing, during which the aircraft struck a tree.

Teardown of the engine disclosed the armature shaft had failed. The nature of the break in the shaft indicated it was a fatigue-type failure.

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1293	Okanogan, Wash.	4/9/60	Ryan PT22 N-49085 (D)	CR PX	0 0	0 0	1 0	0 0	Inadvertent actuation of the mixture control to the idle cut-off position.

(FERRYING) When the private pilot, age 39, with 1,580 total hours, 1 in type, applied throttle following a letdown in preparation for landing, the engine failed to respond. During the emergency landing on a soft field the wheels sank in the soil and the aircraft nosed over.

A witness to the accident, who was also a qualified pilot and power plant mechanic, stated that when he examined the aircraft immediately after the crash he found the mixture control in the "idle cut-off" position. Further examination of the aircraft and engine revealed no other reason for the power loss.

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1294	Iowa City, Iowa	4/9/60	Cessna 195 N-3893V (S)	CR PX	0 0	0 0	0 0	1 1	Failure of left landing gear structure.

(FERRYING) The aircraft had just been acquired by the pilot, private rating, age 36, with 1,000 total hours, 5 in type, and the purpose of the flight was to ferry it to his home base. A normal landing was made; however, during the end of the roll-out the left gear failed and the left wing was damaged.

An inspection disclosed a structural failure had occurred to the upper end of the left landing gear leg where it entered the fuselage landing gear box.

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1295	Cassville, Missouri	4/9/60	Piper J4A	CR	0	0	0	1	Loss of control during take-off which was being made in an attempt to steal the aircraft.
			N-30975 (S)	PX	0	0	0	0	

(STOLEN AIRCRAFT) During an attempt to take off in the stolen aircraft the thief lost control of the plane and it crashed on the runway. The thief was not apprehended.

2-1296	Grinnell, Kansas	4/9/60	Beechcraft 35	CR	0	0	0	1	Inadvertent actuation of the throttle causing the aircraft to roll uncontrolled into a ditch.
			N-2998V (S)	PX	0	0	0	1	

(BUSINESS) When the starter was ineffective because of a low battery the commercial pilot, age 38, with 2,900 total hours, 180 in type, propped the propeller to start the engine. A passenger occupied the pilot's seat while this was done.

After the engine started the pilot climbed onto the wing while the passenger was getting out of the cabin so the pilot could get in. In doing so the passenger hit the throttle. The pilot was thrown off the wing and both he and the passenger tried to hold the plane. The aircraft, however, pivoted on the right wheel which was chocked and then rolled into a power line pole and finally into a ditch.

2-1297	Weyers Cave, Va.	4/9/60	Luscombe 8A	CR	0	0	0	1	1. Loss of directional control during landing in a strong, gusty cross wind 2. Strong, gusty cross wind.
			N-1391K (S)	PX	0	0	0	1	

(PLEASURE) During the roll after landing in a gusty 20- to 35-mph cross wind the private pilot, age 47, with 716 total hours, 640 in type, lost directional control and the aircraft ground looped.

2-1298	Emerald Beach, Texas	4/9/60	Piper PA22	CR	0	0	1	0	Pilot misjudged distance while engaged in unwarranted and dangerously low flight.
			N-3206Z (D)	PX	0	0	1	0	

(PLEASURE) The commercial pilot, age 35, with 429 total hours, 14 in type, had, during the day, made numerous passenger-carrying trips from the beach

(see next page)

Docket	Location	Date	Aircraft	Injury F S M N	Probable Cause
2-1298 (Cont'd)	area in front of a row of houses. On the flight in which the accident occurred he took off with one passenger and after becoming airborne made a steep climbing turnaround followed by a low pass in the opposite direction. The pilot stated the pass was made between 25 and 50 feet above the beach and witnesses said it was as low as 4 feet. Following the pass the pilot made a steep right turn during which the right wing struck the water. The aircraft cartwheeled and sank about 300 feet from shore.				
2-1299	Laytonsville, Md.	4/9/60	Piper PA16 N-6858K (S)	CR 0 0 0 1 PX 0 0 0 1	A strong, gusty cross wind causing the pilot to lose control during the landing roll.
	(PLEASURE) At the completion of a cross-country flight the private pilot, age 27, with 174 total hours, 29 in type, landed in a 25-mph gusty cross wind. During the landing roll a strong gust lifted the right wing causing the aircraft to swerve and nose up. After the occupants deplaned another strong gust blew the aircraft over on its back.				
2-1300	Cooper River (Nr. Cordova) Alaska	4/9/60	Stinson V77 N-2764A (S)	CR 0 0 0 1 PX 0 0 0 3	A power failure for an undetermined cause.
	(BUSINESS) The private pilot, age 41, with 600 total hours, 125 in type, stated that after about one and one-half hours of a cross-country flight the engine stopped without warning. He said that all instruments indicated normal operation of the engine before the power loss and attempts to restart the engine failed. The forced landing was made on an area covered by deep snow. The aircraft nosed over. When the engine could be recovered from the remote area of the accident and examined, no evidence of malfunction or failure was found. The engine started and ran normally throughout its entire power range. Carburetor icing was considered a possible reason for the power loss.				

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1301	Urbana, Illinois	4/9/60	Piper PA22	CR	0	0	0	1	Pilot misjudged and overshot during landing.
			N-8492D (S)	PX	0	0	0	2	

(BUSINESS) During landing, the aircraft, flown by a private pilot, age 21, with 70 total hours, 11 in type, touched down with excessive speed too far down the 2,600-foot runway. As a result the pilot was unable to stop the plane in the remaining runway distance. Past the end of the runway the pilot turned the aircraft to avoid a fence and in doing so struck a tractor.

2-1302	Spring Valley, N. Y.	4/8/60	Champion 7FC	CR	0	0	0	1	Pilot landed the aircraft on the area beside the runway which was unsuitable for landing.
			N-7566E (S)	PX	0	0	0	0	

(STUDENT SOLO) The student pilot, age 44, with 18 total hours, all in type, landed on the sod area adjacent to the hard-surfaced runway. As the aircraft was decelerating in the landing roll the nose wheel struck a rock with impact that failed the gear. The aircraft nosed up.

2-1303	Louisville, Kentucky	4/8/60	Champion 7EC	CR	0	0	0	1	Strong, gusty surface wind.
			N-4322C (S)	PX	0	0	0	0	

(PLEASURE) At the completion of a cross-country flight the pilot, private rating, age 32, with 80 total hours, 30 in type, made a successful landing in a gusty surface wind of 26 mph. As he turned the aircraft off the runway strong gusts struck the aircraft and nosed it over.

2-1304	Panama City, Fla.	4/8/60	Cessna 172	CR	0	0	0	1	Pilot misjudged and overshot with excessive airspeed during the landing approach.
			N-7565T (S)	PX	0	0	0	0	

(STUDENT SOLO) The student pilot, age 23, with 29 total hours, all in type, landed the aircraft with excessive speed approximately half-way down the 5,000-foot runway. In the effort to stop the plane the pilot applied maximum braking during which the aircraft veered off the runway where it contacted soft sand and nosed over.

GENERAL AVIATION

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1305	Shelby, N. C.	4/10/60	Piper J3 N-32642 (S)	CR	0	0	1	0	Engine malfunction and loss of power for an undetermined reason.
				PX	0	0	1	0	

(PLEASURE) A private pilot, age 31, with 117 total hours, 45 in type, stated that about 15 minutes after take-off the engine of the aircraft began to miss and lose power. The pilot said he applied carburetor heat; however, this action was ineffective and he decided to make a precautionary landing. The landing was attempted on a narrow country road during which the aircraft struck brush causing it to ground loop.

Examination of the engine failed to disclose a mechanical reason for the malfunction.

2-1306	Anchorage, Alaska	4/10/60	Curtis C1 N-76H (S)	CR	0	0	0	1	Failure of the right landing gear caused by the forces of an evasive maneuver to avoid a hazardous situation created when the right ski broke through thin ice.
				PX	0	0	0	2	

(BUSINESS) A commercial pilot, age 32, with 520 total hours, 500 in type, landed the ski-equipped aircraft on a snow-covered frozen body of water. While the aircraft was being taxied to the shore the right ski broke through soft ice causing the aircraft to veer toward a parked plane. The pilot applied power and attempted to turn the aircraft to the left which resulted in side forces that failed the right landing gear.

2-1307	Hamilton, Mass.	9/10/60	Piper J3C N-7321H (D)	CR	1	0	0	0	A loss of control during buzzing at low altitude.
				PX	1	0	0	0	

(PLEASURE) While making low level passes in the vicinity of a friend's home the commercial pilot, age 28, with 1,437 total hours, 15 in type, lost control of the aircraft in a steep right turn. Before recovery could be accomplished the aircraft struck the ground in a steep dive.

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1308	Tappahannock, Va.	9/1/60	Piper J3	CR	1	0	0	0	1. Pilot allowed the aircraft to stall during a steep turn at low altitude. 2. Reduced efficiency of the pilot caused by fatigue.
			N-92275 (D)	PX	0	0	0	0	

(CROP CONTROL) The commercial pilot, age 22, with 630 total hours, 60 hours in aerial application flying, was engaged in his ninth crop control flight for the day. The work began about 0600 or 11 hours before the accident.

Following the first spray run of the subject flight the pilot pulled up over trees and began a left turn. The turn was steepened after about 90 degrees at which time the aircraft stalled and dived to the ground from low altitude.

2-1309	Van Horn, Texas	11/12/60	Cessna 172	CR	1	0	0	0	Pilot failed to see a ground obstruction while engaged in careless and reckless flying.
			N-4060F (D)	PX	0	1	0	0	

(PLEASURE) A student pilot, age 34, with approximately 30 total hours, all in type, and with no night flying prior to the subject flight, engaged in low buzzing maneuvers over the homes of friends. During the pass in which the accident occurred he approached the house at a high speed and the aircraft struck a television antenna mast at a point approximately 50 feet above the ground. The aircraft crashed immediately following the collision.

A witness stated that he, the pilot, and the passenger aboard at the time of the crash spent the hours between 1500 and 1800 cst in a bar during which time they each consumed approximately 5 cans of beer. The accident flight was initiated shortly thereafter.

2-1310	Wills Valley, Calif.	10/6/60	Cessna 172	CR	0	1	0	0	Judgment of the pilot in attempting to take off under the existing surface wind conditions indicating downdrafts and turbulence and requiring the take-off be made toward rapidly rising terrain.
			N-6155E (D)	PX	2	1	0	0	

(PLEASURE) En route during a flight from Las Vegas, Nevada, to San Diego, California, the private pilot, age 40, with 350 total hours, 50 in type, landed the aircraft on a meadow in Wills Valley located about seven miles west of the Warner Hot Springs California Airport. The meadow is located at an elevation of about 4,200 feet msl and is bordered by high terrain on the southwest, west and northwest [illegible] ss.

(see next page)

Docket	Location	Date	Aircraft	Injury F S M N	Probable Cause
2-1310 Cont'd)					

After a short period on the ground the pilot taxied the plane to the far end of the meadow and took off to the west into a 30-knot surface wind. The existing wind approached the valley over the high mountainous terrain on the west side creating downdrafts and turbulence in the valley on the lee side of the mountains. The aircraft was unable to gain sufficient altitude under the conditions to clear the rising terrain along the flight path. The pilot attempted to turn left away from the rising terrain; however, the aircraft struck the tops of trees and crashed into the side of the upslope. The plane burned after impact.

Investigation confirmed the existence of downdrafts and turbulence at the time of the take-off. It also showed the aircraft was heavily loaded but not in excess of the allowable gross weight. There was no evidence found of malfunction or failure of the aircraft prior to impact.

2-1311	Nr. Montrose, Colo.	10/14/60	Cessna 182 N-6450A (D)	CR PX	1 2	0 0	0 0	0 0	Noninstrument pilot lost control of the aircraft in instrument weather conditions while attempting VFR flight over mountainous terrain.

(TRANSPORTATION) The private pilot, age 36, with 269 total hours, 14 in type, and no instrument flying experience, departed Monte Vista, Colo., on a flight to Monticello, Utah, at 0630 mst. When the aircraft failed to arrive and could not be located a search for it was conducted along the proposed route of flight. The next day the wreckage was found where the plane had crashed on a steep mountain slope 15 miles northeast of Montrose, Colo. Examination of the structural evidence disclosed the aircraft struck the mountain slope at the 8,200-foot level while it was in a near vertical descent. There was no evidence of mechanical failure or malfunction of the aircraft or power plant prior to ground impact.

It could not be determined if the pilot had obtained a weather briefing prior to take-off. An observer in the vicinity of the crash site stated the visibility throughout the day had been between 200 and 500 feet with intermittent light rain and snow. He also said that low clouds obscured the mountain tops.

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Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1312	Hot Springs, Ark.	10/8/60	Cessna 175 N-7442M (D)	CR	1	0	0	0	Pilot attempted to continue the flight in weather conditions which were unsuitable for visual flight and at an altitude too low to clear the terrain.
				PX	3	0	0	0	

(PLEASURE) During an attempted VFR flight from Hot Springs to Fayetteville, Ark., the aircraft, flown by a commercial pilot, age 44, with 5,500 total hours, 600 in type, struck a mountain.

Physical evidence at the crash site showed the aircraft initially struck trees on one side of the mountain about 200 feet below the crest while it was in a nose-up attitude. The plane then passed over the crest of the mountain and crashed on the other side in a steep nose-down attitude. The manner in which the initial impact occurred suggested the pilot saw the terrain and attempted to avoid it.

A witness who heard the crash and saw the aircraft shortly before it crashed stated she saw the plane flying in a northwest direction. She indicated it was flying toward the mountains where the crash occurred and seemed to be too low to clear them. She further stated the plane was below clouds which obscured the tops of the mountains.

Investigation revealed the pilot had delayed departure of the flight because of weather reports which indicated weather conditions en route were questionable for VFR flight. Before take-off he indicated that he would take off and if the weather was suitable he would continue to Fayetteville. After take-off he radioed the weather was good and he would fly at 1,300 feet.

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1313	Selkirk, N. Y.	8/18/60	Bell 47D N-4231A (S)	CR	0	0	0	1	Improper control coordination during a descending turn at low altitude.
				PX	0	0	0	0	

(CROP CONTROL) A commercial pilot, age 28, with 1,733 total hours, 1,408 in rotorcraft, was making a right descending turn when the aircraft settled and struck the surface of a cornfield. After impact the helicopter rolled over.

Investigation revealed that the descending turn was poorly executed and resulted in a power settling condition. The pilot recognized the condition and, in an attempt to correct it, nosed the aircraft down, reduced the rotor blade pitch and applied power. Because of insufficient remaining altitude the aircraft struck the ground before the pilot action was effective.

GENERAL AVIATION

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1314	Elgin, N. D.	5/4/60	Cessna 182A	GR	1	0	0	0	Pilot attempted to continue VFR flight in instrument weather conditions.
			N-5930B (D)	PX	2	1	0	0	

(PLEASURE) Prior to the initiation of a flight from Fargo to Hettinger, N. D., the noninstrument private pilot, age 68, with 514 total hours, 400 in type, obtained weather information pertinent to the route. He was advised that conditions west of Bismark were unsuitable for the intended VFR flight. He was advised to land at Bismark and recheck the weather before continuing to Hettinger. The flight departed Fargo about 1045. The aircraft crashed about one hour and 15 minutes later at a location 50 miles southwest of Bismark.

Investigation disclosed the pilot did not land at Bismark nor did he seek weather information through radio facilities.

A pilot who flew near the accident site about the time it occurred reported there was a heavy fog which extended from the ground to an overcast, the bottom of which was about 3,500 feet msl. At Elgin, N. D., located about six miles from the accident site, weather conditions at the time of the accident were: ceiling, zero; visibility, one-half mile.

A witness saw the aircraft just before it crashed. She said it circled at an estimated height of 100 feet and descended in a left turn until it crashed. She said that the plane was difficult to see because of the dense fog. The ground was covered with snow.

Docket	Location	Date	Aircraft	Injury	F	S	M	N	Probable Cause
2-1315	Lexington, N. C.	10/18/60	Piper PA22	CR	1	0	0	0	1. Judgment of the pilot in attempting the take-off toward the trees from an area, the distance of which was inadequate for the aircraft to take off and climb over existing obstructions. 2. Lack of familiarity of the pilot with the performance of the aircraft.
			N-2832P (D)	PX	3	0	0	0	

(FAMILIARIZATION) During a round-robin flight from Morristown, Tenn., to Raleigh, N. C., and return, the commercial pilot, age 40, with 237 total hours, 16 in type, made an unscheduled landing on a private grass strip for the convenience of the passengers. The grass strip was 1,050 feet in length and was bordered a short distance from one end by trees. The other end was unobstructed. There was also a plus runway gradient of about 3 degrees in the direction toward the trees.

After a short time on the ground the pilot initiated a take-off toward the trees using the total distance available. The aircraft

(see next page)

Docket	Location	Date	Aircraft	Injury F S M N	Probable Cause
2-1315 (Cont'd)	became airborne but struck one of the trees 28 feet above the ground. The aircraft crashed and burned. Investigation showed the aircraft was loaded to a gross weight of about 1,960 total pounds at the take-off. At 2,000 pounds performance data showed the aircraft required 1,600 feet to take off and climb over a 50-foot obstacle from a hard-surfaced take-off area.				
2-1316	Ponte Vedra, Fla.	5/12/60	Bell 47D N-9391H (S)	CR 0 0 0 1 PX 0 0 0 0	Failure of the pilot to maintain sufficient rotor and engine rpm resulting in a loss of rpm and descent of the aircraft which could not be arrested in the available altitude.
	(CONTRACT/CHARTER) A commercial pilot, age 27, with 2,050 total hours, 900 in rotorcraft, was flying the helicopter about four feet above an area of shallow water in conjunction with aerial application work when he heard a decrease in engine rpm. The pilot applied additional power and tried to "pump" the rpm back; however, before these actions were effective the aircraft contacted the water.				

CORRECTION:

2-1034	Stuttgart, Arkansas	7/25/60			
	Please correct aircraft to read Bell 47D instead of Allied Helicopters.				

CIVIL AERONAUTICS BOARD

SUMMARY OF 100 ACCIDENTS ANALYZED DURING THE PERIOD
JANUARY 1 THROUGH JANUARY 15, 1961

	Accidents	Fatal Accidents	Fatalities
Air Carrier Accidents	0	0	0
General Aviation Accidents:			
Large Fixed-Wing Aircraft (over 12,500 pounds)	0	0	0
Small Fixed-Wing Aircraft (12,500 pounds and under)	98	12	31
Helicopters	2	0	0
Subtotal, General Aviation	100	12	31
Total, all accidents	100	12	31

Statistical Breakdown of Causal Factors by Pilot Certificate

	General Aviation						Air Carrier		
Category	Student	Private	Commercial	ATR	Other	Total	Commercial	ATR	Total
Pilot Personnel	11	39	25	1	1	77	0	0	0
Other Personnel	1	2	3	0	0	6	0	0	0
Powerplant	0	7	3	1	0	11	0	0	0
Rotor Assembly	0	0	0	0	0	0	0	0	0
Airframe	0	1	0	0	0	1	0	0	0
Landing Gear	0	5	2	1	0	8	0	0	0
Equipment & Accessories	0	0	0	0	0	0	0	0	0
Related Equipment	0	0	0	0	0	0	0	0	0
Weather	0	12	4	0	0	16	0	0	0
Airport-Heliport Terrain	0	3	3	0	0	6	0	0	0
Miscellaneous:									
Bird Collision	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0
Incapacitated	0	0	0	0	0	0	0	0	0
Undetermined	0	1	0	0	0	1	0	0	0
ACTUAL NUMBER ACCIDENTS BY PILOT CERTIFICATE	11	54	32	2	1	100	0	0	0

In determining the cause of an accident all contributing factors are considered. These factors are classified according to appropriate categories. For statistical purposes, where two or more causal factors exist in one accident, each is recorded and no attempt is made to establish a primary cause. The figures shown above indicate the number of accidents in which each different category of causal factors was found to exist.

January 15, 1961

THE CIVIL AERONAUTICS BOARD

Reminds you:

"The time you take to check en route and destination weather may save you a lifetime."

Statistics of the CAB show

1. APPROXIMATELY 30 PERCENT OF ALL FATAL ACCIDENTS INVOLVING AIRCRAFT UNDER 12,500 POUNDS OCCUR IN ADVERSE WEATHER CONDITIONS.

2. THE ADVERSE WEATHER CONDITIONS AND THE LACK OF INSTRUMENT FLYING ABILITY OF THE PILOT COMBINE TO CAUSE THE LARGE MAJORITY OF THESE ACCIDENTS.

3. IN MOST OF THE CASES THE WEATHER CONDITIONS EXISTED OR WERE FORECAST AT DEPARTURE.

4. IN A SUBSTANTIAL NUMBER OF THE CASES A WEATHER CHECK WAS NOT MADE BY THE PILOT.

FOR AVIATION WEATHER FROM THIS AIRPORT CALL _____

A SAFETY SUGGESTION FROM THE CIVIL AERONAUTICS BOARD

"Don't prop your aircraft without a competent assistant at the controls."

"To do so is dangerous, poor practice, and may be costly."

A private pilot with approximately 1000 hours learned the merit of our suggestion early one morning last year. As many have, he believed his aircraft was securely tied down, the throttle was only cracked, and it would be all right to prop his airplane without assistance.

When the engine started, the aircraft moved forward, breaking those secure tie downs. The pilot was unable to get to the controls but managed to leap astride the empennage, the precarious position he was destined to occupy for the next 60 minutes. He was able to hold the tail down and partially guide the airplane by dragging his feet while, as one witness described it, "the airplane made many many counterclockwise circles and covered a great portion of the west side of the airport." Efforts by two persons to break into the ever-continuing circles and catch a strut failed because the aircraft was rotating too fast.

It was decided to call the fire department and attempt to drown out the engine. Each time the nose of the aircraft passed facing the fire truck, water was hosed into the engine. After about 5 minutes the engine nearly stopped; however, the fire hose became tangled in a remaining piece of tie down rope attached to one strut. The episode ended and became an accident when the slack in the hose was taken up, the plane was jerked around, the pilot was thrown into a heap, and plane crashed into the fire truck.

A common cause

Records of the CAB's Bureau of Safety show the above accident was unique only in its humorous aspects. In a sampling of 1350 accidents, there were 18 or 1.3 percent of the total resulting from the same cause: Propping an aircraft without a competent assistant at the controls. In many of these accidents the aircraft broke its tie downs or jumped its chocks, showing these precautions are not always adequate.

PRELIMINARY FACTUAL REPORT

ACCIDENT INVOLVING AIRCRAFT OF U.S. REGISTRY, N 6907C AND N 8013U,
NEAR STATEN ISLAND, NEW YORK
DECEMBER 16, 1960

On December 16, 1960, at approximately 1533:40 1/, a midair collision occurred near Miller Army Field, Staten Island, New York, involving a Trans World Airlines Lockheed Constellation, 1049A, N 6907C, and a United Air Lines Douglas DC-8, N 8013U. As a result of the collision, the Constellation fell to Miller Field, and the DC-8 continued in a northeasterly direction, finally crashing in Brooklyn, New York, on Sterling Place near Seventh Avenue. All 128 persons on board the two aircraft and five persons on the ground were killed. Both aircraft were demolished and there was considerable damage to property.

History of United Air Lines Flight 826

United Air Lines Flight 826 of December 16, 1960, was a regularly scheduled nonstop passenger flight originating in Chicago, Illinois, and terminating at the New York International Airport, New York. The flight plan specified a flight in accordance with Instrument Flight Rules to be flown at a cruising level of 27,000 feet, via victor airway 55 and jet airway 60 to New York; the estimated time en route was 1:29 at an airspeed of 478 knots; a ground speed of 530 knots, with sufficient fuel on Board to meet all FAA requirements. The aircraft departed

1/ All times herein are Greenwich civil time and based on the 24-hour clock.

sufficient fuel on Board to meet all FAA requirements. The aircraft departed Chicago at 1411. At the time of departure the aircraft weighed 214,790 pounds, which was within the allowable takeoff weight; the center of gravity was within prescribed limits. The flight to the vicinity of the New York area was normal.

At approximately 1515, New York Center called Flight 826: "United 826 clearance limit is Preston Intersection via jet 60 victor to Allentown direct to Robbinsville, via victor 123; maintain 25,000." Flight 826 acknowledged: "Right, we're cleared to Preston." At 1523:30, Flight 826 reported to New York Center that he was over Allentown, Pennsylvania, at a flight level of 25,000 feet. At this time the Idlewild weather was given by the Center as being: 1,500 overcast; visibility one-half mile; light rain; fog; and altimeter setting 29.65. Approximately two minutes later the Center advised Flight 826 that it was cleared to proceed on victor 30 until intercepting victor 123 to Preston. Accordingly, the flight continued on its general heading towards Robbinsville until reaching victor 30, where it followed this latest flight clearance. During this period of time the flight was descending. At 1530, New York Center cleared 826 to descend to and maintain 5,000 feet. United 826 acknowledged and advised that it was leaving 14,000 feet. The Center then asked the flight if it could make Preston at 5,000 feet. United 826 indicated that they would try. Several other conversations ensued between

United 826 and the Center, and at 1533:28, United 826 contacted Idlewild Approach Control and advised: "Approaching Preston at 5,000." Idlewild Approach Control then gave the flight the following instructions: "United 826, this is Idlewild Approach Control; maintain 5,000; little or no delay expected at Preston; Idlewild landing runway four, right; ILS in use. Idlewild weather: 6,000 scattered; estimated ceiling 1,500 overcast; visibility one-half mile; light rain and fog; wind NNE at seven knots; altimeter 29.36. This transmission ended at 1533:54. United 826 did not acknowledge. It was subsequently learned that Flight 826 had gone beyond the Preston Intersection a distance of approximately ten miles, where the collision occurred. Preston Intersection consists of a 446° radial of Colts Neck OMNI, and a 050° radial of Robbinsville OMNI.

At the time that United 826 was entering the New York area, the aircraft's No. 2 navigational receiver panel was inoperative. This means that one of the two OMNI receivers was out, thereby making it difficult to obtain a fix on an OMNI intersection.

History of Trans World Airlines Flight 266

Trans World Airlines Flight 266 of December 16, 1960, was a regularly scheduled flight originating at Dayton, Ohio, with its destination LaGuardia Field, New York, and with an intermediate stop at Columbus, Ohio. Flight 266 departed Dayton Municipal Airport and landed at Columbus, where an equipment change was made, replacing the Lockheed Constellation 749A, N 6012C, with a Lockheed Constellation

1049A, N 6907C. This substitution was made for pre-planned maintenance purposes. Flight 266 departed Columbus at 1400. The gross weight of the aircraft at the time of takeoff was 101,144 pounds, which was well within the allowable limits. The center of gravity of the aircraft was also reported to be within the prescribed limits. The flight was cleared to LaGuardia Airport via direct Appleton; victor 12 Johnstown, Pennsylvania; victor 106 Selinsgrove, Pennsylvania, victor 6; victor 123 to LaGuardia; to maintain 7,000 feet. Subsequent clearances had the flight climb to 17,000 feet, and then to 19,000 feet. The flight from Columbus to the New York area was routine.

At 1519, Flight 266 reported to the New York Center that it was passing Allentown, Pennsylvania at 11,000 feet. The Center then advised TWA 266 that it was in radar contact and was cleared to the Linden Intersection. Shortly thereafter, TWA 266 was cleared to descend to and maintain 10,000 feet. At 1523, New York Center gave the flight the current LaGuardia weather: "Measured 500 overcast; one mile visibility and light snow; surface winds northwest 15 knots; altimeter 29.66." The flight was advised that ILS approaches were being made to runway four and that the localizer was inoperative. The flight acknowledged. Between 1524 and 1526, New York Center cleared TWA 266 to descend to and maintain 9,000 feet. At 1527, TWA 266 advised the Center that it was at Solberg Intersection. Shortly thereafter, the Center advised TWA 266 that radar service was terminated and to contact LaGuardia Approach Control. At 1528, TWA 266 advised LaGuardia

Approach Control that it had passed Solberg at 9,000 feet. The flight was then cleared as follows: "Maintain 9,000 feet; report the zero one zero Robbinsville; ILS runway four; landing runway 4; no delay expected; wind northeast at 15; altimeter 29.65 " TWA 266 continued to descend, and several conversations were held between the aircraft and LaGuardia Approach Control. At 1532:09, LaGuardia Approach Control advised TWA s 266 to turn right to a heading of 130. Shortly thereafter, the aircraft was vectored to a heading of 150 and then again to a heading of 130 At 1532:47, Approach Control advised the flight that it had traffic at 2:30 position six miles northeast bound During this period the aircraft was descending. At 1533:26 Approach Control advised the flight that there appeared to be jet traffic at the three o'clock position approximately one mile northeast bound. At 1533:42 Approach Control advised the flight to turn to the left; however, this instruction apparently was never received.

Linden Intersection consists of an 096 radial of Solberg and an 007 radial of Colts Neck.

Witnesses:

Many witnesses were interviewed who were located both on Staten Island and in Brooklyn. Some of the witnesses in the Staten Island area said that they actually saw the two aircraft come together and that they watched the Constellation fall to the ground, and that the DC-8 continued in flight until it disappeared from their view. They all reported the vertical visibility to be hazy, but definitely stated

that they could see both aircraft. They gave various estimates of altitudes of the collision, varying from 1,500 feet to slightly above 3,500 feet. (The actual altitude of the collision is believed to have been a little above 5,000 feet.) The witnesses in the Brooklyn area stated that they saw the DC-8 flying at a very low altitude - so low in fact that it was believed to have barely missed several buildings and a church tower. They said that just before the aircraft crashed that it appeared to bank sharply and then fall to the ground.

Collision

The aircraft are believed to have collided when the DC-8 overtook and crossed the right side of the Constellation. The No. 4 engine of the DC-8 struck the fuselage of the Constellation immediately behind the trailing edge of the Constellation wing. A large portion of the tip of the right wing of the DC-8 and the No. 4 engine fell in the vicinity of Miller Army Field.

Public Hearing

A public hearing was ordered by the Board and was held in the ballroom of the St. George Hotel in Brooklyn, New York, beginning January 4, 1961. This hearing lasted eight working days, and 79 witnesses were interrogated.

The investigation of this accident is continuing. As soon as all of the evidence is a matter of record, this evidence will be studied and an Aircraft Accident Report written.

Prepared by Mr. Van R. O'Brien

MC

CIVIL AERONAUTICS BOARD

PRELIMINARY AIRCRAFT ACCIDENT REPORT

ARCTIC-PACIFIC, INC., CURTISS
C-46, N 1244N, Toledo Express Airport,
Toledo, Ohio, October 29, 1960

The Accident

At approximately 2201 e. s. t., October 29, 1960, an Arctic-Pacific, Inc., C-46, N 1244N, crashed during takeoff from the Toledo Express Airport, Toledo, Ohio. Of the 45 passengers and 3 crew members aboard, 20 passengers and the captain and copilot were fatally injured.

History of the Flight

Arctic-Pacific, Inc., provides Supplemental Air Service and operates under a temporary certificate of public convenience and necessity which expires March 30, 1961. The FAA air carrier operating certificate was due to expire at midnight on November 14, 1960.

The purpose of the flight was to transport the California State Polytechnic College football team from San Luis Obispo, California to Toledo, Ohio, and return. N 1244N departed Oakland Airport at 0535 p. s. t., October 27, 1960, for Santa Maria Airport where the football team was to be picked up. The crew consisted of Captain Donald Chesher, Copilot Howard Perovich, and Stewardess Mrs. Danny Miller. A second crew which was to dead-head to Kansas City, consisted of Captain Robert P. Fleming and Copilot Lucien Tessier.

The following information concerns the departure and arrival times and flight times since the departure of N 1244N from Oakland Airport.

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	AIRPORT	TIME	FLT. T.	GD. T.	REMARKS
Depart	Oakland	1335 Z* 27th (0535 P.s.t.** 27th)		0	Chesher in Command No flight plan filed
Arrived	Santa Maria	1435 Z 27 (0635 P.s.t. 27th)	1:00		
Departed	Santa Maria	1611 Z 27th (0811 P.s.t. 27th)	0	1:35	Chesher in Command 50 persons aboard
Arrived	Albuquerque	2005 Z 27th (1305 m.s.t.*** 27th)	3:55	0	
Departed	Albuquerque	2144 Z 27th (1444 m.s.t. 27th)	0	1:40	Chesher in Command 50 persons aboard
Arrived	Kansas City	0110 Z 28th (1910 c.s.t.**** 27th)	3:25	0	
Departed	Kansas City	0242 Z 28th (2042 c.s.t. 27th)	0	1:35	Chesher in Command 2nd crew disembarked at Kansas City. 48 passengers
Arrived	Toledo	0522 Z 28th (0022 e.s.t.***** 28th)	2:35	0	48 persons disembarked at Toledo.
Departed	Toledo	0708 Z 28th (0208 c.s.t. 28th)	0	1:50	Ferry to Youngstown. Chesher in Command
Arrived	Youngstown	0800 Z 28th (0300 e.s.t. 28th)	0:50	0	Chesher slept in Airport Lounge.
Departed	Youngstown	1326 Z 28th (0826 e.s.t. 28th)	0	5:25	Chesher in Command approx. 45 persons aboard.
Arrived	New Haven	1615 Z 28th (1115 e.s.t. 28th)	2:50	0	Approx. 45 persons disembarked
Departed	New Haven	2125 Z 29th (1625 e.s.t. 29th)	0	29:0	Approx. 45 persons aboard. Chesher in command.

* Greenwich Civil Time
** Pacific Standard Time
*** Mountain Standard Time
**** Central Standard Time
***** Eastern Standard Time

	AIRPORT	TIME	FLT. T.	GD. T.	REMARKS
Arrived	Youngstown	2309 Z 29th (1809 e.s.t. 29th)	1:45	0	Approx. 45 persons disembarked
Departed	Youngstown	2355 Z 29th (1855 e.s.t. 29th)		0:45	Ferry to Toledo. Chesher in Command
Arrived	Toledo	0057 Z 30th (1957 e.s.t. 29th)	1:00	0	
Departed	Toledo	0301 Z 30th (2201 e.s.t. 29th)		3:00	Chesher in Command. 48 persons aboard. Aircraft crashed at 2202 e.s.t. during takeoff.

N 1244N was ferried from Youngstown, Ohio to Toledo, Ohio, Saturday evening, October 29, 1960. Following the arrival at Toledo at 1957 e.s.t., the aircraft was refueled. 150 gallons of 100-octane fuel were added to the left and right center tanks, and 327 gallons of 91-octane fuel were added to the left and right front auxiliary tanks to bring the total fuel aboard to 1,062 gallons. Nine gallons of oil were added, 2 gallons to the left engine and 7 gallons to the right engine.

Investigation disclosed that Captain Chesher had been briefed on the weather some time between 2030 and 2100 e.s.t. The weather observer gave existing weather, en route weather, and terminal weather for the planned flight to Kansas City. During this time the weather at Toledo Express Airport was partial obscuration, 1/16 of a mile visibility in fog, temperature 39, dew point 38.

The passengers and crew boarded the aircraft approximately 30 minutes before the actual takeoff. Because of poor visibility in fog, several

aircraft refuelers assisted the pilot in directing the aircraft to the taxiway leading to runway 070. Some passengers stated an engine or engines sputtered and cut out during the engine runup and pre-takeoff check just prior to takeoff. Other passengers stated the runup check was normal.

During the pre-takeoff check of the engines which took as much as 15 to 20 minutes according to some witnesses, the crew obtained an IFR clearance from the tower. The IFR clearance was via Victor airways to Kansas City by way of Joliet, Illinois. At approximately 2200 e.s.t., the aircraft was cleared for takeoff on runway 070.

The aircraft became airborne, veered to the left and crashed approximately 1,000 feet short of the end of runway 070 and 50 feet left of the 07-25 taxiway.

The aircraft's left wing struck the ground on a magnetic heading of approximately 035 degrees, and while in approximately a 30-degree left bank. The aircraft cartwheeled to the left, causing the fuselage to break at fuselage station 399. The rear section of fuselage continued forward and came to rest inverted on a heading of 045 degrees magnetic. The forward fuselage and wings came to rest right-side-up on a heading of 225 degrees magnetic. Impact forces caused the left engine to separate from the engine mounts.

Fire consumed the wreckage immediately after impact and destroyed the cockpit section, the right wing to just outboard of the No. 2 engine, and the fuselage from the cockpit back to fuselage station 295.

The landing gear was found in the full down position although the right gear was not fully locked down. The flaps were found in the full retracted position.

The left fuel tank selector was found positioned on the left center tank which contained 100-octane fuel. The right fuel tank selector was found positioned on the right front tank which contained 91-octane fuel.

The No. 1 propeller blades were found in the feathered position. However, the shim plates of both propellers indicated they were positioned at the low pitch step setting of 10 degrees at impact. One propeller blade from both Nos. 1 and 2 propellers had separated from the propeller.

No. 1 engine had separated from the engine mounts and suffered impact damage in the area of Nos. 12, 13, 14, 15, and 16 cylinders. There was no fire damage to No. 1 engine.

No. 2 engine had not been damaged by impact but had fire damage from the impeller section aft.

The left magneto of the No. 1 engine showed evidence of condensation. The rotor spring center electrode was missing from this magneto as was the center carbon brush. Examination of both engines disclosed no indications of pre-ignition, detonation or internal failure.

No. 1 engine was a Pratt & Whitney R-2800-79 engine. Although this is a certificated engine, it is not eligible for installation on C-46 type aircraft. The engine was overhauled by the U. S. Air Force in 1957 and its installation on N 1244N was in violation of CAM 42.30-1(f).

Of the 26 persons who survived the crash, many stated the left engine sounded and appeared to run rough during the engine runup. They stated the engines sounded normal during takeoff until they experienced a veering to the left followed by some fishtailing of the aircraft. Just before impact,

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several passengers stated the left engine was heard to sputter again as it did during the engine runup.

Witnesses located inside the terminal building and positioned in open doorways overlooking the runway stated the engines sounded as if they were sputtering, missing or cutting out during the takeoff. Some of these witnesses stated the engines sounded as if the throttles were retarded. This was followed by a short period of silence, and then an explosion.

A special weather observation taken one minute after the accident indicated the weather at Toledo Express Airport was partial 9/10th obscuration, zero visibility in fog, temperature 39, due point 38, wind east-northeast at 5 knots.

Investigation further disclosed that with the fuel load, 45 passengers and baggage, and a crew weight of 340 lbs., the aircraft weighed more than the maximum allowable gross weight of 47,100 lbs. for takeoff at Toledo Express Airport.

The investigation of this accident is continuing.

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CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY

PRELIMINARY SUMMARY REPORT OF AIRCRAFT ACCIDENT INVESTIGATION

EASTERN AIR LINES, INC., LOCKHEED ELECTRA L-188, N 5533,
LOGAN AIRPORT, BOSTON, MASSACHUSETTS, OCTOBER 4, 1960

On October 4, 1960, at 1740 e.d.t., an Eastern Air Lines Lockheed Electra crashed at Logan Airport, Boston, Massachusetts. Sixty-two of the 72 persons aboard received fatal injuries. The aircraft was totally destroyed.

N 5533 had arrived in Boston at 1533 as Flight 444 from New York City. The aircraft and its crew were scheduled for turn-around and were to depart as Flight 375 to Philadelphia, Pennsylvania; Charlotte, North Carolina; Greenville, South Carolina; terminating at Atlanta, Georgia.

Routine preparations for the flight, which included filing an IFR flight plan to Philadelphia via Victor Airways 3 and 147 at 10,000 feet, were completed by the crew.

No maintenance was necessary during the turn-around. The aircraft was serviced for the flight to a total of 24,900 pounds of fuel and the total gross weight at the ramp was calculated to be 97,987 pounds. This weight was properly distributed with respect to the center of gravity and was well below the maximum allowable for this aircraft.

Flight 375 departed the ramp at 1735. It was issued an IFR clearance in accordance with its flight plan with instructions to cross Natick intersection at 3,000 feet and to maintain runway heading for two minutes after takeoff. The flight taxied to runway 9 where takeoff was commenced at 1739.

Numerous groundwitnesses were interrogated as to their observations of the flight during its takeoff and crash. In addition, the surviving passengers described their recollections of events preceding the accident. It is very significant that there is extremely close agreement among all these statements. A probable flightpath and sequence of events has been developed from the statements of these witnesses. It appears that the taxi to runway 9 was normal. Takeoff was commenced and the aircraft lifted off the runway in a level attitude after a ground roll of about 2,500 feet and attained a height of 30 to 40 feet. It continued at this height still in nearly level flight for a horizontal distance of several hundred feet before rotating to a normal climb attitude. The airplane then climbed straight ahead for a short interval. While the airplane was in this initial climb several of the witnesses observed an unusual puff of gray smoke from engine No. 1. Others saw a ball of fire from engine No. 2. No witnesses saw both the indications of trouble from these engines. After reaching an altitude of 100 to 200 feet the aircraft made a flat left turn to a heading of about 60 degrees. While on this heading the aircraft maintained its nose-high attitude but appeared to settle approximately one-half of the height it had attained.

Two witnesses snapped photographs of the aircraft at this point in the flightpath. Assessment of the first negative indicates that at this time the aircraft was on a heading of 32 degrees magnetic, at an altitude of 121 feet m. s. l., and 6,400 feet from the camera. It also appears that the deck angle at the time was about 11 degrees from the horizontal and the aircraft was at an angle of bank of 8.5 degrees. The second photograph, taken about one second

later, was also assessed. This photograph showed the airplane to be at an altitude of 121 feet m. s. l., on a heading of 32 degrees magnetic as before; however, at this time the deck angle had increased to 16 degrees and the angle of bank to 12 degrees. The aircraft was then seen to execute a maneuver most closely described as a wing-over. During this maneuver the nose came up higher and the airplane climbed to an estimated altitude of 350 feet while the left wing dropped to near vertical. The nose then fell through rapidly and the aircraft descended, striking the water almost vertically and while rotating to the left. It appears that the aircraft was airborne less than 30 seconds and during the maneuvers turned more than 270 degrees to strike the water on a south-southwesterly heading.

The weather was good at the time and was not a factor in this accident.

Following the accident, investigators received a report that a number of bird carcasses had been found on the runway. It was estimated that about 75 bodies or pieces of bodies, identified as starlings, were scattered predominantly on the left side of runway 9 between the intersections of taxiway 33 and runway 33. The remains were strewn over an area roughly 400 feet long by 200 feet wide, the midpoint of which was about 3,700 feet from the approach end of runway 9. Several ornithologists as well as personnel from the U. S. Fish and Wildlife Service concurred in the opinion that the birds had been killed the evening of October 4.

Salvage operations to recover the aircraft were undertaken immediately by the U. S. Navy. All major portions of the aircraft and powerplants were

recovered and transported to a warehouse for examination. In addition, an extensive search was conducted to recover the bodies of all occupants. All except one were recovered and identified. Dragging operations are still continuing in an effort to locate the remaining victim.

Structures

A study of the wreckage indicates that the aircraft struck the water vertically but slightly left wing first and while still rotating to the left about its longitudinal axis. The Nos. 1 and 2 engines broke up and over the left wing and Nos. 3 and 4 broke down and under the right wing. All flight control surfaces were recovered. Impact marks made by the aileron counterweights on rear wing spar vertical stiffeners indicated the left aileron was in the neutral position at the time of left wing breakup. Corresponding marks made by the right aileron counterweights indicated that this aileron was displaced downward about one-third of its travel when the right wing struck the water. The elevator and rudder surfaces were undamaged prior to salvage and the position of each at impact was indeterminable.

Control cables, push-pull rods, and linkage from the surfaces to the boost packages showed no abnormal conditions. Damage noted in these areas was determined to be the result of impact forces. The landing gear was found in the fully retracted position. The wing flaps were found at the takeoff setting and were symmetrical. It was determined that there was no structural failure or malfunction prior to striking the water.

A dent approximately seven inches long, four inches wide, and one-half inch deep was found near the top of the airscoop on the No. 1 engine. It

appears that this dent was made prior to impact because a propeller blade cut mark, which was made on impact, passed directly across the mark but did not touch the bottom of the crater. There are no metal scratches in the dent which indicates it was made by some non-metallic object, perhaps a bird. However, the mark is too big to have been made by a starling but could possibly indicate a strike by a gull. All other damage noted was determined to have been the result of impact forces.

Powerplants

All four engines and propellers were recovered. The No. 1 propeller was fully feathered and that engine shut down. Engines Nos. 2, 3, and 4 were operating at impact and their propellers were found at blade angles of 39.9, 40.9, and 41.1 degrees, respectively. These blade angles represent the following shaft horsepower being developed at an airspeed of 80 knots: No. 2 - 3,500; No. 3 - 3,700; No. 4 - 3,800. At an airspeed of 120 knots the respective shaft horsepowers would be: No. 2 - 2,550; No. 3 - 2,850; No. 4 - 2,950.

When the powerplants were raised from the Bay during the salvage operation bird feathers were found in the oil coolers of engines Nos. 1 and 4. Upon teardown a number of samples of foreign matter were removed from the compressor section, bleed air valves, fuel nozzles diffuser section, burner cans, and turbine section of engine No. 1. This material consisted of metal, carbon, marine life, feathers, tissue, and fibers. Some of the feather fragments were identified as starling feathers. Samples of similar foreign material were also removed from engines Nos. 2 and 4. However, the amount

of foreign material in engines Nos. 2 and 4 was substantially less than that found in engine No. 1. None of this type of material was found in engine No. 3.

Mechanically, all four engines were found to be in good condition with the exception of impact damage. No. 1 showed no rotational damage to the compressor section or turbine section. Nos. 2, 3, and 4 all showed rotational damage to the compressors and turbines from impact. There was no evidence of over-temperature conditions in any of the engines and all appeared to have been capable of normal operation prior to impact. This differs from the first report. What was thought to be evidence of over-temperature was determined upon further examination to be rust caused by salt water immersion.

A small piece of the No. 4 burner can in the No. 1 engine was found lodged against the inlet guide vanes to the first stage of the turbine section. This piece had previously been repaired. No reason for the failure could be determined; however, the failure would not have had any immediate and apparent effect on the operation of the engine.

The No. 1 emergency shutoff (panic handle), which is located in the cockpit, had been pulled. Actuation of this handle shuts down the engine selected and feathers its propeller. In addition, it shuts off the fuel valve in the fuel control and the oil tank shutoff valve electrically. The Nos. 2, 3, and 4 panic handles had not been actuated.

There was no evidence of any malfunction or failure in any of the reduction gearing assemblies or propeller actuating mechanisms and all four appeared to be capable of normal operation prior to impact.

Systems

Most of the aircraft instruments and systems components were recovered. Readings of all instruments were taken immediately upon recovery and the instruments were then disassembled to determine extent of damage and reliability of the readings.

The turbine-inlet-temperature gauges indicated 400 degrees centigrade, 960 degrees centigrade, 950 degrees centigrade, and 978 degrees centigrade, respectively. The gauge indicating 400 degrees centigrade was for the No. 1 engine which was feathered. The other three temperature indications are in the normal takeoff region. The No. 1 torquemeter (horsepower indicator) reading was below zero horsepower - the synchro of its phase detector was found in a position to transmit a signal of -875 horsepower to the torquemeter. No. 2 torquemeter read 3,350 horsepower, its phase detector 3,315 horsepower; No. 3 torquemeter was 3,360 horsepower, phase detector 4,320 horsepower; No. 4 torquemeter 3,540 horsepower, phase detector 3,122 horsepower.

All instruments were subjected to ultraviolet-light examination to determine, if possible, whether any marks were made by instrument pointers during the impact sequence. The results of this examination were negative.

All four generators were recovered; however, the bell housing for No. 1 was missing and it was impossible to establish whether this generator was rotating at impact. Nos. 2, 3, and 4 showed circumferential scoring over arcs from 30 degrees to 60 degrees which indicates rotation and sudden stoppage. The emergency inverter, which only operates when all four generators

are off the line, was not rotating at impact. Single starling feathers were found in generators Nos. 1 and 4 and a single gull feather was found in No. 3. No feathers were found in No. 2. The only way these feathers could get into the generators is from the generator blast tube which carries cooling air from the oil cooler inlet area in each nacelle. It is not considered likely that these feathers could interrupt the normal operation of the generators.

The hydraulic boost packages appear to have been capable of normal operation prior to impact. The only damage noted to these units occurred at impact or during the salvage operation.

The emergency and tank fuel shutoff valves are cable-operated. These cables were jerked and pulled during the breakup, moving the valves to random positions. The four crossfeed valves were found in the closed position which is the normal operating position.

Human Factors

There were 33 passenger seats in the aircraft. All of these seats, except 19-C and 19-D and the lounge seats, were torn out of the aircraft. All were recovered and placed for detailed examination of the failures. Some of the seats left the aircraft forward and upward at an angle of about 20 degrees. Others evidenced predominantly side loading. Fourteen of the center seat-belt attachments failed and seven others partially failed.

Survivors had occupied seats 9-C, 11-C and 11-D, 19-D, and lounge seats B, D, and F. The seats occupied by the two remaining survivors could not be determined. Only the two stewardesses were able to recall how they evacuated the aircraft. One of the girls opened the emergency exit on the right of the lounge section and both girls departed through that door.

C I V I L A E R O N A U T I C S B O A R D

PRELIMINARY

AIRCRAFT ACCIDENT REPORT

Northwest Airlines Lockheed Electra, N 121US,
near Cannelton, Indiana, March 17, 1960

SYNOPSIS

At 1525 c.s.t., on March 17, 1960, a Lockheed Electra, model L-188C, N 121US, owned and operated by Northwest Airlines, Inc., crashed approximately six miles from Cannelton, Indiana, after failure of the right wing. All 63 persons on board were killed.

Flight 710 departed Chicago, Illinois at 1438 c.s.t., on an intended nonstop flight to Miami, Florida. The flight was to cruise at 18,000 feet. All reporting points were made on time and the flight was progressing according to plan; no messages were received which indicated that the crew of Flight 710 was experiencing any difficulties prior to the breakup.

Investigation

Northwest Airlines Flight 710 of March 17, 1960, a Lockheed Electra aircraft, N 1210S, was scheduled between Minneapolis, Minnesota, and Miami, Florida, with an intermediate stop at Midway Airport, Chicago, Illinois. The crew consisted of Captain Edgar E. LaParle, First Officer Joseph C. Mills, Flight Engineer Arnold W. Kowal, Stewardesses Constance Nutter and Barbara Schreiber, and Flight Attendant Mitchell D. Foster.

Prior to departure the crew was briefed by the company meteorologist on the present and expected weather conditions along the route. This briefing consisted of a general discussion of the synoptic situation, a review of the en route and terminal forecasts, together with all sequence and pilot reports. The meteorologist said that thunderstorms which were located in Florida were discussed as was the intensity of the jet stream over the southeastern states, the latter because it appeared to be growing in intensity. No mention was made, however, of any clear air turbulence being present along the route.

A flight plan was prepared which indicated a flight in accordance with instrument flight rules (IFR), via Victor Airways 2, 97, and 6, to Midway, a cruising altitude of 15,000 feet, a true airspeed of 340 knots, and an estimated time en route of 53 minutes.

The flight departed Minneapolis at 1251 1/ and arrived at Midway at 1355; the trip to Chicago was routine. It should be noted that some of the passengers said the landing at Chicago was very hard; others said that it was a normal landing in every respect.

During the short time the aircraft was on the ground at Chicago, approximately 30 minutes, it was refueled and prepared for continuation of the flight to Miami. While this was being done Captain LaParle went to the company operations office where he reviewed the latest weather information pertaining to the flight. There is no company meteorologist stationed in Chicago. As a matter of company policy this same weather information was later attached to the flight's clearance papers and given the crew prior to departure. These papers are kept in the cockpit throughout the flight.

1/ All times herein are central standard based on the 24-hour clock.

The flight plan, prepared by the crew and filed with company operations, indicated a flight from Midway Airport via Victor Airway 53 to Peotone, Illinois, Victor 171 to Scotland, Indiana, Victor 243 to Chattanooga, Tennessee, Victor 51W to Atlanta, Georgia, Victor 97 to Albany, Georgia, Victor 159W to Cross City, Florida, Victor 7 to Fort Myers, Florida, and Victor 35 to Miami, Florida; a cruising altitude of 18,000 feet, a true airspeed of 337 knots, and an estimated time en route of 3 hours and 37 minutes. The clearance given the flight by Air Route Traffic Control (ARTC) was, "NW 710 cleared to the Miami Airport, Peotone, Victor 171 to Scotland, flight planned route, maintain 18,000."

The flight departed Chicago at 1438 with 57 passengers including one infant. The gross weight of the aircraft at the time of takeoff was 107,661 pounds; this was within the maximum allowable gross takeoff weight limitation of 110,590 pounds, which limitation was imposed in order to comply with the maximum allowable gross landing weight at Miami. According to company records the center of gravity was within prescribed limits.

At 1445, the flight reported to the Indianapolis, Indiana, ARTC Center over Milford, Illinois, at 18,000 feet and estimating Scotland, Indiana, at 1512. At 1513, Flight 710 reported over Scotland maintaining 18,000 feet and estimating Bowling Green, Kentucky, at 1535. At this time the flight was advised by ARTC to contact the Memphis, Tennessee, ARTC Center on 124.6 mcs., at 1530. The 1513 contact was the last known radio communication with the flight.

At approximately 1640, reports were received by Northwest Airlines at Minneapolis that Flight 710 had crashed near Cannelton, Indiana. The time of the crash was established as approximately 1525.

A radar operator at the Indianapolis Air Surveillance Station reported that he monitored the flight by radar to within seven miles of Scotland, Indiana, and that the flight appeared to be normal.

Weather

Surface stations nearest to the route reported a broken to overcast cloud deck from the Chicago area to Terre Haute, Indiana, with an average base altitude of 1,500 feet above the ground. Above this cloud deck was a second cloud layer which was broken to overcast with its base at approximately 4,000 feet. This upper layer extended from Chicago to the scene of the accident and its tops were reported by pilots as being 7,000 to 7,500 feet near Chicago and

becoming 5,000 to 6,000 feet between Evansville, Indiana, and Louisville, Kentucky. Generally clear conditions prevailed above these cloud formations with inflight visibility unrestricted in central United States.

Considering upper wind reports available from ground based observations as well as pilot reports, the following data has been extracted relative to the magnitude of horizontal and vertical shears as well as wind shift across the troughline (along the Illinois-Indiana border).

1800 c. s. t. Data

Horizontal Shear at 16,000 feet = 39 kts./150 N. M.
at 18,000 feet = 52 kts./150 N. M.

Vertical Shear

Nashville, 16,000-18,000 feet = 10 kts./1,000 feet.

Dayton, 16,000-18,000 feet = 2.5 kts./1,000 feet.

Wind shift across trough

At 18,000 feet, 50 degrees between Peoria and Dayton
60 degrees between Peoria and Nashville

At 16,000 feet, 40 degrees between Peoria and Dayton
30 degrees between Peoria and Nashville

0600 c. s. t. Data

Horizontal Shear at 16,000 feet = 48 kts./150 N. M.
at 17,000 feet = 80 kts./150 N. M.

Vertical Shear

Nashville, 16,000-17,000 feet = 26 kts./1,000 feet

Dayton, 16,000-18,000 feet = 0
18,000-20,000 feet = 5.5 kts./1,000 feet

Wind shift across trough

At 18,000 feet, 60 degrees between Peoria and Dayton

At 16,000 feet, 50 degrees between Peoria and Dayton
40 degrees between Peoria and Nashville

Pilot Reports (resume of few of most significant)

1. 1310 c. s. t., 50 miles south Dayton, moderate to severe clear air turbulence 20,000 feet - 500 feet thick - F101.

2. 1400 c. s. t., Cincinnati, moderate to heavy turbulence 20,000 to 25,000 feet, T-33.

3. 1430 c. s. t., New Hope, Kentucky, choppy at 21,000, 10-15 degrees centigrade temperature drop at edge of jet stream. Descended and showed severe airspeed fluctuation and turbulence - Electra.

4. 1515 c. s. t., Columbus, Ohio, to York, Kentucky, moderate to severe turbulence 11,000 - 17,000 feet - aircraft type unknown.

5. 1500 c. s. t., Louisville to Cincinnati, moderate clear air turbulence 17,000 to 25,500 feet - B-57.

6. 1530 c. s. t., 50 miles north Louisville, decreased speed and descended from between 20,000 and 25,000 to 15,000 feet because of heavy to severe clear air turbulence - B-57.

7. 1640 c. s. t., Louisville to Nabb, Indiana, severe clear air turbulence 19,000 feet - DC-7.

8. 1830 c. s. t., Cincinnati, moderate to severe clear air turbulence 11,000 to 17,000 feet - Constellation.

The synoptic situation as reported on the surface weather chart for the midafternoon of March 17, 1960, was as follows: A low pressure area was centered over the northern portion of the lower peninsula of Michigan. This low pressure area extended to high levels (above 30,000 feet). A marked troughline at all altitudes extended southward from this low along the Illinois-Indiana border. A ridge of high pressure extended from the southern plains northeastward across Arkansas, western Tennessee, central Kentucky, and into southern Ohio.

The written forecasts published by both Northwest Airlines and the United States Weather Bureau and available to the crew of Flight 710 at Minneapolis and Chicago reflected the wind field as shown by the observed data. It is important to note, however, that neither of these sources of weather information mentioned the possibility of clear air turbulence along the route.

Witnesses

Approximately 75 groundwitnesses who were near the accident scene and a number of airmen who were flying in the area at the time were interviewed.

The laywitnesses were located within an area that included the most distant places from which the aircraft could be seen or the aerial explosion heard by a person having normal vision and hearing.

A composite description of what these witnesses saw and heard follows: The time was 1515. The weather was clear except for scattered cumulus clouds

with bases at about 4,000 feet; visibility was good. The aircraft was flying in an approximate north to south direction, in level flight, and at a high altitude. Suddenly two puffs of white smoke were seen. Seconds later these were followed by a large cloud of dark smoke. Two loud explosions were then heard and a large object was seen to emerge from the smoke cloud and fall nearly vertically, trailing smoke and flame. Smaller objects were later seen to fall. The fuselage continued in level flight for a few seconds and then fell to the ground describing a large trajectory arc as it did so. It struck the ground with such terrific force debris was thrown nearly 250 feet into the air.

Six USAF aircraft were on a refueling mission in the area at an altitude of 31,000 to 32,000 feet. Three of these aircraft were KC-135's and three were B-52's. Airmen manning these aircraft said that they first saw the smoke trail of this accident at 1532. The cloud was the shape of a child's top, dark in color as if produced by burning some product with a petroleum base. The bottom of this smoke disappeared into scattered clouds. A horizontal streamer of dark smoke which began a considerable distance north terminated at the smoke cloud.

The smoke cloud was first sighted when they were 26 nautical miles north-northwest of it. Their bearing of approximately 170 degrees nearly paralleled the course of Flight 710. They passed abeam of the smoke cloud at 1539, at which time they were about 12 nautical miles west of it.

During the seven-minute period, from first sighting the smoke to the abeam check, the smoke cloud and streamer retained its original form with little or no indication of dissipating or breaking up. The USAF airmen estimated the smoke cloud to be at an altitude of 25,000 feet.

Wreckage Distribution

The major portion of the aircraft struck the ground in a nearly vertical attitude in a field where the ground sloped to the south. The soil at the point of impact was soft and contained no rocks. Small trees near the point of impact were not struck by the aircraft. Impact forces formed a crater which measured 30 feet across its top from east to west and 40 feet from north to south; it was 12 feet deep. Most of that portion of the aircraft which struck the ground forming this crater disintegrated and was buried within it. Only a few fragments of wreckage were visible in the bottom of the crater. A shallow depression 2 feet

deep and 11 feet wide extended southward from the crater for a distance of 16 feet. Fragments of the left wing were visible in this depression. Portions of the vertical tail were imbedded in the west rim of the crater with the crumpled upper end of the rudder protruding from the ground. Pieces of horizontal tail structure were imbedded in the north rim of the crater. A smoldering fire burned below the surface of the crater bottom for several days until extinguished during excavation. The impact explosion hurled small pieces of wreckage in all directions from the crater, the greatest distance being approximately 1,500 feet to the east and southeast. The heaviest concentration of wreckage scattered by the impact explosion was in the southeast quadrant within a radius of 100 feet from the crater. The southwest quadrant contained a moderate to heavy concentration of pieces, and only a light scattering of pieces was found in the northwest and northeast quadrants. The geographical location of the crater was 37°54"38'N. Lat. and 86°38"W. Long., or approximately 6 miles due east of Cannelton.

The south end of the crater contained the No. 2 engine and propeller, parts of the left main gear, and wing structure, including flap pieces, aileron, and trim tab sections. The north end of the crater contained the fuselage structure, cockpit control system, electrical panel bits, various system components, nose gear pieces, elevator torque tubes and rudder post, bits of tail structure, servos, etc. Upon removal of the wreckage from the crater it was apparent that the fuselage with its tail, most of the left wing, and the No. 2 powerplant had contacted the ground in an almost vertical nosedown position. All structure removed from the crater was found to be severely fragmented from ground impact.

At the completion of the excavation the main crater measured 53 feet across the top from north to south, excluding the extension into the area where the left wing pieces and No. 2 engine and propeller were removed. The measurement across the top east to west was 44 feet. The excavation of the crater was continued to a depth of 31 feet until there was no further evidence of any structure remaining in either the sidewalls or bottom.

A preliminary survey of the accident area by helicopter disclosed that, in addition to severely fragmented wreckage at the crater, the main portion of the right wing, the outboard powerplants, and many small pieces of wreckage were widely scattered in a general direction north and noreast from the crater.

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Approximately 350 soldiers were used in a ground search of a 21-square mile area. The soldiers covered this area by walking in a line abreast. Investigating personnel followed the line of soldiers, marking, identifying, and plotting the location of each scattered piece of wreckage as it was found.

The parts which separated from the aircraft in flight consisted of the complete right wing with powerplants, the outer end of the left wing and aileron, the No. 1 QEC and nacelle, and the outboard portion of the left elevator.

The right wing was found on a bearing of 10°30"30' at a distance of 11,291 feet from the crater. The Nos. 1 and 4 power sections and their respective propellers with reduction gears were found as four separate pieces all within a radius of less than 2,000 feet of the right wing. Nearly all of the scattered parts of the right and left wings and the outboard nacelles were distributed along a path approximately one mile wide and nearly seven miles long. The magnetic heading of this scatter path was approximately 70 degrees or at nearly right angles to the flightpath, with the heavier of the scattered pieces found at the west end and the least dense at the east end.

The outlying components of the aircraft, the powerplants, and propellers were transported by Army helicopter to an area near the crater. From that location all of the salvaged aircraft structure was transported in sealed vans to the Lockheed Aircraft Corporation at Burbank, California, for further examination. The powerplants were similarly transported to the Allison factory at Indianapolis, Indiana.

Aircraft Structures

Study of the wreckage and wreckage distribution at the scene of the accident disclosed that the outboard powerplants and engine support structures, the complete right wing, and the outer portions of the left wing and aileron separated from the rest of the airplane in flight during such a short time interval that the sequence of these separations was not apparent. In addition, the main wreckage, the outboard engine support structures, the outer end of the left wing, and the portion of the right wing between the fuselage and the inboard nacelle, were so severely disintegrated that detailed study was necessary to identify numerous pieces of wreckage and to determine the nature of the failures.

To facilitate the necessary detailed study of the wreckage, various "reconstructions" of different parts of the structure were made in a restricted area

at the Lockheed factory. Primary interest centered on the outboard engine support structures and on the inboard portion of the right wing. As a result, these portions of the structure were mocked-up in three dimensions. Simpler "reconstructions" were used in connection with the rest of the wing, the horizontal tail, and the vertical tail. Flight control system parts and fuselage wreckage were examined without "reconstruction."

Numerous fractured pieces of wreckage were subjected to metallurgical examinations and analyses in the Lockheed Laboratories. These examinations disclosed no evidence of fatigue cracking, nonconforming material, overtorquing of nuts, or missing attachments. They did yield evidence as to the direction of loads producing failures.

Examination of the fuselage, the vertical tail, the landing gear, and the flight control systems disclosed no indication of malfunction or failure prior to impact with the ground, other than control system failures resulting from the right wing separation in flight.

The only indication of malfunction or failure in the horizontal tail, prior to impact with the ground, was that the portion of the left elevator outboard of the hinge of station 147.8 disintegrated and separated from the airplane. As indicated by the wreckage distribution, this occurred appreciably subsequent to the wing and outboard powerplant separations and very shortly before the main wreckage struck the ground. The separated pieces of elevator skin bore numerous wrinkles and small tears in the wrinkled areas as a result of repeated deformations of high magnitude consistent with both upward and downward twisting and bending of the elevator. This damage is typical of flutter in conventional sheet metal construction.

The left wing "reconstruction" disclosed that from an irregular fracture line, roughly centered at station 482, inboard to the fuselage the left wing structure, aileron, and flap remained attached to the fuselage until it struck the ground. The portions of the left wing and aileron outboard thereof fragmented and separated from the airplane in flight. Study of the fractures in the outer end of the wing box section disclosed that they resulted from excessive fluid pressures pushing the upper and lower covers and the front and rear spars away from the intermediate truss-type ribs. Similarly, outward-acting fluid pressure pushed the solid tip rib at wing station 584 off the ends of the spars. This

rib is the outboard bulkhead of the outboard fuel tank, which extends inboard to wing station 221, with no intermediate bulkheads or baffles other than the truss-type ribs at 17 to 18 inch spacings. Failure and separation of the outer end of the left aileron resulted from rearward bending as a consequence of the wing box section disintegrating.

Similar but lesser damage was found at the outer end of the right wing box section. There a large segment of the upper cover was forced upward off the truss-type ribs and separated from the wing in flight. In addition, the solid end rib at station 584 and the outer end of the front spar web were bulged outward and partially separated from each other. The damage to the outer ends of both the right and left wing box sections is consistent only with excessive pressures generated by fuel in the partially filled outboard tanks ramming into the outer end as a result of high rotational accelerations associated with failure of the right wing at the root. Overpressurization of the outboard tanks during refueling would have caused prior distress much farther inboard.

Study of the damage to the right wing between the fuselage and the inboard nacelle disclosed a fracture in the front spar at wing station 78 and one in the rear spar at wing station 101. These were the inboard ends of the spar sections which remained with the separated right wing. The upper and lower wing covers and ribs between the spars in this area were shattered and many pieces fell to the ground separately when the wing separation occurred. The hinged leading edge between the fuselage and the right inboard nacelle also fell to the ground separately in a number of pieces.

This hinged leading edge separated from the wing by the upper skin pulling off the rivet heads in a generally forward direction at the attachment to the terminal extrusion which connects to the upper cap of the front spar. After this failure the leading edge rotated downward to the limit of travel of the piano hinge which attaches to the lower cap of the front spar, and the rear lugs of the piano hinge fractured in bending. The end ribs of this hinged leading edge were damaged by interference with the ends of the adjoining fixed leading edge sections. Some of this damage was normal service wear from interference with the gap seal back-up angles. Superimposed on this were scratches and rib deformations resulting from abnormally large up-and-down movement of the hinged segment relative to the fixed segments and from abnormally large up-and-down spanwise bending deflections.

Prior to separation of the inboard hinged leading edge from the wing, as indicated by an abrupt discontinuity in the direction of the leading edge upper skin pulling off the heads of the rivets in the seam paralleling the upper spar cap, a section of the right wing front spar upper cap flange buckled upward, separating from the vertical leg of the spar cap with outward progression of the crack between stations 78 and 89. At and adjacent to station 78 the upper part of the front spar web buckled and took an "S"-shaped deformation after the above mentioned flange separation. At station 78 there was also a vertical fracture of the front spar web, which preceded a horizontal fracture extending outboard from station 78. The rear spar failed at station 101 in rearward bending. Tears of the spar cap flanges from the vertical legs of the spar caps progressed outward considerable distances from the spar fractures.

The upper and lower covers of the Electra wing consist of long 7178 and 7075 aluminum alloy extruded planks machined to form spanwise stiffeners integral with the skin. The low energy absorption and yielding of these materials prior to failure results in fractures singularly lacking in indications of the loads producing failure and of failure progression. However, the fact that irregularly saw-toothed diagonal fracture lines in the bottom cover of the right inboard wing extended from the front spar at station 83 to the aft edge of plank 4 at station 155, and from the aft edge of plank 5 at station 155 to the rear spar at station 95, indicates repeated reversals of loading during the breakup. Laboratory examinations of the fractures also disclosed some indications of both tension and compression due to alternate upward and downward loading of the wing, combined with corresponding reversals of shear due to torsion. Slight spanwise bowing of two large separated pieces of the lower cover in this area is consistent with permanent set due to long column buckling at a time when the ribs at stations 83, 101, and 119 were providing little or no lateral restraint.

The fractures of the right wing upper cover between the fuselage and the inboard nacelle had some characteristics of local compression buckling of the upper surface between stations 83 and 101 and some characteristics of the wing hinging about a chordwise line through the upper surface between stations 83 and 101 after the structural integrity of the front spar and lower surface was destroyed. Directly aft of the front spar, at and adjacent to station 83, the upper cover fractures occurred in conjuction with the spar cap flange separating from the vertical leg and buckling upward.

Reconstruction and study of the right wing ribs at stations 83, 101, 119, 137, 143, and 155 disclosed no uniform pattern of failure in the diagonals, partly due to the lack of sufficient evidence to make a positive determination of the exact manner in which most of the diagonals failed. However, there were a few positive instances of failure consistent with nosedown torsional loading. Several of the rib diagonal failures were quite similar in appearance to corresponding ones found in an American Airlines Electra after the main landing gear wheels struck a snow bank during takeoff. A portion of the lower cap of the rib at station 83 which remained attached to one piece of lower cover by Huck bolts at the plank 1-2 and 3-4 splices had all rivets sheared in a random pattern at five of the six "H" clips between the above-mentioned points. On this piece of rib cap there were abrasions due to rubbing of separated diagonals against the cap and of one rib tab on the mating "H" clip.

In this area of the wing most attachments of rib caps to diagonals and to the wing cover failed. Both the random pattern of the failures and the abrasions on mating parts are indicative of dynamic conditions with high and changing stresses in the wing covers during and after the rib failures. This random pattern of rib and rib attachment failures in the No. 3 tank area is entirely inconsistent with known failures produced by overpressurization of an Electra fuel tank.

Study of the damage to the left outboard engine support structure and nacelle disclosed that the lower right longeron fitting aft of the firewall failed in a clean tension break. After this the front end of the engine support moved upward and to the left with progression of damage until separation from the airplane occurred. Laboratory examinations of the Lord mounts which support the propeller reduction gear box disclosed evidence of repeated bottoming due to abnormal loading in various directions. Numerous curvilinear scratches, approximately partial ellipses, on the outer surface of the swirl straightener extension and severely scratched areas on the inner surface of the tail pipe bell mouth indicate repeated interference due to large cyclic motions of the engine relative to the wing prior to gross overall displacement of the engine support structure from its normal position. Initial failure of the right outboard engine support structure consisted of a tension separation of the upper left

longeron from the attach fitting at the firewall. The front end of the engine support then moved downward and to the right and rotated with the propeller with progression of damage until separation from the wing occurred. In the process of destruction the right lower longeron tore off the rear attach fitting with repeated interference between the longeron and fitting. The Lord mounts which support the propeller reduction gear box also were damaged due to abnormal loading in various directions.

Numerous fractured fittings and parts of the left and right outboard engine support and nacelle structures were subjected to laboratory examinations. These examinations disclosed no evidence of fatigue cracking, nonconforming material, overtorquing of nuts, or missing attachments. All efforts failed to disclose positive evidence identifying any of the noted damage to the outboard engine support and nacelle structures as having existed prior to the last flight.

All recovered wreckage was examined for evidence of fire having caused the disintegration in flight. Only one probable area of fire prior to the right wing separation was found. This was in the aft part of the right outboard nacelle and the portion of the flap aft thereof and was only of sufficient duration to melt thin aluminum alloy sheet prior to impact with the ground. It produced no weakening of the structure in the areas where the inflight separations of the right wing and outboard engine support structure occurred.

Powerplants

This accident was characterized by separation in the air of portions of Nos. 1 and 4 powerplants as well as the right wing. Major powerplant components were found along the wreckage path in the following order:

1. No. 4 propeller, reduction gear assembly, and torquemeter.
2. No. 1 propeller and major portion of the reduction gear assembly.
3. No. 4 power section
4. No. 3 powerplant in its entirety with the right wing.
5. No. 1 power section, torquemeter and a portion of the reduction gear assembly.
6. No. 2 powerplant in crater at the fuselage site.

All components lay at the location at which they first contacted the ground except for a minor displacement downslope of the No. 1 power section.

There was no fire damage on any of the powerplants. The blades of all propellers, except those of No. 2, were found in their entirety with or in the immediate vicinity of their respective hubs. The No. 2 propeller, along with the remainder of the powerplant, was dug from the fuselage crater site and only identifiable portions of all blades were recovered.

Powerplant control systems were damaged by separation and impact such that they revealed no reliable information with respect to power configuration at any time prior to impact.

Examination of the engines and propellers for operational failure included:

1. Oil systems for significant contamination.
2. Propeller reduction gear and accessory drive systems for gear and/or bearing failure.
3. Torquemeters for rotational interference.
4. Power section rotors for overtemperature, bearing distress, or rotor failures.
5. Safety couplings for typical operational decoupling markings.
6. Fuel pumps and fuel controls for significant contamination or evidence of malfunction or failure.
7. Propeller pitch-change mechanisms for significant contamination or evidence of malfunction or failure.
8. Propellers and engines for evidence of overspeeds.

This examination was negative with respect to evidence of operational failures. Examination of the Nos. 1 and 4 powerplants showed that the struts remained with the power section of both engines. The torquemeters remained with the No. 1 engine power section and with the No. 4 propeller reduction gear assembly. Separation of No. 1 engine occurred through the reduction gear case at approximately the main diaphragm split line. Stud failures that occurred at separation were necked down and bent in a pattern showing counterclockwise rotation of the forward part as separation occurred. The separation fractures of Nos. 1 and 4 engines did not show evidence of fatigue or post separation markings which indicated load reversals.

The inner surface of the air inlet housings and compressor cases of Nos. 1 and 4 engines were rubbed by the compressor blades. There were aluminum deposits

on the thermocouples and turbine nozzles of the same engines. The high speed pinion of No. 1 engine remained with the torquemeter assembly. Spiral marks were evident on the drive side of the pinion gear teeth. Separation of the rotating parts of No. 4 engine occurred at the forward end of the compressor extension shaft where it engages the torquemeter shaft. Spiral marks were made after disconnect showing the power section end was rotating faster than the torquemeter end. Ends of some of the splines of the extension shaft were upset rearward; also, light axial scrape marks from front to rear showed on some of the extension shaft splines.

Aircraft Systems

Damage to the aircraft was so extensive that no aircraft system, as such, remained intact. Systems components received light to extreme impact damage and in many cases fire damage was evident. The following are the salient facts disclosed by examination of the recovered components.

Many items of the hydraulic system were badly damaged by impact forces and in some cases fire had been present. Damage to valves and pumps precluded operational checks of such units. No operational damage was noted on any units. Hydraulic system items associated with the right main gear remained intact on the gear but were for the most part covered with a moderate coating of smoke deposit. The right fluid heat exchanger was recovered separately with only a small dent in the housing, and undamaged by fire. Both service center packages received moderate impact and fire damage.

Most of the recovered parts of the control surface boosters received severe impact damage. Based on the position of shutoff and bypass valves, the aileron and elevator boosters were in the "ON" position and the rudder was almost completely in the "Manual" position. However, all cables to the controls were broken and the inflight positions of these valves may have been altered at impact.

Loss of electrical or hydraulic power permits the autopilot engaging valve to move to the disengaged position. This was the position of the elevator and rudder valves; however, the solenoid core of the aileron valve was found trapped in the body in the "ON" position, the probable result of impact forces.

The four check valves of each hydraulic manifold were tested. All except three from the aileron manifold passed the test. These three permitted a very

slight internal leakage in the closed position and signs of operational distress were noted during their inspection.

The load control units and sensors were considerably damaged. The only operable parts were the pistons that actuate the sensors. The main spool control valves were distorted but were properly assembled.

One of the two retaining pins of the divider section of the rudder cylinder was missing. There was no indication of flaring on the remaining pin. The hole showed no sign of scoring nor was the barrel damaged in the immediate area of the hole. Nothing was observed during the examination to suggest booster malfunction prior to the accident.

Because of extensive damage examination of the electrical system yielded little information. There was indication of rotation of the No. 2 AC generator at the time of impact and no indication of rotation for those on engines No. 1, No. 3, and No. 4. Impact marks on the inverter indicate that it was not operating at the time of impact. There was no indication of electrical fire or overload on any of the units or wire bundles.

The radio equipment was completely demolished by impact; there were no indications of electrical overload or burning of any of these units. Examination of the badly damaged components of the various instruments and the autopilot yielded no useful information.

Impact damage prevented testing of fueling valves No. 1, No. 2, and No. 3. Fire damage to seals, switches, etc., prevented the testing of valve No. 4. Disassembly of these valves showed no signs of operational distress or abnormal wear. All four dump valves were in the closed position. The right dump check and swivel valve was relatively undamaged and closed. The left assembly received severe impact damage and was partially open.

The relief valves of the vent valves were bench checked. Although the valves from No. 1 and No. 3 tanks had been burned and were sticking on the first test, all four valves consistently opened at the specified pressure on repeated tests.

Only the right wing fuel shutoff valves were recovered. The No. 3 was approximately 25 percent open and the No. 4 was open. The No. 2 emergency shutoff was not identified among the recovered items. The No. 1 was one-half open, the No. 3 was approximately 5 percent open, and the No. 4 was closed.

All crossfeed valves were accounted for. The No. 1, No. 3, and No. 4 were closed. The No. 2 and the left-to-right wing valves were approximately one-third open.

The engine-driven compressor from the No. 3 engine was intact. It had been damaged by impact but was unburned. The compressor from the No. 2 engine was demolished by impact but was unburned. Examination of oxygen and air-start system items disclosed no significant information.

Inspection of the anti-icing system ducting disclosed no evidence of internal duct fire. The two fire extinguisher containers of the No. 2 nacelle were destroyed by impact. One of the discharge heads was recovered. It had not been fired. Both containers from the No. 3 nacelle were recovered intact and fully charged. One portable CO_2 cylinder, identified as being from the flight station, was damaged by impact. Its handle and discharge horn were missing but it still retained a charge.

Maintenance Records

Review of the maintenance records of N 121US disclosed only one item that appeared of possible significance to the accident investigation. This pertained to a refueling incident in which No. 3 fuel tank developed a leak at a nacelle wing fairing attachment crew location. The leak was attributed by Northwest Airlines personnel to rupture of the tank sealant by an excessively long screw. Although subsequent investigation disclosed that the tank had been overfilled, detailed study of the right wing wreckage, as previously mentioned, disclosed no structural damage or deformations due to over pressurization of the tank. A review of all other Northwest Airlines records pertinent to the airworthiness of this airplane disclosed northing of significance.

Original Certification of the L-188

To obtain a type certificate for a fixed-wing airplane, which has a weight in excess of 12,500 pounds, compliance must be shown with the provisions of Part 4b of the Civil Air Regulations. As a general rule the provisions of that Part which are in effect on the date of application for a type certificate are the regulations applicable to the type. In the case of the Lockheed Aircraft L-188 application for type certification was made on November 11, 1955, with the result that the applicable airworthiness regulations were contained in Part 4b effective December 31, 1953, and Amendment 4b-1 and 4b-2 of that Part.

In addition to the specific requirements contained in Part 4b, Section 4b.10 of that Part states that an airplane shall be eligible for type certification if it complies with the airworthiness provisions established by the Part or if the Administrator finds that the provisions not complied with are compensated for by other factors which provide an equivalent level of safety This section also requires the Administrator to make a finding that no feature or characteristic of the airplane would render it unsafe for the transport category.

Since the turbine-powered airplanes, at the time of this application, were still in the design stages, the Civil Air Regulations did not encompass airworthiness requirements specifically applicable to the unique design of these airplanes. Accordingly, the Civil Aeronautics Administration developed a set of special conditions to be applicable to this airplane type. The special conditions were developed through the activities of a Turbine-Powered Transport Evaluation Team composed of employees of the Civil Aeronautics Administration. During the certification process numerous amendments were made to Part 4b of the Civil Air Regulations which included many of the applicable special conditions to the L-188. On July 23, 1957, the Civil Aeronautics Board adopted Special Civil Air Regulation Number SR-422 which became effective on August 27, 1957. This special regulation contained a revised set of performance requirements for turbine-powered airplanes and made applicable the provisions of Part 4 of the Civil Air Regulations effective on the date of application for type certification together with such provisions of all subsequent amendments to Part 4b, in effect prior to August 27, 1957, as the Administrator of Civil Aeronautics finds necessary to ensure that the level of safety of such airplanes is equivalent to that generally intended by Part 4b.

In view of Special Civil Air Regulation Number SR-422, the Civil Aeronautics Administration amended the set of special conditions applicable to the Lockheed L-188 to incorporate those provisions of Part 4b in Amendments 4b-3, 4b-4, and 4b-6 which were comparable to those specific special condition previously established by the Administrator, as well as the performance requirements contained in SR-422. Those special conditions which were not incorporated in the aforementioned amendments were retained.

In order to monitor and approve the type certification of aircraft the Civil Aeronautics Administration established Regional Offices throughout the United States. In the case of the Lockheed L-188, Region IV was responsible for determining that the airplane type complied with the Civil Air Regulations and the applicable special conditions. For many years the Civil Aeronautics Administration has utilized a designee system to assure compliance with the Civil Air Regulations. The establishment of this system was due to the limited number of personnel available in the CAA's field offices. Under this system designated employees of the applicant are delegated to approve certain data, drawings, etc. The approval of the basic data and method of analysis was retained by the Civil Aeronautics Administration, but the actual analysis of the data was approved by the designees and reviewed by the Administrator. The only area of the certification process where designees are used quite sparingly is in the flight test area. In almost all cases the flight tests were conducted by Civil Aeronautics Administration employees.

On August 22, 1958, the Civil Aeronautics Administration issued type certificate No. 4A22 approving the Lockheed L-188A-08 and L-188C type airplanes.

Major Structural Difficulties Encountered after Certification

Subsequent to the delivery of the first few airplanes, Lockheed Aircraft conducted a flight test to determine the characteristics of a mechanical disconnect for the flight control boost system at the design dive speed of 405 knots. This flight test was conducted on October 31, 1959, and consisted of diving the airplane from cruise altitude with various boosters disconnected. On the second dive, with the speed maintained at or slightly below the speed for limit Mach number, turbulence was encountered; the speed was dropped off 6 to 8 knots. After passing through the turbulence a fuel leak was observed from under the right wing. Ground inspection disclosed that the main damage was halfway between Nos. 3 and 4 engines. This consisted of some rivets with missing heads from which fuel was leaking; in addition, there was a shallow buckle near the rear beam just inboard of the No. 4 nacelle. The nature of the wing damage and subsequent inflight measurements indicated that the failure was due to high wing torsions.

As a result of this difficulty, the airplanes already delivered were speed restricted until a fix could be designed and installed. The resulting fix consisted of reinforcing the wing between the inboard and outboard nacelles.

During the original certification of the Electra the airplane was equipped with Allison engines and Aeroproducts propellers. Certification included a vibratory stress survey of the propellers. It was determined, based on past experience, that the inboard propellers were the more critical and only the inboard propellers were instrumented. Later a Hamilton Standard propeller was installed on the airplane and a new certification was sought. At this time it was decided to conduct the vibratory stress survey on one outboard and one inboard propeller. As a result of this test it was found that the outboard propellers were more highly stressed than the inboard propellers and that these stresses exceeded acceptable levels. This condition was caused by a higher than anticipated inflow angle due to a downward torsional bending of the wing with increasing speed. Outboard propeller blade stresses were reduced satisfactorily by reworking the nacelles to provide a 3° uptilt of the propeller plane. Inboard nacelles were similarly modified to reduce cabin noises and vibrations.

Difficulty was encountered on the Electra airplanes with impact stresses during landing which caused cracks in the milled wing skin both outboard and inboard of the inboard nacelles and loosening of the fasteners attaching the upper and lower wing panels to the main landing gear ribs. As a result, Lockheed issued Service Bulletins 306 and 337 which required the installation of a doubler outboard and inboard of each inboard nacelle on the upper wing surface respectively.

In addition, difficulty has resulted from overpressurization of the fuel system. In one case where foreign material was in the fuel manifold system the fuel inlet valve was held in the open position after the tank was filled. Consequently, structural deformation of the wing resulted and an inspection of all fuel manifolds was conducted. Lockheed believes that if the correct procedures are followed during the refueling operation such failures will not occur.

Reevaluation Program

On March 20, 1960, the FAA issued, as a temporary measure, an emergency airworthiness regulation which reduced the Electra V_{no} from 324 knots CAS to 275 knots or 0.55 Mach. Following a meeting on March 22 with representatives of Lockheed, Allision (GMC), Electra operators, NASA, and CAB, the FAA took the following additional action:

1. Because this and a previous Electra accident were believed to have occurred at or near a cruising speed of 275 knots CAS,

it was considered necessary to make a further speed reduction to provide an adequate safety margin. Consequently, a second emergency airworthiness regulation was issued on March 25, 1960, limiting V_{no} to 225 knots CAS or 0.55 Mach and establishing a V_{ne} of 245 knots CAS or 0.55 Mach. Also included in this second regulation were requirements calling for immediate propeller feathering if the torquemeter indicator registered zero or full scale; deactivation of the autopilot until appropriate modifications could be designed and installed; adherence to Lockheed prescribed procedures in refueling operations.

2. Under emergency authority specified in Sections 40.21, 41.1, and 42.5 of the Civil Air Regulations, the FAA, in an amendment to the Operations Specifications, ordered a one-time inspection on all Electras within 30 days of the order date, March 25, 1960. The inspection included, in addition to the severe turbulence inspection specified in the Lockheed Structural Repair Manual, an internal examination of the entire wing with emphasis on wing ribs for damaged attachment tabs, buckled rib braces, loose or sheared rivets, and damaged or cracked clips. Additionally, a thorough inspection of the elevators, elevator tabs, and related attachments was also required during the same 30-day period. The amended Operations Specifications further called for daily inspections of powerplant magnetic sump plugs; inspection of fuel tanks involved in a reported tank overpressurization; structural inspections following any reported incidents of flight through severe turbulence, hard landings, or overweight landings.

3. On March 25, 1960, the FAA notified the Chiefs, Flight Standards Divsions that observance and surveillance of L-188 aircraft en route operation and training was to be increased for a period of 30 days. The telegram specified that inspections should be concentrated in the areas of flight planning, preflight, placard speeds, operating techniques, inadvertent entry into turbulence, abnormal equipment operation, post flight activities, and flight training.

On March 25, 1960, following several meetings in which the Electra problem was discussed, the Administrator requested the Lockheed Aircraft Corporation to conduct an engineering reevaluation of the Electra. The objective of this program was to reveal any design or operational characteristics of the airplane causing structural effects more critical than those provided for and possibly influencing disintegration in flight. Briefly, the program encompassed flight tests, structures investigations, aerodynamics investigations, design studies and special investigations, and tests. Extensive assistance was provided by the NASA, Boeing, Douglas, and other organizations in carrying out this program. A like program, appropriate to the equipment, was also carried out with respect to the engines and propellers.

Included in the flight test program were expanded measurements of wing and nacelle loads and stresses during smooth and abrupt maneuvers, measurement of the dynamic response of the wing and nacelles during gusts, extension of flight flutter response tests, expanded measurements of internal loads and stress distribution in the wing and nacelles, and reanalysis of inflight loads measurements made prior to the accident.

Numerous stiffness and rigidity tests were made on Electra serial No. 1077 for use in flight dynamics analysis. Primary attention was directed to component rigidities from the outboard propeller plane through the engine, nacelle, and wing to the fuselage centerline. The effects of simulated failures at various points in the outboard engine/nacelle installation were measured, but not at any point in the wing structure itself.

In reevaluation of the airplane control system and autopilot characteristics, special attention was directed to the influence of possible malfunctions, failures, and induced effects on the sudden buildup of destructive control forces. The investigation included both analytical methods and the use of an elevator system functional mockup. A rigorous series of tests was conducted on the mockup to induce oscillatory or other performance failures under extreme simulated failures and malfunctions in the system. Nothing was found that might have produced a hazardous situation under the flight conditions of the subject aircraft.

A comprehensive review was made of all strength analysis procedures covering methods of determining internal loads, allowable strengths, and margins

of safety. In addition, to review of the original analysis, refined procedures were applied to the wing, wing rib, and wing beam analyses. In addition, the effects of damaged ribs on other rib loads and on the rigidity and strength of the wing was computed. Since the QEC structure had previously been static-tested to ultimate strength, attention was focused on changes in the design loads imposed.

Reinvestigation of the structural loads was performed in regard to the following: wing loads in maneuvers, wing loads due to gusts, landing loads, and loads produced by autopilot malfunctions. Loads and stresses determined in the above-mentioned flight tests were used extensively in this program.

Reaudit of the flutter characteristics was divided into two areas of analysis and test. Analytical solutions were obtained by two independent processes of analog and digital. In the latter, 59 degrees of freedom were used. Wind tunnel tests were conducted on three different models. The first consisted of a nacelle-propeller model in the Lockheed 8-by-12-foot tunnel in which stiffness in pitch and yaw was varied over broad ranges. The second was an eighth scale half-span dynamic model of the wing with nacelles and propellers. This was tested in the Lockheed tunnel with varying engine-propeller stiffness and variations in wing fuel quantity. The third, an eighth scale model of the complete airplane, was tested in the NASA 19-foot Langley tunnel. More complete variations of engine-propeller stiffness and damping and wing fuel distributions were covered. In addition, the effects of propeller overspeeding were investigated.

The reevaluation program disclosed two discrepancies in the design of the airplane. One of these was that significant loads imposed on the wing intermediate ribs between the fuselage and outboard nacelles by shell distortion had not been included in the design loads. The other was that the dynamic response of the outboard nacelles in turbulence was different from that used in the original design, with the result that the torsional loading of the wing inboard thereof was increased. In addition, the reevaluation program disclosed that with the stiffness of a powerplant-nacelle installation reduced below normal propeller oscillations could become destructive at the operating speed of N 121US at the time of the accident.

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CIVIL AERONAUTICS BOARD

File No. 1-0002

AIRCRAFT ACCIDENT REPORT

ADOPTED: July 26, 1960 **RELEASED:** July 29, 1960

NATIONAL AIRLINES INC., DOUGLAS DC-6B,
N 8225H, NEAR BOLIVIA, NORTH CAROLINA, JANUARY 6, 1960

SYNOPSIS

At approximately 0238 e. s. t., January 6, 1960, a National Airlines DC-6B crashed in a field approximately 1-1/2 miles northwest of Bolivia, North Carolina. All 29 passengers and the crew of five were killed.

Flight 2511 of January 5, 1960, departed New York International (Idlewild) Airport at 2334 on an IFR clearance scheduled as a nonstop flight to Miami, Florida. The flight proceeded routinely in accordance with its flight plan until shortly after passing Wilmington, North Carolina.

At 0231 Flight 2511 contacted the company radio station at Wilmington while over Carolina Beach at 18,000 feet, and transmitted a routine progress report. Shortly after the completion of this radio contact a dynamite explosion occurred in the passenger cabin. Following this explosion the aircraft entered a wide descending right turn and crashed 1-1/2 miles northwest of Bolivia at 0238 some 16 miles west of its intended flight path.

No reference is made in this report concerning the placing of the dynamite aboard the aircraft or of the person or persons responsible for its detonation. The malicious distruction of an aircraft is a Federal crime. After the Board's determination that such was involved, the criminal aspects of this accident were referred to the Department of Justice through its Federal Bureau of Investigation.

INVESTIGATION

The Flight

Flight 2511 of January 5, 1960, was one of two aircraft used as replacements for Flight 601, which was scheduled as a nonstop Boeing 707 jet flight to depart Idlewild at 2115, 1/ utilizing Pan American Aircraft N 710PA under a lease agreement.

Owing to the late arrival of N 710PA from Miami, the flight was rescheduled to depart at 2215. During the turnaround inspection on N 710PA it was discovered that the copilot's No. 3 aft window was cracked and would require replacement. Since it was estimated that the replacement time would be about eight hours a National Lockheed Electra, N 5003K, and a National Douglas DC-6B, N 8225H, were substituted.

1/ All times herein are eastern standard based on the 24-hour clock.

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Passengers originally ticketed on Flight 601 were enplaned on a first-come, first-served basis on the Electra and then the DC-6B. Seventy-six passengers boarded the Electra, which departed New York International Airport at 2334. The remaining 29 passengers boarded the DC-6B which left the terminal at 2334. The flight plan filed by Captain Southard requested routing as follows: Radar vectoring to Coyle VOR, V-1 airway to Wilmington, North Carolina, control 1150 to West Palm Beach, Florida, and V-3 airway to Miami, Florida, requesting an altitude of 18,000 feet.

Following receipt of taxi clearance, flight 2511 taxied to runway 31 left. Flight 2511 then received the following clearance from Idlewild clearance delivery on 121.6 mcs., "National twenty-five eleven ATC clears you to the Wolf intersection via Idlewild radio beacon, Idlewild VOR one three zero radial, Victor sixteen, cross Wolf at, and maintain three thousand, cross Idlewild radio beacon at two thousand." The clearance was read back by Flight 2511 and acknowledged. The flight then contacted Idlewild tower on 119.1 mcs., and was cleared for takeoff. After takeoff Flight 2511 contacted departure control and was radar vectored to Victor 16 airway and then contacted New York Center on 124.1 mcs., which radar vectored the flight to a position six miles east of Point Pleasant and cleared it to navigate direct to Coyle VOR. During the departure the flight was given successively higher altitudes and reported over Coyle at 16,000 feet. New York Center then cleared the flight to 18,000 feet, which was the requested flight plan altitude.

Flight 2511 proceeded in a routine manner in accordance with its flight plan and clearance, and reported to Washington Center over the Wilmington (North Carolina) VOR at 0227, 18,000 feet, estimating Azalea intersection at 0302 and Gateway intersection as the next reporting point.

During the flight from Idlewild in addition to the communication contacts with FAA centers, Flight 2511 maintained contact with National Airlines company radio stations located at Idlewild, Washington, and Wilmington. It is the practice of the company to have its pilots make their position reports to ARTC.

At 0213 Flight 2511 established contact with the company radio at Wilmington on 128.7 mcs. At this time the flight reported it was over Kinston at 0210, 18,000 feet, and estimated Wilmington at 0230, with Azalea as the next checkpoint. At this time the Wilmington operator informed the flight that the Wilmington altimeter setting was 30.17.

At 0231 Flight 2511 reported to company radio at Wilmington as over Wilmington at 0227, at 18,000 feet, estimating Azalea at 0302, with Gateway as the next checkpoint. The flight reported that at the time of this radio contact they were over the Carolina Beach radio beacon (an "H" facility which is located 16 nautical miles from the Wilmington VOR on a heading of 200 degrees), that the flight had been on instruments to Cofield (VOR), then in and out of the clouds, and was now on top for the first time. The company radio operator logged the time of the termination of this message as 0231. This was the last contact with Flight 2511.

At apporximately 0700 a telephone call was received by the National Airlines radio operator from a Richard Randolph of Bolivia, North Carolina, advising that there was airplane wreckage in the field near his house 1-1/2 miles northwest of Bolivia. This wreckage was later identified as that of N 8225H.

Structures

Initial examination of the main wreckage scene showed that the major portion of the aircraft was scattered over a large area in the vicinity of Bolivia, North Carolina. In addition, reports were received of wreckage being located at Kure Beach approximately 16 miles east of the Bolivia site.

It was apparent from the initial examination at the scene that a sizable portion of the fuselage was missing and as a result of this initial examination it was evident that a three-dimensional reconstruction of the fuselage and center wing wreckage was necessary to fully explore the aircraft disintegration pattern. The wreckage therefore was removed to a hangar at the Wilmington Airport where a chicken wire and wood framework was constructed, and which corresponded to the contour and size of a DC-6B fuselage.

All of the wreckage found at Kure Beach was found to be from the fuselage or from structure attached to the fuselage. There were two relatively large sections of the fuselage sidewall structure from the right side just aft of the lavatory, and two sections of interior hatrack structure from the same area. Also found at the Kure Beach area was a section of the wing fillet structure which attaches to the fuselage directly below the hydraulic compartment area, a section of the right sidewall of the hydraulic compartment, 3 of the 4 cabin oxygen bottles and one triple seat unit. Other pieces found at Kure Beach included pieces of fuselage frames, portions of plexiglass from cabin windows, pillows, seat cushions, window curtains, the right ice light, a life jacket, pieces of the right lavatory door and aft partition.

Examination of the aircraft structure and the wreckage distribution indicated that an inflight disintegration of the aircraft had occurred, which initiated at a point in the fuselage near the leading edge of the right wing on the right side of the passenger cabin. The portions of wreckage recovered in the Kure Beach area were all from this general location.

After the fuselage wreckage was positioned on the mockup, it was found that approximately 90 percent of the fuselage plating or skin had been recovered and identified. Most of the missing pieces of the fuselage apparently came from an irregular-edged, triangular-shaped area above and extending forward from the leading edge of the wing on the right side of the fuselage. Numerous small fragments of upper fuselage shell structure from this triangular area, totaling about 20 square feet of surface were found, and identified, but their small size prevented their being positively located within this area.

A portion of fuselage between stations 238 and 260 was found to contain some 13 propeller cuts. All of these cuts were staggered and were positioned progressively forward as they progressed upward. The lowest cut, which was at station 25 between stringers 17 and 18, distinctly showed marks indicative of high-speed feathering of the metal, and it was evident that subsequent to the initial fuselage failure this portion was forced out and into the No. 3 propeller plane.

The fuselage flooring was relatively intact except for a missing area extending approximately 50 inches inboard from the right side of the fuselage and extending forward from station 410 about 14 inches. This missing area of flooring comprised the flooring between seat rows No. 6 and No. 7. The edges of the flooring adjacent

to the missing area were irregular and extensively deformed. Five adjacent pieces of flooring from this area were recovered from the main wreckage area. All of the floor carpeting between the seat tracks was recovered except for a portion corresponding to the missing flooring on the right side forward of the front spar.

The carpeting immediately forward and aft of the missing area was cut and torn in numerous places and upon X-ray examination was found to contain numerous foreign objects which included pieces of .025 inch wire, rivets, and rubber-backed nylon material similar to that used in the manufacture of an airline type flight bag. Manganese dioxide deposits were also found on this carpeting.

Eight heavy electrical cables are contained in three conduits which connect the right wing junction box in the hydraulic compartment to the main junction box in the cockpit and which run through the area of the missing portion of the fuselage and adjacent to the missing portion of the floor. These cables were severely damaged and had numerous separations and cuts, and the conduits were found to be separated in numerous places.

All of the interior furnishings aft of the lavatory area of the fuselage were examined for foreign deposits or debris or for evidence of any unusual conditions. Particular emphasis was placed on the area just forward of the wing since this appeared to be the focal point of the fuselage disintegration. Numerous tiny pieces of wire approximately .025 inch in diameter and necked down at each end were found scattered throughout this area. Deposits of sodium carbonate, sodium nitrate, and complex mixtures of sodium-sulfur compounds were found in the air vent in the hatrack section from the right side of the cabin in the area of the focal force of the initi disintegration.

One of the triple seats which was installed in the right side of the passenger cabin, and which was recovered at the main crash site exhibited damage which was somewhat different from that found on most of the other seats. This seat was severely damaged and had numerous bends, failures, and buckling of its structure. Also evident were areas of both heavy and light pitting of the structure and there were numerous small indentations and some large ones. One of the seat belts was missing and portions of the upholstery material were missing with the material adjacent to the missing portions showing a shredded appearance. Some of the seat webbing material was torn and cut; however, most was missing. The bottom of this seat assembly was splattered with a black substance which was identified as manganese dioxide.

Many articles and portions of the fuselage or interior furnishings from this area were collected and submitted for laboratory examination for evidence of explosive residues or foreign object damage, and numerous particles of wood, wire, metal particles, and other objects found to have penetrated various of the interior furnishings in the cabin in the area surrounding the initial airframe failure were subjected to laboratory examination.

Extensive damage was initially observed in the wing center section and fuselage hydraulic compartment area; however, the reconstruction of this area showed no failure or malfunction which could be considered as a causal factor of this accident.

Two pieces of the hydraulic compartment center wing structure were recovered

from Kure Beach. Except for these two pieces all the rest of the structure recovered from this compartment was located at the main crash site. There was no evidence of fire or vapor explosion, and no arcing of electrical wiring in the hydraulic compartment area.

All flight logs for a six-month period prior to the accident were reviewed. Items affecting airworthiness were cross-checked against the inspection supplements to determine corrective action.

All inspection supplements for the six-month period were studied for airworthiness items such as cracks, corrosion, rigging, fuel leaks, seeps and/or stains. Malfunctions of the hydraulic system, flight surfaces, cabin heater system, air conditioning, and pressurization system over the previous six months were also reviewed.

All Airworthiness Directives, Engineering Orders, and Manufacturer's Service Bulletins applicable to N 8225H were reviewed for compliance and were found to be current. All engine records and the last overhaul records were reviewed. The propeller records were researched back to the date the propellers were received by National Airlines.

The comprehensive study of the maintenance records and maintenance history of N 8225H, its engines, and propellers revealed no data that could be related to any tructural weakness or deterioration.

Powerplants

The Pratt and Whitney R-2800-CB16 engines installed on N 8225H sustained severe impact damage and were recovered on the outer perimeter of the wreckage area. They were widely separated from the area which contained the forward and aft fuselage sections.

Nos. 1 and 2 engine assemblies remained attached to the left wing until ground impact, at which time they broke off. They were recovered, severely impact damaged, from water-filled craters approximately 1,900 feet from the forward and aft sections of the fuselage and in the opposite direction from the locations of powerplants Nos. 3 and 4.

The Nos. 1 and 2 powerplant assemblies showed no evidence of fire in flight or of burning after impact. The accessory section and the nacelle structure of No. 2 engine did, however, show light soot deposits.

The Nos. 3 and 4 powerplant assemblies were located approximately 2,150 and 2,025 feet, respectively, from the area containing the forward and aft fuselage sections. These two powerplant assemblies had separated from the right wing with their nacelle structures still attached to the engine and mount assemblies.

No. 3 engine was recovered in a nosedown and inverted position in a crater approximately four feet deep. Severe fire damage was found to the rear section of this engine. The lower inboard and outboard sections of the antidrag cowling were detached at impact and were found approximately 25 feet from the engine. Both these cowl sections were found to be moderately sooted on their inside surfaces. The nacelle

structure was severely crushed at impact. The firewall was ruptured at two places in the lower inboard area as a result of impact. The ground fire had entered zone 3 through these openings and burned part of the propeller control relay junction box. No other zone 3 components were fire damaged. The firewall contained no evidence of fire burning through the structure itself.

The outboard sections of the accessory cowlings remained on the engine and were severely fire damaged. The inboard accessory cowlings were detached at impact. They were excessively oil coated on the inner surfaces but showed no evidence of fire damage.

The No. 4 powerplant was located approximately 600 feet southwest of the No. 3 engine. This powerplant was buried approximately six feet in a water-filled crater and was found in a nosedown and inverted position. This powerplant had separated with its nacelle structure attached to the engine mount. There was no evidence of fire either prior to or after ground impact.

All of the powerplant and propeller assemblies evidenced severe ground impact damage. Upon disassembly and inspection, however, no evidence was found of internal failure, operating distress, or other malfunction. All of the main bearings, master rod bearings, and other bearings were found to be in place and adequately lubricated. Examination of the main screens and sump plugs failed to reveal any evidence of any foreign material or contamination.

All of the propeller assemblies remained in place with their respective engines. All blades exhibited impact damage in varying degrees and two blades of the No. 3 propeller assembly evidenced paint smears on their face side as a result of contact with fuselage structure.

The four propeller assemblies all evidenced severe ground impact damage. Examination of the dome assemblies, pitch changing mechanisms, stop levers, barrel halves, and spider assemblies failed to show any evidence of any malfunctions or pre-impact failures. Examination of the slip ring assemblies, thrust bearings, and washers, and remaining components of the propeller assemblies showed no indication of inservice difficulty.

The blade shims and shim plates of the four propeller assemblies showed that the respective blade angles at ground impact were: 30 degrees, 30 degrees, 45 degrees, and 34 degrees. The No. 4 propeller assembly showed light impact markings on the shim plates at 50 degrees and also had heavy indentations at approximately 34 degrees.

The No. 1 propeller governor was broken from its pad at impact and was not recovered intact. The No. 2 propeller governor was examined and the speeder rack spring measurement was equivalent to 2240 engine r. p. m. The No. 3 propeller governor speeder rack spring position also indicated 2240 engine r. p. m. The speeder rack spring in the No. 4 propeller governor was intact in its housing and measurement of the rack spring position indicated 2240 engine r. p. m. also.

Fuel System

The fuel tank compartments in the wings were damaged to various degrees at impact. The fuel tanks in the entire left wing area between the front and center spars were severely broken apart at impact. The fuel tank compartments in the right inner wing were also severely damaged. The fuel tanks in the wing outboard of the No. 4 engine

and the tanks aft of the center spars were severely broken apart at impact. The fuel tank compartments in the right inner wing were also severely damaged. The fuel tanks in the wing outboard of the No. 4 engine and the tanks aft of the center spar in the left wing were, however, relatively intact.

Examination of the fuel tank areas showed no fire damage prior to or after ground impact. The fuel tank structure showed no evidence of fuel leakage except that there was evidence of a heavy fuel seep at the No. 4 dump valve manifold fitting at the center spar adjacent to the No. 4 nacelle. Examination of the fuel drain valves, fuel selectors, and crossfeed valves showed no leakage or other malfunction except for impact damage.

Weather

At the time of the accident, there was a low pressure area centered in the Gulf of Mexico, with a quasi-stationary front extending eastward from this low across the Florida Peninsula just north of Melbourne and into the Atlantic. A ridge of high pressure existed on the north side of this front extending from the Virginia Capes westward through the Ohio Valley to the central Plains.

Associated with the frontal structure described above, precipitation was falling throughout Virginia, the Carolinas, and Georgia. This precipitation was mostly in the form of rain except for snow in northern and western Virginia and western North Carolina.

The freezing level in the vicinity of the crash was between 10,000 and 12,000 feet, with multiple layersof clouds extending from below 1,000 feet to approximately 18,000 feet. Rain and fog existed at the accident site. Some difficulty with engine icing was reported by aircraft flying in clouds and precipitation several thousand feet below the cruising level of National Flight 2511 (18,000 feet). No difficulties because of icing would have been encountered at 18,000 feet over eastern North Carolina nor were any reported.

In view of the relatively stable upper air conditions over the area, no significant turbulence would have existed at 18,000 feet nor was any reported.

Strong west-southwesterly winds were present over the accident site. At 18,000 feet, the velocity would have been slightly in excess of 100 knots with high velocities (85 knots plus) reported at all altitudes between 18,000 and 12,000 feet. A sizeable reduction in velocity occurred in the level between 12,000 and 10,000 feet (Norfolk reporting 85 knots at 12,000 and 52 knots at 10,000 feet). Thereafter, the wind decreased gradually from 10,000 feet to the surface.

Human Factors

From the passenger manifest it was determined that 29 passengers and a crew of five were aboard the aircraft. Initially, two of the passengers' bodies could not be located. Both of these bodies, however, were found later; one was in the main wreckage area, and the other was recovered from Snow's Marsh on the west side of the Cape Fear River some 16 miles from the main wreckage area.

The local coroner ordered post-mortem examinations of the passengers and crew as deemed necessary to determine the cause of death of each.

The body recovered from Snow's Marsh was identified as that of Mr. Julian A. Frank. The autopsy conducted on the body of Mr. Frank showed extensive avulsion (tearing away) of the lower extremities, and X-rays showed numerous foreign objects to be imbedded in its tissue. In view of the nature of the injuries to Mr. Frank, it was determined that further examination of the body was necessary to assure complete documentation of the injuries sustained. Accordingly, a second examination of the body revealed many additional foreign particles imbedded in the body and further documented the injuries sustained by this body.

Some of the more significant facts determined during the examinations of Mr. Frank's body are as follows:

1. Irregular erythematous (reddened) areas of skin on the face.

2. Dislocation of the right humerus without apparent fracture.

3. Fragments of steel-colored wire imbedded in the superficial flexor muscles of the right forearm.

4. Partial avulsion of soft tissue of the right thumb, index finger, and middle fingers with partial denuding of skin of the fingers and palmar surface of the hand.

5. The left hand was extensively mutilated, with multiple skin lacerations and absence of the distal portions of all fingers.

6. A small piece of brass was found imbedded in the muscle mass below the left elbow.

7. Left fibula missing and left tibia amputated at lower third. Extensive mutilation and fragmentation of muscle tissue manifested by tears in a longitudinal direction with the loss of much skin.

8. Right tibia amputated a few inches below the condyles at the knee and the fibula amputated below its head. Below the upper fifth of the thigh posteriorly, and below the lower thigh anteriorly, there was mutilation of the muscles similar to that found in the left lower extremity.

9. X-ray examination revealed small opaque particles in the right wrist. These were found to be wire particles similar to those found in the right thigh.

Miscroscopic examination of the body tissues revealed other significant facts:

1. The right hand was found to have concentrated blackened areas which were also present on the fingers and wrist. The blackened areas consisted of granular particles of varying size and shape. The right palm had many particles imbedded in or attached to the epidermis.

2. The right anterior surface of the forearm had heavy deposits scattered over the surface which were similar to powder residues from a gunshot at close range both from microscopic character of the deposit and the way in which the particles were attached to the epidermis.

3. Several areas on the right arm just above the wrist were darkened but were not similar to the carbon black of the outer areas. These areas were reddish-black, similar to an abrasion, but the epidermis was intact. The skin was toughened in these areas suggesting coagulation of the protein material.

4. Microscopic examination of the fractures of the fingers of the right hand showed splinters of bone in random directions to the main shaft. There were several areas of split bone with osseous strands bridging the separated bone sections.

5. Microscopic examination of the right hand revealed numerous fibers adhering to the surface and imbedded in the tissue. One fiber was observed protruding from the epidermis like a growing hair. The surrounding tissue was relatively free of foreign matter. Upon pulling the single fiber a whole bundle about 2 mm. in diameter emerged from under the skin. The epidermis then retracted leaving a pinpoint hole with an underlying pocket lined with clean subcutaneous tissue.

The foreign particles removed from the tissues of the body of Mr. Frank were mostly quite small in size but included one object 7.2 cm. in diameter. The majority of these particles were examined in the laboratories of the Federal Bureau of Investigation.

Some of the more significant particles included:

1. Small metal wires .025 inch diameter, imbedded in the right wrist.

2. A small piece of brass was found in the left forearm, several pale greenish-brown threads about 10 cm. long, and also some balled-up fine fibers.

3. From the right knee, thigh, and hip over twenty separate items were removed. These included, wires, fibers, and a number of other different colored materials not identified.

4. From deep within the left leg, five small items were removed. In addition two pieces of a woman's hat ornament were found in the muscle tissue of this left leg. One was circular in shape 1.4 cm. in diameter and 1 mm. thick; the other was 7.2 cm. in diameter and 1 mm. thick. Both pieces were grey-tan in color and were of coarse velvet-like material. Attached to the longer piece was a piece of a woman's hat veil 8 by 2 cm. in size.

5. Metal particles were also found in the chest tissue, and a number of fibers were found in the tissue of the face.

Extensive search for evidence within the fuselage of the aircraft resulted in the finding of four human bone fragments which were identified as from tubular type bones such as the tibia or femur. A fragment of bone 10-1/2 inches long was found at station 350 in the hatrack area. This bone was identified as a left fibula, distal end, with the distal articulations intact. In the tissue attached to this bone fragment were pieces of olive-drab cloth, a brass plate similar to the front brass retainer plate of a Westclox "Travette" alarm clock, and miscellaneous other foreign material.

The wire fragments removed from the body of Mr. Frank were determined to be .025 inch diameter, low-carbon steel wire. Each wire particle was tension necked at both

ends. Similar wire particles were found imbedded in the seat belt of one of the right triple seats. Similar wire particles were also found imbedded in the floor covering.

A small piece of brass was removed from the left forearm just below the elbow. This piece, approximately 1/32 inch thick, 1/8 inch wide, and 1/8 inch long, was curved at one end and broken at a bend at the other end.

A lifejacket found at Kure Beach was found to have zipper teeth imbedded in it, and was penetrated by fragments of flesh-colored rubber and blue nylon fibers similar to those composing the airline zipper-type flight bags. Black deposits on this lifejacket were found to contain nitrate residues.

Black crusty particles removed from the right hand were found to be manganese dioxide, a substance found in dry cell batteries. Manganese dioxide was also found on the underside of one of the right triple seats and on various parts of the airplane.

Analysis

The Aircraft

The examination of the aircraft wreckage disclosed no evidence of any malfunction or failure of the aircraft, its powerplants, propellers, or systems prior to the detonation of dynamite in the passenger cabin.

The review of the aircraft records and the maintenance and overhaul records showed that all work was properly accomplished and adequately supervised.

Human Factors

The finding of the body of one of the passengers some 16 miles from the main wreckage area, where all the other bodies were recovered, was considered significant in that it clearly showed that some type of cabin failure had occurred early in the sequence of events. Also, the examination of the fuselage in close detail indicated that the forces which caused the cabin wall failure emanated from within. The examination of Mr. Frank's body showed that the injuries sustained were significant in nature as they were not of the type normally associated with an aircraft accident. The existence of an explosive force in close proximity to this passenger is indicated by the avulsion injuries noted, the traumatic amputation of the lower extremities, and the fragmentation of muscle tissue manifested by tears in a longitudinal direction and loss of much skin, and the splinters of bone found in random directions to the main bone shaft of the fingers of the right hand. In addition, the numerous particles of metal, fiber, cloth, wire, and other objects found in the body tissue could only have resulted from the detonation of an explosive in close proximity to this passenger. Medical experts with extensive experience with battle field "landmine injuries" and other injuries resulting from explosives indicate that the injuries sustained by the body found at Snow's Marsh could only have been caused by an explosive blast.

Weather

Analysis of the weather existing prior to and at the time of the accident clearly indicates that weather was not a factor in this accident.

The winds aloft existing at the time of the accident, which were in excess of 100 knots from the west-southwest at 18,000 feet and in excess of 85 knots between 18,000 and 12,000 feet, clearly explain why many small light pieces of the aircraft cabin wall were not found. These parts drifted east-northeast from the point of the initial explosion and fell into the ocean. This is also verified by the subsequent finding of a number of these missing parts which had washed up along the beach.

Structures

A lengthy and detailed study of the wreckage was conducted to determine the cause of the initial aircraft structural failure. The possibility of several different failures was considered. These included: A fatigue failure of the cabin structure followed by explosive decompression; a propeller blade failure followed by cabin penetration and explosive decompression; the malfunction of the cabin pressurization system causing a structural failure; foreign object penetration; a lightning strike; fuel vapor explosion; oxygen bottle explosion; and the possibility of the detonation of an explosive substance within the aircraft.

The nature of the initial damage, the intensity of the force involved, and the location from which the force emanated, together with the check of the aircraft structure and its systems, eliminate the possibility of a fuel vapor explosion.

The study and analysis of the wreckage revealed information which in effect iminated all of these possibilities except for the possibility of the detonation of an explosive substance within the aircraft.

The extreme force of the agent causing the initial cabin failure strongly indicates that a highly explosive substance was involved. The deformation of the structure surrounding the focal point of the damage was similar to that resulting from the detonation of a high explosive. The fragmentation of the cabin structures adjacent to the focal point of the structural failure also indicates that a high explosive was the causal agent.

The sodium carbonate, sodium nitrate, and complex mixtures of sodium-sulfur compounds found in the air vent of the passenger cabin are typical of the residues found after the detonation of dynamite. The presence of nitrate traces on a lifejacket found in the Kure Beach area also substantiates the fact that an explosive substance was set off in the passenger cabin. Manganese dioxide is commonly found only in the black mix portion of a dry cell battery. This substance, found on one of the cabin windows, and on the triple passenger seat indicates the presence of a dry cell battery within the immediate explosive force area. The blast damage pattern seen in the cabin structure and to the passenger seats shows that the focal point of the explosion was beneath the triple seat next to the right cabin window of seat row No. 7.

The nitrate traces found on the lifejacket and the presence in the air vent of the residues usually found after the explosion of dynamite in addition to the other facts set forth conclusively show that a dynamite explosion was set off in the passenger cabin.

Conclusions

It is the Board's conclusion that Flight 2511 proceeded in a normal manner with-

out operational difficulty, mechanical failure, or malfunction until shortly after passing the Carolina Beach "H" facility a short distance south of Wilmington, North Carolina.

At approximately 0233 a dynamite charge was exploded, initiated by means of a dry cell battery within the passenger cabin and at a point beneath the extreme right seat of seat row No. 7.

Mr. Julian A. Frank was in close proximity to the dynamite charge when the detonation occurred.

The dynamite explosion severely impaired the structural integrity of the aircraft and after making a wide descending right turn, it experienced inflight disintegration and crashed 1-1/2 miles northwest of Bolivia, North Carolina, at 0238.

Probable Cause

The Board determines that the probable cause of this accident was the detonation of dynamite within the passenger cabin.

BY THE CIVIL AERONAUTICS BOARD:

/s/ WHITNEY GILLILLAND
Chairman

/s/ CHAN GURNEY
Vice Chairman

/s/ G. JOSEPH MINETTI
Member

/s/ ALAN S. BOYD
Member

/s/ J. S. BRAGDON
Member

SUPPLEMENTAL DATA

Investigation and Hearing

The Civil Aeronautics Board was notified of this accident January 6, 1960, by the Federal Aviation Agency and an investigation was immediately initiated in accordance with the authority of Title VII of the Federal Aviation Act of 1958. A public hearing was ordered by the Board and was held commencing March 22, 1960, at Wilmington, North Carolina.

The Carrier

National Airlines is a Florida corporation and maintains its principal offices in Miami, Florida. This corporation holds a current Certificate of Public Convenience and Necessity for scheduled and nonscheduled operations, and possesses valid Air Carrier Operating Certificates for these operations.

The Aircraft

N 8225H was a Douglas DC-6B aircraft, manufacturer's number 43742, fuselage number 300. The total time on the airframe was 24,836:49 hours, and the airframe had accumulated 11,284:13 hours since overhaul.

The engines installed were Pratt and Whitney R-2800 CB-16. No. 1 engine had a total time of 11,626:31 and 849:20 hours since last overhaul. Engine No. 2 had 21,583:37 hours total time and 1,274:28 hours since last overhaul. Engine No. 3 had ~,203:48 hours total time and 885:49 hours since last overhaul. Engine No. 4 had .,509:24 hours total time and 1,730:00 hours since last overhaul.

The propellers installed on N 8225H were Hamilton Standard 43E60 with 6859-8 blades.

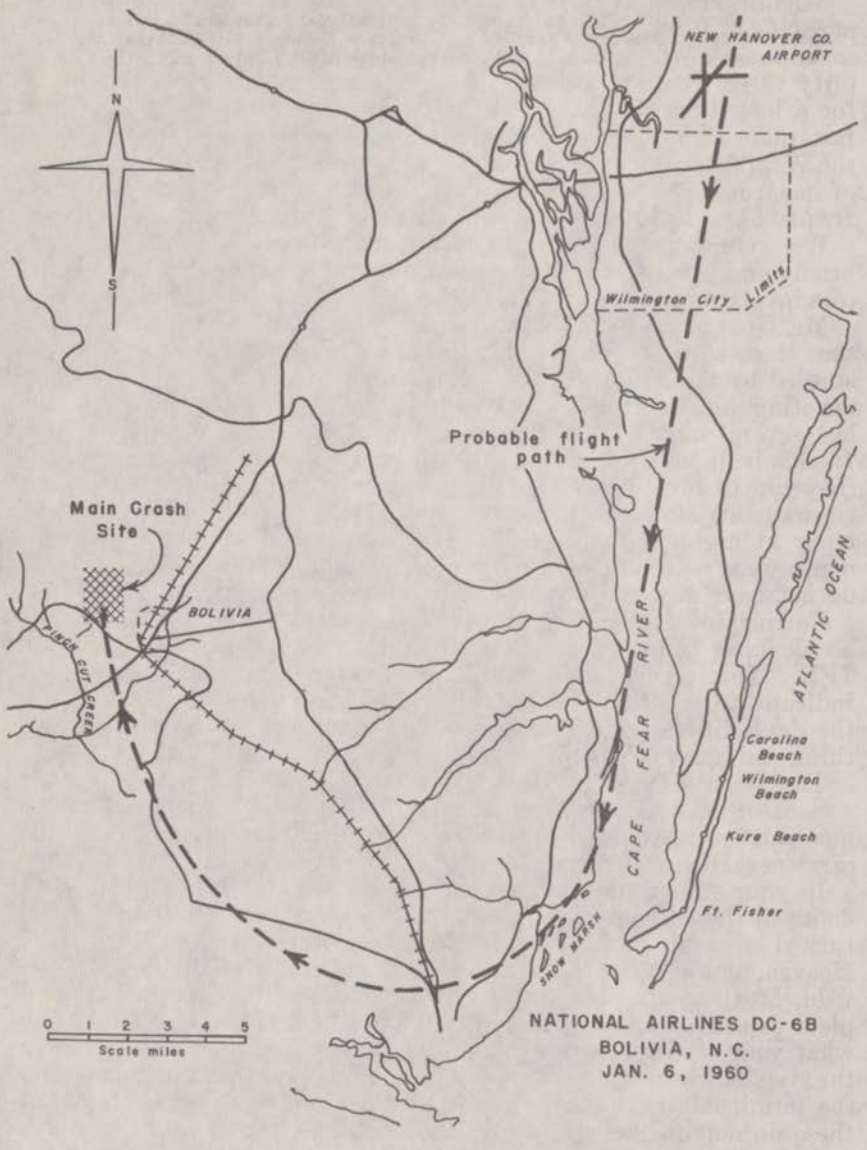
Flight Personnel

Captain Dale H. Southard, age 46, was employed by National Airlines December 2, 1942. He held a current airman certificate with an airline transport pilot rating. He had a total flight time of 16,117 hours, 8,234 of which were in DC-6 aircraft. He satisfactorily passed his last FAA first-class physical examination November 24, 1959. His last line check was completed July 8, 1959, and his six-month instrument check was completed July 6, 1959.

First Officer Richard L. Hentzell age 31, was employed by National Airlines September 30, 1954. He held a commercial pilot certificate and an instrument rating. His total flight time was 3,863 hours, 723 of which were in DC-6 equipment. His last FAA first-class physical examination was passed on September 4, 1959. His last line check was completed October 22, 1959.

Flight Engineer Robert R. Hallickson age 35, was employed by National Airlines November 20, 1954. His total flight time was 3,187 hours, of which 3,074 were in DC-6 equipment. He held a current flight engineer's certificate and an aircraft mechanic's certificate with airframe and powerplant ratings. His last second-class FAA physical examination was passed on December 22, 1959, and his last line check s completed November 21, 1959.

Stewardess Valerie E. Stewart, age 25, was employed by National Airlines November 1, 1957. Stewardess Marilu L. O'Dell, age 23, was employed by National Airlines November 1, 1957. Both had received stewardess training, including emergency procedures and ditching.



NATIONAL AIRLINES DC-6B
BOLIVIA, N.C.
JAN. 6, 1960

Senator MONRONEY. Now, in your charts, you show that some 46 percent of all accidents in 1960 involving air carriers occurred during some phase of the landing operation. I would like to ask you to amplify these terminal area hazards. It has seemed to the committee for a long time that the last 2 minutes of flight now with the very fast planes approaching supersonic speed is still the same as when the Wright brothers had the only planes in the air and it is these areas of hazards that sometimes get overlooked by the spectacular and less frequent accidents that occur that get all of the attention.

We were wondering if you would detail some of these accidents briefly and some of the causes, probable causes or possible causal factors involving these?

Mr. GOUGH. Yes, sir. I wish I could do that. I would say to you that these statistics and figures are being continuously and presently studied by the Flight Safety Foundation, for instance, and a man is devoting his entire attention to and has given some papers in the last several months, one of which is current, called Journey's End. In this he is breaking down these figures in the many ways in which they can be broken down to show you how far from the end of the runway this accident occurs, how many were during the day, or how many at night, how many were on instrument approaches and how many were not, and these figures are becoming very revealing, but I do not have any more than the barest highlights to indicate to you.

For instance, it is my impression at the moment that there are more accidents in this area under ideal weather conditions than there are IFR. This, if it isn't corrected, is a dangerous sort of thing, but it indicates to you that the controlled flight is a more precise one than the daylight one, under ideal weather conditions. Now that sort of thing and many other things come from this.

This is for U.S. air carriers——

Senator MONRONEY. This is what I intended to focus on at the moment, because this involves all the 59 million people who fly the air carriers each year.

In your statement, you have mentioned two rather important accidents to the committee, one the Electra crash that hit the dike and turned over on its back, in which there were no lives lost, thank Heaven, and also the rather spectacular accident to the DC–8 at Idlewild, Mexican aircraft, that by great good fortune was not a complete catastrophe, and some of this type of accidents, I think, and what your study up to now would reveal, where deficiences exist in the system, where deficiences exist in removing obstructions to making the terminal area hazards less hazardous and more safe. Some of these do not involve and we do not intend to incorporate this series into the more complicated series which we will come to later in the air traffic control system, but this committee for a long time has been very much concerned at what appears to be the safety sections of Government, the CAB and FAA falling between two chairs where the local airport committees or authorities fail to meet the challenge of today's demands on their airports to such simple things as runway lighting, center guideline approach lighting, and other things. We expect to hear from the FAA considerably when they testify later on what progress is being made on these very simple areas that could be corrected in a short period of time and yet which by your statistics

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show that 46 percent of all the accidents involving air carriers occurred during some phase of the landing operation.

Mr. GOUGH. Yes, sir; I would comment further on that, the column next to it, from 1954 to 1959——

Senator MONRONEY. Which book are you reading from?

Mr. GOUGH. I am looking at book 1, table Q.

Senator MONRONEY. What marker?

Mr. GOUGH. There are several categories here, takeoff, cruising; I am in the landing area.

Senator MONRONEY. I have it. Do all the committee members have that before them?

Mr. GOUGH. Yes, it is noticeable there that in the 1954–59 period, on the approach, 12 percent of the accidents were charged to this landing approach, and in the 1960 period there were 13. This is characteristic of the way in which accident percentages appear; the same kind of people do the same kind of thing in the same way, so much is personnel, so much material. Here it appears again, down at subtotal for landings, 47 percent of all the accidents in 1954–59 and 46 in 1960.

Senator MONRONEY. In other words, we haven't gained in this area, which scientifically appears to be simple, but which perhaps from the personnel figure may be continuingly hazardous. We haven't really gained any since 1954 on averages; is that correct?

Mr. GOUGH. This figure would tend to indicate that, but my quick thought would be that the type operations you have today are markedly different from 1954 and not quite reflected here. There are many more IFR flights completed. There are many more flights of very high performance equipment completed under severe operational conditions which this figure doesn't show. It only shows that of all the accidents that do occur, 46 percent of them occur in this landing phase.

Senator MONRONEY. All terminal area phase.

Mr. GOUGH. Right.

Senator MONRONEY. Takeoff is also included there and, as you mentioned before, you had these 102 passengers on the Mexican airline plane that by some miracle were saved. Now, let's get down to specific cases. You have had some investigation of this accident, have you not?

Mr. GOUGH. Yes, sir.

Senator MONRONEY. This is our jurisdiction since it occurred on American territory?

Mr. GOUGH. Yes.

Senator MONRONEY. Now, we would like to know what steps have been taken, what are the preliminary findings at least as to the reason the plane did not get off the ground or if it did get off, whether it was airborne properly or if it were the case of runway hazards, such as excess amount of slush or things of that kind on the runway?

Mr. GOUGH. You understand our report isn't completed nor is our investigation completed.

Senator MONRONEY. I understand. Have there been public hearings on this so far?

Mr. GOUGH. No, sir.

Senator MONRONEY. Do you intend to have them?

Mr. GOUGH. No, sir.

Senator MONRONEY. It seems to me, as you mentioned earlier, it is just as important to find out the cause of an accident in which maybe only two lives were lost, but where there was a possibility of losing 102 lives or more——

Mr. GOUGH. Right.

Senator MONRONEY (continuing). On a matter that apparently involves runway takeoff conditions, as it does to go into the probable cause with searching effect as to an accident where a great number of lives were lost. It is, by your own statement, it is just by pure good luck that this didn't occur.

Mr. GOUGH. That is being done. The accident investigation is continuing. It is interesting to note when you mention the possibility of slush, that the outside air temperature was 15°. There have been all manner of stories, none attributable to CAB, and you would like to have the facts of this.

Senator MONRONEY. That is true. We have been confused by what we have read in the newspapers, what we have heard on the grapevine, as to some of the effects of this. We are still in the winter season and I wonder if anything has been done. I hear rumors that there have been some changes ordered as to the degree of slush on a runway in which a jet will be allowed to take off. We are quite interested in these particular specific cases.

Mr. BOYD. May I interject, Mr. Chairman?

Senator MONRONEY. Yes.

Mr. BOYD. The Board is going full speed ahead on the investigation of Aeronaves' DC–8 accident. We are engaged here, to some extent, in the field of international relations and we do not propose to hold a public hearing. However, all of the information will be provided by deposition and we are hopeful that we can have a very speedy conclusion of this investigation and furnish the committee with not only a preliminary but a final statement of probable cause in this accident.

Senator MONRONEY. Going back again to what was developed earlier, on the basis of what we now know or what the Board now knows on this, has there been any corrective action taken to impose limitations on the takeoff of this type of aircraft under runway conditions that might have been responsible for this accident?

Mr. GOUGH. We have not found anything in the investigation yet that required us making a formal recommendation to the FAA. This means that there has not been anything obvious in the factfinding to date which would indicate to us that we should recommend the FAA to make a regulation change.

What they have done about it, I am not familiar with, but the investigator in charge of this accident is here, if you would like to talk with him.

I find it of interest to note such facts as this, that an airline survey truck had made a check of the runway and it was in good shape, and that the temperature was such that there was not any slush, and the visibility was good. The picture appears to me to come down into the operational aspects of the airplane itself and this is going to require considerably more detailed study.

When it was decided the airplane was not performing as it should perform, the crew took action to stop it. There is a good chance that

had they not taken this action, the disaster would have been very, very great, because of the energy involved when it struck an obstacle and that is as much as I know about it. But the investigator is here, if you would like to talk to him.

Mr. BOYD. We would much prefer, Mr. Chairman, if it would be possible, if it is deemed advisable by the committee to go into this accident in further detail, to do so at this time in executive session. if that would be possible.

Senator MONRONEY. I think we will hold that one off.

I gather from what you say that you have not—you are not far enough along to make any definite statements as to probable cause and possible cause?

My purpose in getting into this one particularly was to find out if there was anything having to do with runway conditions that would lead or should lead to immediate preventive regulations to limit take-offs under this type of condition.

If you are satisfied from a preliminary investigation that this is not the case, then whatever we take up from what you have learned thus far, which perhaps has been unverified and all sides of the story have not been developed, we can take this up later in executive session.

We do not wish to force your hand and make a report on a half or a third of the facts. But you do know more about the Electra crash that hit the dyke.

Now this, I think, was another one that you mentioned as an important accident that does not involve the terminal area hazards, some of which this committee has been aware of for quite a while.

Are you prepared to testify some on this situation?

Mr. GOUGH. Not I; no, sir. I mentioned those two accidents to indicate the area in which I hoped that we would have time to review them as incidents of what could happen, but they involved no fatalities; this one involved no fatality again, and this is an area which has been put into the background a bit by the areas of fatalities we have had to investigate.

Now the head investigator for that accident is here. We have not published a report of probable cause. We do know many of the facts, but the investigation has not been entirely completed.

Senator MONRONEY. Suppose we have some of the facts. This is happening on an airport that this committee has been excessively critical of, and I think we are not going to get anywhere if we are talking around the bush and in generalities.

I think we have to come to grips with some of the things that have happened in the past year and get these laid on the record at this time.

Mr. BOYD. Mr. Chairman, this is Mr. Philip Goldstein.

Mr. Goldstein is the investigator in charge of the American Airlines' Electra accident at LaGuardia.

Senator MONRONEY. Just a moment, please. It is apparent to the chairman that some of the things that the committee, I think, is anxious to go into have not been fully understood by the CAB. For that reason, I think it would be beneficial to an orderly development of the record and to all of us to recess until 2 o'clock, and ask you gentlemen to get together and organize your testimony along the lines of the four categories mentioned previously.

Again I go back to one; by your own statistics, 46 percent of all accidents last year occurred in the terminal areas.

Therefore, we would like to select some of the current cases in the area for a report on the facts. We don't ask you to conclude the probable cause, but only to furnish the subcommittee with the facts that you have thus far.

I would ask you to assemble for discussion this afternoon, the terminal area hazard, No. 1; the accidents that are perhaps largely attributable to weather—this involves the Arctic-Pacific case at Toledo, Ohio, the Capital Viscount case at Holcroft, Va.—and we have talked some about the Mexican airline crash, whether it involved really the runway or the weather, or something else, so you can get that; No. 3, the structural or mechanical defects which involve some of the major problems we have had last year; and, No. 4, the air traffic control and personnel factors involved, which include such things as air traffic control and others.

I believe we will save a great deal of time if we would give you gentlemen a couple of hours to try to get it organized, and present it in a way that I think will be far more understandable, at least for the nontechnical minds of this committee, to hear this afternoon.

So the committee will stand in recess until 2 o'clock this afternoon, at which time we will ask the CAB to come up with these facts.

(Whereupon, at 11:55 a.m., the committee was recessed, to reconvene at 2 p.m. of the same day.)

AFTERNOON SESSION

Senator MONRONEY. The Aviation Subcommittee will resume its hearings.

Prior to adjournment at noon, we asked the representatives of the CAB to give us some definite and specific information on several different types of aviation accidents and I presume that during the noon recess, they have assembled this information.

Before we start, did you have something?

Senator COTTON. Mr. Chairman, before you start the hearing I am merely voicing for others as well as myself, if it would be proper: We are all naturally concerned and interested in the unfortunate accident of the Vice President's plane. We are thankful he was not in it, but extremely sorry that it happened and that the pilots were lost.

I wonder if the agency here, for our own satisfaction, would tell us what is known so far about it?

Mr. BOYD. Yes, sir.

STATEMENT OF HON. ALAN BOYD—Resumed

Mr. BOYD. The aircraft, which was a Convair 340, departed Austin, Tex., last night at 7:08 p.m., central standard time, headed for the ranch. The weather at the time described as 900 feet overcast, 2,000 feet. 900 feet broken, 2,000 feet overcast with rain and fog. There was no transmission from the aircraft indicating any difficulty of any kind. The wreckage of the aircraft was discovered this morning 7 miles southeast of Johnson City, Tex., which is in the neighborhood of the ranch.

I am not exactly sure what the relationship is between Johnson City and the ranch, but it is in the same neighborhood.

As you stated, both pilots had sustained fatal injuries. These were the only occupants of the aircraft. The CAB accident investigator in charge is now either on the scene or will be there very shortly. We have no additional information at this time.

Senator COTTON. Thank you.

Senator MONRONEY. You have no information what the weather conditions were at the point of destination?

Mr. BOYD. No, sir; but there is no weather reporting service at the destination, but I would assume that the weather would be similar at the ranch to the reported weather at Austin.

Senator COTTON. What was the type plane?

Mr. BOYD. A Convair 340, twin engine.

Senator COTTON. And both pilots were men of long experience?

Mr. BOYD. Yes, sir, that is my understanding; very competent type of personnel.

Senator MONRONEY. Your men are on the scene?

Mr. BOYD. Yes, sir; our accident teams have been set up. The investigator in charge was designated and is now on the scene.

I don't want to belabor any points that we have covered earlier, but I would point out to you gentlemen, that this is one of the reasons that we are not able to handle with dispatch accidents that have occurred in the past where there were no fatalities because we feel that it is so essential to drop other accident investigations to get into those where fatalities did occur, and this does foul up our operations from the standpoint of routine.

Senator MONRONEY. The personnel working on it happened to be stationed in the Texas area?

Mr. BOYD. Fort Worth.

Senator MONRONEY. You have them in 10 stations throughout the country, I believe you testified.

Mr. BOYD. It is entirely possible, Senator, we will send some of the men who are here in the room to that accident as soon as the investigator in charge has made a preliminary analysis of the areas that, for example, have powerplants. He may ascertain that there seems to have been something wrong with the powerplants, in which case, we would send some of our specialists from Washington.

Senator COTTON. This terrain, was it level?

It was not a mountainous section?

Mr. BOYD. No, sir, not mountainous; it is western Texas plains country.

Senator COTTON. Thank you, Mr. Chairman.

Senator MONRONEY. Of course, it is too early to ascertain definite information at this time.

When we adjourned, we were going to have Mr. Philip Goldstein, the Chief of the Investigation Division, tell us something about the LaGuardia crash when the plane struck a dike and turned over. While there were no fatalities, it seemed apparent that this was a typical example of the terminal area hazards which concern this committee rather greatly.

Mr. BOYD. Mr. Chairman, with your indulgence, we have made a substitution.

I would like to ask Mr. Van O'Brien, who is quite familiar with the case, to testify on that accident.

Senator MONRONEY. That will be fine.

STATEMENT OF VAN O'BRIEN, SAFETY SPECIALIST, SAFETY BUREAU

Mr. O'BRIEN. Senator Monroney and the committee, I was not the investigator in charge of this accident. Mr. Arnold Holdstein of our New York office was, and Mr. Ralph Thompson was the operations chairman. However, I did take the depositions and I think maybe I can answer some of the questions, if not all of them.

With your indulgence, I have prepared a short history of the flight, which I think will help you understand something of this accident, and I would like to read it, if I may.

Senator MONRONEY. Yes, sir.

Mr. O'BRIEN. American Airlines flight 361 of September 14, 1960, a Lockheed Electra, L–188, N6127A, was a scheduled passenger flight between Boston, Mass., and St. Louis, Mo., with an intermediate stop at LaGuardia Airport, New York, N.Y. The crew consisted of Captain Gordon E. Staples, First Officer Herbert L. Schleicher, Flight Engineer Kenneth F. Thoman, and Stewardesses Margaret Fleming and Donna Gilligan.

Prior to departure the crew was briefed on available terminal and en route weather conditions as well as pertinent forecasts. The local Boston weather at 0600 was clear, visibility 15 miles plus, wind west-northwest 14 knots, altimeter setting 29.83. The weather at LaGuardia at the same time was clear, visibility 15 miles plus, wind west-northwest 10 knots, altimeter setting 29.97.

Accordingly, a flight plan was prepared by the crew which specified a flight from Logan Airport, Boston, to LaGuardia Airport in accordance with visual flight rules at a cruising altitude of 8,500 feet, true airspeed of 260 knots, and an estimated time en route of 45 minutes.

Approximately 10 minutes prior to departure, Supervisory Captain Sheldon E. Pangborn boarded the aircraft for the purpose of conducting a semiannual flight check of Flight Engineer Thoman. With Captain Staples' consent, and in accordance with existing company policies, Captain Pangborn then occupied the left pilot's seat and Captain Staples moved to the jump seat located immediately behind the captain's station.

The flight departed Boston at 0705——

Senator MONRONEY. This captain on the check ride was an employee of the American Airlines?

Mr. O'BRIEN. An employee of American Airlines, supervisory check pilot.

The flight departed Boston at 0705. The gross takeoff weight at the time of departure was 91,367 pounds, well under the maximum allowable gross takeoff weight of 99,250 pounds. Fuel on board weighed 17,600 pounds, and the estimated fuel burnoff on the Boston-LaGuardia leg of the flight was 3,600 pounds. There were 70 passengers on board. That makes, with the crew of 6, 76 person total.

At 0752, flight 361 called LaGuardia approach control and reported it was over New Rochelle, N.Y., VFR. The flight was then given the following clearance:

American 361, LaGuardia approach control, at New Rochelle contact LaGuardia tower 118.7, runway 31, wind west-northwest 18, altimeter 30.02. Field information: taxi eight closed. Runway 31 4,900 long. Have you in radar contact.

Flight 361 acknowledged and at 0755 reported to LaGuardia tower that it was over City Island. The tower acknowledged and asked the flight to report when overhead, and gave the wind as northwest 20 knots.

In the landing pattern at this time were American Airlines flight 518, No. 1 to land, and N5AA, a Beechcraft Travelaire, No. 2 to land, and flight 361 was given the No. 3 position.

Just prior to the time flight 518 landed, the tower advised another aircraft N116D, then approaching the outer marker, that the wind was northwest 30 knots. Flight 518 and N5AA landed and reported clear of the runway respectively at 0758 and 0759. At 0800:27, in answer to a query from flight 361, the tower advised, "361 cleared to land." Flight 361 acknowledged, and this was the last radio transmission from the aircraft.

At 0800:50, N16D called the tower and advised that an aircraft had crashed on the airport. Emergency equipment was immediately alerted. The tower personnel later stated that at the exact moment of the crash their attention was diverted from the American Electra by other local traffic.

LaGuardia Airport is bounded on three sides by water. Because the surface of the airport is located at a height nearly level with the water, a dike has been constructed around the water sides of the airport to prevent flooding. This dike is 161 feet from the approach end of runway 31 and stands approximately 8.2 feet above the runway surface and 5.5 feet above the mean water level. The dike is sodded and its top surface is somewhat irregular.

Investigation revealed that both the left and right gear of the main landing gear struck the dike 1.355 and 1.335 feet below the top of the dike respectively. The nose gear did not strike the dike. The above measurements were made by establishing a horizontal reference line by means of a transit.

After initial impact, Nos. 1 and 2 propellers struck the ground 131 feet farther on. The aircraft continued its forward motion simultaneously rolling and turning to the left. When the aircraft came to rest, inverted, it had turned 180° and was approximately 1,000 feet from the dike and 150 feet to the left of the left edge of the runway. During the slide, the left wing severed and slid forward, finally stopping a few feet from the attached right wing. Fire started in this area and was confined in the main to the left side of the aircraft as it lay inverted. The aircraft was ostensibly damaged by impact forces, smoke, and fire.

Now, so much for the short history of the flight.

I have a few notes here on evacuation, if you would like those, Senator.

When the aircraft stopped sliding, its occupants found themselves hanging by their safety belts upside down. To add to their con-

fusion, the inside of the cabin was darkened by mud and soot on the outside window pane. Some passengers were able to extricate themselves. Others needed assistance. All on board turned to and did the job. The stewardesses, who were seated in the rear lounge did an excellent job in allaying the fears of the passengers by quickly calling out the necessary instructions for debarkation. The lounge exit door was dislodged and jammed by impact forces. However, the stewardesses were able to move it sufficiently for it to be used as an exit. They immediately called to the passengers to come to the rear of the aircraft. Everyone who was questioned said there was no panic and that the evacuation was orderly.

Two airline mechanics were witnesses to the accident as they were working on a parked aircraft only a short distance away. They jumped on their tug and drove to the scene immediately. They were able to extinguish the fire by the buffet door and open it. This door could not be opened from the inside. Passengers immediately began using this additional means of egress.

A male passenger who was seated in the forward end of the aircraft opened an emergency window exit and left through it. He was a naval aviator and, as he ran around the nose of the aircraft in the direction of the hangar line, he thought of the crew. They were still trapped in the aircraft, being unable to open the jammed window. This man located the external emergency cable release for the sliding window, actuated it, and helped the crew through the window to safety.

Before leaving the accident scene, the flight crew, stewardesses, and two mechanics thoroughly checked the aircraft to be certain passengers were out. All on board were saved from a situation which had first looked completely hopeless.

Now, the runway at La Guardia, 13–31, the one which is being used on this particular day, is normally 5,347 feet long and 150 feet wide. But because of construction, which was in progress at the time, on runway 4–22, the available runway was decreased to 4,899.5 feet. This decrease of 447.5 feet is measured from the approach end of runway 13 and is marked by painting standard runway threshold marks commencing at that point with runway threshhold lights on either side of the pavement.

There are no physical obstructions on runway pavement and this area is available as overrun area when landing on runway 31.

Now, what that means simply is this: that the runway itself was curtailed somewhat due to this work that was going on down toward the end and they had put these lights and these patch marks, painted them, on the end of the runway to notify the pilot that he was approaching that end. However, in an emergency, had he found it necessary, he could have overrun these and used the full length of the runway. In so doing, however, I must point out, he would be taking the chance of the possibility of running into trucks and other paraphernalia which were there at that time in that area.

Senator MONRONEY. You want the record though not to show that the pilot coming in had anything underneath him more than 4,900 feet?

Mr. O'BRIEN. That is correct.

Senator MONRONEY. Because there were people engaged in construction work at the other end. Is that not true?

Mr. O'BRIEN. That is right, Senator.

Now Captain Panburn, being supervisory pilot, as well as Captain Staples, the captain who was originally in command of the aircraft, both knew of the work which was going on at La Guardia and both knew that the runway had been shortened to the length I just gave.

Senator MONRONEY. The 4,900 feet extends not from the area immediately adjacent to the dike, but some kind of a glide ratio giving you—I mean the runway began perhaps 100 or 200 feet, didn't you say, from the dike?

Mr. O'BRIEN. Yes, 161 feet, I believe I said, and from there on you had 4,899.5 feet.

Senator MONRONEY. Is this the same runway on which Northeast lost a plane several years ago?

Mr. O'BRIEN. I am not certain. It seems to me it was No. 22, but I am not sure.

Senator MONRONEY. I thought it was the other runway. I might be mistaken.

What is the minimum runway length on which the Electra is certificated to land under those weights?

Mr. O'BRIEN. That varies, of course, Mr. Senator, with the weight of the airplane, and I am not sure I have that right here among my notes, but it was well within the 4,900 feet, well within. In fact, I don't have them, I'm sorry.

Senator MONRONEY. What significance do you attach to the fact that apparently within a few minutes of the time the force of the wind given at 20 knots, was raised to 30 knots? Is that gusting?

Mr. O'BRIEN. I would say that the weather that day, as I understand it, at least, was gusty. It had been reported at 30. It had been reported at 20. There was a varying of 10 knots, and it was in each instance, I believe, from the west northwest, which is fairly close to being down this runway, which is runway 31 or 310 degrees. I think also, I would like to point out that there were three airplanes, one a Lockheed Electra, one an Arrow Commander, and one a TWA Constellation, which were all waiting at the approach end of runway 31, lined up ready to take off as soon as they got the word from the tower. Each of these pilots of these airplanes had a good opportunity to watch the approaching Electra.

We got some varying statements from all of the witnesses who observed the approach. Several of them said that the Electra appeared to be coming in fairly low. I am speaking now of the one that struck the dike, fairly low. Others said the approach appeared to be perfectly normal in every respect. But those who said that it appeared to be normal, agreed that toward the end of the approach just prior to striking the dike, the airplane had let down slightly below the top of the dike.

The captain involved, Captain Panburn, said that he considered the approach to be normal in every respect. It was his intention to land short and by short, I mean as close to the approach end of the runway as possible, and at no time did he apply any additional power, indicating that perhaps he thought that he was too low or anything he should make an effort to do something about.

Captain Panburn said he felt that the reason that he struck the dike was that in making this normal short approach, as he called it, he encountered a downdraft which caused the airplane to sink appreciably and again quoting Captain Panburn, he said there was not sufficient time to apply power to counteract this or to do anything about it.

Prior or a very few minutes prior to the accident, a Beechcraft Travelaire came across and landed on that same runway. He said that he got down a little below the dike; it was visible to him that he would have to do something about it. So he did apply power, rose up over the dike, and landed safely. He said there was a little turbulence. A few minutes prior to that, a Convair came in and the captain of this flight said that there was considerable turbulence and as a result, I believe—I am stating this from memory—I think as a result he said he came in with more power than he normally would have.

Getting back to the weather, the weather in itself, other than the possibility of a downdraft, as a matter of fact, the weather was good, extremely good. The visibility was 15 miles and the ceiling was quite high. The downdraft, according to all of the meteorological data that we have, should not have been present. There was, however, a chance certainly of a disturbance such as an eddy caused by the wind pouring down the runway and crossing over the dike.

Senator MONRONEY. Isn't it normal, if you have, say, 20-knot wind, and within a minute or two it changes to 30 knots, to describe that to an incoming pilot? It seems to me the pilot, according to what you said, received no information concerning these gusts.

Mr. O'BRIEN. You asked, Senator, if it is known to do that. Without being wishy-washy, I would say "Yes" and "No." It depends an awful lot upon the operator at the tower, whether he considers it of importance. The wind that day was such that it should have helped the pilot make a short landing rather than cause a long landing to be made, if you understand what I mean. It hit on the nose and should have helped him pretty much. The fact that it was a little gusty, I don't think truly that they considered that in the light as you have expressed it. I don't think they considered it of that much importance with that type of airplane. It was a big, heavy airplane; they come in pretty fast, and so on.

Senator MONRONEY. Of course, dikes are on three sides, as you pointed out. It is on the end of the runway No. 22, and the end of runway 31, which with a 4,900-foot runway in front, takes more than the normal skill of landing on an airport that is flush with the surrounding terrain; does it not?

Mr. O'BRIEN. I would not think so, to be perfectly honest.

Senator MONRONEY. You would not recommend that all airports be built with 8-foot dikes?

Mr. O'BRIEN. No; I certainly would not.

Senator MONRONEY. This is one of the principal airports of the United States and yet we put up with this condition for as many years as we can remember where there have been a number of accidents. Certainly the dikes did not help the situation any.

Mr. O'BRIEN. I think La Guardia Airport, as such, is one, as you say, which worries the pilot, not only because of the dock at the present time, but because of the construction going on on it, and

so on, and I think that is what Captain Pangburn meant when he said he was trying to land as short as he possibly could. He wanted to have available to him as much runway as was necessary.

The question of skill in going over a dike that has been there for so many years and so long, and all these pilots have been flying over them year in and year out, I presume, although I am not one of them, I would certainly think that one gets accustomed to that type of thing and would not consider it a terriffic hazard.

Senator MONRONEY. Even with the limited length of the runway?

Mr. O'BRIEN. As I said, the airplane is supposed to be—I have never flown one, Senator—but the airplane is supposed to be an airplane that lands within a rather short distance compared to some airplanes. It is one that I understand the brakes function very well, as well as the propellers, and it is true, this particular day it was shortened, but even so, considering the wind and everything, I think that it was safe.

Senator MONRONEY. The weather was clear and the visibility good?

Mr. O'BRIEN. Yes, sir.

Senator MONRONEY. But these boys have to use this even in bad visibility, low, sometimes undulating ceilings?

They have to come in there every day.

You have not reached any finding of probable cause.

Do you reach a finding of probable cause in the nonfatal accidents?

Mr. O'BRIEN. Yes, sir; but we have not at this time.

However, as a result of this accident, the Board has made two recommendations. I will read them to you if you would like to have them.

Senator MONRONEY. If you please.

Mr. O'BRIEN. On September 22, 1960, it was suggested to the Administrator of the Federal Aviation Agency that the visual glide slope system, currently undergoing tests by the FAA, be applied to La Guardia Airport as soon as practical. That was one of them.

Senator MONRONEY. Now amplify that just a bit for the benefit of the committee.

Mr. O'BRIEN. You must excuse me, Senator, if I talk about something I don't know too much about, but it is my understanding that the visual glide slope system is something——

Senator COTTON. Will you give us that phrase again? I have not gotten it yet.

Mr. O'BRIEN. Visual glide slope system. It is a system of lights which in general guide the pilot by telling him visually whether he is high or low. If he gets a green light, for instance, as he is coming down looking at this, these may not be the correct lights, but this is the general idea.

Senator MONRONEY. To help us, is this inside the cockpit of the airplane?

Mr. O'BRIEN. This is out on the runway.

Senator MONRONEY. High intensity approach lighting?

Mr. O'BRIEN. The airport, yes, sir; and if it is green, why everything is fine, he is coming along just fine.

If it is amber, he is a little bit too high; if it is red, he is too low.

Now that type of system is—I read the other day in the paper—that they are preparing now to put this system in a number of air-

ports around the United States and this was our recommendation that it be put at La Guardia.

Senator MONRONEY. This visual glide slope system was operative that day?

Mr. O'BRIEN. No.

Senator MONRONEY. It was not installed?

Mr. O'BRIEN. Not installed, but we have asked it be installed as soon as possible.

Senator MONRONEY. Do you have any idea whether it was ordered to be installed?

Mr. O'BRIEN. That you will have to ask the FAA, I don't know. I have a reply here, however, to that letter. This is in book No. 2, in section G, page 8, and it says:

FAA reply, received October 10, 1960, states La Guardia has high priority in their installation program.

Senator MONRONEY. On La Guardia, you have approach lighting on only two sides, do you not?

You have an approach from the opposite end of this runway 31, and you have approach lighting on the opposite end of runway 22, is that correct?

Mr. O'BRIEN. I think that is correct.

Senator MONRONEY. But so far as you know, up to now, has there been anything done about the approach lighting on 22 and 31?

Mr. O'BRIEN. Sir, do you mean with respect to visual glide slope system? No, sir; I do not know. According to this letter, which we received on October 10, it has a high priority.

Senator MONRONEY. Both of these involve overwater approaches, do they not?

Mr. O'BRIEN. Yes, they do.

Senator MONRONEY. Do you know if there is any conflict with the Army Engineers or the people who control the water channels in and around La Guardia that is delaying this?

Mr. O'BRIEN. Sir, that is something I don't know anything about.

Senator MONRONEY. It would properly be FAA.

Mr. O'BRIEN. More properly be FAA.

Senator MONRONEY. According to your recommendation, immediately after this accident, this would, in the feeling of the air safety people of CAB, have been at least a contributing factor in adding to the safety of this landing?

Mr. O'BRIEN. I don't think there is any question of it.

Senator MONRONEY. Senator Cotton?

Senator COTTON. This guide slope system, is it operated by human agency in a tower somewhere, or is it automatic?

Mr. O'BRIEN. Sir, I honestly don't know.

Senator, if you will excuse me, I have never even seen one of them.

Senator COTTON. Perhaps I did not express my question well. I was just wondering if a plane that is flying in to land, you have said, if he is flying in on the right course and gets a green light, if he is too high, he gets an amber light, if he is too low, he gets a red light.

Now, I wondered whether giving him the amber light or the red light, was something automatic or whether someone in the tower watched him come in and used human judgment in gaging whether he was too high or too low and regulated those lights, whether it was

dependent on human judgment by somebody outside of the cockpit?

Mr. BOYD. Pardon me, Senator, I think Mr. Gough may be able to address himself to this question with more familiarity than Mr. O'Brien, with your permission.

Mr. GOUGH. I am somewhat under the impression that you are thinking of this glide slope like the glide slope lighting for instrument landing systems where there are piles out in the water.

The thing that Mr. O'Brien is alluding to was a research and development test being made by the FAA on various other kinds of aids such as a crossbar "T" on the end of the runway, which would enable a pilot to line up the crossbar with something and see down the glide slope as he approached.

The Navy has a deck landing system somewhat like this, or a landing system, that kind of visual glide slope aid that could apply to any runway.

Mr. BOYD. These are permanent fixed installations, Senator. They do not depend for their operation upon any human activity, unless it be the checking of light bulbs, for example, in systems that use lights, to see that they are operating.

Senator COTTON. Then as I realize, certainly I am talking about something I don't know anything about, but I am trying to find out—then the pilot came in, if he was flying too high, the angle at which he looked at these lights would show him an amber light if he were flying too low. The angle at which he would look at these installed lights would show him a red light.

Mr. BOYD. That is correct.

Senator COTTON. So they are fixed permanently and in such a manner that the color of the light that he sees is determined by the course that he is coming in, and that is the way he corrects his course.

Mr. BOYD. That is exactly right, sir.

Senator COTTON. Now, under the present situation, my misunderstanding of it, no final conclusion has been drawn as to what caused this accident, but it is true, isn't it, that pilots are certified by the FAA for piloting a certain type of aircraft into certain landing fields?

Mr. O'BRIEN. That is right; yes, sir.

Senator COTTON. So that a pilot, the pilot taking this ship, for instance, into La Guardia had been certified to pilot an Electra and to pilot it into La Guardia at that point?

Mr. O'BRIEN. Yes, sir.

Senator COTTON. Now, the three factors being considered are: One, whether the approach is safe in its physical situation; two, whether the pilot was in error and exercised poor judgment; and three, whether the FAA improperly certified him for that particular craft and that particular place.

Are those some of the factors that you are considering?

Mr. O'BRIEN. Well, I would say, "Yes, sir," and according to the latter, he was considered, I suppose, better than the average pilot, since he was the supervisory check pilot.

Senator COTTON. So presumably, he was certainly entitled to his certification?

Mr. O'BRIEN. Yes, sir.

Senator COTTON. So it boils down to a question of whether it was a safe approach to have or whether this pilot was in error or unskillful in that particular operation?

Mr. O'BRIEN. Yes, sir.

Senator COTTON. And you have not yet determined what it was due to?

Mr. O'BRIEN. We have not at the present time; no, sir.

Senator COTTON. Have you considered the means for making the approach physically safer than it is with this kind of a dike and approach?

Is that one of the things that are being considered?

Mr. O'BRIEN. That was one of the reasons that we suggested the visual glide slope system because we cannot remove the dike and the airplane is certified to land on that runway, even at the length it was on this particular day. And, as you say, the crews were all certified so I don't know if there is too much you can do with the physical layout of the thing except some visual aid which might help him judge his height over the dike.

Senator COTTON. If it were possible to lengthen the runway, that is one way of making the approach safer.

The longer the runway the less danger there is; you don't have to hit it so soon, the less danger there is of striking an obstruction; isn't that right?

Mr. O'BRIEN. Yes, sir. I was assuming of course that was impossible.

Senator COTTON. Thank you.

Senator MONRONEY. I think our interest in this is the fact that this committtee for the past 4 years has been talking about approach lighting and up to this good day, we get two or three a year, while these planes get faster, larger, and more demanding on the pilots, and La Guardia is one of the most notorious examples of failure to respond in any way to add to the safety of runway 31 or runway 22, with its particular disadvantages of the 8-foot dike. It seems like the least that could be done by the New York Port Authority would be to respond to what the Airline Pilots Association have habitually testified to at each hearing, and almost all users of La Guardia, for better aids to assist these pilots.

I think if I recall your testimony correctly, you said that the pilot would have been greatly aided in effecting a safe landing had this glide pattern been established so that he could gage his proper glide under conditions which apparently, from your testimony, was at least 10-mile gusts up to 30 knots an hour, which makes a safe margin of landing a little more difficult, because he has to allow for a changing wind as he is coming in right on the nose.

I don't know how many more hearings, or how many more airplanes are going to have to be lost before we can get something done. Even the dikes could be moved farther out in the channel, I would think, with only perhaps 200-foot dikes and shoulders to bring it out of the way of the landing strip that they have.

This seems to go on and on. They are spending millions of dollars for passenger facilities to reorient Idlewild, but the safety features seem to be left as the last detail to be completed.

I just wonder when we and under what circumstances the safety people will gather up their courage enough to really talk plainly about La Guardia landing facilities.

Mr. O'BRIEN. Mr. Boyd, do you want to answer that question?

Mr. BOYD. This is an area, Senator, where I think we spent maybe too much time this morning, trying to point out that we are strictly in a situation as far as the Board is concerned, of putting out the immediate fires, and we have not extended our activities into the area of physical facilities other than the aircraft themselves or the navigational aids.

Now, I think it is entirely possible that we should get into this area, although I must be frank to say there is nothing we can do about it except to lend the weight of our experience should we be concerned that the dike, for example, is a hazard to air navigation.

Senator COTTON. Do you mean you could not close an airport, you could not stop carriers going into an airport if you found that its approach was unsafe physically?

Mr. BOYD. I would not say that we could not stop it, Senator. However, this is an area that we have never gotten into, and I can't give you a definitive answer on it.

Actually, as far as the Board is concerned, our past activities in relation to airports have been in dealing with the economic aspect of our regulation rather than the safety aspect of it.

Senator COTTON. I can understand why you would want to be thoroughly equipped before you exercise such arbitrary power, why you would want to have the money to have an ample engineering staff, or whatever kind of experts you need so that you would be sure of exercising meticulous justice before you took such drastic steps; but I am interested to know if legally you must have the authority right now, if you felt that the situation demanded it, to say that there shall be no more common carriers landing in La Guardia on such and such a strip until some physical danger is remedied.

Do you or do you not under the law have that power, Mr. Boyd?

Mr. BOYD. Well, I can't answer that. I can't give you a definitive answer on that point, Senator. I will be happy to prepare an answer from our legal department on this subject, but today I cannot tell you the answer.

Senator COTTON. Does the FAA have any such power?

Mr. BOYD. I believe the FAA has positive authority in that area.

Senator COTTON. Somebody ought to have, oughtn't they?

Mr. BOYD. Yes, sir; I think so. Now I am confident that if, as a result of any of our investigations, the Board concluded a particular airport was not a safe place in which to operate, we would so advise not only the FAA, but the air carriers whose economic operations we regulate immediately.

Senator COTTON. The FAA, if you so advised them that—you are off the cuff at least—that your understanding that the FAA could simply close that particular airport or that particular strip or approach involved for traffic until the situation were remedied?

Mr. BOYD. I have that impression. I don't state that as a fact.

Senator COTTON. Would you be able to get into the record at this point later whether that is true or not?

Mr. BOYD. Yes, sir.

Senator COTTON. And I was not quite plain—excuse me, Mr. Chairman—I was not quite clear in my mind—you say that you could recommend to the air carriers whose economic problems you control or that you handle their economic problems. What do you mean by that,

that you, as the CAB, could in some way prevent the American Airlines or Eastern or any other airline from using an unsafe strip; that you have some power over them that you would not have over the airport?

Mr. BOYD. Well, you see, sir, my statement was that if we reach such a conclusion we would certainly advise these air carriers.

Secondly, under the economic provisions of the statute, we are authorized and have in many cases certified air carriers into specific airports. In the past few years it has not been our practice to do that, rather we have given them area certification, but I am inclined to believe that we could order a suspension of operations in an area. I know we have the power of suspension.

Senator COTTON. Do you have the power to withdraw the certification of X strip in Z field?

Mr. BOYD. In theory we do. I don't believe we could do this legally unless we applied it to all carriers who were certificated into that area.

Senator MONRONEY. Or by types of aircraft, you could certificate into La Guardia, DC-3's perhaps, or planes of a certain weight and require planes of greater weight to land at Idlewild or Newark or Teterboro, couldn't you?

Mr. BOYD. I am just about 2 feet over my head right now, Senator. I would like to back off right here and tell you we would have to study this before I could make any firm statement on it.

Senator MONRONEY. We had testimony last year on Rikers Island Channel accident that had there been high density approach lighting, the pilot would have had a far better chance for a safe landing in that accident.

We have an example, by great good fortune, and heroic action by the stewardess in the cabin to get everybody out alive, but here you have, what appears to me, to be the same hazard with the 8-foot dike and short runway and heavy plane, and certain atmospheric conditions that lend themselves to danger and slight miscalculations that normally could be corrected by proper approach lighting.

This committee is wondering how long, how long, oh Lord, are we going to have to each year go over this same hazard and find nothing whatever done in this major airport.

Mr. BOYD. Mr. Chairman, I think on that point that the FAA will go into the subject in great detail, and this is really their area. I would say, sir, since the Congress has appropriated within the very recent past what appears to be, for the first time, an adequate amount of money for research in this area, that the FAA has done a tremendous job of evaluating the different types of approach lighting and I understand that on some of them they have found some pretty bad bugs.

This, of course, is what they are trying to guard against before they buy a whole package and start going to work with it. They want to be sure it is the right thing, and I am inclined to think that they have reached the stage now where they feel they found a good system that is foolproof.

Senator MONRONEY. The centerline approach lighting and all have been rather standard since the last 10 years, and there are many features in military aviation and others, yet I, for one, as fearful as I like to be of public money, would rather have some help than wait

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more years for the final ultimate of perfection in glide slope and other aids because there will be millions of people landing at LaGuardia or other places while we are waiting for this last ultimate perfection of engineering genius.

I think the time has come for action here and in a few other airports, where on the basis of known evidence of accidents that have occurred, fortunately some not fatal, why we can take lessons and begin to move in any direction of greater safety, particularly high density airports.

I do not wish to belabor this much further. I think we have had a good roundup of this. Senator Schoeppel, do you have any questions?

Senator SCHOEPPEL. I would like to ask one question.

Do your records disclose you have had any number of pilots previous to this accident reporting on the dangerous aspects of this runway and this dike?

Somebody's records ought to show something, if the Pilot Associations are coming in there by the thousands. Do you have any record of it?

Mr. O'BRIEN. Senator, I am quite sure any such statement made by the pilots would be reported to FAA and not to us.

Senator SCHOEPPEL. Of course, you don't have to insulate yourselves from the other agency. It would seem to me you would have a continuity of information with reference to that.

I was just wondering whether you had any information on it from pilots who come in there—pilot complaints.

Mr. O'BRIEN. As I said to Senator Monroney just a few minutes ago, I know the pilots are very unhappy about LaGuardia.

Mr. BOYD. We have no such record, Senator.

Senator SCHOEPPEL. Thank you.

Senator MONRONEY. One thing, before we move on to other cases. There was nothing to indicate any of the old trouble of the Electra with the structural stability, nothing in the altimeter?

Mr. O'BRIEN. Nothing was found in the airplane or its components that there was any malfunction.

Senator MONRONEY. This was purely a landing accident and no other factors other than that the pilot was on the wrong glide slope and perhaps with certain wind conditions and a runway facility that narrowed at least to some degree the margin of the safety in the landing, is that correct?

Mr. O'BRIEN. Also to add to that, the pilots themselves said that to the best of their knowledge the airplane was functioning normally.

Senator MONRONEY. If there are no other questions on this particular accident, let's move on to the starling case at Logan Airport.

Mr. BOYD. Mr. Chairman, Mr. Arthur Newmann will testify on the Boston Electra.

Senator THURMOND. Mr. Chairman, may I ask a question?

Senator MONRONEY. Of the last witness?

Senator THURMOND. Of the last witness.

I have had to be in and out attending another meeting, simultaneous with this one. I want to ask you this question: Have steps been taken to correct the defects with the Electras to your satisfaction?

Senator MONRONEY. Could I cut in there? We are now talking about the landing facilities and accidents in the terminal areas. We

have an entire category, category 3, where we are going to take up the structural and mechanical defects of planes.

Senator THURMOND. I will wait and ask that question later. That will be all right.

Mr. O'BRIEN. Thank you, Senator.

Senator THURMOND. My only point was to ask if any of the previously known structural deficiencies which appeared in any of the previous accidents was present in this particular accident.

We have many people vitally concerned about this and I have had a number of inquiries. But I will make that inquiry later.

Senator MONRONEY. You may proceed. State your name for the record and your title.

Mr. NEUMANN. My name is Neumann; initials, A. E.

With your indulgence, Senator Monroney, I have a very brief summary of the Boston Electra accident that took place October 4 and I would like to cover this.

Senator MONRONEY. Speak up just a little louder please.

Mr. NEUMANN. On October 4, 1960, at 1740 eastern daylight time, an Eastern Air Lines Lockheed Electra crashed at Logan Airport, Boston, Mass. Sixty-two of the seventy-two persons aboard received fatal injuries. The aircraft was destroyed.

N–553 had arrived in Boston at 1533 as flight 444 from New York City. The aircraft and its crew were scheduled for turn-around and were to depart as flight 375 to Philadelphia, Charlotte, Greenville, and terminating in Atlanta, Ga.

After the routine preparations, Eastern Air Lines flight 375 began takeoff on runway 9 at Logan Airport, Boston. Everything was normal until immediately following lift-off, at which time the aircraft, as seen by witnesses, seemed to react as follows: While in its initial climb, some witnesses observed a puff of gray smoke emanating from No. 1 engine. Other witnesses saw what was described as a ball of fire from No. 2 engine.

Following these indications, after reaching approximately 100 to 200 feet of altitude, the aircraft made a flat turn to a heading of about 060 degrees.

While on this heading, the aircraft maintained a nose high attitude but appeared to settle approximately one-half of the height it had attained. The aircraft was then seen to execute a maneuver most clearly described as a wing-over. During this maneuver, the nose came up higher, the aircraft gained some altitude while the left wing dropped to near vertical. The nose then fell through rapidly and the aircraft descended, striking the water almost vertically while rotating to the left.

The aircraft was airborne less than 30 seconds, during which it had turned more than 270 degrees to strike the water on a south southwesterly heading. The weather was good and wasn't considered a factor.

Two photographs were taken by amateur photographers on the field, a Captain Jacobs of Northeast Airlines, and a Mr. Williams. These were used to assist the operations group in establishing a probable flight path profile. Birds at the left side of the runway 9 between the intersections of taxiway No. 33 and runway 33. About 75 bodies and pieces of bodies of these birds were strewn over an area

400 feet long by 200 feet wide, midpoint of which was 3,700 feet from the approach end of runway 9.

The Board called in the services of ornithologists, Fish and Wildlife, and those people determined that the birds had been killed on the evening of October 4.

The salvage operations were carried out by the Navy and the wreckage was transported from Winthrop Bay to the warehouse in Hingham, Mass., for a detailed examination. This examination disclosed that there had been no malfunction or structural failure of the airframe prior to impact.

All four engines and propellers were recovered. No. 1 propeller was fully feathered and that engine had been shut down. Engines Nos. 2, 3, and 4 were operating at impact and air propellers were found at weight angles of 39.9, 40.9, and 41.1 degrees, respectively. These blade angles represent the following shaft horsepower being developed at an airspeed of 80 knots: No. 2, 3,500; No. 3, 3,700; and No. 4, 3,800 horsepower.

At an airspeed of 140 knots, respective shaft horsepowers would be No. 2, 2,550; No. 3, 2,850; No. 4, 2,950.

When the powerplants were raised from the bay during the salvage operation, bird feathers were found in the oil couters of engines Nos. 1 and 4. Upon teardown, a number of samples of foreign matter were removed from the compressor section, feed air valves, fuel nozzles, diffuser section, burnt cams and turbine sections of engine No. 1.

This material consisted of metal, carbon, marine life, feathers, tissues, and fiber. Some of the feather fragments were identified as starling feathers. Samples of similar foreign materials were also removed from engines 2 and 4.

However, the amount of the foreign material in engine Nos. 2 and 4 were substantially less than that found in No. 1. None of this type of material was found in engine No. 3. Mechanically all four engines were found to be in good condition with the exception of impact damage. No. 1 showed no rotational damage to the compressor section or turbine section. Nos. 2, 3, and 4 all showed rotational damage to the compressors, and turbines from impact. There was no evidence of overtemperature condition in any of the engines, and all appeared to have been capable of normal operation prior to impact.

The systems of the aircraft were thoroughly checked. The emergency inverter, which only operates when all four generators are off the line, was not rotating on impact. This would indicate that at lease one engine was operating all during the 27 seconds of the flight following impact with the birds.

In summing up, we know that the airplane was intact when it struck the water and that engines 2, 3, and 4 were developing new maximum power. We also know it struck birds on the takeoff with a result of total loss of one engine and temporary loss of power on at least two others. From aircraft performance, we can calculate a flight path which coincided with eyewitness testimony and the aircraft position as shown in photographs.

From all of this information it appears that seconds after the aircraft lifted off the ground, it ran through a large flock of birds. The engines ingested a number of these birds with an immediate loss of power. The No. 1 engine was feathered or shut down by the pilot,

at least two others had a temporary loss of power. At this time, the aircraft, instead of accelerating normally, decelerated to a speed below that necessary for control. This also occurred in a matter of seconds. At the end of this time, roughly 12 seconds after lift-off, the aircraft was in serious trouble. The total time the aircraft was in the air was about 27 seconds.

Senator MONRONEY. I believe CAB has issued a formal finding that the ingestion of the birds was the probable cause.

Mr. NEUMANN. No, sir. We haven't issued a formal probable cause.

Mr. BOYD. We have issued a tentative finding of probable cause, Senator.

Senator MONRONEY. You found no evidence to indicate any of the previous difficulties of structural or mechanical or altimeter matters in this accident?

Mr. NEUMANN. No, sir; we did not.

Senator MONRONEY. A fine analysis. It comes down primarily to the evidence so far adduced that it was the ingestion of the starlings?

Mr. NEUMANN. That is correct.

Senator MONRONEY. Have you issued any recommendations to the FAA?

Mr. NEUMANN. We have made recommendations. This is in another area. This is in an area of seats of the aircraft.

Senator MONRONEY. You might detail to the committee what that was, please.

Mr. NEUMANN. We have issued a recommendation to formulate a basic research program to improve the tolerance of all turbine engines to bird ingestion.

Senator MONRONEY. I didn't get that.

Mr. NEUMANN. We have recommended that the FAA formulate a basic research program to improve tolerance of all turbine engines to bird ingestion.

And also, as a result of this accident, recommendations were made relative to the seats in a particular aircraft.

We have our Mr. Doyle who was the group chairman of human factors that could elaborate on that, sir, if you would like to talk to him personally.

Senator MONRONEY. I believe that would be quite important at this time. This is a rather age-old question of configuration of the passenger seating.

Mr. NEUMANN. It more or less has to do with the attachments, sir, of the seats, and not so much the direction of seating.

Senator MONRONEY. I think the committee would like to hear that recommendation.

Mr. BOYD. The next witness, Mr. Chairman, will be Mr. Bernard C. Doyle, who is Chief of the Human Factors Group of the Civil Aeronautics Bureau of Safety. Mr. Doyle is a gradute aeronautical engineer and a lawyer. He is also accused of practicing medicine.

Mr. DOYLE. On November 14, 1960, the Chairman of the Civil Aeronautics Board prepared and sent a recommendation, or six recommendations, to the Federal Aviation Agency. These recommendations are as follows: No. 1, we found the lounge seat belt attached cable failed in the aft seat on the right side of the airplane. This seat belt cable passes through a bracket which is on the vertical half mem-

ber of the seat, and the belt was cut during the decelleration when forces were applied to the passenger as he was strapped in this seat.

We have had a previous failure of this same belt attachment cable in the Electra accident in the East River. We have had a total of two belt failures for two people occupying these seats. We have had eight additional exposures of other people in the lounge whose seat belts in these two accidents did not fail, and therefore we recommended that an airworthiness directive be issued which would require the removal of the bracket on the aft seat belt lounge cable attachment.

The second recommendation dealt with the failure of the lounge partitions. This is the partition which separates the lounge area from the main passenger cabin area. In this particular accident we had one of the stewardesses sitting immediately aft of this partition on the side facing the seat. During the decelleration forces applied to the stewardess, her body was impinged on the partition which separates the lounge from the passenger area, and the partition failed along the bottom, applying the decelleration load of the stewardess to the seat 19–A and B, which is the last seat on the left-hand side of the airplane. We felt that this additional load applied to A and B, plus the load that was on the seat by the two occupants of the seat, caused the seat to fail. This seat, when it failed, crashed into 18–A and B, which failed and crashed into 17–A and B. Of the 10 occupants that survived this accident, we have 9 of them located, and none of the 9 came from the left-hand side seats 17, 18, or 19–A and B. We therefore recommended that the partition between the passenger cabin and the lounge be reenforced.

The third recommendation dealt with the passenger seat belt failure themselves. This seating was configured for two occupants. It is a welded tubing construction. The center seat belt attached fitting for the two people is in the aft longitudinal member. The aft end of the longitudinal member separates the two seat pans. This is welded at the end, and a concentration of all loads goes through this particular area. The seat belts are attached by drilling a hole through the tubing, near the weld, with a belt passing through the hole, and the concentration of loads applied to the seat backs, which are also attached at this point, plus the deceleration forces on the belts themselves, through the people, caused 14 failures and 7 partial failures of this center seat belt attachment. It was therefore recommended that this particular belt installation be redesigned.

The fourth recommendation dealt with the seat tiedowns themselves.

I might mention, Senator, that the former recommendation was only applicable to this particular design of seats. This isn't common to all Electra aircraft.

The fourth recommendation dealt with the seat tiedowns themselves. We felt that the seat failed at the outside wall attached fittings. This particular seat is attached by legs at the aisle side and into the wall of the airplane on the outside. This failed along the outside. These failed on the outside of the attachments and through torque pulled the legs off the seats and they failed. We recommended the seat tiedowns themselves be reenforced. This would be applicable, as far as the wall attachment fitting, to all Electras, while the floor attachment fitting would be only applicable to this particular seat.

The fifth recommendation dealt with the service trays on the backs of seats. This particular tray we have evidence of striking by the passengers seated behind the trays, and we felt that this accounted for many of the head injuries sustained in this accident. There were over 50 percent of the fatalities with head injuries.

The sixth and last recommendation concerned leg injuries of the occupants in this particular accident, and this is not peculiar to this particular aircraft. It is evidenced in practically all accidents at high decelleration. We found quite a number of leg injuries, I can give you that, fractured legs out of this. There were a total of 39 occupants who sustained fatal injury who received leg injuries. This, we feel, was due to the deceleration forces and the legs flying forward and hitting the aft stretcher on the seat in front. We recommended in this case that the Federal Aviation Agency conduct a research program to develop a seat which would eliminate this hazard in aviation.

That is it.

Senator MONRONEY. Has the CAB, or any of your experts, ever pressed for rear-facing seats?

Mr. BOYD. No, sir.

Senator MONRONEY. It has never been discussed as a result of that accident investigation?

Mr. DOYLE. This subject has been discussed in aviation circles for years, and I know when the Civil Aeronautics Board had the regulations, prior to the last statute in 1958, during the annual airworthiness reviews, this subject had been discussed in many instances.

Senator MONRONEY. No orders or suggestions have ever been made by CAB to that end?

Mr. DOYLE. No, sir.

Senator MONRONEY. On your experience as an aeronautical engineer and investigator, would rear-facing seats have reduced the accident toll in this case?

Mr. DOYLE. If the seats stayed in the airplane, whether they were facing forward or rearward, they would have, I believe—in my own opinion we would have had more people get out of this airplane. Whether you are sitting forward or aft, unless the seat stays in the airplane, you are subject to having a tremendous increase.

Senator MONRONEY. In other words, the stability of the attachment of the seats to the body of the airplane itself would have a great deal to do with lessening the incidence of accidents or death. Is that correct?

Mr. DOYLE. Yes.

Senator MONRONEY. Senator?

Senator COTTON. These were all individual seat belts?

Mr. DOYLE. Yes, sir; these were all individual seat belts.

There is a common attachment for the two-passenger seats. The forward-facing two-passenger seats have a common seat belt attachment. However, they are independent belts.

Senator COTTON. Is it required of the seat belts in all carriers that they be individual seat belts for each passenger? In other words, what I have in mind, I have ridden, I think in some private plane in which a side seat—there would be one seat belt that would encompass two passengers. Is that permitted ever in any of the side seats or any other seats in common carriers?

Mr. DOYLE. I am not sure of my ground. I don't believe it is permitted on air carriers except where a berth is provided. If you have a berth you can have two people in the berth with one belt.

But on the air carrier aircraft I don't believe you could do that. There are regulations along this line. I don't remember them.

Senator COTTON. Thank you.

Senator MONRONEY. Senator Schoeppel?

Senator SCHOEPPEL. No questions.

Senator MONRONEY. Senator Thurmond?

Senator THURMOND. No questions.

Senator MONRONEY. Senator Hartke?

Senator HARTKE. I was wondering, could I ask a question of Mr. Neumann on his prior testimony?

Senator MONRONEY. Yes.

Senator HARTKE. Mr. Neumann, how many eye witnesses were there to this particular crash at Boston immediately prior to the time they watched it and at the time it did start to come down?

Mr. NEUMANN. I don't have the exact count here. I could look it up in just a few minutes.

Senator HARTKE. Do you have an estimate of how many, roughly?

Mr. NEUMANN. I would say that we have about 75. That would be just a very rough guess.

Senator HARTKE. Did any of these witnesses describe any birds in the air to you beforehand, that they saw any birds before the plane started its downward movement?

Mr. NEUMANN. No, sir; we have no one that saw the starlings.

Senator HARTKE. You had 70-some-odd, or roughly that many witnesses, and not a one saw any birds?

Mr. NEUMANN. No, sir; because this occurred on the end of the runway opposite the passenger terminal and quite a distance. It would have been almost impossible.

Senator HARTKE. And little boys and all, on the other end, they didn't see any either?

Mr. NEUMANN. The other end of the airport is Winthrop Bay, so there wouldn't have been anyone out in that area.

Senator HARTKE. No witnesses saw any birds beforehand?

Mr. NEUMANN. Not to my knowledge; no, sir.

Senator HARTKE. Now the conclusion, tentative conclusion of the Board, as I understand it, is that there was a power failure due to ingestion of the birds that caused the crash. Is that right? Is that a fair interpretation?

Mr. NEUMANN. Not exactly, sir.

The birds played an important part. In other words, without birds the accident would not have occurred.

Senator HARTKE. What else went with it?

Mr. NEUMANN. There is the problem of control of the aircraft, for one thing, and there are other ramifications that developed from the bird ingestion and loss of power.

Senator HARTKE. In the tests which were made of similar engines, didn't you have ingestion of birds?

Mr. NEUMANN. Yes, sir. Allison ran quite a comprehensive study.

Senator HARTKE. Did you develop there sufficient loss of power to any of the engines to materially affect the flight of the airplane?

Mr. NEUMANN. I think it was determined that there was sufficient power loss due to the ingestion at the tests made at Allison that had the same intervals been applied to this particular airplane the progress of the flight as it occurred would have been possible.

Senator HARTKE. Then the witness, or the statement made on the television show the other night to the contrary is probably wrong. Is that right?

Mr. NEUMANN. I don't follow you, sir.

Senator HARTKE. Did you see the television show the other night?

Mr. NEUMANN. Yes, sir; I did.

Senator HARTKE. The witness there testified that there was not a loss at any time in these tests sufficient to affect the performance of the engine, or cause a power loss. That testimony, then, probably is wrong?

Mr. NEUMANN. Well, I think we did have, through the tests that Allison made, we did have adequate indication there was enough power loss.

Senator HARTKE. There was a power loss?

Mr. NEUMANN. Yes; enough to do just exactly what happened.

Senator HARTKE. This had to occur in more than one engine; is that not right?

Mr. NEUMANN. That is right, sir.

Senator HARTKE. Because this plane is capable, with enough power, to take off on two engines?

Mr. NEUMANN. If it has reached a certain speed it can continue on two engines. I don't believe it can take off on two engines. It may, under particular conditions.

Senator HARTKE. I understand your conclusion now is that the loss of power due to ingestion of birds, coupled with other factors——

Mr. NEUMANN. That is correct.

Senator HARTKE. And those other factors, principally, was to control the plane. Is that right?

Mr. NEUMANN. Yes, sir; that is right: unable to attain sufficient speed due to lack of power to continue on in the normal manner.

Senator MONRONEY. It might be interesting at this point to put in for the record the release of the Civil Aeronautics Board under date of February 16 of this accident:

> Just summarizing it, from all of this information it appears that seconds after the aircraft lifted off the ground it ran through a large flock of birds. The engines ingested a number of these birds with immediate loss of power to No. 1 engine which was either auto-feathered or was shut down by the pilot. At least two others had a temporary loss of power. At this time the aircraft, instead of accelerating normally, decelerated to a speed below that necessary for control. This also occurred in a matter of seconds. At the end of this time, roughly, 8 to 12 seconds after liftoff, the aircraft was in serious trouble, and a crash was inevitable, regardless of the actions of the pilot. The total time the aircraft was in the air was about 27 seconds.
>
> The Board believes that this pilot had only seconds after striking the birds in which he could have taken action to prevent as catastrophic an accident as did occur. In that time he would have had to perceive the danger, analyze the situation, decide on the proper action, and take it. The Board believes, in view of the sudden onset of the emergency this time interval was so short no pilot could be expected to react effectively.
>
> This accident has pointed out several items concerning passenger safety which the Board believes will require additional intensified study. A tremendous amount of research has been done in the past and will continue in the area of crash survival in the attempt to reach the ultimate in passenger safety.

Another area requiring intensified study arising out of this investigation is that of the control of birds on and in the environs of airports. While this is not a new problem, the possibilities of such tragic results were not anticipated. A study aimed to eliminate or control birds on airports has been undertaken by the U.S. Fish and Wildlife Service. Funds for the project have been provided by the FAA.

The Board also believes that further improvements are necessary in jet engines to minimize the possibility of power loss caused by ingestion of birds.

It must be understood that all of these are long-range projects. We do not believe there will be any overnight solutions.

The matter discussed here is not the sum of information developed by our investigation. In addition, it should be emphasized that our findings are tentative and that our investigation is not closed. It should also be realized that our further study could conceivably alter these findings.

A complete analysis and final report of this accident will be issued by the Board at a later date.

There was some evidence of an aircraft that had either landed or taken off just before this crash that there was an extremely large number of birds in the runway area, was there not?

Mr. DOYLE. On the runway area, did you say, sir?

Senator MONRONEY. Yes, or in the runway area.

Mr. DOYLE. Subsequent to the takeoff of the Electra, two FA–6's came in and landed on runway 33. They taxied back along taxiway 33. When they passed runway 9 they saw birds on the runway. This was immediately subsequent to the accident.

Senator MONRONEY. These were dead birds?

Mr. DOYLE. Yes, sir.

Senator MONRONEY. Did any other pilots experience a large number of birds during this time?

Mr. NEUMANN. Sir, the only two flights that we have any record of was, one, a Northeast Airlines, and another a TWA flight, and I don't have with me right at the present time the exact number of minutes, but it seems to me like it was around 7 minutes prior to this accident that the TWA had a flight depart, and we contacted the crew and they did not see any birds.

There were no birds. The usual sea gulls, yes; but not the flock of starlings that this flight encountered.

Senator MONRONEY. This accident is peculiar. I mean bird danger is rather peculiar to jets, is it not, that with your piston driven aircraft there is little likelihood of the type of accident that apparently occurred here?

Mr. NEUMANN. Yes, sir; that is correct.

Senator MONRONEY. So this is a new menace that has come about through the use of turbine powered aircraft.

Mr. NEUMANN. Yes, sir.

Senator MONRONEY. Do you know any steps that have been taken to control the bird menace?

Mr. NEUMANN. As far as the Logan Airport is concerned, they have a bird watch that has been operating, and is operating now, and at the request of the pilot they will precede him down the runway and clear the runway of any birds. It is a shotgun, and other means of frightening the birds away.

Senator MONRONEY. I was reading someplace—I don't know whether it has been installed, apparently as a result of this accident—where they have an automatic popgun that fires itself every few

seconds automatically to create a noise that is supposed to be a bird frightener. Is that correct?

Mr. NEUMANN. I think they have such devices operating. However, I believe they lose their effectiveness. Once the birds get accustomed to it, why, I believe they are more or less anticipating this noise. It is quite similar to the birds resting on a wire as a train goes by. Once they get accustomed to the trains, why, they no longer are frightened.

Senator MONRONEY. I see.

So far as you know, there has been no antibird device that so far could be adapted as a foolproof system, or birdproof system?

Mr. NEUMANN. No, sir, not effectively, not that we know of.

Senator MONRONEY. Other than perhaps preceding the aircraft down the runway——

Mr. NEUMANN. That seems to be the most effective.

Senator MONRONEY. Senator Cotton?

Senator COTTON. I wonder if I could ask, perhaps Chairman Boyd would be the one to ask: Reference was made here a few minutes ago to a program on a national television network regarding these accidents. Was this program or programs—are they cleared with your Board.

Mr. BOYD. Yes, sir, this was one program. There is no other project, to my knowledge.

Senator COTTON. And all of the alleged testimony is checked for its accuracy before it appears, before it did appear in the program?

Mr. BOYD. Yes, sir. Incidentally, the television company told us that they had never done this with anybody else in the past, but they gave us complete freedom to view their entire program and to make changes to assure accuracy.

As a matter of fact, Senator, the vast majority of the program was devoted to meetings and/or hearings such as this today, which were matters of public record to begin with.

Senator COTTON. Have there been other programs that have been put on in which you have not been invited to check them or approve them?

Mr. BOYD. The only other program of this type that I know anything about, Senator, was a local television station effort that was filmed in connection with the Bolivia, N.C., accident. To our knowledge, however, this program was never run. Now, we did not see any films of this, but we were advised by—I believe it was the Charlotte, N.C., television station—that they were going to run a complete program on it.

Senator COTTON. I don't expect you to have any authority to control or attempt to exercise any over a network or television station on their own hook, invited witnesses or bystanders, as they frequently do, to come in and tell what they saw in connection with an accident. Wouldn't you regard it as a practice that should be under pretty strict supervision and exercise with a good deal of care the matter of in any way putting on shows that tended to show any results of any official investigations of accidents?

It seems already in this room, I think one Senator seemed to have gotten an impression from a witness that you gentlemen did not have, which only goes to show that the public could well get misapprehen-

sions and misunderstandings which might have some repercussions. Would you care to comment on that problem?

Mr. BOYD. Yes, sir, this is a problem that faces any public agency, one that would face this committee, I am sure.

The statement that was adverted to earlier was in fact a correct statement by the witness and it was a statement that was given by this witness in the public hearing on the accident. Now, as I recall the witness said, and he said accurately, that the tests that were run by Allison—did not cause a flame-out; if I am not mistaken, that was his term. However, he also said that if the engines hadn't been shut down during these tests on a couple of occasions, the turbines would have burned up. So, this was a question of how you want to take this business.

The testimony of this witness definitely established, however, a very sudden and severe loss of power.

Senator COTTON. But this witness, was he a Government expert connected with some agency that was engaged in this experiment or was he just an unofficial bystander?

Mr. BOYD. The witness was not an unofficial bystander, Senator. He was a member of the engineering team, the power team of the accident investigation. He is, I think, the senior research engineer for the Allison Division of General Motors, and the tests, his participation in the investigation was under the supervision of our engineering investigator assigned to that accident, so I wouldn't say that he was a bystander. He has an official status in this.

Senator COTTON. So in giving his evidence in the form of a public television show, his statement, although completely correct, was of such technical nature and had to do with such fine gradations, at least use of terms, which the public are not entirely familiar, that it could be misinterpreted by the public?

Mr. BOYD. I would like to make one point very clear, Senator. He did not give this testimony in a television show. He gave this testimony, just as we are testifying before you today——

Senator COTTON. At a public hearing.

Mr. BOYD. Absolutely.

Senator COTTON. And the only official statements or acts depicted on the television screen were public hearings and public proceedings?

Mr. BOYD. No, sir; not altogether. For example, a number of feet of film were shown that covered the briefings, the daily briefings, which our accident investigating team had. Now these were official in the sense of the agency, but they were not public, although they were not private as distinguished from being public. This is just the daily routine that you don't consider as being a public presentation. Also, there was some coverage of an inspection visit by Members of the House of Representatives, the Interstate and Foreign Commerce Committee of the House of Representatives, which, again, I don't think would come under the category of a public hearing, because these gentlemen were not up there for the purpose of holding hearings; they were up there for the purpose of familiarizing themselves with what went on, and there were, of course, a number of shots of the terminal at Logan Airport.

Senator COTTON. Of course, it is a well-known fact that the Members of the House of Representatives are quite eager to be shown on

the television screen, while Senators are shrinking and retiring and don't like that to happen. [Laughter.]

This, of course, is said facetiously. I saw a part of that production, and I suppose it a very proper thing to do. On the other hand, it seemed to me that it could have its dangers when you are dealing with as delicate a subject as the feelings of the public in regard to air safety. While I wasn't criticizing you, I was curious to know just what your policy was.

Just one more question, Senator, if I may be permitted.

When you say "briefings" the briefings of your team or of your investigators, just what do you mean by that?

Mr. BOYD. As will be true in the case of this Convair which crashed last night, the Board, the Director of the Bureau of Safety, designates an investigator in charge immediately upon receipt of notice of an accident. The investigator in charge will ascertain which teams—we have a number of teams or designations of teams—and the investigator ascertains how many teams he will need, witness group, powerplant group, structures group, records group, and so forth. The investigator in charge will get all of these people from the CAB, and from other parties who are interested. For example, the aircraft manufacturer, the engine manufacturer participates in our investigation under the aegis of the CAB investigator. The organization is set up as soon as possible. The individual teams are assigned their responsibilities. They are given such information as the investigator in charge has at the moment. They strike out on their various courses. They meet each morning for a briefing to ascertain what I found out yesterday, which is of interest in the overall investigation, and, furthermore, my team, for example, may have discovered something that the powerplants team will want to pursue further.

This is the purpose of the daily briefings, and this is the briefing that is of and for the members of the investigating teams.

Senator COTTON. Of course, the reproduction of that procedure might be said on the one hand to be of immense interest to the public and perhaps instill in the public more assurance or reassure the public that careful and painstaking investigations are made of these accidents. On the other hand, you occupy a position in which we hope—and we in Congress are constantly open to public criticism and learn how easy it is to have anything we say or do completely misunderstood, misinterpreted, or sometimes significance attached to it that should not be attached to it or intended—it would seem that this sort of production could be attendant with a good many dangers to the public confidence and, for instance, I run into a lot of people in the traveling public who have read about these accidents. I had someone say to me the other day, "I won't fly on an Electra; it is a dangerous ship."

Somewhere that impression, because of these accidents, because of what happened, has gotten circulated. So a type of plane or some carrier, some airline, could well be the sufferer from misunderstandings of that sort. I wonder if you as a Board have considered or worked out as general policy the matter of these investigations?

I realize we in Congress are usually more the offender of that sort of thing than you are. Don't think I am criticizing. I am just wondering if you have.

Mr. BOYD. No, sir. We have a normal procedure; yes, sir. We have the public information officer who deals with the press in the vast majority of the accidents, which are subject to our investigation, and he tries to furnish, in conjunction with the investigator in charge, all of the information in which we feel there is a legitimate public interest, which does not put us in the area of speculating.

Senator COTTON. Thank you.

Senator MONRONEY. Isn't it a fact, Mr. Chairman, that you could no more control the television reporting on accidents than you could the newspaper stories? It is in the realm of a summarization and use of material which the editors or the producers feel are important in the area and we just have to trust our free press or free television to portray it as best it can?

Mr. BOYD. That is absolutely correct, Senator, and this is a problem from which I don't believe there is really any escape, because I try to get home at night in time to watch the news at a quarter of seven on television, and in a few instance, where I have known what happened really, I sometimes find that the impression one gets from the television show is altogether inaccurate and this revolves on a matter of judgment on the part, not only of the TV cameraman, but of the commentator. So I don't think there is really any great hope in any of these areas that nobody will ever get the wrong impression.

Senator COTTON. I think the chairman's question—perhaps he was out inadvertently—placed a slightly erroneous interpretation on my question. I think I made it plain to you that I wasn't suggesting that you should restrain either the newspapers or the television people from transmitting the news to the public. I was questioning more on the matter of having reproduced your procedure, like briefings and other things.

Mr. BOYD. Yes, sir. We—as I said, the television company was most gracious in permitting us to examine this to ascertain whether or not it was accurate. And this they deemed to be a considerable effort on their part, which I think it was. And we feel very strongly that the public interest should be served to free exchange of information as long as we don't get into the area of speculating on what might have caused an accident when we don't know.

Senator—Mr. Chairman, if I may revert back for a moment to one question you asked about birds on the runway: At Logan, there was an abort on a takeoff a month after the Electra crashed. This was with another Electra, and the pilot had gotten up almost to flying speed when he ran into this mass of starlings, which neither he nor the copilot had seen before. According to his testimony, at the time of our investigation, the starlings completely obliterated his view in front of him. He did the only thing that could be done, he chopped his throttles and stopped. Fortunately, he was still on the ground, or we might have been investigating two accidents up there.

Senator MONRONEY. Thank you very much.

Were there any other questions on Boston Logan aircraft accident?

Going on to the others then, with regard to the Missoula, Mont., Northwest crash, where the plane collided with the mountain, was that a landing approach collision or did it occur during flight?

Mr. GOUGH. He was letting down. We are prepared to give you a story on that one.

Mr. BOYD. That was prior to landing approach.

Senator MONRONEY. It would have been normally within reasonable distance of the terminal area.

Mr. BOYD. Yes, sir.

Mr. Chairman, we were planning to provide you with testimony on the Electra accident at Cannelton, on the one at Buffalo, Tex., on the C–46 at Hill Air Force Base, within the item of structures; then the Arctic Pacific C–46 accident, and the Capital accident in Virginia, and the Montego Bay accident in Jamaica, covering the suboperations of weather; and TWA-United midair collision in New York on the subject of traffic control.

If you would like us to discuss the Missoula, Mont., accident, we will be happy to do so, sir, although at the moment we have not reached a conclusion on it and it is a case where the man was flying, the plane was in instrument weather conditions and hit the side of a mountain.

Senator MONRONEY. It would not be then normally considered a terminal area accident?

Mr. BOYD. No, sir.

Senator MONRONEY. How about the Guam accident, the accident on supplemental carrier, World Airways, in which 80 people were killed on takeoff. Was that——

Mr. BOYD. That would be a terminal area accident. As to whether we have any information on that, I don't know.

Senator MONRONEY. Was that investigated by the Civil Aeronautics Board or by the military?

Mr. BOYD. That was investigated by us; we have or had a man out there.

Senator MONRONEY. Now, do you have any information on this?

Mr. BOYD. Mr. Philip Goldstein, Chief of the Operations Division, Bureau of Safety, Civil Aeronautics Board.

Mr. GOLDSTEIN. I don't have any notes on the Guam accident. I will have to give it to you from memory.

This was an accident that occurred shortly after takeoff. It was in an operational area. The aircraft failed to gain altitude, and struck some rising terrain, close to the airport.

At the present time, we have not finished the analysis of the accident and I could not give you the probable cause.

Senator MONRONEY. What are the known facts that are indisputable—lost one motor or two motors, or what happened? What happened generally?

It is not that we ask you to define the probable cause. These accidents which occur halfway around the world sometimes become obscure. Yet what can be learned from them can constitute greatly to our efforts to achieve aviation safety.

Mr. GOLDSTEIN. The aircraft became airborne, after a fairly normal takeoff run, and it failed to climb.

After the accident, we found that the cowl flaps were in the open position on all four engines. Now in aircraft such as these, the climb performance is very critical with the cowl flaps open.

Senator MONRONEY. This is the little breathers, that come up when the airplane is taxiing, warming up for taking off and then are closed at the time of takeoff; is that correct?

Mr. GOLDSTEIN. That is correct; for engine cooling.

Senator MONRONEY. Are they manually closed or automatically closed?

Mr. GOLDSTEIN. Those are closed by the crew.

Senator MONRONEY. You found all four open?

Mr. GOLDSTEIN. All four of the cowl flaps were open.

Senator MONRONEY. Was there testimony or inquiry to establish the fact that the plane would not properly climb out with them open?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. Was there any evidence of any overweight or any history of the aircraft that it had failed to be maintained or kept in proper operational condition?

Mr. GOLDSTEIN. As I recall, there was a temporary patch on one of the empennage surfaces; however, this did not affect the flight of this aircraft.

Senator MONRONEY. So far as you know, there was nothing that would have—a deficiency in maintenance or rejected on inspection or anything like that?

Mr. GOLDSTEIN. I don't recall any such evidence.

Senator MONRONEY. And that investigation is still underway?

Mr. GOLDSTEIN. Yes, sir.

Senator COTTON. When you say these were closed by the crew, you mean from within the aircraft or by the ground crew?

Mr. GOLDSTEIN. No, sir; these are controlled by the pilot or co-pilot in the aircraft.

Senator COTTON. Then they are closed automatically by the pilot mechanically?

Mr. GOLDSTEIN. Yes, sir; they are closed mechanically; it is by the use of a switch in the cockpit.

Senator MONRONEY. That would be on the regular checklist before takeoff, is that correct?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. After he is cleared for takeoff, then in the final checklist, this would be a procedure that would normally be followed in all operating manuals?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. Senator Hartke?

Senator HARTKE. No questions.

Senator MONRONEY. Do you consider this Toledo crash a weather accident? We are going to group that accident in this category, are we not?

Mr. BOYD. That is covered under operations and weather, Senator.

Senator MONRONEY. Yes, sir.

Are there any others in this list that you consider to be strictly a terminal area problem?

Mr. BOYD. Well, we have the—this gets to be a question of definition, Senator, the TWA–United mid-air collision.

Senator MONRONEY. This, I think we want to take under the subject of air traffic control, because it involves a great deal more than normal deficiencies of landing space.

Mr. BOYD. We don't consider it as a terminal area accident.

Senator MONRONEY. In the Atlanta, Ga., crash of the 880, that was on a training flight?

Mr. BOYD. Yes, sir.

Senator MONRONEY. Is there any information relative to its cause that you can give us at this time?

Mr. BOYD. Well, that, of course, was clearly a terminal area crash. The Board has undertaken extensive analysis of this. We get into the areas of training procedures and controllability in that crash.

Senator MONRONEY. Since you have not had time enough perhaps to make a more complete public report, would you care to discuss this in executive session?

Mr. BOYD. Yes, sir, we would be happy to do so.

I will say this is a most difficult type of accident to ascertain the probable cause of, in that it does require some very extensive engineering studies. We would be glad to go into it with you in executive session to the extent we can.

Senator MONRONEY. Aside from those, in the scheduled airlines, and the supplemental carriers, other than those which have been grouped in other categories, those are the principal cases involving the terminal area crashes, is that correct?

Now, one other that we asked about, and I understand informally that because this was an Avianca aircraft, it involved the study and investigation that was carried on by a foreign government. Would you like to comment on this in open session or would you think this would be something that would have to be taken up in executive session?

We want to know more about this accident and the reason for it, but I can appreciate some reciprocal agreements between the governments for carrying on their own inspection.

Mr. BOYD. I think, Senator, that it really makes no difference to us whether this is taken up in open session or executive session.

As you indicated, the committee realizes that the Civil Aeronautics Board did not investigate that accident and about all we can tell you is what is in the report issued by the Jamaican Government.

Senator MONRONEY. That is a public record, is it?

Mr. BOYD. Yes. We have that here.

Senator MONRONEY. We would like to have that, and then if there is any further study, we can take it in executive hearing.

Mr. BOYD. All right.

Senator MONRONEY. This is strictly a terminal area type accident.

Mr. BOYD. We will make available to you our copy of that.

Mr. Goldstein is the man most familiar with it.

Senator MONRONEY. I note Senator Hartke's particular interest because it involved the death of the son of one of our distinguished colleagues from Senator Hartke's State.

I think if this is a public document, we would like to have it. I know I have not seen the results and I am sure that the committee and press perhaps have not had it either.

Mr. GOLDSTEIN. This is a very lengthy report. This was prepared by the Jamaican Government, and with your permission, I would like to read their conclusion as to the cause of this accident.

1. The cause of the accident was the adoption of the final approach path resulting in a heavy landing during which a major structural failure occurred in the port wing in the immediate vicinity of Station 80 joint caused by the transmission of stresses through the undercarriage in excess of those which

would be encountered if the rate of sink of the aircraft at the time of impact had been controlled within the designed maximum of 10 feet per second.

2. The primary responsibility for the safety of an aircraft and its complement is vested in the cabin. The primary responsibility for this accident must rest on Captain Duque. However, there is evidence of mitigating circumstances in that the errors of judgment that precipitated the disaster reflects some deficiency of knowledge which should have been instilled in the training and flight proficiency checking of the pilots of FHK–177. A measure of responsibility for the accident must therefore evolve on the supervisory and advisory authorities responsible for the overall conduct of the operation.

Senator MONRONEY. That is the full summary?

Mr. GOLDSTEIN. That is the conclusion and probable cause of the accident as given by the Jamaican Government.

Senator MONRONEY. Senator Hartke, would you like to see the full report? It is a public document.

Senator HARTKE. No; I don't want that, and you do whatever you want to.

Mr. Chairman, I would just like to say, I had occasion—this is a sidelight on this thing—I have had occasion to watch some of these people work. I never watched a man work so hard for as many hours in my life as Mr. Goldstein one time and I want to commend him for that.

But in regard to this particular accident, in other words, the pilot himself had worked long hours, long beyond what would be normal in the United States; is that the fact?

Mr. GOLDSTEIN. Yes, sir; according to our standards.

Senator HARTKE. According to our standards, and there was nothing that we could do in the United States, even under the present regulations, to have kept him here or prohibited him from flying or stopped him or anything else?

Mr. GOLDSTEIN. That is correct.

Senator HARTKE. And as far as supervision and training, there was not anything we as a government under the present setup, regulations and laws, could have done?

Mr. GOLDSTEIN. That is my understanding; we have no control.

Senator HARTKE. That was beyond the control of the CAB or FAA or any other agency of our Government?

Mr. GOLDSTEIN. Yes, sir.

Senator HARTKE. Under the present situation as it is today, there is nothing under the regulations—this is in relation to a question I asked earlier—which makes the foreign carriers comply with the same type of safety regulations that our domestic carriers use, is that correct?

Mr. GOLDSTEIN. I believe I would like to have that question deferred to the FAA.

Senator HARTKE. All right.

One other thing I would like to ask you is this: When this plane—I think this is in the report, but as it landed, many of the people were burned to death, were not killed on impact; is that correct?

Mr. GOLDSTEIN. Yes; that is correct.

Senator HARTKE. I would like to ask you then, from the CAB standpoint, if there has not been developed a fire inerting system under NASA supervision which would have been, if it had been on this plane, probably could have stopped this particular flash fire afterward?

Mr. GOLDSTEIN. I know that NASA has done considerable work along these lines. However, I am not thoroughly familiar with it.

Mr. GOUGH. I couldn't answer that question.

Senator HARTKE. You are not familiar with this?

Mr. GOUGH. I am familiar with the tests that were made for crash fire inerting, but I could not say there is a system that would have eliminated that fire.

Senator HARTKE. There have been tests by NASA which you are familiar with, I am sure, developing a fire inerting system generally which is to put out fires caused by fuel, caused by friction, or any other type of spark; isn't that true?

Mr. GOUGH. That is the attempt.

Senator HARTKE. And it has worked on military planes and has been shown to be effective in film strips and tests; isn't that true?

Mr. GOUGH. There have been tests and they have shown generally that you can determine ignition sources. They don't say you can catch all of them.

Senator HARTKE. But they have demonstrated rather conclusively, have they not, I am not trying to play a game with you, I am trying to find out if you have seen these films?

Mr. GOUGH. I have seen these films.

Senator HARTKE. And they demonstrated if you had this equipment on the planes it probably, in most cases, would put the fires out. The one over in Germany is about the same thing?

Mr. GOUGH. I think that would be a big help. I think that is in the right direction.

Senator HARTKE. You don't think the equipment is developed far enough?

Mr. GOUGH. I am sure it has not been developed far enough because it isn't being generally used. This was a research project you talked about. The development of it for specific applications is something else.

Senator HARTKE. Mr. Chairman, I don't want to get boxed into an argument over what is what, but here again, in the field of general publication, that has been the reason that the manufacturers won't put it on because plane carriers don't demand it, and the reason plane carriers don't demand it is because Federal agencies say they don't have to have it, and Federal agencies say they don't have to have it for some reason and it just goes in a merry-go-round, although this has been published several times and probably been available and tested on Navy equipment.

Senator MONRONEY. I think if the Senator would permit a suggestion, this appears to me to come more within the evaluation duties of the Research and Development Section of FAA which is spending a huge amount of money on these devices and the CAB has just told us that they have a hard time keeping up with accident investigation with their present staff.

Senator HARTKE. Mr. Chairman, I couldn't agree more. I do think that these people do a fine job in accident investigation, I honestly do.

Senator MONRONEY. I share that view, and we will have, for the Senator's information, testimony from the FAA Research and Development on this subject. This will come at a later stage in the hearing.

If there are no further questions on this—Senator Cotton?

Senator COTTON. No questions.

Senator MONRONEY. We discussed informally the Sabena 707 accident in Brussels. It is my understanding that it is too early to have anything definitive, that this is being investigated by the Belgian authorities, and that two of our observers are at present on the scene of the accident by invitation of the Belgium Government; is that correct?

Mr. BOYD. I don't know. We have two there by invitation of the Belgian Government, Senator. There are two FAA personnel on the scene. Whether they are from the U.S. office or whether from the Paris office of FAA, I do not know. I can state, sir, that the Civil Aeronautics Board has advised the Department of State that we would be happy to furnish observers, whatever the Belgian Government might desire from us in connection with the investigation of this accident.

Senator MONRONEY. You have heard nothing from the State Department as yet?

Mr. BOYD. The Embassy in Belgium has been advised and has the authority to indicate to the Belgian Government, but we have received no word.

Senator MONRONEY. If there is anything further we can take it up in executive session.

We move on now to the question of the Arctic-Pacific crash of the C–46 at Toledo, which resulted in 22 fatalities.

I believe you are prepared to give us the data that has been developed so far. Public hearings have been held on this, have they not?

Mr. BOYD. Arctic-Pacific; yes, sir.

The next witness will be Mr. C. E. Stillwagon of our Kansas City office, who was the investigator in charge of this accident. You may proceed, Mr. Stillwagon.

Mr. STILLWAGON. Mr. Chairman, members of the committee, I have a brief I shall read with your indulgence.

Senator MONRONEY. Speak up a little louder. This is a large room and it is hard for those attending the hearings to follow unless you speak louder.

Mr. STILLWAGON. This is an accident concerning Curtiss C–46, N–1244N, on the Toledo Express Airport, October 29, 1960.

At approximately 2201 eastern standard time, an Arctic-Pacific, Inc., aircraft crashed during takeoff on the airport. Of the 45 passengers and 3 crew members aboard, 20 passengers and the captain and copilot were fatally injured.

Arctic-Pacific, Inc., provides supplemental air service and operates under a temporary certificate of public convenience and necessity which expires March 20, 1961. The FAA air carrier operating certificate was due to expire at midnight of November 14, 1960, and the purpose of this flight was to transport the California State Polytechnic College football team from San Luis Obispo, Calif., to Toledo, Ohio, and return.

N–1244N departed Oakland airport at 0535 Pacific standard time on October 27, 1960, for Santa Maria airport where the football team was picked up. The crew consisted of Capt. Donald Cheser, Copilot Hard Perovich, and Stewardess Mrs. Danny Miller. A second crew

which was to deadhead to Kansas City consisted of Capt. Robert Fleming and Copilot Lucien Tessier.

The flight departed Santa Maria at 0811, Pacific standard time on the 27th, and made fuel stops in Albuquerque and Kansas City, and arrived in Toledo at 0022 eastern standard time on the 28th.

The aircraft unloaded the California Polytechnic football team and deadheaded to Youngstown where they picked up another football team which was transported to New Haven, Conn. Upon return trip to New Haven, the ballplayers were unloaded at Youngstown and the aircraft deadheaded again to Toledo where it arrived at 1957 eastern standard time in the 29th.

Investigation disclosed that Captain Cheser had been briefed at Toledo on the weather sometime between 2030 and 2100 eastern standard time following his arrival there to pick up the football team for the return trip to Santa Maria. The weather observer gave existing weather, en route weather and terminal weather for the planned flight to Kansas City.

During this time the weather at Toledo Express Airport was partial obscuration, one-sixteenth of a mile visibility in fog——

Senator MONRONEY. A little slower please—one-sixteenth of a mile in fog?

Mr. STILLWAGON. Yes, sir. Temperature 39, dew point 38.

The passengers and crew boarded the aircraft.

Senator MONRONEY. You had one-sixteenth of a mile. That was the visibility. What was the ceiling?

Mr. STILLWAGON. Ceiling was variable, partial obscuration.

Senator MONRONEY. What does that mean?

Mr. STILLWAGON. In this case the fog was what I believe would be considered ground fog, and was according to PIREPS some 3,500 feet thick.

Senator MONRONEY. How low was it? What was the measured ceiling?

Mr. STILLWAGON. On the ground and up approximately 3,500 feet mean sea level which would bring it down to about 2,300 feet.

Senator MONRONEY. Was your measured ceiling 100 or zero or 200 or what?

Mr. STILLWAGON. The ceiling—you could see the stars straight up, but if you looked off at an angle you couldn't see any ceiling. In other words, it was what is termed variable, partial obscuration. It was a ground fog.

Senator MONRONEY. Okay.

Mr. STILLWAGON. The passengers and crew boarded the aircraft approximately 30 minutes before the actual takeoff.

Because of poor visibility in the fog, several aircraft refuelers assisted the pilot in directing the aircraft to the taxiway leading to runway 7. Some passengers later interviewed stated that an engine or engines sputtered and cut off during the engine runup and prior to takeoff. Other passengers stated the runup check was normal.

During the pretakeoff check of the engines, which took as much as 20 minutes, according to some witnesses, the crew obtained an IFR clearance from the tower. The IFR clearance was Victor Airways to Kansas City by way of Joliet, Ill.

At approximately 2200 eastern standard time, the aircraft was cleared for takeoff on runway 070, and the aircraft became airborne, veered to the left and crashed approximately 1,000 feet short of the runway 070 and 50 feet left of the 07–25 taxiway. The aircraft's left wing struck the ground on magnetic heading of approximately 35° and while in approximately a 30° left bank.

The aircraft cartwheeled to the left, causing fuselage to break, the rear section continued forward and came to rest inverted on a heading of 45° magnetic. The forward fuselage and wing came to rest right-side-up on a heading of 225°.

The impact forces caused the left engine to separate from the mounts and fire occurred immediately after impact and destroyed the cockpit section, the right wing to just outboard of the No. 2 engine, and the fuselage from the cockpit back to fuselage station No. 295, and the landing gear was found in the full down position, although the right gear was not fully locked down.

The flaps were found in the full retracted position. The shim plates of both propellers indicated they were positioned at the low pitch setting of 10° at impact. One propeller blade from both No. 1 and No. 2 propellers had separated from the hub, and No. 1 engine had separated from the mount and suffered impact damage in the areas of Nos. 12, 13, 14, 15, and 16 cylinders. There was no fire damage to No. 1 engine. No. 2 engine had not been damaged by impact but it did have fire damage on impeller section aft.

The left magneto of No. 1 engine showed evidence of condensation. The rotor-rotor spring center electro was missing from this magneto as was the center carbon brush.

Examination of both engines disclosed no indications of preignition detonation or internal failure. No. 1 engine was a Pratt & Whitney R–2800–79. Although this is a certificated engine, due to a technicality, this engine was not eligible for installation on C–46 type aircraft. The engine was overhauled by the U.S. Air Force in 1957 and its installation on N–1244N was in violation of CAM 42.30–1(f).

Of the 26 persons who survived the crash, many stated the left engine sounded and appeared to run rough during the engine runup. They stated the engine sounded normal during takeoff until they experienced a veering to the left, followed by some fishtailing of the aircraft.

Just before impact, several passengers stated the left engine was heard to sputter, again as it did during the runup. Witnesses located inside of the terminal building and positioned in open doorways overlooking the runway stated the engines sounded as if they were sputtering, missing, or cutting out during takeoff. Some of these witnesses stated the engine sounded as if the throttles were retarded. This was followed by a short period of silence and an explosion.

A special weather observation taken 1 minute after the accident indicated the weather at Toledo Express Airport was partial nine-tenths obscuration, zero visibility in fog, temperature 39, dew point 38, wind east, northeast at 5 knots.

Investigation further disclosed that with the full load, 45 passengers, baggage, and a crew weight of 340 pounds, the aircraft weighed

more than the maximum allowable gross weight of 47,100 pounds allowable for takeoff at Toledo Express Airport.

Investigation on this is still continuing.

Senator MONRONEY. I see. In other words, there are several points of violation: one is the use of an unauthorized motor, last overhaul I think you said in 1957?

Mr. STILLWAGON. Yes, sir. There is a technicality connected with that. Something, the regulations, I believe, state to the effect that an engine must be overhauled within a given period to be placed on the airplane legally, and if not, if it has been stored for over a year, it must be dismantled to the extent that you can see the inside as to whether it is full of rust, corrosion, or what have you.

This was not done to this engine, therefore due to this technicality, it was illegally installed.

Senator MONRONEY. Probably more than a technicality?

Mr. STILLWAGON. Hard to tell what was inside.

Senator MONRONEY. In other words, it was put on without proper examination and after having been withdrawn from the Government storage warehouse?

Mr. STILLWAGON. It was in storage for about 2 years, quite a stretch.

Senator MONRONEY. What was the time that the motor was installed on the plane?

Mr. STILLWAGON. The engine had zero overall time but had run some 200 hours after the date of installation on this airplane.

Senator MONRONEY. That would not be an excessive amount of time had it been inspected properly?

Mr. STILLWAGON. No, sir, it would not.

Senator MONRONEY. Now, the captain of the plane, Captain Chesher——

Mr. STILLWAGON. Yes, sir.

Senator MONRONEY. Was he the man under some kind of an action on his license for flying——

Mr. STILLWAGON. It was my information that he had had a license revoked and had appealed, and due to that, he was still legal to fly.

Senator MONRONEY. This was on appeal to the Civil Aeronautics Board?

Mr. STILLWAGON. Yes, sir. Insofar as that is concerned, while his license was still in his possession, he had not been properly checked out in his 6 months proficiency checking, so he was not legally permitted to fly that trip.

Senator MONRONEY. Furthermore, the reason that his license, as I understand it, was under suspension, was the fact that he had supposedly flown more hours than he was legally permitted to fly. Being a part owner of the company, as I understand it, he——

Mr. STILLWAGON. Yes, sir, I don't think he was part owner. In any event, he had flown many more hours than he was supposed to. He failed to keep proper records and many things in connection with it.

Senator MONRONEY. Was there any evidence of the entire flight being flown by Captain Chesher without any normal rest period?

Mr. STILLWAGON. I checked back to indicate he had flown continuously some 13 hours plus in one stretch. Although he had another crew on board, they had not been flying.

Senator MONRONEY. He had been doing the sole flying?

Mr. STILLWAGON. That is correct.

Senator MONRONEY. Was the other crew qualified to fly?

Mr. STILLWAGON. They were along for the purpose of relieving him and flying various legs. However, they had not done that.

Senator MONRONEY. I see. The ceiling, you said, measured immediately after the crash, was zero-zero; is that correct?

Mr. STILLWAGON. No; the ceiling was not zero-zero; it was still variable, as it had been in the first place. However, the information that we have from the Weather Bureau is expressed as partial nine-tenths obscuration; zero visibility; temperature, 39; dew point, 38.

We have Mr. Halon in our party, who is the weather expert for the Board. I believe he would be better able to explain that ceiling situation than I am.

Senator MONRONEY. Yes, sir. We will be glad to hear from him.

Mr. HALON. Mr. Chairman, this is something which has been of concern to us in the Board for some time, the entire question of ceiling and visibility as we now measure it and, in connection with your points relative to terminal areas, this is one problem that has led to a memorandum which we have just sent to the National Advisory Committee on Aeronautical Meteorology, drawing their attention to at least 15 accidents in the last 10 years where this question of ceiling and visibility has arisen and certain deficiencies that have shown up, and ask that they take a fresh look at the entire problem.

We have given them one possible course of action, after the following summary, which is contained in this report.

The foregoing, we believe, indicates clearly, we believe, a view of present practices with respect to observation and operational use of ceiling visibility. Any new procedures should provide for (*a*) the proper location of observers and observing facilities to afford observations related to the approach area, the active runway, and takeoff area; (*b*) the reporting of only those visibilities and clouds and amounts and heights that are actually observed; and, (*c*) the establishment of operational minimum based upon directional visibility on the runway of intended landing or takeoff.

We then go into certain recommended actions for their study and hope that something comes from it but back to the immediate point, with respect to the accident at Toledo Express Airport, the ceiling, believe it or not that night, was unlimited, according to the present definition. Until the obscuration due to fog or whatever else may be causing the obscuration completely obscures the sky, so that it is ten-tenths covered, as they put it, there is no ceiling due to the obscuration, so that at this time, from 2057 eastern to 2218 eastern standard time on the night in question, until 2228, the ceiling was unlimited and visibility ranged from one-sixteenth to zero in fog.

At 2228, the sky was completely obscured, and they were reporting an indefinite zero ceiling with visibility zero. So that I can go into the direct observations if you wish, but that is the case, in other words, at the time of the accident, and from 2133 until 2228, approximately 1 hour, nine-tenths of the sky was obscured by fog, visibility zero, but they could still see the moon dimly through this fog, so the ceiling was unlimited.

Senator MONRONEY. This kind of gets into the question of semantics. What we are trying to arrive at is whether the weather was safe enough for a takeoff at the time. As I understood the testimony of the preceding witness, he had to have ground crews walking the very

short distance ahead of him, evidently with a flashlight to show him how to reach the taxiway.

Now, we are not concerned here with terms of art and measurement so much as we are in whether practical commonsense would have a man trying to get off a runway with an old airplane and a pretty heavy load, and whether there was any advice that he received that would have indicated to a prudent pilot that it was a dangerous takeoff, period?

Mr. STILLWAGON. Mr. Chairman, the regulation or the rule insofar as when you can or cannot take off is concerned, is regulated through the operations manual of the individual company.

The FAA has no regulation on takeoff. If you can make it, fine and dandy. But, each company has its own regulations as to various airports, what your limitations are or your minimums, and in this case, as I recall, his minimum was 300 feet ceiling and one-half mile visibility with variables of say 400 and three-quarters, or something of that sort. And he did not obey the regulations that are set up in this company's operations manual.

Senator MONRONEY. Did this company have an operations manual?

Mr. STILLWAGON. He had one; yes, sir.

Senator MONRONEY. Doesn't the FAA have minimums in which normally you consider the field closed for landings or takeoffs?

I think it is 200 at Washington National Airport and half a mile. I believe almost all of the airports, have fixed minimums set by the FAA and that there are company manuals which may require even more adequate minimums which if violated can also subject the pilot to action by the FAA.

This seems to me to be an area which should be more thoroughly explored.

Mr. STILLWAGON. I am afraid that they have no rule as to the minimum for takeoff. It is dependent upon the company manual and the manual is approved by the FAA.

Senator MONRONEY. You mean there is no such thing, then, as a minimum at Washington National Airport?

Mr. STILLWAGON. For takeoff, yes sir. Well, it depends on the part for which they are operating. These people are operating under part 42 of the Civil Air Regulations.

Senator MONRONEY. That is different from the scheduled airlines?

Mr. STILLWAGON. To some extent.

Senator MONRONEY. Scheduled airlines do have to observe certain minimum takeoff limits by the FAA; is that correct?

Mr. STILLWAGON. To my knowledge.

Senator MONRONEY. Why is part 42—this is a certificate given by the CAB for nonscheduled carriers; right—why would the rule be different for their takeoffs, in view of the fact that the scheduled airlines with their vast publicity and their vast operations would be inclined to back this up in ther manuals, whereas a nonscheduled airline might be less likely, I think, to have minimums written in its manual?

Mr. STILLWAGON. I am afraid I can't answer that, sir.

Mr. BOYD. Mr. Chairman, I think that question can best be answered by the FAA. I don't believe we are qualified to give you an answer to that.

Senator MONRONEY. But the part 42 certificate is one that you issue. They operate under an exception. And I wonder if the exception includes also their exception from the FAA minimums which apply to scheduled certificated airlines.

Mr. BOYD. No, sir. The exception to which you allude is an exception from the economic aspects of our regulations only.

Senator MONRONEY. It doesn't exempt them from any safety aspects?

Mr. BOYD. No, sir.

Senator MONRONEY. Those are the things we want to find out; where the authority rests on these matters. Certainly, as far as your testimony indicates, you do not make the rules on the minimums for takeoff or landing, you do not enforce them, because this is an action by the FAA against the pilots, and you would have no authority to physically prohibit a takeoff under such adverse conditions as those possibly existing at the time of the accident. It that correct?

Mr. BOYD. None whatsoever.

Senator MONRONEY. Let's get this in plain, simple, 25-cent language.

At the time this man taxied out with his aircraft, how far could he see on the ground?

Mr. STILLWAGON. The best we have been able to compile is about 150 feet.

Senator MONRONEY. About 150 feet?

Mr. STILLWAGON. Yes, sir.

Senator MONRONEY. He would have to inch his way out on the runway because you had a ground fog that might not go up very high, but vertically it was almost impenetrable?

Mr. STILLWAGON. That was correct. He had nothing from the ground up.

Senator MONRONEY. As he reached the end of the runway to prepare for takeoff and runup, how far could he then see down the runway?

Mr. STILLWAGON. He said he could see, in answer to a query from the tower, three lights. The lights, as I recall, are about 60 feet apart.

Senator MONRONEY. That would be 180 feet, would it not?

Mr. STILLWAGON. Yes.

Senator MONRONEY. Then the measured ceiling, you had none, it was undulating and indefinite and uncertain; is that correct?

Mr. STILLWAGON. Yes.

Senator MONRONEY. But as far as the posture of the aircraft, going down the runway at a speed of takeoff, which probably approaches 90 miles an hour at least——

Mr. STILLWAGON. With the load he had on, he would have to have approximately 103 knots to take off.

Senator MONRONEY. Approximately 115 miles—or 118 miles an hour, with 180 feet visibility. In other words, he would not hardly have any chance to see where the lights were that he was passing?

Mr. STILLWAGON. That is correct.

Senator MONRONEY. Now, did you have the tapes from the control tower to the plane in question? Did you examine those and have those played back to know what the control tower operator said?

Mr. STILLWAGON. Yes, sir; we had the tapes.

Senator MONRONEY. What kind of tapes?

Mr. STILLWAGON. That is only oneway tape, you only get the tower conversation of it. We do not get the captain's conversation.

Senator MONRONEY. You have heard these tapes played back?

Mr. STILLWAGON. Yes, sir.

Senator MONRONEY. What do they indicate—not direct quotes; you don't have direct quotes here, do you?

Mr. STILLWAGON. That I do not, but they simply indicated that he was unable to see but a very, very short distance, due to the fog. He indicated no further troubles. He accepted his clearance from ATC, given to him through the tower, and was cleared for takeoff, and that was the last that was heard from him.

Senator MONRONEY. That was the clearance, was it, for his ATC flight plan, which was cleared by the Air Traffic Control Center, and not by the tower?

Mr. STILLWAGON. That is correct. The ATC gave clearance to the tower, the tower radioed it to the captain, or whatever member of the crew was receiving it, and then, when he declared he was ready for takeoff, the tower cleared him for takeoff.

Senator MONRONEY. Did that mean that the tower was saying that there was no conflicting traffic in the air, or in the pattern?

Mr. STILLWAGON. That was correct, sir.

Senator MONRONEY. That was as far as it went?

Mr. STILLWAGON. Yes; they wouldn't have cleared him had there been any conflicting traffic.

Senator MONRONEY. Would they have any right to say this field is below minimums, and you are carrying passengers for hire, and the tower notifies you that takeoff would be in violation of the air traffic safety rules?

Mr. STILLWAGON. Well, the tower had a perfect right to tell him that, but they couldn't do anything about it. They had no authority to stop him from taking off.

Senator MONRONEY. That is what I am trying to get at.

Mr. STILLWAGON. No, sir.

Senator MONRONEY. What appears to be, if there is a regulation, that you say perhaps it doesn't apply to part 42 operators, and this is going to be a good question for the FAA to answer when they come here, but, certainly, there are some minimums that apply to the private pilot, to business aircraft, to a nonscheduled airline, or to a cargo carrier, where they are just not given absolute freedom to take off in weather so limited that they could not even see the lights on the runway.

Isn't there any one on the Board familiar with what the law or regulations are? It seems to me to be one of the fundamental issues of air safety.

Mr. BOYD. Mr. Chairman, I am a little reluctant to go out on a limb, but I don't believe the FAA—I don't believe there is authority in the law today to advise or to require a carrier, whether it be part 42 or the scheduled, to stay on the ground.

Senator MONRONEY. Every few weeks or so we read where Idlewild, Washington National, Midway has been closed to all traffic.

Mr. BOYD. That is true.

Senator MONRONEY. Somebody must close it. There must be some minimums below what is necessary to authorize the closing of the field and which would result in automatically stopping traffic. I mean, just during these recent snowstorms, we were told that it was closed to traffic. Once in a while a plane gets in trouble and they bring him in on radar.

Mr. BOYD. I think, Mr. Chairman, Mr. Zacko of our operations staff can give you a pretty good brief rundown on this whole situation.

Senator MONRONEY. I think this is probably one of the most important features of the hearing. If even the scheduled airlines may be able to take off on the decision of one man, contrary to the established minimums, then I think we should know it right away and have hearings specifically designed to correct that failing.

Mr. BOYD. With your indulgence, sir, Mr. Zacko will address himself to that point.

Senator MONRONEY. State your name.

Mr. ZACKO. Joseph C. Zacko, Civil Aeronautics Board, Operations Division.

Perhaps I can clarify this takeoff minimum question. The Administrator has established a takeoff and landing minimum for aircraft operating under part 40 and part 42 of the Civil Air Regulations. We have approach minimums for part 40, part 42, and part 43. The only exception would be for the part 43 general operating aircraft, personal owner-type aircraft; they have no takeoff minimums.

Zero zero, an aircraft operating as a private aircraft, has no minimums for takeoff. Part 42, part 40, do have takeoff minimums established by the Administrator. They are published as rules of the Administrator and they appear in coast and geodetic charts.

Senator MONRONEY. These are applied to the part 42 operators, the certificated nonscheduled operators?

Mr. ZACKO. That is correct.

Senator MONRONEY. This airline, as I understand, had not yet qualified, so what part would he be operating under?

Mr. ZACKO. Even a part 45 operator—this was an operator who was operating on a part 45 air taxi or commercial operator on charter flights—still has to operate under the operational provisions of part 42 of the Civil Air Regulations. This is whether or not he has a certificate of convenience and necessity from the Civil Aeronautics Board. The Administrator requires that he meet the operational provisions of part 42. This includes weather minimum. That is established in part 60 of the Civil Air Regulations.

Senator MONRONEY. Now, what would be those minimums for the Toledo Field?

Mr. ZACKO. I do not have a chart available at this time which would contain the minimums for takeoff. This depends on the type of aircraft used, the lighting system, and so forth. The Administrator takes all of these things into account, number of engines, the available number of alternate airports, and many things are taken into consideration before these minima are established.

Senator MONRONEY. But if the visibility was 180 feet, as was described, seen to 200, or whatever range it was, do you know any airport in the United States that would have that as a sufficient visibility, ground visibility for takeoff?

Mr. ZACKO. If my memory serves me correct, the lowest visibility that I can recall on that, a scheduled air carrier can depart, is one-quarter of a mile with an airport available as an alternate within 15 minutes flying time.

Senator MONRONEY. That would be over 1,000 feet visibility?

Mr. ZACKO. Yes, sir.

Senator MONRONEY. But if the takeoff was below minimum, who would be the one to advise, so that the pilot would be on notice what the minimum was?

Mr. ZACKO. The tower should advise the pilot of the existing visibility. However, the tower has no authority to deny takeoff clearance to an aircraft regardless of weather conditions.

Senator MONRONEY. But to say he clears him for takeoff, then that is a misnomer?

Mr. ZACKO. That is right, all he is saying, with reference to other traffic, this aircraft is cleared for takeoff. He has no authority to deny clearance.

Senator MONRONEY. Was there anything in the tape of the responses from the tower when the pilot apparently had advised that he could see three lights down the runway, that this was evidently below minimums or anything of that kind?

Mr. STILLWAGON. No, sir; there was not.

Senator MONRONEY. In other words, there was nothing in the tapes that would indicate any advice from the air-traffic control tower that this plane should not take off or that it might be a violation of the rules and regulations of the FAA?

Mr. STILLWAGON. No, sir; nothing said in that relation at all, sir. The only thing that the tower advised this man was that the fog is pretty thick, watch out for parked aircraft. He made a walking tour of the area and located other aircraft, so he knew where they were.

Senator MONRONEY. Senator Cotton?

Senator COTTON. Regardless of how reprehensible or ill-advised this takeoff may have been in relation to the visibility, did the visibility or rather the lack of it, actually have anything to do with this particular accident other than the fact that there wouldn't have been an accident if they hadn't taken off?

Mr. STILLWAGON. I would consider it as a contributing factor.

Senator COTTON. How, in what way?

Mr. STILLWAGON. Well, this pilot was probably having considerable trouble seeing where he was going, for one thing, as you can well imagine. The possibility of a partial loss of power on one engine was developed. And by virtue of the fact that the fog was known to be some 2,800 feet thick from the runway up, the pilot undoubtedly wanted to get up out of that as fast as he could, and when he was having trouble trying to find the runway, trying to go down the runway, his supreme effort was to get the airplane in the air where he could steer it.

Senator COTTON. In other words, you would be inclined to believe that first he actually took off or left the ground sooner than he should have in the safe operation?

Mr. STILLWAGON. Yes, sir.

Senator COTTON. And secondly, attempted to gain altitude at a faster rate or greater or sharper angle than he should have safely, is that correct?

Mr. STILLWAGON. That is correct; coupled with that he had an aircraft that was, oh, in the neighborhood of 2,000 pounds overweight.

Senator COTTON. But to that extent, lack of visibility, I am not excusing, but to that extent, the lack of visibility did actually contribute?

Mr. STILLWAGON. It was a contributing factor.

Senator COTTON. But the main factor was the inefficiency or the mechanical deficiency of the motor?

Mr. BOYD. Senator, if you will excuse me, sir, we are getting awfully close to speculating here on probable cause.

Senator COTTON. I am sorry. In other words, not having completed your investigation and major findings, I shouldn't try to ask such specific questions?

Mr. BOYD. I am afraid, sir, we might feel very foolish, if we expressed this afternoon our thinking——

Senator COTTON. I didn't mean to get you in that situation. I think the question of whether or not the visibility contributed to the accident was all right to show on this record.

Mr. BOYD. Yes, sir; I think that very definitely that is a fact, that we can all agree on that.

Senator COTTON. I won't ask any more questions.

Senator MONRONEY. We'll want to go further into these regulations as to minimum takeoffs. Does the Board have any correspondence up to now with the FAA, as a result of this accident regarding takeoffs under less than minimum specified conditions?

Mr. BOYD. Mr. Chairman, we have not had any correspondence with the FAA on this specific subject, but it is our understanding that the FAA has, at the present time, a project under study dealing with the matter of possible denial of clearance where there are inadequate minimums for takeoff in the ice——

Senator MONRONEY. Regarding accident investigations it seems to me that some clearer procedure is needed so that when you find a very questionable situation, where at least there is a strong suspicion that it has contributed to a large number of casualties, that a temporary emergency rulemaking action could be taken.

Mr. BOYD. I think if the FAA concluded that this was an emergency situation, they do have the authority to adopt such an emergency regulation.

I should point out, Mr. Chairman, though, I think for the purpose of objectivity, that the matter of an instrument takeoff is not really considered a critical operation by and large.

I don't mean that it is an everyday affair, but it has been my experience that certainly in the military, and not just in the interceptor operations, the pilots are trained, as a matter of course, to make instrument takeoffs and I believe this is true of all the commercial scheduled air carriers.

I think part of their training is that they make takeoffs under the hood. I don't speak as any expert on this matter at all, but I do believe that you would find that a great many instrument takeoffs have been made and that it is not considered a dangerous maneuver.

Senator MONRONEY. I was under the impression, as your witness was from your Operations Department, that there was at least about a minimum of one-quarter of a mile.

Mr. BOYD. Yes, sir.

Senator MONRONEY. To see that the plane is properly started down the runway at least, and that you have about 200 feet, as you are on instruments and visual before you get your nose into the soup, and it would seem to me that we come to a situation where again I think that the pilot could be summonsed on his license responsibility for violating a rule if he makes it.

There is nothing in the law to give the airport manager or anyone the right to require that the plane not take off under conditions below the minimum.

Mr. BOYD. That is very true, sir. I do think it fair to point out, however, that this accident encompasses problems other than that of merely taking off without sufficient visibility.

Senator MONRONEY. I am sure it does. Those are questions that certainly a careful review of the law may correct. The right to fly while under suspension should be a matter of concern to the Board. You might have to have the option of saying you are suspended from all flying until we can take a look at this.

These are the things that make these accidents quite important in searching for air safety. The overloading of the plane is another thing. Under the conditions he was taking off, this magnified it, because if he was trying to horse the plane off the runway early because he could not see the runway, and was going beyond the pull of power that was proper for his takeoff or anything else, that compounds the danger factor in this whole operation.

Mr. BOYD. Yes, sir; I think that in the field of violations, such violations as we had in this case, neither the Board nor the FAA can afford, in the public interest, to show very much sympathetic understanding.

I think that we have both got to be very harsh in our judgment, because there is so much at stake here in terms of human life.

Senator MONRONEY. Well, is there anything further on this particular accident you would like to tell us?

Mr. BOYD. No, sir; that covers that.

Senator MONRONEY. It is now past 5 o'clock, and the subcommittee will recess until 2 o'clock tomorrow afternoon. If you could arrange to have your people come back, we will have you conclude your testimony.

The full Interstate and Commerce Committee will meet tomorrow morning to consider confirmation of Mr. Halaby as the Federal Aviation Administrator.

The subcommittee will stand in recess until 2 o'clock.

(Whereupon, at 5:10 p.m., the subcommittee was adjourned, to reconvene at 2 p.m., Tuesday, February 21, 1961.)

AIR SAFETY

TUESDAY, FEBRUARY 21, 1961

U.S. SENATE,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
SUBCOMMITTEE ON AVIATION,
Washington, D.C.

The subcommittee met, pursuant to adjournment, in room 5110, New Senate Office Building, at 2:20 p.m., Hon. A. S. Mike Monroney (chairman of the subcommittee) presiding.

Senator MONRONEY. The Subcommittee on Aviation will resume its hearings.

At the conclusion of our hearings last evening we were examining the second category of accidents—weather—in connection with our effort to find means of improving our safety performances in the four areas announced yesterday.

We had completed, I think, the Arctic Pacific case. We had another case, the Capital Airline crash, Viscount at Holdcraft, Va., on January 18, 1960. I wonder, Mr. Boyd, if you or your able experts could give us the known facts regarding this crash. I don't believe you completed this accident investigation; therefore, we would ask you only to make available to us the summary of the situation so that we would have some frame of reference to consider the possible safety measures that might help in a case of this kind.

STATEMENT OF HON. ALAN BOYD, CHAIRMAN, CIVIL AERONAUTICS BOARD, ACCOMPANIED BY MELVIN N. GOUGH, SR., DIRECTOR, BUREAU OF SAFETY; LEON TANGUAY, DEPUTY DIRECTOR, BUREAU OF SAFETY; ROSS T. NEWMAN, ASSOCIATE GENERAL COUNSEL; ROBERT FROMAN, ASSISTANT DIRECTOR, SAFETY BUREAU; GEORGE HALDERMAN, ASSISTANT TO THE DIRECTOR, SAFETY BUREAU; WILLIAM McNAMARA, CHIEF, SAFETY ANALYSIS DIVISION, SAFETY BUREAU; JOSEPH FLUET, CHIEF, OPERATIONS DIVISION, SAFETY BUREAU; JOHN F. PAHL, CHIEF, ENGINEERING DIVISION, SAFETY BUREAU; APP PHILLIP GOLDSTEIN, CHIEF, INVESTIGATION DIVISION, SAFETY BUREAU; MARTIN CLARK, SAFETY SPECIALIST, SAFETY BUREAU; ARTHUR NEUMANN, SAFETY SPECIALIST, SAFETY BUREAU; C. E. STILLWAGON, SAFETY SPECIALIST, SAFETY BUREAU; AND JOSEPH ZACKO, SAFETY SPECIALIST, SAFETY BUREAU

Mr. BOYD. Mr. Chairman, Mr. Phillip Goldstein, who testified yesterday, is here, prepared to give you a summary of the facts as

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known on the Capital Viscount crash at Holdcroft last year and also to relate certain recommendations which we made as a result of known facts in that case.

Senator MONRONEY. Thank you very much, Mr. Goldstein.

Mr. GOLDSTEIN. Capital Airlines flight 20 departed Washington National Airport at 2140 Eastern Standard Time on an IFR flight clearance to the Norfolk airport. The flight was properly dispatched and takeoff was normal and the flight proceeded in a routine manner until reporting at 2201 over the Tappahannock low frequency range, at 8,000 feet, and estimated Hopewell VOR at 2212. Approximately 4 minutes later a new clearance was issued to flight 20:

> Capital 20 cleared to the Norfolk ILS outer marker from over Tappahannock, Victor Airway 213 Hopewell, then via the Hopewell 140 degree radial to Deep Creek, direct to the Norfolk Outer Marker, to maintain eight thousand, contact Norfolk radar on frequency 118.5 over Hopewell.

The crew's acknowledgement of this clearance was the last radio contact with Capital flight 20. Up to that time, all radio communications were normal and the pilot made good his calculated ground speed. There were no indications of any difficulties. Witnesses indicated that a low-flying aircraft executed two circles in a left pattern within a 2-mile area of the impact site just prior to the time of the accident. The circles were made at increasingly lower altitudes. Many witnesses believed the aircraft was experiencing some type of engine difficulty. Application and removal of power, or cutting on and off the engines, occurred at least three times.

There was a final roar of power just prior to impact.

The investigation revealed that there was no evidence of structural failure or malfunction of the primary structure or the flight control systems prior to impact. Examination of the powerplants and propellers indicated that the No. 1 and 2 propellers were feathered, the No. 3 and 4 propellers were at or near the flight fine position at blade angles of 24 and 26 degrees, respectively. There was no evidence of internal failure of any of the powerplants or propellers prior to impact.

The weather conditions indicate that the flight 20 would have encountered light to moderate icing from the time the flight reached approximately 5,500 feet on the climb-out from Washington until descending below the 6,000-foot level between Tappahannock and the Hopewell VOR.

Senator MONRONEY. Do I have that correct, that there would have been icing above 6,000 and there would be little icing at below 6,000?

Mr. GOLDSTEIN. Yes, sir, the temperatures were warmer below 6,000.

Senator MONRONEY. Yes.

Mr. GOLDSTEIN. During the investigation, it was disclosed that the Capital Airlines procedure relating to the use of engine cowl propeller and anti-icing system provided that this system be turned on at any time the outside air temperature was plus 5° C. or colder.

The aircraft manufacturer had issued an amendment to this procedure that required that the system be turned to any time the temperature was below plus 10° C.

Capital Airlines had been using the plus 5° C. method and it was not generally known throughout the line that this new procedure was in effect.

The Board made a recommendation to the FAA that this be brought to the attention of all Capital pilots on July 14, 1960.

Senator MONRONEY. That would be to use your deicers at any time the temeprature fell below 10° C.?

Mr. GOLDSTEIN. Yes, sir; that is right.

Now inasmuch as the Grumman Gulfstream and the F–27 aircraft use the same power package, it was recommended on October 31, 1960, to the FAA that the instructions relative to the new procedure be incorporated in the manuals of those two aircraft.

Senator MONRONEY. Could I ask you right here, so we will understand the extent of the deicing equipment, does that include deicing on the wings and the propeller and the motor, carburetor, and other things?

Mr. GOLDSTEIN. This is the engine cowl deicing equipment, around the air intakes on the engine?

Senator MONRONEY. I see.

Mr. GOLDSTEIN. One other recommendation was forwarded to the FAA as a result of our investigation and this had reference to the refueling facilities at Washington National Airport in which we recommended that the Federal Aviation Agency require the installation of filters between the unloading barge and the storage tanks and at the internal filter housing, and cover on the top of the storage tank be coated with rust preventive.

Now the FAA replied to these recommendations and indicated that they would take steps to implement them.

Senator MONRONEY. Is that all?

Mr. GOLDSTEIN. That is all I have.

Senator MONRONEY. In other words, in reconstructing the accident, you said Nos. 1 and 2 motors were feathered?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. This would indicate, would it not, a loss of power on Nos. 1 and 2 motors?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. For some reason. The action taken by the Board to raise the level of temperature for deicing procedures would indicate that there at least was some degree of evidence uncovered that there could have been at the base of this accident an icing up of the air intake which cut off the flow of power on these two motors; is that correct? That is not probable cause but, from what we know of undisputed facts—Nos. 1 and 2 motors were feathered—it would certainly indicate that the motor was inoperative and, as I understood in the earlier reports, that the flat spin apparently, that the plane crashed in, as I understand it, the tail and the nose of the plane almost came down in a flat position. It would indicate that there could have been a loss of power on two motors for one cause or another and this loss could have resulted in the configuration or the attitude of the plane in which it was found?

Mr. GOLDSTEIN. Yes, sir; that is correct.

Senator MONRONEY. The application of this went to the Grumman and F–27 as well, which has the same—it is a similar motor to the Brittania motor except it is a smaller size Rolls-Royce, is it not?

Mr. GOLDSTEIN. Yes, sir; a Rolls-Royce engine.

Senator MONRONEY. There was some icing trouble I believe in the early days on the Brittania which caused a revision on that.

Mr. BOYD. I might mention, Mr. Chairman, in connection with the accident at Holdcroft, we had considerable testimony concerning the engine itself and this particular model of the Rolls-Royce turboprop engine has a phenomenal mechanical reliability. It is probably one of the finest engines that has ever been built. They had had very little mechanical difficulty that would cause a loss of power.

Senator MONRONEY. There was no way you could tell whether the motor was off at cutout except for the position of the propellers on this plane?

Mr. GOLDSTEIN. That is correct.

Senator MONRONEY. No other contributing causes. What was your dew point that night?

Mr. GOLDSTEIN. I have to look that up. Sir, I don't have the dew point.

Senator MONRONEY. Were icing conditions reported at that altitude?

Mr. GOLDSTEIN. Yes, sir; the icing conditions existed throughout the flight from the time it reached 5,500 feet on the climbout until it descended below 6,000 feet in the area of the accident.

Senator MONRONEY. In the previous years, we had some cases that I don't believe had been completely resolved with reference to the Viscount. As I recall, they happened in below-freezing weather as well. I wonder if you have gone over those accidents? There was one in Michigan, I believe, where the Viscount went in short of the runway. There was another one, if I remember correctly, in Chicago that was unexplained and if you have—in the light of what your request to the FAA was on the deicing procedures—have you gone back and looked at these other accidents in relation to what you apparently found in this accident?

Mr. GOLDSTEIN. Sir, we haven't completed the evaluation of this accident yet and as soon as we do, we will look over the previous accidents to see if any of this applies to those.

Senator MONRONEY. I see.

It would not be too unnatural, would it, in flight, that two motors could possibly ice up while the other two might remain operative?

Mr. GOLDSTEIN. Well, there is always this possibility that two engines could ice up and the other two would continue to operate properly.

Senator MONRONEY. Would you lose power or go into a flat spin rather quickly, I mean, if you did lose power on two motors? Would you be inclined to go into a flat spin?

Mr. GOLDSTEIN. I would say, "No," sir. The aircraft is controllable with two engines out on either side, as long as the air speed is maintained.

Senator MONRONEY. And with the props properly feathered?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. These apparently were, because at the time of the impact, the props were set in a feathered pitch on one and two, and practically normal on the others, that is correct?

Mr. GOLDSTEIN. Yes, they were in the low range on the other two engines.

Senator MONRONEY. Was there any evidence of other icing on the plane other than perhaps the intake?

Mr. GOLDSTEIN. No, sir; not at the time.

Senator MONRONEY. There had been no trouble on the controls or on the leading engine?

Mr. GOLDSTEIN. Not that we could determine.

Senator MONRONEY. Was that a hot wing?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. Senator Schoeppel, we were going over this Viscount accident, weather accident at Holdcroft, Va., before you came in, and they had raised the procedure regarding notification to the FAA on all planes of this type that where the original was to use deicing procedures at 5° above zero centigrade to 10° below zero centigrade, at least to the committee there was some evidence that the air intake on these Nos. 1 and 2 motors, both of which were found to be completely feathered, at the time of the crash, had perhaps iced up at the difference betwen this 5- and 10-percent margin and corrective steps have been taken to notify the FAA and all planes of this type, with this type of motor certificated, have been notified.

Was there any other weather problem that you had in any of the accidents in the last year's list? There was weather. I believe we skipped the Missoula, Mont., accident which was a possible combination of weather and terminal area, that struck a mountain coming in in a snowstorm condition.

Mr. BOYD. Yes, sir.

Senator MONRONEY. Would you care to relate the known facts on that?

Mr. BOYD. While we are getting our Montana man ready, Mr. Chairman, we do have a very recent incident in which—incident rather than accident—in which weather probably played a part, which you might like to hear related at this time.

Senator MONRONEY. We certainly would.

Mr. BOYD. Involving a TWA plane in Baltimore on February 8.

Mr. GOLDSTEIN. TWA flight 61, Boeing 707, experienced difficulty during the takeoff in Baltimore on runway 28 on February 8. This flight started the takeoff run—the copilot was making the takeoff—and when they got up between 70 and 80 knots, the aircraft started to weathercock and slide sideways. The captain attempted to straighten it out and was unable to do so. He decided to abort the takeoff. The aircraft continued to slide sideways and slid through a snow bank at the side of the runway. No injuries and no damage to the aircraft and the passengers all deplaned through the rear exists on the aircraft.

Now prior to the takeoff, just prior to the takeoff, TWA had sent their ground personnel down the runway in a car to check the snow and slush condition. They found that there was a quarter to a half inch of slush on the runway and this was within their allowable limits for takeoff. They reduced the gross weight of the aircraft to approximately 95 percent of their certified takeoff gross to compensate for the slush condition on the runway.

The weather at the time was precipitation, ceiling 800 feet, sky obscured, visibility 1 mile, light snow and light sleet, and they were taking off, quartering with a crosswind from the left.

Senator MONRONEY. Did you mention crabbing from the side?

Mr. GOLDSTEIN. Yes, sir; the aircraft entered a skid sideways.

Senator MONRONEY. I mean prior to the time it went in to the snowbank. It was not going down the runway parallel?

Mr. GOLDSTEIN. The aircraft started to sort of weathercock.

Senator MONRONEY. What does that mean?

Mr. GOLDSTEIN. Turn in to the wind as it went down and started sliding sideways.

Senator MONRONEY. I see.

Mr. GOLDSTEIN. They were unable to control this with no steering.

Senator MONRONEY. From this position, did you conclude that greater attention needs to be paid on the runway conditions, I mean, as to slush on the runway?

Mr. GOLDSTEIN. I believe that in this case, although the slush made the runway surface slick, that this was not the major contributing factor to this accident. This was the fact that one fellow was making the takeoff, the other was trying to steer the nose wheel, and they kind of got out of synchronization on it. This is the preliminary information that we have.

Senator MONRONEY. I see. The slush is a definite factor in it, but had the slush not been there, it wouldn't have occurred.

In the early days, when we were anticipating jet problems, there was always some discussion of whether snow would be a very definite handicap to jets. Apparently it hasn't been the handicap that it was thought to be. However, slush apparently is becoming—because of its sensitivity to picking up the necessary flight speed at the very one point on the runway—that it does become more and more important than we thought last year, perhaps. Is that where you are paying more and more attention to that feature?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. You have of course a situation where the temperature shows that there would not have been slush on the runway, at Idlewild, on the Mexican crash, but it still might have been thawing because of the traffic or something, regardless of the temperature.

There are still some of those who feel that runway conditions might have had some impact on the Mexican DC–8 takeoff.

Is there any study going on as a result of these two runway incidents on whether the speed indicators are free of ice? I have heard some discussion that, I believe you have two speed indicators on the jets that show you your takeoff speed, and that those I believe are protected in the usual way with a fail-safe system where their heaters can be turned on so that the intake of the air to give you your speed would be kept ice-free. I wondered if there had been any study made by your experts in that regard to see if special attention is paid in the checklist under icing conditions to keep both of the speed indicators, pilot's and copilot's speed indicators, ice-free by the use of heaters?

Mr. GOLDSTEIN. This is an item on the pretakeoff checklist and we do go into this phase of it to find out whether or not they were actuated if we have a live crew to talk to and——

Senator MONRONEY. If the plane is totally destroyed, you have very little visual evidence?

Mr. GOLDSTEIN. That is right, very little visual evidence and outside of finding the switches that control these, which are not definite proof that they were on or off, we have no way to really tell.

Senator MONRONEY. Not to get back to the Mexican airline crash exactly, but did you recover the flight recorder that was in the DC–8?

Mr. GOLDSTEIN. In the Mexican accident?

Senator MONRONEY. Yes, sir.

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. Has that been read out?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. It is still a matter of private depositions between ourselves and the Mexican Government, which we will probably go into and should go into in executive session.

Do you have any questions, Senator Schoeppel?

Senator SCHOEPPEL. No, sir.

Senator MONRONEY. Thank you very much.

Mr. BOYD. Mr. Chairman, at this time Mr. Tanguay, who is the Deputy Director of the Bureau of Safety and most familiar with the Missoula, Mont., DC–4 accident, will give you a brief summary of the facts of that accident as we know them today.

Mr. TANGUAY. Senator, as I remember this particular flight, the aircraft was proceeding on from Seattle to Missoula and went at a location of approximately 13 miles from Missoula, at which point the Alberton outer marker is located the aircraft crashed.

The weather was quite bad. It was snowing. However, the weather at the terminal area was clear and, also, along the valleys that proceed along the edge of the outer marker the clouds were down to about, in some places, 500 feet above the terrain.

Now, instead of this aircraft reporting over the outer marker, we found it crashed right almost directly beneath the west edge of the outer marker at an altitude of about 3,100 feet.

This aircraft had evidently been proceeding down the valley. He hadn't been maintaining his altitude, according to witnesses, and about the point where he crashed the valley narrows considerably and the indications are that the pilot attempted to turn and while attempting this turn, a real tight turn, struck the mountain and crashed at that spot.

As I said before, the weather was good down low in the valley and at the terminal area.

Those are the highlights of that particular accident.

Senator MONRONEY. He was at what altitude? Or did he report his altitude over the outer marker?

Mr. TANGUAY. No, sir; he did not report over the outer marker. This flight was to cross the outer marker at 9,000 feet. The flight did not report crossing the outer marker or when departing 9,000 feet.

Senator MONRONEY. It is higher on the mountain than it is presumed this plane was flying at?

Mr. TANGUAY. I don't recall the altitude exactly, but I believe the safe altitude is around 7,000 feet. That would make him 2,000 feet over the minimum safe altitude.

Senator MONRONEY. Three thousand above the outer marker?

Mr. TANGUAY. I am sorry; yes.

Senator MONRONEY. Then the terrain goes above that point, so he was flying down the valley—where is the outer marker located, on the mountain?

Mr. TANGUAY. Right on the very top of the highest mountain in that particular area.

Senator MONRONEY. I thought you said he was flying at 10,000 feet?

Mr. TANGUAY. I should have said approximately 9,000 feet.

Senator MONRONEY. He would have been 3 miles above the highest point.

Mr. BOYD. His flight altitude was 9,000, Mr. Chairman. The actual elevation at impact was approximately 3,100.

Mr. TANGUAY. And the minimum would be 7,000. His minimum flight altitude would have to be 7,000: he was actually flying 9,000.

Senator MONRONEY. No signs of mechanical difficulty or no reports of icing?

Mr. TANGUAY. No, sir. We did not discover anything wrong at all along those lines—structural failure or mechanical failures.

Senator MONRONEY. Apparently all motors were performing normally?

Mr. TANGUAY. Yes, sir.

Senator MONRONEY. It is presumed he was flying down this valley?

Mr. TANGUAY. That is what the indications are; yes, sir.

Senator MONRONEY. Witnesses testified "low flight above the terrain."

Mr. TANGUAY. Yes, sir.

Senator MONRONEY. You say the valley narrows. Perhaps in an effort to get out of the valley and climb out, he turned into the mountain?

Mr. TANGUAY. Yes, sir.

Senator MONRONEY. I believe that is all.

Do you have any other incidents regarding weather?

I see none.

Mr. BOYD. No, sir, we have no accidents pertaining to the weather.

Mr. John Pahl, who is the Chief of our Engineering Division of the Bureau of Safety, is now prepared to undertake a discussion of the heading of the structural and mechanical. His testimony relates specifically to the Electra accident at Cannelton, and he also will be in a position, if you so desire, to discuss the Electra accident at Buffalo, Tex.

This is John Pahl.

Mr. PAHL. A Northwest Airlines flight 710 departed from Minneapolis 12:51 p.m., on March 17, 1960. It arrived at Midway at 1:55 p.m., the trip to Chicago being routine.

It should be noted that some of the passengers said the landing at Chicago was very hard. Other said that it was a normal landing in every respect.

During the short time the aircraft was on the ground at Chicago, approximately 30 minutes, it was refueled and prepared for continuation of the flight to Miami.

The flight departed Chicago at 2:38 p.m. with 57 passengers.

The gross weight of the aircraft at the time of takeoff was 107,661 pounds. This was within the allowable gross weights takeoff limita-

tation of 110,590 pounds, which limitation was imposed in order to comply with the maximum allowable gross landing weight at Miami.

At 3:15 p.m., the flight 710 reported over Scotland maintaining 18,000 feet and estimating Bowling Green, Ky., at 3:34 p.m. The 3:13 p.m. contact was the last known radio communications with the flight.

The time of the crash was established as approximately 3:25 p.m. The main wreckage dove into the ground approximately 6 miles east of Cannelton, Ind. A radar operation at the Indianapolis air surveillance station reportedly monitored the flight by radar to within 7 miles of Scotland, Ind., and that the flight appeared to be normal.

The en route weather was good over most of the route. However, some eight pilots of various types of aircraft flying in the general area reported moderate to severe turbulence at altitudes ranging from 11,000 up to 25,000 feet.

Approximately 75 ground witnesses, who were near the accident scene and a number of airmen who were flying in the area at the time were interviewed. A composite description of what these witnesses saw and heard follows:

The time was 3:15 p.m. The weather was clear except for scattered cumulus clouds with bases at about 4,000 feet. Visibility was good.

The aircraft was flying in an approximate north to south direction in level flight and at a high altitude. Suddenly two puffs of white smoke were seen. Seconds later, these were followed by a large cloud of dark smoke. Two loud explosions were then heard, and a large object was seen to emerge from the smoke clouds and fall nearly vertically, trailing smoke and flame.

Smaller objects were later seen to fall. The fuselage continued in level flight for a few seconds and then fell to the ground, describing a large trajectory arc as it did so.

It struck the ground with such terrific force that debris was thrown nearly 215 feet into the air.

The parts which separated from the aircraft in flight consisted of the complete right wing with powerplants, the outer end of the left wing and aileron.

The No. 1 QEC being the combination of propeller, powerplant, and that part of the engine mount and cowling, and the outboard portion of the left elevator.

The right wing was found a distance of 11,291 feet slightly east of north from the crater made by the fuselage. The Nos. 1 and 4 power sections and their respective propellers with reduction gears were found as four separate pieces all within a radius of less than 2,000 feet from the right wing. Nearly all of the scattered parts of the right and left wings and the outboard nacelles were distributed along a path approximately 1 mile wide and nearly 7 miles long, extending to the east from the right wing.

The scattered components of the aircraft were transported by Army helicopter to an area near the crater.

From that location, all of the salvage aircraft structure was transported in sealed vans to the Lockheed Aircraft Corp. at Burbank, Calif., for further examination.

The powerplants were similarly transported to the Allison factory at Indianapolis, Ind., for detailed examination. The study of the

wreckage distribution, including projectory study, indicated that the disintegration of the right wing, the outer end of the left wing, that includes the outboard powerplant also, occurred within a very short period of time, probably within 10 seconds. And that the disintegration of the left elevator outboard section occurred considerably afterward and very shortly before the fuselage struck the ground.

At this time, the fuselage was in the last part of its projectory and obviously it was traveling at speeds much higher than the designed dive speed of the airplane with the result that the failure of the elevator, which was in flutter, was of no significance.

At the Lockheed factory, three dimensional mockups of the outboard powerplants and of the inboard section of the right wing were made for my future examination and comparison of the fractures and study of the manner in which the fractures took place.

Concurrently with this detailed examination, the Lockheed factory was engaged in a reevaluation of the airplane at the direction of the Administrator of the FAA. The efforts along both lines were frequently coordinated.

Many organizations participated, namely the National Aeronautics and Space Administration, the other aircraft manufactures, and the Board also employed the services of the National Bureau of Standards, particularly in regard to examination for evidence of any fatigue failures.

The net result of all this work was that very definite evidence of catastrophic flutter was found, particularly at the inboard section of the right wing. There were numerous bits of evidence indicating rapid reversals of bending and torsional stresses in the wing and indications of interferences due to similar reversals of bending and torsional loading.

The reevaluation of the Electra included many efforts which covered practically the whole of the considerations used in designing the airplane within the in-load and express distributions aerodynamics, flutter, allowable strengths and stresses, effects of damage of powerplant structure, and included also a number of wind tunnel tests as well as flight tests.

The wind tunnel tests consisted of three series, the first being an engine propeller combination at a Lockheed tunnel; the second being a 1/8-scale half span wing with the two powerplants; and the third—that second was at the Lockheed tunnel—and the third was a dynamically similar 1/8-scale airplane, including all engines and controls and including the capability of controlling, or I should say, adjusting the propeller pitch.

The wind tunnel tests proved very conclusively supporting the results of the theoretical research that were reduced stiffness of the support structure, the outboard propellers could gyrate in what is called the whirl mode, and this whirl mode is a result of the air flowing into the propeller in a direction other than straightened partly and also due to inertia loads on the structure from gusts or other maneuvers. And the gyroscopic forces of the revolving propeller have a very great influence on the resultant direction of motion of the propeller when a force is applied and with the airplane in the normal condition, the gyroscopic effect is damped out quickly and causes no difficulty.

However, with the stiffness reduced sufficiently, the gyro whirl mode can become self-sustaining. In other words, once excited, it will continue, and if the stiffness is even less, it will become divergent and that is it will progressively get worse and cause further damage of the structure until on the Electra, the frequency of this oscillation which starts out in the neighborhood of five cycles per second, reduces to somewhere around three cycles per second at which time the natural frequencies of the wing in bending and torsion, torsion being the more critical in this case, couples with the whirl mode frequency, causing a forced flutter, which is catastrophic.

Mr. BOYD. I might say, Mr. Chairman, that Mr. Pahl moved out to Lockheed and lived there with the wreckage of this aircraft of Electra and monitored all of the action that was taken which brought about the correction of the problem that he has just described to you and I have no hesitation in saying that we feel Mr. Pahl knows as much about this business theoretically and practically as anybody you could have at this witness table.

Senator MONRONEY. The Indiana crash, if I read correctly from the papers was almost a counterpart of the Buffalo, Tex., crash, except it was the left wing that first disintegrated and then the right. What I would like to ask is were the early falling pieces picked up in generally the same chronological order?

Mr. PAHL. There was a great similarity in regard to the sequence of disintegration. However, there were some differences, too. For example, in the Buffalo accidents, the damage to the inboard and of the left wing indicated that the wing was more nearly intact at the time of disintegration.

It was carrying a high-up load at the time it fell. However, there were also evidences of flutter during this disintegration. And in the case of the Buffalo accident, there was no reason to believe that there was any turbulence of any significance in the air.

Senator MONRONEY. You have no reason though to know it. This committee in executive session investigated this accident. There was practically no reported air traffic in the neighborhood and you would probably have no evidence of turbulence in this area had it not been for being on a very high density traffic artery of jet traffic involved with the pilots reporting from on top what they were going through.

Mr. PAHL. I believe our meteorologist could speak on the basis of his studies and aftercast, that there is fairly good evidence to indicate that the conditions in one cast were appreciably different than those in the other.

Senator MONRONEY. In other words, this clear air turbulence which apparently was present in the Indiana crash, which as I understand it—correct me if I am wrong—is the cycles of air at the edge of a jet stream, is that correct?

Mr. PAHL. It is at the edge of a jet stream and a jet stream can be predicted.

Senator MONRONEY. Do you find jet streams as far south at that time of the year as when the Electra crash at Buffalo occurred?

Mr. PAHL. I am not a weather expert, but there was a jet stream there that day in that area.

Senator MONRONEY. You mean in Indiana or in Texas?

Mr. PAHL. No; in Indiana.

Senator MONRONEY. We knew nothing about clear air turbulence at the time of the Buffalo crash apparently.

I never heard the term used. Were you aware of it at that time?

Mr. PAHL. Yes, sir. Many airlines have been using jet streams for a considerable length of time. Pan-American started during World War II, as I remember it, in forecasting—their meteorologists forecasting where the flights might expect to pick up the jet stream and they also learned that there was turbulence due to entering the jet stream in the wrong way.

Senator MONRONEY. Why do you say then that there was no evidence of this clear air turbulence in the Buffalo crash?

Mr. PAHL. I would like our meteorologists to give any detailed explanation, but from the winds and temperature measurements aloft and pressures, it is possible to see that either a clear air turbulence is or is not possible in a given area.

Senator MONRONEY. Do you have him at the table?

Mr. BOYD. Yes, sir, Mr. Halnon. He is our chief meteorologist.

Mr. HALNON. Mr. Chairman, first on the Indiana crash, the pilot reports which were received and the information relative to winds, upper winds and temperatures made us suspicious of the possibility of clear air turbulence in connection with that crash.

As Mr. Pahl has stated, clear air turbulence has been known of for a considerable number of years. In fact, one of the studies which we had performed with respect to the Indiana crash has a bibliography of about four pages relative to the subject. There is still some difficulties in completely accurate forecasts of clear air turbulence, but on the basis of this suspicion we went into a much more detailed study of the clear air turbulence in the Indiana crash.

To summarize it rather briefly, we prepared 15 charts of the upper wind and temperature information available from all sources from the Weather Bureau's stations, from pilot reports, and so forth, from 11,000 to 45,000 feet, and with these results. Examination of the data reveals at 18,000 feet over southern Indiana the flight path of the aircraft concerned was just to the east of a marked troughline and on the northern edge of a high velocity southwest-northwest flow in an area characterized by pronounced horizontal and vertical wind sheer.

It is widely recognized, referring to United Air Line's circulars 48 and 49 and their attached bibliography, that severe clear air turbulence is probable in such an area. Many pilots operating on the northern side of this high velocity windflow and at approximately the same altitude reported severe clear air turbulence.

We then had four separate studies made of this clear air turbulence situation on that date. We requested one from the U.S. Weather Bureau, which the Chicago University office of that Bureau did for us; the department of meteorology and oceanography at New York University also conducted one; and Meteorologist Research Corp. at Altadena, Calif., did one for Northwest Airlines; and we conducted our own.

In summary, without going into details, it is readily apparent there was remarkably good measure of agreement between the four meteorological studies summarized and on the basis of our own study, we

could not help but conclude that severe clear air turbulence was highly probable at the time and place of the accident.

Now on the Texas accident, to relate that, we then went back naturally to review our data on Texas. We found no evidence of the conditions necessary for existence of clear air turbulence as such. No Jetstream of the winds at flight altitude.

I don't want to delay the committee too much. My recollection of the winds would be that they were on the order of the flight altitude of 10 to 15 knots, very much different from those that existed over Indiana at the time.

Senator MONRONEY. No evidence of jetstreams in the neighborhood or connected with it?

Mr. HALNON. No evidence of jetstream; no evidence of pronounced troughline that was evidenced in the Indiana case immediately to the west of it; and no evidence of wind sheers which we always look for in connection with clear air turbulence.

Senator MONRONEY. For the information of the committee, what force would these set up? I mean, would they be like flying into the force you would find in a heavy thunderstorm, or an up-and-down sheer?

Mr. HALNON. No, sir. I think it is perhaps best characterized by one of the studies which was made which in turn referred to some work done by three coworkers, Clem, Hislop, and Davies. They described the characteristics of such clear air turbulence as short, sharp hammerings like a boat pounding over rough choppy water, as opposed to long-term up-and-down drafts which one finds in the typical flight storm.

Senator MONRONEY. In experiencing these, your true jets probably experience a great many of them because they search out and cross over and use and ride the jetstreams and obviously if they are going to get this to them they have to cross this area of turbulence which is always found on the borders of the jetstreams?

Mr. HALNON. No; it is not always found on the borders of jetstreams and this is one of the problems of accurately forecasting them because it occurs in patches along the borders of such a jetstream. It has preferred areas of existence that many of the major air carriers now forecast their clear air turbulence.

United Air Lines has done a remarkable amount of work as has Eastern Air Lines and others in this field. It is interesting to note on the date in question that several of the major air carriers had forecast clear air turbulence for the area of the crash.

Senator MONRONEY. What I would like to know, and perhaps this would more properly come from the former witness—the stresses that were set up in the Electra were perhaps because of the combination of the turbo-driven prop and the wing structure, had a peculiar and a catastrophic effect on the Electra but apparently has not bothered your true jets; is that correct?

Mr. BOYD. Mr. Pahl will answer that question.

Senator MONRONEY. I would like to ask that the paper you referred to, if it is not too voluminous, be included at this point in our hearings because I believe it is the first paper that has been presented before the Congress, at least, as to the scientific and meteorological aspects of clear air turbulence.

Mr. BOYD. Yes, sir. A copy will be provided.

(The above-mentioned material is on file with the committee.)

Mr. PAHL. In regard to the clear air turbulence, it is extremely probable on the basis of the meteorological investigations at the time and place of the accident. There is good agreement in regard to the probable intensity of the individual gusts input. I believe an average figure is about an effective gust velocity of up to 30 feet per second, possibly a little lower than that. This intensity, in a single gust, is well taken care of in the civil air regulations. They require gust intensities greater, so that it will not impose excessive loads on the wing.

However, it is theoretically possible that a series of gusts inputs of considerably lower intensity could cause oscillation of the structure in a critical manner if they were at the proper frequency, which would be a combination of the size of the gusts and the speed of the airplane flying through the air so that successive gusts that encounter the airplanes at successive intervals of time, the intervals being uniform.

However, the gust research which has been quite extensive—the NASA has conducted a great deal of such research—indicates that one of the characteristics of natural turbulence is that it is random rather than uniform with the results that it appears improbable that washboard gusts of clear air turbulence could be the whole explanation of the flutter starting.

In regard to whether or not we would have any differences on torque jets as compared to prop jets, I don't see that there would be any significant difference other than any airplane with a propeller has the gyroscopic effect of the propeller to consider when there is considerable loading and deflection of the structure.

Senator MONRONEY. In other words, as I understood your testimony, it was the oscillation of the heavy prop setting up harmonics with the flutter that was caused by the clear air turbulence, that in synchronization it caused the strain on the plane that lead to disintegration?

Mr. PAHL. The clear air turbulence, or it could be in another case a maneuvering load factor which would apply a disturbing load to the propeller. This sort of loading starts the gyrowhirl mode——

Senator MONRONEY. Gyrowhirl mode progression or recession?

Mr. PAHL. I said recession. A gyroscope recesses to 90° to the applied load.

Senator MONRONEY. In other words, to make it crystal clear, as I understand it, it sets up what a farm boy would call a wobble in the orbit of the propeller; is that correct?

Mr. PAHL. Right.

Senator MONRONEY. It's no longer cutting the air at a straight base, but one side would be either slanted in or slanted out, would it not?

Mr. PAHL. Right.

Senator MONRONEY. And would be going back and forth?

Mr. PAHL. Well, in the normal structure, though, without any damage, the damping of this structure and also the damping due to the aerodynamic forces is such that the whirl mode ceases very quickly. However, if the stiffness of the supporting structures is reduced sufficiently from the normal, then we get to the range of neutral

stability where, once excited, the whirl mode will continue indefinitely, and if the stiffness is reduced still further we get to the unstable range where, once excited, it progressively gets worse.

It is the stiffness of the structure supporting the propeller out in space.

Senator MONRONEY. It would be the motor mount or——

Mr. PAHL. Engine motor mount, wing, anything, all the structures that support it.

Senator MONRONEY. In other words, one acts on the other; is that correct? The wobble or the oscillation of the propeller going into a different flutter on the wing sets up a combination of things and then working on a weakened motor mount or attachment of the motor to the wing, all three of these things have to be present. Is that correct?

Mr. PAHL. Yes. They have to have reduced stiffness and, of course, the airspeed must be above a certain critical value, and the engine revolutions per minute within the cruising revolutions per minute range before the gyrowhirl mode can become self-sustaining or divergent.

Senator MONRONEY. This would occur at what point on the Electra?

Mr. PAHL. Approximately 260 to 270 knots indicated.

Senator MONRONEY. That would be how many miles per hour?

Mr. PAHL. That is dependent on a number of things, altitude and temperature. I can range—theoretically the indicated airspeed under some conditions can be the same as true, but it is usually roughly 2 percent less per thousand feet altitude. However, that is very rough. The temperature makes a great deal of difference.

Senator MONRONEY. At those speeds primarily, it would take at least a cruise speed at the high level to set up this situation under the old structure of the Electra?

Mr. PAHL. Yes. There is a critical airspeed for a certain range of stiffness. If the stiffness is higher, then a higher airspeed can be critical, and if it lowers, a lower airspeed could be critical.

Senator MONRONEY. So as the planes were reduced to 225 knots, this took it out of the range and in that way added to the stiffness because you were not straining against the limits of the structure. Is that correct?

Mr. PAHL. It made the likelihood of flutter, due to the whirl mode, extremely remote.

Senator MONRONEY. I see.

Now, in the reconstruction of these aircraft, could you detail to the committee the principal points in which the structure was improved, or modified?

Mr. PAHL. Yes, sir. Of course, that is something which is improved by the Federal Aviation Agency. However, I am familiar with the improvements made, if you would like me to enumerate them.

Senator MONRONEY. I think while we are on the subject of accidents, we might involve the Texas accident as well. It might be wise to have your interpretation of it.

Mr. PAHL. There are numerous modifications in the QEC structure of the airplane principally affecting the support of the engine in the engine mount. This engine consists of a component which looks like a typical turbojet engine with a propeller gearbox several feet out in front of the engine and a driveshaft connecting the two. One of the

modifications consists of changing the supports of the propeller gearbox. Originally there were two very large lower mounts at the sides of the Lord mounts. Those are shock absorbing amounts which permit appreciable rotational deflection of the gearbox due to high peak stresses and loads. The modification added mounts at the top and bottom of the gearbox to prevent freedom of rotation up and down of the gearbox in the event that the driveshaft and driveshaft housing of the engine were completely severed, or similar motion due to other causes.

The rear mount of the engine originally consisted of one Lord mount on top of the engine which was capable of taking vertical and side loads, but had a length to prevent it absorbing fore and aft loads due to the fact that a jet engine expands and contracts as it heats up and cools, and would cause abnormal internal stresses that didn't have that feature. That mount was retained, but in addition a mount was added at the side of the engine to take side loads, greatly stabilizing this torque at the rear of the engine.

The engine mount structure originally had a single diagonal strut on each side going upward and forward from the firewall or the lower nacelle longeron to the gearbox—over, I should say, to the nose cowl in which the gearbox is supported. This nose cowl is the official Lockheed name for the part. However, it is not cowl in the old sense of the word; it is primary structure—sometimes it has been referred to as the "horse collar" due to its shape, which somewhat resembles a horse collar. These single diagonal struts were replaced with double struts, and the point at which they attached to the nose cowl was lowered so that the attached point is now very close to the side Lord mounts.

This combination of changes increases rigidity very appreciably. And there were also a number of doublers and stiffeners added in the nacelle structure aft of the QEC structure to reduce the deflections and increase the stiffness of the nacelle structure itself.

When I say nacelle here, I mean the part of the insulation which is a permanent component of the wing itself.

In addition to these changes to the powerplant support, there were modifications to the wing. The front plank on the upper surface of the wing was replaced with a much heavier plank. This word "plank" might be somewhat confusing, but the skin, wing skin, of the Electra is made of a series of extruded and machined strips of highly heat treated aluminium alloy extending from the fuselage spliced continuously out to the tip section of the wing panel, and each one of these pieces forms both skin and integral stringers due to the extruding and machining operation.

On the lower surface there were several of the planks in the forward part of the wing changed to much heavier broad sections and there was a doubler added between the inboard and outboard nacelles on the lower surface from the aft edge of the new No. 3 plank to the rear spar.

In addition, all the intermediate ribs in the wing between the fuselage and the outboard nacelle were considerably modified. The number of diagonals in the ribs were increased and the attachments of the diagonals and the tabs which attached the ribs to the planking were modified to make them stronger.

That summarizes basically the structural changes in the Electra.

A doubler is a piece of metal laid on top of another piece which either is, let's say, the basic wing skin or basic fuselage skin, and the purpose of the doubler is to act as a reenforcement within a certain area without requiring replacement of the original.

Senator MONRONEY. This accident—As you say, there was no evidence of the clear air turbulence in the Buffalo crash that you found in the other crash; but do you feel that these are so closely related to the disintegration of the plane and other evidence that you found that the fix that was ordered after the careful study and recovery of parts in the Tell City crash will protect against any accident such as the Buffalo, Tex., crash?

In other words, is there anything different, generally speaking, between the Buffalo crash and the Indiana crash?

Mr. PAHL. The two crashes are enough alike that although the Board hasn't determined the probable cause yet, I am confident myself that the fix eliminates the probability of a recurrence of either crash.

Senator MONRONEY. Are you familiar with the suggestions made to FAA other than those pertaining to the structural modifications that you apparently did some work on in connection with the FAA in finding need for the reenforcement of the motor mounts and the straightening of the wings, and other things that were done? Is there any other air safety regulation that you suggested?

Mr. PAHL. We made a number of recommendations in connection with these accidents.

Senator MONRONEY. In other words, you recommended prior to the Tell City crash that all Electras now equipped with overflow valves be fueled with overwing fuel caps open; is that correct? That was one of the first things you recommended?

Mr. PAHL. That was one of the recommendations.

Senator MONRONEY. That was a result of the Buffalo, Tex., crash. There was some suspicion that maybe the fuel had been forced into the wing because of the sticky overflow valve, wasn't it?

Mr. PAHL. There had been an incident involving the airplane of another airline where the internal structure of the wing was severely damaged during refueling due to failure of the shut-off valve which was not operating. And in the examination of the records pertaining to the airplane involved in the Cannelton accident we found evidence of a possible overpressurization of the wing sometime prior to the accident. However, additional study which included the three dimensional mock-up of the inboard portion of the right wing, which took some time, due to the many small pieces involved, proved to our satisfaction that the No. 3 fuel tank, which was the one involved in this incident, had not been damaged—or I should say, the structure, the wing structure in the No. 3 fuel tank area, had not been damaged by overpressurization in this refueling incident.

Senator MONRONEY. I believe on the 4th of April 1960, you recommended formation of the Design Review Board to study the Lockheed Electra aircraft.

Mr. PAHL. Yes, sir.

Senator MONRONEY. And FAA suggested the Review Board was unnecessary.

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I presume all agencies were working together anyway to get the evidence and find what was necessary.

Mr. PAHL. As it worked out, it was a workable arrangement. However, I personally believe it would have been better if we had had the Design Review Board.

Senator MONRONEY. Then on the 11th of April you recommended—the CAB recommended that the Chief, U.S. Weather Bureau urge that increased emphasis be placed on reporting and forecasting clear air turbulence and that appropriate research be accelerated. This was done, or was sought for in these papers that you have now introduced in the record; is that correct?

Mr. PAHL. Yes; Mr. Halnon could reply better to that one.

Mr. HALNON. Very quickly, Mr. Chairman, on that one we sent this over on April 11, and as an outgrowth of it the Weather Bureau has initiated a program of modest sorts. They have established a research center there at Evansville for this purpose, and are endeavoring to increase their research activity so that they could do a better job of detecting and forecasting clear air turbulence.

Senator MONRONEY. On the 12th of April you recommended all Electra aircraft not then inspected be grounded until inspected. The FAA replied on the 14th, outlining FAA's reasons for not complying in this recommendation. Is that correct?

Mr. PAHL. Yes, sir.

Senator MONRONEY. This didn't mean your suggestion was not, as some people have taken, that they all be permanently grounded until the fix was accomplished, but you wanted them to be grounded until they all had been inspected?

Mr. PAHL. That is correct, sir.

Senator MONRONEY. I understand they were inspected shortly thereafter. Is that not correct?

Mr. PAHL. Yes; at the time we made the recommendation approximately one-half had been inspected.

Senator MONRONEY. I see.

Then on the 13th of May you recommended to the FAA Administrator one-time inspection for discrepancies in control surface booster assembly.

I don't understand exactly what that recommendation is.

Mr. PAHL. The control surface boosters are mechanisms in the different control systems—elevator, rudder, and aileron—which by means of a hydraulic pressure provide greater control forces to the control surfaces than can conveniently be applied by the crew's pushing on the column or turn-twisting the aileron wheel. This particular item was the result of examination of one of the boosters from the airplane involved in the Cannelton accident in which it was found that one of the pins which holds the two parts of the actuating cylinder together was missing from the assembly, and the geometry was such it was obvious it never was there since the last assembly. However, that omission did not cause the accident; but it is undesirable and could cause trouble.

Senator MONRONEY. This was FAA advice, instruction to the fourth regional office to accomplish recommended inspection. And it has taken place.

These are the recommendations I believe you made?

Mr. PAHL. Yes.

Senator MONRONEY. In summary, you would say you are pretty generally in agreement with the FAA on the fix required, and as these come of the line with the fix, that you are satisfied that it is a good safe aircraft to resume its service; is that correct?

Mr. PAHL. Yes, sir.

Senator MONRONEY. Did you have anything to add, Mr. Boyd, in summary of this?

Mr. BOYD. No, sir; that covers the structural mechanical aspects so far as the Electra is concerned, Mr. Chairman.

Should you so desire, we are prepared at this time to proceed with a discussion of the C–46 accident at Hill Air Force Base in Utah, where I believe a wing came off the aircraft.

Senator MONRONEY. Yes; we would.

First, before we leave this, I don't want this time to go by without complimenting the very diligent and very technical work that was done both by the CAB investigators working with the FAA and with all phases of the industry to do a masterful detective job to find the reasons and causes for this accident and the steps that were taken to correct it and to bring about the additional structural improvements that were found to be necessary.

I think sometimes we are shocked by the accidents—we are always shocked by those—and we fail to go back and express appreciation for the long, tedious, and sometimes extremely difficult job that has to be done to assemble all of the pieces and parts and tiny clues to arrive at the ultimate value of an accident investigation, that is, how to get the fix so that the next one is less likely to occur.

The committee, I know, does appreciate the technical skill, competence, and industry of your staff in working on it.

Mr. BOYD. Mr. Chairman, I will speak for the Bureau of Safety and say that we very much appreciate your thoughtfulness in acknowledging what we at the Board think is a very fine job, and I can assure you, furthermore, that the Bureau of Safety is dedicated to the proposition of continuing to warrant your approbation by their actions in the future.

Now, Mr. Martin B. Clark, who is the Assistant Director of the Engineering Division of the Bureau of Safety, will discuss the C–46 Hill Air Force Base accident.

Senator MONRONEY. This involved a nonscheduled aircraft—a part 42 operator?

Mr. BOYD. That is correct.

Mr. CLARK. Capital Airways flight, C–46 type cargo aircraft, departed Tinker Air Force Base on October 15 with the destination at Hill Air Force Base, Ogden, Utah, on a schedule to Ellsworth Air Force Base, Rapid City, S. Dak.

The flight departed Tinker routinely and proceeded to Ellsworth Air Force Base where it landed without incident. Additional cargo was placed aboard and the flight departed Ellsworth at 0835, mountain standard time, with an estimated time en route to Hill Air Force Base of 2 hours and 50 minutes.

At approximately 10:58, mountain standard time, the flight reported to Hill Air Force Base approach control that he was passing through Ogden Canyon at 8,500 feet and requested radar vectoring

for a simulated ILS approach. The Hill Air Force Base approach control made radar identification and provided the required assistance.

The flight routinely, with the assistance of the approach control, descended to 6,500 feet, and his last position as noted by the approach control was about 10 miles from the runway and 1 mile west of the final approach course. At this point the aircraft disappeared from the controller's radar scope.

Witnesses in the area who observed the aircraft at this point observed the right wing separating from the aircraft very suddenly. The aircraft crashed 10 miles from the end of runway 14 at Hill, within the boundaries of the town of Plain City, Utah. The right wing fell on a roadway between two houses in a residential area, and the main wreckage ended up in a cultivated field and a very intense fire resulted at ground impact.

Examination by Board investigators disclosed that the wing had separated at the point where the outer wing panel attaches to the center wing panel. This attachment is made through a series of attack angles on the top surface of the wing and the bottom surface of the wing, attack angles being on the center section and the outboard section, and the two of them being, in effect, clipped together by a series of bolts.

Sixty-two bolts tie the attack angles on the lower surface. The forward 31 of these bolts are seven-sixteenths of an inch in diameter and the aft 31 are three-eighths of an inch in diameter. The Board investigators recovered 12 of the seven-sixteenths inch bolts, 4 of the three-eighths-inch bolts in the molten debris at the main wreckage site. These parts were submitted for laboratory examination and it was confirmed there that the failures were due to fatigue of the bolts.

The laboratory report also indicated that the bolts themselves were slightly below the specified hardness, that there was some decarbonization involved in the failure, and that the threads on the bolts were cut as against the more standard practice of rolling the threats.

In addition, corrosion pits were also found at the points of the nuclei of the fatigue.

This information was relayed immediately to FAA and a recommendation was proposed to them that an immediate inspection be conducted and to have the bolts replace on all other C–46 aircraft. The FAA very promptly took action and initiated emergency regulations in the form of a telegraphic AD calling for this immediate inspection of the bolts, and setting up, also in the AD, a retirement life of 10,000 hours for the bolts.

I might point out that our investigation of the records of this aircraft disclosed that these bolts were the original bolts that had been put in at the time of the manufacure of the aircraft, and the aircraft had on it some 20,000 hours.

Senator MONRONEY. There had not been a requirement in the major overhaul for the replacement of these bolts up to that time; is that correct?

Mr. CLARK. That is correct.

The aircraft had gone through one major overhaul in 1956, when it had 10,454 hours and 51 minutes on it. At that time the bolts were inspected and 11 new ⅜-inch bolts were installed and 1 7/16-inch bolt was installed; and the replacement of these bolts is a nonconditioned

item. In other words, they are examined and if it is the opinion of the mechanic they are replaced.

Under the new AD, Airworthiness Directive, these bolts will be replaced at every 10,000-hour overhaul; period.

Senator MONRONEY. I see.

Thank you very much.

Are there any other accidents that you have in category 3 of structural or mechanical defects?

Mr. BOYD. No, sir. That completes our testimony on structural and mechanical features.

We are prepared at this time, Mr. Chairman, if you desire, to present Mr. Joseph Zacko to discuss the United-TWA collision in New York last December in connection with air traffic control category.

Senator MONRONEY. Yes.

Mr. Zacko, will you proceed in your own way on this accident.

I might say that I attended several of the hearings that were held in New York and talked to several of the technicians during the course of this accident, and again I found that the men were certainly dedicated in trying to ascertain all of the factors, and there were many of them involved in this accident.

The searching examination that was conducted is again to the credit of your people that worked on this.

Mr. BOYD. Thank you, sir.

Mr. ZACKO. Thank you, sir.

Senator, I have prepared a brief summary of the activity of both aircraft. This is brief. A lot of times have been omitted, but in order to bring the panel up to date in the sequence of events as they occurred on that date, I will read this brief.

We will commence both flights from Allentown, Pa., inasmuch as this is the area we are most vitally concerned with.

United Flight 826 reported to the New York Center over Allentown, Pa., and was cleared to descend to and maintain 13,000 feet. Now, this altitude is the initial clearance that he received over Allentown. I did not trace the flight back to his destination, Chicago.

Senator MONRONEY. It was perfectly normal from takeoff until it reached the Preston holding pattern and so I think you are proper in the chronology of starting at Allentown.

Mr. ZACKO. New York Center further advised United 826 to proceed on Victor 30 until intercepting Victor Airway 123.

I have a chart, Senator, which will perhaps assist you in getting a pictorial display of these airways as I speak of them. I believe the chart to your left, Senator Monroney, will perhaps assist you better in following the flight.

The circle to your far left represents the Allentown Omni. The one on the lower part of the paper represents the Robbinsville Omni. To the far right is the Coltsneck Omni. The line going parallel to the paper on the upper portion is Victor Airway 6, the flight path of the Transworld aircraft.

New York Center further advised United 826 to proceed on Victor 30 until intercepting Victor Airway 123. United 826 was originally cleared via Allentown direct to Robbinsville. Victor 123, which was approximately 12 to 15 nautical miles further than his revised clearance to Preston—have you found this, sir?

Senator MONRONEY. Yes. This is not shown on the solid line, is it? It would be on the 7° bearing from Coltsneck, is that correct, on a 346? He would have flown, in other words, a dogleg, or rather he would have flown and reversed his course over the Coltsneck and thus would have had a greater mileage to travel than the course that was finally changed to at Robbinsville.

Mr. ZACKO. That is correct. Originally cleared Allentown to Robbinsville. His clearance then amended Allentown, Victor Airway 30. Victory Airway 123 to Preston.

United 826's position crossing Victory Airway 30 was confirmed by the New York Center and the distance of 16 miles to Victor Airway 123, Victor Airway which forms Preston was given

An additional radar position report was given to United when he was 2 miles from crossing Airway Victor 433, or approximately 16 miles from Victor 123. United 826's clearance limit was the Preston intersection with a minimum altitude of 5,000 feet. New York radar service was terminated and the aircraft was advised to contact Idlewild approach control.

Senator MONRONEY. At what point was the United plane on the map that I have, that this would give?

Mr. ZACKO. This was in the area of Preston intersection.

Senator MONRONEY. Would you say 2 miles from Preston? I think this is rather important.

Mr. ZACKO. This has not been fully determined.

Idlewild approach control made numerous attempts to establish communication with United 826, all of which were unsuccessful. United did not establish communications with the Idlewild approach control facility.

We will take Transworld 266 from Allentown. He reported to the New York center passing Allentown at 11,000 feet, and was cleared via Victory Airway 6 to Linden intersection.

This is the northernmost line on your chart, from left to right.

He was advised to maintain 9,000 feet. Shortly after passing the Solberg Omni New York Center advised Transworld 266, radar service terminated, and to contact La Guardia approach control. La Guardia approach control subsequently cleared Transworld 266 to descend to 5,000 feet and commence radar vectors to final approach to La Guardia. These vectors were commenced at the Linden intersection.

La Guardia approach control advised Transworld 266 of traffic at 230, 6 miles, northeast bound. This is while he was being vectored from Linden.

Senator MONRONEY. This is presumed to be the United plane; correct?

Mr. ZACKO. This was unknown traffic.

Senator MONRONEY. Unknown traffic?

Mr. ZACKO. Unknown traffic.

Transworld was then given further vectors with reference to traffic on final aproach to La Guardia. They were providing radar separation to the traffic preceding him going into La Guardia. This was the reason for his vector.

It was further cleared to descend to 1,500 feet, and advised of what appeared to be jet traffic at 3 o'clock to his position or 1 mile northeast bound.

Senator MONRONEY. One mile away from his plane, from the TWA plane at that point?

Mr. ZACKO. That is correct, at 3 o'clock, which would be to his right, 1 mile.

Subsequently, La Guardia control made numerous attempts to establish communications with Transworld 266, all of which were unsuccessful.

TWA 266 and United 826 collided in the vicinity of Miller Army Air Field, a distance of approximately 10 nautical miles northeast of the Preston intersection.

This is a brief history of the flight of both aircraft.

Senator MONRONEY. Now, the cutoff of area radar on your time schedule, in other words, from the time that area radar cut the United plane loose and told him his next communication would be from the approach radar, and the time that has been established as the time of the collision, how much time transpired?

Mr. ZACKO. From the time the aircraft was changed to approach control?

Senator MONRONEY. And the time the area radar cut the United plane loose and told him to contact Idlewild approach control, or the estimated time of the collision—how much time was involved there?

In other words, if you can't establish the position of the United plane in reference to when area radar cut him loose by miles or position, perhaps in the element of time we could establish some degree of his location at the point of handoff.

Mr. ZACKO. We have times on the original factual report that were taken from the correlated tapes from the center.

At 1533:28, United 826 contacted Idlewild approach control and advised he was approaching Preston at 5,000.

At 1533:33, United 826—several attempts were made at this time to establish communications with United by Idlewild approach control, all of which were unsuccessful.

At 1533:20, New York center transmitted the following:

826 Roger, and you received the holding instructions at Preston. Radar service is terminated. Contact Idlewild approach control 123.7. Good day.

This was at 1533:20.

Senator MONRONEY. In other words, there was 8 seconds.

Now, as I understand it, at 1533:28 he did contact approach control and give his altitude—United gave his altitude as 5,000; is that correct?

Mr. ZACKO. That is correct.

Senator MONRONEY. The transmission back, some 5 seconds later, received no answer?

Mr. ZACKO. That is correct, sir.

Senator MONRONEY. It was apparently 8 seconds before United reported to the approach control at Idlewild from the time he had been cut loose by area radar?

Mr. ZACKO. By the center radar.

Senator MONRONEY. By the center radar, so could you fix for the benefit of the committee, what was the estimated time of the collision?

Mr. ZACKO. Sir, this is in the area of analysis. We have a flight path submitted, we have times from the flight recorder that have

been analyzed by our engineering division and when all of these facts have been assembled, we will have a pretty accurate time of the collision.

Senator MONRONEY. The plane you said at Allentown was at what, 17,000?

Mr. ZACKO. Yes, sir.

Senator MONRONEY. What is the distance between Allentown in the path of flight and distance to Preston, approximately?

Mr. ZACKO. Approximately 45 miles.

Senator MONRONEY. It is about 7 or 8 minutes, is that correct?

Mr. ZACKO. That is correct.

Senator MONRONEY. I mean I am looking on the time-flight recorder, and was there a conversation at Allentown regarding the pilot getting down to his 5,000-foot minimum with the tower at Allentown?

Mr. ZACKO. Yes, sir, there was.

Senator MONRONEY. Do you have that?

Mr. ZACKO. Sir, I have the complete factual report that was presented at the hearing wherein we have the times and altitudes of the history of flight of both aircraft. In my summary, I quoted the 5,000 feet as being the lowest altitude. The reason for this being there was some question as to whether or not United could in fact reach Preston at 5,000 feet.

Senator MONRONEY. That was the first time I had heard that, that was a minimum altitude that he was cleared to. It did not necessarily mean he could not have used any altitude or proper altitude from 5,000 feet up; is that correct?

Mr. ZACKO. It didn't place any restriction on the altitude above 5,000.

Senator MONRONEY. That is what I say, the pilot to get ready for his landing at Idlewild and conform to air traffic instructions, could have, had he sought to slow down his rate of descent, could have arrived over Preston at 9,000 or 11,000, could he not?

Mr. ZACKO. That is correct.

Senator MONRONEY. I mean, in other words, he was cleared for everything excepting below 5,000?

Mr. ZACKO. That is correct. He was advised that the only delay at Preston, insofar as him commencing approach to Idlewild, would be in his descent to 5,000.

When he reached 5,000, then he could expect further clearance to Idlewild Airport.

Senator MONRONEY. Was there a conversation with the control tower at Allentown when he received these instructions? Do you have that handy?

Mr. ZACKO. There wasn't any conversation with the tower or approach control at Allentown. This was all to the New York center.

Senator MONRONEY. I see. Do you have that?

Mr. ZACKO. Yes, sir.

Senator MONRONEY. Would you carry from Allentown on in—the conversation, taped conversation with the center?

Mr. ZACKO. This is what my history of the flight at the hearing consisted of. History of flight, United flight 826, all times referred herein are Greenwich mean time based on a 24-hour clock.

At 1523:30, United flight 826 reported to the New York center that he was over Allentown, Pa., at 23½. New York center acknowledged.

At 1524:37, New York center transmitted the Idlewild weather to United 826 as being 1,500 overcast, visibility one-half mile, light rain, fog, and altimeter setting 29.65. United 826 acknowledged.

During this time, New York center requested United flight 826 to advise his intentions. United 826 responded by stating, "We are starting down." The center then cleared United 826 to descend to and maintain 13,000.

At 1525, United 826 acknowledged this clearance.

New York center then cleared United 826 to proceed on Victor 30 until intercepting Victor 123 and advised that it would be a little bit quicker for him that way.

At 1525:20, United 826 acknowledged, and the New York center advised him to maintain his present heading until intercepting Victor Airway 30. United 826 acknowledged.

At 1526:49, was cleared to descend and maintain 11,000 feet. Clearance was acknowledged and United 826 reported leaving 21,000 feet. The center acknowledged.

At 1527:5, United 826 requested the altimeter setting from the New York center. This was given as 29.65. United acknowledged and the center then relayed the Idlewild runway for visibility as being 5,500 feet. United acknowledged.

At 1528:41, New York center advised United 826 that he was crossing the center line of Victor 30. United 826 acknowledged and replied:

Roger, we are heading on Victor 30 and how many miles do you show us from Victor 123?

In the background of this transmission the following could be heard:

How far to Victor 123?

The center replied:

At this time, I show you 15—make it 16 miles, 123.

United replied at 1528:59:

Sixteen miles. Thank you.

New York center added:

Right now you are about 2 miles crossing Victor airway 433.

United acknowledged.

At 1530:07, New York center cleared United 826 to descend to and maintain 5,000 feet. United 826 acknowledged and advised, "Leveling 14,000."

New York center then asked United 826 if he could make Preston at 5. United indicated he would try.

Between 1531 and 1533, the following transmissions were made between New York center and United flight 826. New York center:

United 826, if holding is necessary at Preston, southwest 1 minute pattern right turns on the 050 radial of Robbinsville. The only delay will be in descent.

United 826 replied:

Roger, no delay. We are out of 7.

New York center:

You are out of 7 now, thank you. Report leaving 6.

United 826, "Roger."

At 1533:1, United 826 reported, "Out of 6."

New York center asked United 826 if he had left 6 for 5. United 826 replied affirmatively.

At 1533:20, New York center transmitted the following:

826 Roger. And you receive the holding instructions at Preston. Radar services terminated. Contact Idlewild approach control 123.7. Good day.

United 826 replied:

Good day.

At 1533:28, United 826 contacted Idlewild approach control and advised he was "approaching Preston at 5,000."

Idlewild approach control then transmitted the following at 1533:33:

United 826, this is Idlewild approach control, maintain 5,000. Little or no delay at Preston. Idlewild landing runway 5 right. ILS in use. Idlewild weather, 6,000 scattered, estimated ceiling 1,500 overcast; visibility, one-half mile; light rain and fog; wind is north northeast at 7 knots; altimeter, 29.63. Over.

This transmission ended at 1533:54. United 826 did not acknowledge.

Senator MONRONEY. I gather from what you have just read that there was nothing clear in the pilot's instruction to the pilot that it was a minimum of 5,000 clearance. I mean, I would take this conversation to mean that he was instructed to be at 5,000 when he reached Preston.

Mr. ZACKO. I think, Senator, if we go back, the only restriction was to the delay that might have been expected at the Preston intersection and this was predicated on him arriving at 5,000 at Preston. If he could make it, fine, he would be cleared for approach. If he could not, when he arrived at 5,000, he would not have been cleared.

Senator MONRONEY. Listening to the hearings, however, in New York, it seemed apparent to me that speed was quite an element in this possible overflight of Preston; that the distance and the time was rather short to descend to the 5,000-foot altitude, but listening to the summary of the conversation with the towers, with the center, I did not get the idea that he had the latitude of being anywhere above 5,000.

I heard nothing in your description of that, which was repeated rather often around the hearings at least, that he said, "OK, we will dump it."

Was there anything in the transcription that——

Mr. ZACKO. We played the tape back many times trying to determine precisely what was said on the tape. Many people listened to it and it was really difficult to determine exactly what the pilot said. It sounded like "We will try this," but it certainly did not sound like "We will dump it."

Senator MONRONEY. But the fact remains on the examination of the flight recorder, the plane's speed as it approached Preston was far beyond the approach speed for the United manual; was it not?

You might give us those two speeds, what the United manual provides for as you go into the holding pattern, and what the indicated speed was on the tape adjusted, of course, to altitude and temperature.

Mr. ZACKO. The speeds for the standard holding pattern is contained in the criteria established for the holding pattern by the Federal Aviation Agency, which I believe is 180 knots. The read-out on the flight recorder, in the area of Preston holding the pattern, was in the area of 446 knots ground speed, 403 true, or indicated 358 knots.

Senator MONRONEY. This was more; at that speed, it would have been impossible to have held in that limited Preston area?

Mr. ZACKO. Senator, we conducted a series of flight tests utilizing a DC–8 type aircraft over the same route of flight and the aircraft did stay within the confines of the holding pattern of airspace allocated by air traffic control.

Senator MONRONEY. At that speed?

Mr. ZACKO. Well, I was not on the flight at the time, but I am quite sure that the speeds were in excess of 180 knots.

Senator MONRONEY. There is a lot of difference between excess of 180 knots and indicated speed of 446 knots.

Mr. ZACKO. Well, I would like to refer this to someone that was aboard the aircraft at the time.

As I recall, the flight speeds ranged from 250 knots to 300 knots for entry into the pattern.

Mr. BOYD. We have available, Mr. Chairman, one of our men who was on board the aircraft when that flight was made and he can testify to the speeds that were utilized in the test flight.

Mr. George Halderman, who is special assistant to the Director of the Bureau of Safety.

Mr. HALDERMAN. Mr. Chairman, it is correct, I was on board when United made a flight descending and attempting to fly somewhat the same pattern as that that was reported.

The speeds at Preston were considerably higher. I do not have them with me. However, after passing the Preston intersection and entering into the Preston holding pattern, the speeds were reduced before the completion of the first cycle or the first cycle in the holding pattern.

Senator MONRONEY. Did you use deceleration on the motor?

Mr. HALDERMAN. Yes, sir; deceleration was used by the use of reverse thrust. That was being used in the deceleration.

Senator MONRONEY. I understand on this particular type plane, you do not have spoils on the wings.

Mr. HALDERMAN. That is correct.

Senator MONRONEY. You use motor deceleration?

Mr. HALDERMAN. That is correct.

Senator MONRONEY. What is the impact of this deceleration on passenger comfort—or those unaware of performance of the aircraft?

Mr. HALDERMAN. In maintaining the high speed descent and using the reverse thrust even in the idle position, there is some small amount

of turbulence associated with the engines being in the reverse thrust position.

Senator MONRONEY. Like decelerating brakes on a car or train?

Mr. HALDERMAN. Yes, sir.

Senator MONRONEY. The noise?

Mr. HALDERMAN. The higher the power, the higher the noise level.

Senator MONRONEY. That was used after you went into the turn at Preston?

Mr. HALDERMAN. This was used on the descent, after clearance was given from the last altitude which I believe was 14,000 feet, from 14,000 feet to Preston, attempting to cross Preston at 5,000.

Senator MONRONEY. But still you do not think your speed—the speed was cut down below the 446 that was indicated on the tape recorder?

Mr. HALDERMAN. I did not have the figures of that test flight. I was not in the cockpit at the time.

They are available and could be made available to you.

Senator MONRONEY. I would like to have them made available for the record, if you will, at this point.

(The information referred to is as follows:)

CHARTS OF SPECIAL UAL DC–8 FLIGHT TESTS RESULTS AND UAL DC–8 FLIGHT 826 DESCENT TO PRESTON INTERSECTION AS RESULT OF TESTIMONY BY MESSRS. ZACKO AND HALDERMAN, CAB, FEBRUARY 21, 1961

The following three charts depict the results of the read-out of the flight recorder which was installed in UAL DC–8 aircraft N 8011 U during the flight test in the New York area on December 27, 1960. The purpose of this flight test was a demonstration by UAL to the CAB in an attempt to duplicate the flight path of the UAL DC–8 Flight 826 which was involved in the New York collision December 16, 1960.

On each of the three charts the results of the flight path descent from approximately 15,000 feet are listed as "test flight 1, 2, and 3" and are compared with the read-out of the flight recorder of Flight 826 which is contained at the bottom of each page.

On the first chart, identified as "page 43–D (or fig. 13)" is shown the time vs. altitude of each of the three flights. It shows the flight tests 1, 2, and 3 passing through the Preston intersection at approximately 6,800, 8,000, and 7,700 feet, respectively, as compared with the 8,800 feet which is the altitude at which Flight 826 arrived at Preston.

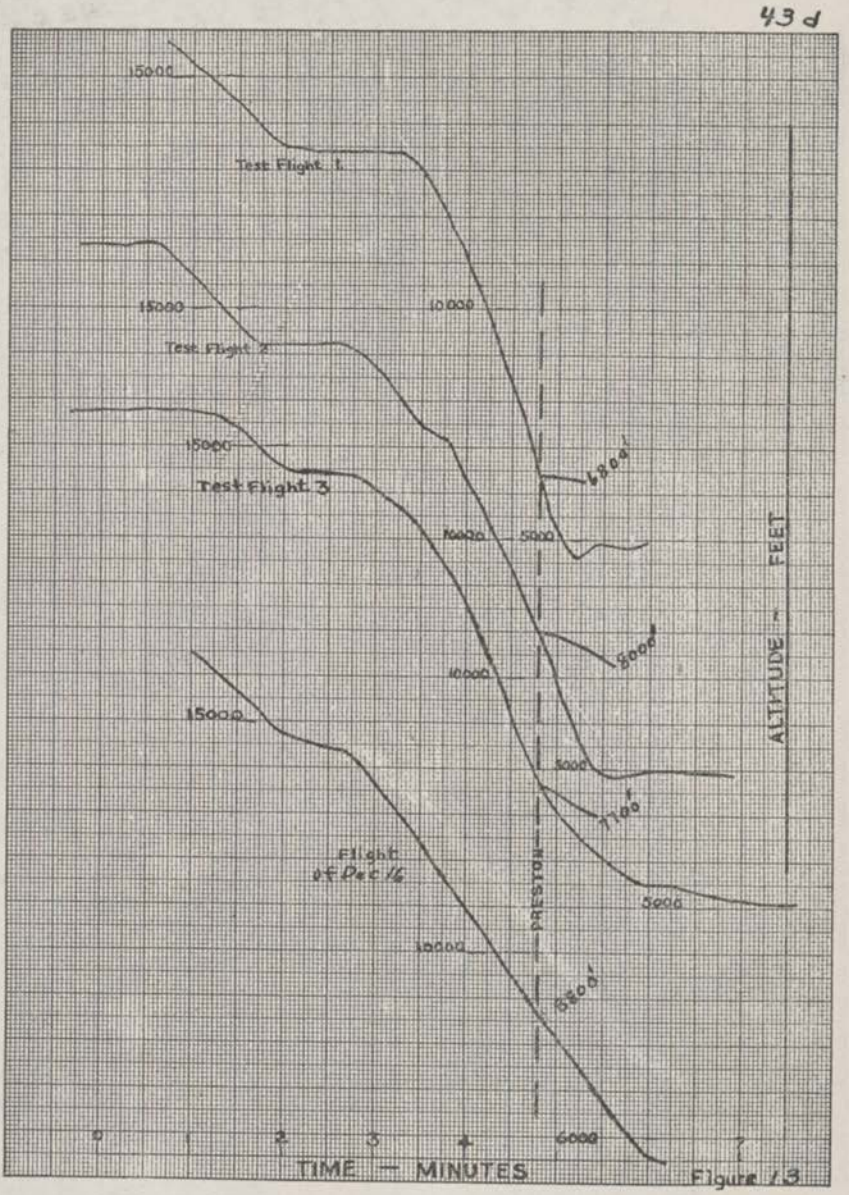
On the second chart, identified as 43–E (or fig. 14), depicts the indicated airspeed of the test flights 1, 2, and 3, as being 280 knots, 276 knots, and 275 knots, respectively, as compared with the speed of 360 knots which Flight 826 passed through Preston on December 16, 1960.

The third chart, identified as 43–F (or fig. 15), indicates that test flights 1, 2, and 3 passed through Preston intersection on a magnetic heading of 40 degrees, 39 degrees, and 36 degrees, respectively, compared to a bearing of 39 degrees which Flight 826 passed through Preston on December 16, 1960.

The Waste King standard calibration curves were used in determining altitude, airspeed, and bearing.

In these figures the traces for the three runs of the special UAL DC–8 flight on December 27, 1960, and the corresponding portion of the traces from the flight of December 16, 1960, are plotted with time alignment based on passage for ease of comparison.

Reductions of the test run airspeed and heading data to ground speed and track direction with further conversion accounting for difference in wind, pressures and temperature aloft on December 16 and December 27, would provide a more valid basis for comparisons.


43 d
15000
Test Flight 1.
15000
10000
Test Flight 2
15000
Test Flight 3
5000
5000'
10000
5000
1100'
15000
Flight of Dec 16
10000
5800'
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ALTITUDE — FEET
0
1
2
3
4
6000
7
TIME — MINUTES
Figure 13

43 e

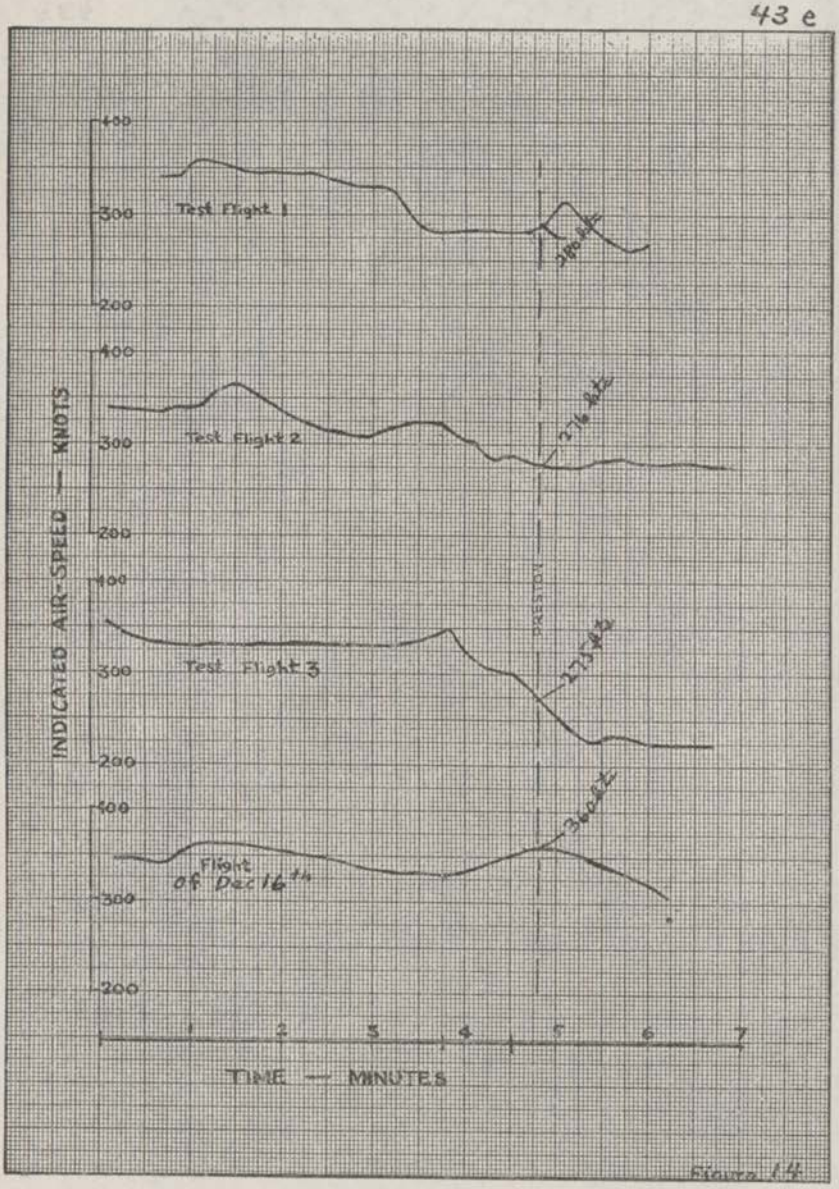

Figure 14

43 f

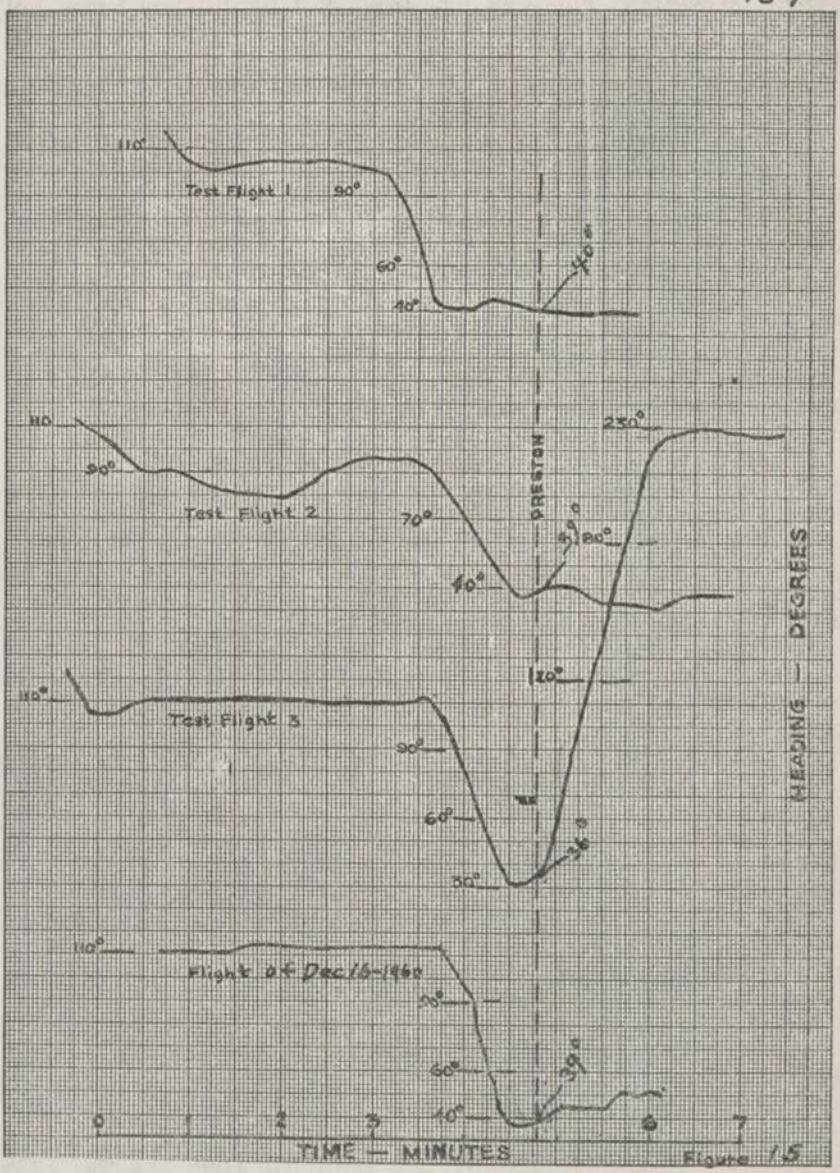

Figure 15

Senator MONRONEY. Submit them to the committee later.

You were over Allentown at the same altitude, or simulated the same altitude of the United flight in question and tried to arrive at the 5,000 feet or did arrive at the 5,000 feet altitude with the use of deceleration over Preston?

Mr. HALDERMAN. This was done three or four different times, but they did not return to the Allentown range. They returned to the area which was west of Victor 125, which was at an altitude of approximately, I believe, 14,000. And the descent was made from there to Preston simulating the same flight.

Senator MONRONEY. And the same speed or approximate speed that you would theorize at least the plane would be flying at cruise speed?

Mr. HALDERMAN. They were attempting to duplicate the same time which would have given approximately the same speed, and the speed at Preston intersection was considerably higher than the standard holding pattern as prescribed by the FAA or as being used by United. However, that speed was cut down materially after entering the holding pattern before the first circle was made.

Senator MONRONEY. Now, did you run another test to fly the dogleg Coltsneck range and coming back into Preston on deceleration, or was it just the one trip or one route?

Mr. HALDERMAN. No, it was all done, sir, on the same flight. However, there were four, I believe, four descents made; pretty much the same dogleg, as shown on your map.

Senator MONRONEY. I see. It would have added how many miles had he flown along two legs of the triangle to reach Preston. I mean, coming in off of Victor 130 to Coltsneck and back to Preston? How many miles would that have added to his flight?

Mr. ZACKO. This is from Coltsneck proceeding——

Senator MONRONEY. Had he flown the two base legs of the triangle that was formed there between Preston, Robinsville range and Coltsneck?

Mr. ZACKO. His clearance as originally given by Airway Traffic Control Center would have been approximately 12 to 15 miles longer, nautical miles.

Senator MONRONEY. He would have had 3 or 4 more minutes to decelerate or to reach his holding pattern?

Mr. ZACKO. That is correct.

Senator MONRONEY. Do you have a copy of the reported outage on one of his radio panels, the conversation apparently to the company radio reporting, I think, prior to Allentown, was that he had lost one of the panels on his radio panel?

Mr. ZACKO. He reported No. 2 electrical panel out, which our investigation disclosed that this would be his No. 2 Omni—No. 1 Omni would have been inoperative.

Senator MONRONEY. He would have had only one Omni from the trip from Allentown on?

Mr. ZACKO. He reported his No. 2 electrical panel out.

Senator MONRONEY. Now, to quit Victor 130 which he was on and pick up 123 for about 10 miles of the trip, he would have had the use then of only one Omni?

Mr. ZACKO. That is correct.

Senator MONRONEY. Lacking the one Omni, he would have had to, as he was searching his bearing and crossing and reaching Victor 123, he would have then, after he had his northeast bearing, or compass the course set on Victor 123, he would then had to use his one remaining Omni to pick up the 346-degree bearing off of Coltsneck; is that correct.

Mr. ZACKO. That is correct.

Senator MONRONEY. That is about 10 miles from the point where he left Victor 130 to reach Preston?

Mr. ZACKO. Yes, sir. And that is Victor 30.

Senator MONRONEY. Victor 30?

Mr. ZACKO. Yes, sir.

Senator MONRONEY. Then at his speed at that point and indicated speed of 446 knots would have given him not too many minutes. Could you calculate that for me?

Mr. ZACKO. I believe this was depicted on the flight path that you have on that chart in front of you, sir. The time he would get the indication——

Senator MONRONEY. He was leaving Victor 30 at 1531, and he would have reached almost Preston at 1532; is that correct?

Mr. ZACKO. That is right.

Senator MONRONEY. So he had 1 minute, if he used his Omni, to find Victor 130 to get the bearing to give him his fix at Preston.

Mr. ZACKO. That is correct.

Senator MONRONEY. That was the only fix he would have been able to make to accurately determine his holding pattern, the location of his holding pattern?

Mr. ZACKO. No, he could have himself used the Solberg Omni, 120 degrees radial——

Senator MONRONEY. Still the use of his Omni?

Mr. ZACKO. Still use the one Omni.

Senator MONRONEY. He would have had to tune to Solberg or the other and would have had Victor 130 and switched over to either the Coltsneck range or the Solberg range, so there would have been a manual transfer of his wavelength either way on his one remaining Omni.

Mr. ZACKO. It would have taken three changes, change from Victor 30 to be established on Victor 123, and then between either Coltsneck or Solberg to establish the Preston intersection.

Senator MONRONEY. We have, according to this timetable, about 1 minute, perhaps a little bit more, perhaps 1½ minutes of time. It looks as though he left Victor 30 to do that on the recorded time.

Mr. ZACKO. Yes, sir.

Senator MONRONEY. He had no other means at that point to determine whether he was approaching Preston, on Preston, or beyond Preston?

Mr. ZACKO. No, sir, to my knowledge.

Senator MONRONEY. The plane did not advise the area or the area control or, of course, did not have time to advise the approach radar of this deficiency in his navigational system?

Mr. ZACKO. He never definitely established communications with the approach control.

Senator MONRONEY. That is what I meant.

68755—61——29

But as far as the air traffic control system, they were unadvised as to any deficiency throughout the entire trip?

Mr. ZACKO. That is correct. Air traffic control was not advised of any navigational assistance that United had requested or could have requested.

Senator MONRONEY. Had he declared that half of his directional radio was out, he could have requested assistance from area control and then would have perhaps been given different instructions as to how to proceed?

Mr. ZACKO. He could have requested this information from air traffic control people and if he requested assistance, I am quite sure he would have been given assistance.

Senator MONRONEY. It could have led to a rerouting of his approach into Idlewild, even away from Preston or on another route, could it not?

Mr. ZACKO. Again, we are conjecturing. He could have done many things. He could have asked for complete GCA approach or asked for PPIA approach, or many things he could have done if he felt he was having any great problem navigating the aircraft.

Senator MONRONEY. Perhaps this is more properly a subject of FAA, but would the normal operation of landing instructions had the area radar or the control radar been advised of this deficiency they could have without him asking for it given him a different approach, could they not, on their own volition?

Mr. ZACKO. I don't believe so; I would say this is not true. The administrator has issued or promulgated a special regulation 445 effective February 17 of this year where the pilot is required to report any inoperative navigational radio equipment that he has aboard the aircraft.

However it is still incumbent upon him to request assistance from the air traffic control.

Senator MONRONEY. In other words, it is merely required that he report in but it is not required that he accept radar vectoring or a different GCA approach.

Mr. ZACKO. I don't think this would have any particular effect on what he would receive. This would mean individual handling insofar as air traffic control people are concerned and unless he requested assistance I don't believe that he would have gotten it.

Senator MONRONEY. The regulations, as I now understand have for the approach to Preston have been changed have they not, the short cut is no longer in use?

Mr. ZACKO. That is correct.

Senator MONRONEY. What route do they now fly—Coltsneck?

Mr. ZACKO. Allentown direct to Robbinsville, Victor 123 to Preston.

Senator MONRONEY. I don't see how that changes it. I mean you come down over the Robbinsville Omni vortac of the Omni far south of 130 or the intersection of the Robbinsville range with 130.

Mr. ZACKO. Well, 123 is formed by 53 radials from Robbinsville with United clearance that he received from the inland traffic control center which he was complying with did not include Robbinsville it was on Victor 30 which is a considerable distance northeast of the Robbinsville Omni.

Senator MONRONEY. I am still trying to find the new route here that he will take. He left Victor 30 apparently at less than a minute before he was at the actual intersection.

Was this the actual route he was flying?

Mr. ZACKO. The new route or the route he was previously cleared on you will have to forget about any reference to Victor 30.

This didn't come into the picture until he was advised that this would be a shorter route to take.

It was originally cleared Allentown Robbinsville Victor 123 to Preston. Radar advised him that he could proceed via Victor 30 to Victor 123 and hence to Preston.

Senator MONRONEY. I still don't understand where the new route is.

Mr. ZACKO. Actually it isn't a new route. They just said you will no longer use Victor Airway 30.

You will proceed at Allentown to Robbinsville and thence to Preston.

Senator MONRONEY. I see.

I see. You go directly over Robbinsville and then pick up——

Mr. ZACKO. Fifty degrees.

Senator MONRONEY. Center of the circle showing Robbinsville and you then pick up Victor 123—is that correct?—which gives you a great deal more distance than you had in the route this particular United plane took.

Mr. ZACKO. That is correct. Approximately 12 to 15 miles difference.

Senator MONRONEY. You are still using Preston as a major holding point for Idlewild; is that right?

Mr. ZACKO. That is correct.

Senator MONRONEY. Is Linden the major holding point for La Guardia?

Mr. ZACKO. Yes, sir; it is.

Senator MONRONEY. The only one from the west?

Mr. ZACKO. On a north operation, they vector them off.

Senator MONRONEY. Sir?

Mr. ZACKO. On a north operation they have various holding points depending on the direction of landing traffic. This was a north operation this day so they were vectoring from Linden to La Guardia final approach. I would like to find out the normal routing from Preston to Idlewild. This would be Preston to the Scotland Lightship and thence via the——

Senator MONRONEY. Preston to——

Mr. ZACKO. Vicinity of Scotland Lightship and thence via localizer course.

Senator MONRONEY. This would take it out from Preston; this would have been his normal approach to Idlewild had he held at Preston and had he been picked up by the approach radar—is that correct?

Mr. ZACKO. That is correct.

Senator MONRONEY. He would have been vectored out of the way of the incoming traffic into Idlewild and into La Guardia.

Mr. ZACKO. He would be vectored to the final approach course to Idlewild.

Senator MONRONEY. It would have taken him out of the line of flight?

Mr. ZACKO. That is correct.

Senator MONRONEY. Instead of into the line of flight had he held at Preston, had he been picked up by approach radar and vectored east and then north into Idlewild?

Mr. ZACKO. That is correct.

Senator MONRONEY. Because he was in overflying Preston, he was flying directly into what might be termed a one-way street going in the opposite direction into LaGuardia?

Mr. ZACKO. That is correct, sir.

Senator MONRONEY. Now, as to this gap in the radar control, testimony I know was given by some airline pilots that presumed that they were continually under radar control. This, I thought, was answered somewhat in the hearings in New York. In fact even in this case, the area radar had terminated their portion of the control of the flight by radar, and definitely told him he was to report for further directions to the approach radar at Idlewild. Did the public hearings develop any substance to support this contention? I mean the pilots that flew this every day thought they were under continuous radar surveillance.

Mr. ZACKO. Some of them did have this belief that they were under, shall we say, continual guidance from the radar system. There seemed to be quite a misunderstanding between the various services provided by air traffic control and the use of the term "radar," I think, is misunderstood as the radar service which was being provided to the United flight in this particular case was not a PPI approach, GCA approach, or in any way to be considered navigational assistance. It was merely to provide separation from known IFR traffic. This is the type of radar service that was being provided.

Senator MONRONEY. Have you reached any definite conclusions relative to whether the radar service was terminated before the United aircraft actually reached Preston?

Mr. ZACKO. Sir, again we get into the question of what is the radar service. The radar service that was being provided to this aircraft was merely to separate him from known IFR traffic. The air traffic control people had no obligation whatever to follow this aircraft in to the holding pattern at Preston to assure that this aircraft would be holding this pattern. They were merely obligated to provide radar separation between known IFR traffic and this, to the best of my knowledge, they had done, and this service was terminated. They in no way were providing this man with a PPI approach.

Senator MONRONEY. I am sure the purposes of your investigation determined probable cause. The purpose of our exploration here is to determine, if possible, the possible modifications that could make accidents like this impossible. And in the radarscope used by your area radar, could the radarman in the center have detected at the point they told the United pilot, "Good day," whether his position was over, beyond, or not yet to Preston?

Mr. ZACKO. Yes, sir; he could have.

Senator MONRONEY. Was Preston fixed on your area radarscope clearly identifiable as the operator is watching the scope?

Mr. ZACKO. Yes, sir.

Senator MONRONEY. The one I saw up there, I didn't think was, excepting in vague position. I recognize that they are watching American flight No. so-and-so behind the United coming and maintaining

separation there, but what we are searching for here is how to identify such a slippage in navigation, perhaps because of speed or perhaps because of an outage of power radar direction-finding devices to be sure because of the very close tolerance bewteen the Linden holding pattern and the Preston holding pattern that the man is actually not overflying it. A fail safe system might have caused him to do a 180, if he were so advised by area radar.

Mr. ZACKO. Had the approach control seen the aircraft approaching Preston, he could have advised him. In fact, under all radar, it is possible to give every bit of assistance to aircraft operating the aircraft control system. However, this would slow the flow of air traffic into the airport to a mere standstill. Every controller would provide individual flight following for every aircraft that departed and entered a large terminal area. When we speak of radar, this is not the kind of search that is being provided.

Senator MONRONEY. Wait a minute. You are talking about something that this committee is concerned with. And that is, are we in such a great rush to accomodate an exceptionally large volume of traffic into limited airspace, that we are doing less than is humanly possible with the known instrumentation now installed to make certain that these planes are in their right position?

Is the system being so crowded and is the scheduling so demanding that we do not have time for the radarman in the area control to identify or to even watch for overflying of a very vital holding point—that can mean the difference between life and death for 100 or more people?

Mr. ZACKO. Sir, I believe the answers to these questions you will have to get from air-traffic management people. They are the ones that set up the separation standards and say what the air-traffic controls can do and must do.

Mr. BOYD. I think, Mr. Chairman, that our investigation in this matter really does not make our people technical experts on what the capabilities of this existing equipment are, that we are really looking at a very small segment of this.

Senator MONRONEY. I appreciate that, but the fact remains that the conversations and the testimony and the depositions of these men who were working these planes on area radar and approach radar were taken by the CAB investigator.

This is one of the reasons we had the CAB written into the FAA Act, so that we would have an independent agency to check on anything that might be termed to be inadequate procedures or instrumentation or separation of crowded air traffic.

United, I believe, in the statement which they have submitted to the committee contend, on page 10, that—

> the physical facts make it apparent that the United aircraft had already proceeded past the Preston intersection at the time the controller terminated radar service and yet the radar controller did nothing.

Now, with the time element in here of 1 minute, with the time plus, from the time he left Victor 30, and the time at the indicated speed he would have been over Preston, and the various fixes he would have had to obtain on his one remaining omni, it would certainly indicate that we should take a closer look as to whether additional duties should be imposed on the area radar operators even to the extent of

having an extra man looking over the other man's shoulder who is looking at possible collisions from behind to be wary of collisions from in front.

Mr. BOYD. Mr. Chairman, this is at the very heart of our investigation of probable cause. This is something that is no inextricably intertwined with the probable cause that I can assure you we are devoting a tremendous amount of time and talent and effort to the study that you refer to and that we fully expect to be in a position to make some recommendations along this line.

But, as I am sure you can appreciate, probably better than most anybody else, we are dealing with a most complicated system here and we cannot shoot from the hip.

Senator MONRONEY. This I appreciate. I think this is perhaps one of the most important accidents in the recent history of aviation to study because it deals with the whole system of air-traffic control and the responsibilities of air-traffic control in these high density traffic areas where airspace has apparently shrunk to the very minimum to where two major holding patterns for two major airports must be placed within 10 or 15 miles of one another, with nothing excepting a simple radio fix to keep one traffic pattern from flying into the middle of the other.

Mr. BOYD. I can assure you, sir, we are most conscious of our responsibility in this area.

Senator MONRONEY. Are you certain that it would be possible under the instrumentation that you have seen in the area radar at Idlewild, while it was not perhaps his duty under present procedures, but for the radar man to have detected, had he been watching this plane and this plane only, the fact that he was beyond or over or on the near side of Preston at the time the radar surveillance that he was carrying on was terminated?

Mr. ZACKO. I would say his radar is capable of defining the Preston holding pattern.

Senator MONRONEY. All right. This plane carried a transponder, I presume?

Mr. ZACKO. That is right.

Senator MONRONEY. Did the evidence with the area radar indicate that it was operative?

Mr. ZACKO. Yes, sir.

Senator MONRONEY. With this transponder also then, would it have been visible on the scope of the approach radar of La Guardia?

Mr. ZACKO. Only if they had the same code tuned in.

Senator MONRONEY. Apparently he detected traffic at 2:30 and at 3 o'clock approaching and narrowed to 1 mile. It must have been some kind of a pip, whether it was a reflection or accelerated pip from the transponder—that was the question?

Mr. ZACKO. He had a primary target return, this was not a transponder target.

Senator MONRONEY. It was not?

Mr. ZACKO. No, sir.

Senator MONRONEY. This, in other words, indicates he was not on the code?

Mr. ZACKO. That Idlewild was on.

Senator MONRONEY. At Idlewild and both of these radars worked in the same general traffic pattern?

Why, technically, could not that transponder code be available to the controller at LaGuardia as well as at Idlewild? Or to the area controller? Would you have a different code for the area radar and the Idlewild radar?

Mr. ZACKO. Mr. Monroney, perhaps I should explain that we have some major items which we are considering during our continuing course of the investigation pertaining to this accident.

One of the items would be the use of the transponder for the other station to identify an aircraft.

As it is utilized today, it was meant for Idlewild to identify this aircraft.

Now, if we had the code known to the LaGuardia people, the LaGuardia controller could have selected this code, and identified this as conflicting traffic.

This is one of the areas that we have under consideration to explore. We don't know what the various ramifications will be so far as the air traffic people are concerned with the availability of these codes.

Senator MONRONEY. As I understand from electronic people, you could, while you waited for 3-D radar, you could code both the identification into the transponder and also an altitude code to show the altitude that the plane carrying the transponder is flying and thus get around, for the time being, at least, the deficiency we have in only two dimensional radar.

Mr. ZACKO. We have discussed many of these problems with the Air Traffic people. We find that one of the uses of the transponder which they object to is that it clutters up the scope, and it makes other targets unreadable. And if you have a series of transponder targets on the scope, then it blots out vital traffic and this is one reason for them not utilizing the transponder to its fullest extent.

Senator MONRONEY. In other words, what you are saying then is that even though the control-tower operator at La Guardia, had he known these planes were at the same altitude, he would have had no way of reaching the United plane or to know how to warn it as well as the plane he was working, of an impending collision course?

Mr. ZACKO. No, sir; he could have got the transport out of the way of United.

Senator MONRONEY. He could not have gotten United out of the way because he would have not known what wavelength the United was on, and had no way of reaching the cockpit of that plane?

Mr. ZACKO. Perhaps I should explain what we have in mind. All traffic proceeding to the Preston pattern going into Idlewild would be on one transponder code. This would be at 5,000 feet. Now this transponder code would only show up to the folks at La Guardia approach control facilities, so whenever they see this target getting out of the Preston pattern, they will know this is an aircraft that is at the same altitude and conflicting traffic, without making any phone calls, any transmissions at all, just merely vectoring the aircraft around this known traffic.

Senator MONRONEY. Could you tell me, in the course of your investigation, whether any question was asked as to why in these very narrow separated holding patterns of major traffic, that the planes were stacked both at 5,000 at the same altitude. You had altitudes for vertical separation that were evidently available, and the margin of

safety, of course, could have been added by this vertical element. Did you find in your investigation that it has been customary for the period of time these two holding patterns have been in use, that they are just automatically stacked for the convenience of crowding more traffic in at a faster rate at 5,000 feet?

Mr. ZACKO. Again, sir, we are getting into the items of consideration. This is the holding-pattern criteria that have been established for use under instrument conditions.

Senator MONRONEY. At 5,000 feet?

Mr. ZACKO. Those holding patterns have very standard holding pattern of 16.5 miles long, 6.5 miles wide, and the outer peripheral edges of these patterns may touch.

Senator MONRONEY. They may touch?

Mr. ZACKO. We have a condition at Washington National Airport that was recently eliminated, this was the McLean holding pattern and Collins holding pattern. The criterion for establishing these standard instrument approach procedures may actually touch the outer edges of these holding patterns.

Senator MONRONEY. You mean all the time I have been flying around in holding patterns, that the condition exists that the man will be perfectly within the holding pattern, and in the soup and if the two planes happens to come together in the space that they are allocated to, there could be collision?

Mr. ZACKO. Well, no; we have to go back into the criteria for establishing these patterns. This area is to take care of the maneuvering required by an aircraft. The actual holding pattern itself would be something on the order of 7 miles long, and say 1¾ miles wide. This is the airspace that is allocated for holding. The outer peripheral area is all the maneuvering space. He isn't supposed to go out that far, but this is maneuvering room that he has. I might add that these holding patterns are based on DC–3 airspeeds. They haven't been revised in many years. We are aware of the fact that the FAA is presently working on revision of holding patterns. But at present, this is the holding pattern that exists.

Senator MONRONEY. Now, the altitude is variable generally in the holding pattern according to how many planes are in the stack?

Mr. ZACKO. This is in the same holding pattern, the altitude is variable.

Senator MONRONEY. That is what I say, so you could have four or five planes in the same holding patterns stacked at different altitudes?

Mr. ZACKO. Yes, sir.

Senator MONRONEY. But, when you have, as you had here, apparently only two planes in the holding pattern, and both were put at 5,000, descending to 5,000—I think the TWA plane was a little higher over at Linden, was it not?

Mr. ZACKO. 5,500 descending.

Senator MONRONEY. But, did you find in your discussions with the men responsible in the air traffic control towers or the area radar, that it is customary, when only one plane is in the holding pattern, that they both be given almost the identical altitudes?

Mr. ZACKO. Yes, sir; this is the way it is set up. This is common at many facilities.

Senator MONRONEY. It all depends then on his getting that little fix when you pass over Preston?

Mr. ZACKO. This is a cooperative system.

The controller clears an airplane to a fix, he has to have reasonable assurance that it is not going to go beyond that fix.

Senator MONRONEY. And it has not happened in 2 years and 8 months, but finally, something is wrong, and the instrumentation, or something is wrong some place else, and then there is no fail safe separation that is built into the system. If you miss the Preston fix, as apparently this one did, then you have the Nation's worst air disaster. This, I think, is another reason why this is of such transcending importance—to find out what can be done, particularly about this birdcage pattern of airport location that you have in the New York City area, where you have to intermix the traffic to four airports by flying literally through a birdcage.

None of these are clear or simple directional approaches, but come from all points of the compass and it seems to me that out of these hearings and out of your studies and out of the FAA study, can certainly come some improvement in the system—something to provide even at the inconvenience of crowding so many schedules in, or to delay the landing a bit, to find wider avenues of approach even if you have to detour a few of them out over the Atlantic Ocean to bring them in.

There is nothing as safe in aviation as a little separation by airspace. You can do everything else with sophisticated instrumentation, but in the final analysis it is the distance between the two aircraft that gives you your ultimate safety.

The hour is now about 5. We hope we will not interfere with the Washington Birthday shopping of the members of the Air Safety group or the press, but I feel that it would be useless to continue further this evening and we would like, if it is agreeable with the CAB members, and their staff, to further impose on overtime and holiday time to continue with this tomorrow morning at 10.

Will that be agreeable, Mr. Chairman?

Mr. BOYD. Yes, sir.

Senator MONRONEY. Could we do anything to give them compensatory time following the hearings?

Mr. BOYD. Well, I trust, Mr. Chairman, we will be able to give them tomorrow afternoon off as compensatory overtime.

Senator MONRONEY. We will try.

Thank you very much.

We will resume our hearings at 10 tomorrow morning.

(Whereupon, at 5:05 p.m., the subcommittee was adjourned, to reconvene at 10 a.m., Wednesday, February 22, 1961.)

AIR SAFETY

WEDNESDAY, FEBRUARY 22, 1961

U.S. SENATE,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
SUBCOMMITTEE ON AVIATION,
Washington, D.C.

The subcommittee met, pursuant to adjournment, in room 5110, New Senate Office Building, at 10:30 a.m., Hon. A. S. Mike Monroney (chairman of the subcommittee) presiding.

Senator ENGLE. (presiding). The subcommittee will be in order.

Senator Monroney is delayed because of a speaking engagement this morning. He wanted to ask the representatives of CAB some questions, so I am looking for some more witnesses.

Mr. Pyle hasn't arrived yet, has he?

Mr. BAKKE. No, sir, not yet.

Senator ENGLE. Is there anyone here from the National Pilots Association prepared to make their opening statement?

It is my intention to ask the members of CAB to stand by until Senator Monroney arrives and we will take such testimony as we can before that and then he can go ahead with such questions as he desired to ask of the representatives of CAB. I have no questions to ask because, unfortunately, I couldn't be at the previous hearings and I have neither heard the testimony nor read the record. But I am looking for another witness to proceed with their prepared testimony.

Is there anyone here from the National Pilots Association?

(No response.)

Senator ENGLE. Is there anyone here prepared to make a statement from the National Association of State Aviation Officials?

(No response.)

Senator ENGLE. Is there anyone here prepared to make a statement for the Air Traffic Control Association?

(No response.)

Senator ENGLE. Do we have one over here?

Mr. MCDERMOTT. No, Senator. I merely said the Air Traffic Control Association isn't prepared to testify.

Mr. BOYD. I wonder if you could advise us, sir, at what time Senator Monroney is expected?

Senator ENGLE. I would like to know that myself. He was supposed to be here at 10 o'clock, but I had information he was delayed.

Are you prepared to go forward, Mr. Lawton?

Mr. Lawton, you may proceed.

STATEMENT OF WILLIAM K. LAWTON, EXECUTIVE DIRECTOR, NATIONAL BUSINESS AIRCRAFT ASSOCIATION, INC., WASHINGTON, D.C.

Senator ENGLE. Will it be all right with you if we interrupt your testimony when Senator Monroney comes back?

Mr. LAWTON. Yes, sir.

Senator, in response to the invitation of the committee and in accordance with their desires to have the testimony submitted by February 17, and with their concurrent desire to have the witness brief the written testimony, it is my desire to proceed in accordance with those directions, if that is acceptable to you, sir. My objective is to brief the testimony, not to read it entirely, unless the Senator would wish this to be done.

Senator ENGLE. It would be preferred if you would summarize where you can and without objection the entire statement will appear in the record as if read, but you will please indicate to the court reporter when and if you depart from the printed text so that she will be sure to have it in addition to the prepared statement.

Mr. LAWTON. Thank you, Senator.

This association is honored by the subcommittee's invitation to appear and to make its views known regarding the progress which has been made toward achieving greater safety in the air during the past 12 months.

As an association whose regular membership is composed of companies owning and operating their own aircraft as a normal means of transportation of their company personnel and in the conduct of their company's business, we are—and have always been—seriously concerned with all aspects of safety in the air.

What does constitute this business fleet? Generally, there are three categories or types of operation to be considered.

The first is known as corporate-executive flying, which is conducted by companies operating aircraft over 12,500 pounds in gross takeoff weight and which are flown by professionally qualified pilots. The great majority of these hold airline transport ratings or at the least commercial pilot certificates with instrument ratings.

The second is known as business flying, which is conducted by companies operating aircraft under 12,500 pounds gross takeoff weight and which are flown by professionally qualified pilots all of whom hold commercial pilots certificates and an instrument rating.

The third is classified as personal business flying, which is conducted by companies or individuals operating aircraft under 12,500 pounds gross takeoff weight and who hold commercial pilot certificate or private pilot certificates without instrument ratings.

In the first segment—corporate-executive flying—it is estimated that this fleet is composed of 900 aircraft. These range from Lockheed Lodestars through DC–3s, Convairs, and Martins, and include four makes of turboprop equipment and will include, this year, at least one make of turbojet.

The second classification—business flying—comprises the ever-growing fleet of more than 5,000 light twin-engined aircraft carrying from 4 to 10 passengers. It also includes a great number of single-engined

aircraft from three-seven place and this category numbers about 5,000 aircraft; in this group are more than 100 helicopters.

The third group—the personal business aircraft—it is estimated numbers 18,000 aircraft, most of which are single-engined.

This total of 28,000 aircraft is the largest segment of civil aviation in the world. The business fleet has compiled an estimated 6,100,000 hours in 1960. This hours-flown figure represents a steady increase and one which is forecast to reach 8 million hours by 1965.

As a contrast, we may compare this fleet's activities today with those of the air carriers by stating that the business fleet of 28,000 aircraft flies 6,100,000 hours, while the air carriers, with about 2,000 aircraft, flies an estimated 4,200,000 hours.

The business fleet's missions range from transportation of company personnel on routine business trips throughout the United States, Canada, Mexico, and the Caribbean and extending in the past years to South America, Africa, and Europe to their uses as test-bed vehicles for new products.

More than 700 of the large multiengined aircraft stand ready to be called into service during national emergency as the National Emergency Defense Airlift fleet under the jurisdiction of Defense Air Transport Administration of the Office of Civil and Defense Mobilization.

Thousands more light twin- and single-engined aircraft will be available to the State OCDM directors for use during national emergency.

It is estimated that 66 percent of these business aircraft are equipped for instrument flight rule flying. This would include 100 percent of the heavy multiengined and light twin-engined aircraft and about 70 percent of the single-engined aircraft. However, the greatest amount of instrument flying actually performed in the business fleet is carried on in the heavy multiengined and light twin-engined equipment.

The FAA reports indicate that the greatest increase in instrument flying shown in their annual reviews over the past 10 years has been in the area of general aviation. These figures show that both air carrier and military instrument approaches have decreased in the past 2 years, while those of general aviation have continued increasing. In 1959—the latest figures obtainable—general aviation made 12 percent of the instrument approaches throughout the country. Ten years prior it was about 5 percent.

The increasing uses of the air traffic control system, as evidenced by the increasing number of instrument approaches and contacts made by air traffic control centers with the general aviation fleet, reflect the expenditures which these operators have made in providing their aircraft with reliable communications and navigational equipment which are needed to fly under instrument flight rules.

One of the basic requirements for the business aircraft fleet is its ability to go to any airport at any time. To provide this maximum flexibility the business aircraft operators have—far beyond any regulatory requirement—spent millions of dollars for advanced radio and navigational equipment. A rule of thumb for estimating the costs involved in supplying this extra equipment is that the business aircraft operators spend, on the average, 20 percent above the cost of

the aircraft at the factory for additional communication and navigational equipment.

About 50 percent of the heavy multiengined business aircraft fleet and its operations—it may be said that business aviation has become a dominant factor in the U.S. civil aviation picture. With more aircraft, with more pilots, with more hours flown per year, and with more airports used, business aviation has, likewise, paid ever-increasing amounts of revenue to the Federal Goverment, to the State governments, to local governments, to airports, through direct taxation as well as through fees paid for services rendered. Business aviation is contributing to the stability of the airframe and engine manufacturing industry, as well as to the scores of electronic manufacturers supplying this great fleet. Business aviation is giving employment for tens of thousands of persons from coast to coast.

Most important of all, business aviation is providing to the business economy of the Nation a safe, fast, and efficient method of transportation and is bringing the benefits of the air age to thousands of communities which are isolated from other forms of air transportation.

Forecasts made by both private and governmental researchers indicate that business flying will continue to grow in numbers of aircraft and in hours flown, from its present size and activity, until, by 1975, the fleet may number 75,000 aircraft flying 22 million hours each year.

RULES AND REGULATIONS PASSED IN 1960 BY FAA

In reviewing the rules and regulations passed by the Federal Aviation Agency during 1960 which had an effect on or were applicable to the business aircraft operator, it is found that of 19 proposals circulated as "Notices of Proposed Rule-Making for Changing the Civil Air Regulations" that 11 of these proposals would have some bearing on business aircraft. The others were particularly confined to air carrier application only.

This does not take into account the hundreds of airspace changes which were proposed and accomplished; nor does this number take into account changes in the Administrator's regulations which were proposed and made; nor does this number take into account the scores of proposed airworthiness directives that were promulgated by the FAA and later amended, dropped, or adopted.

Perhaps the most significant proposal made, although the subject had been under consideration for several years, was that which eventually resulted in the raising of the floor of the airways and the collateral freeing of airspace for the movement of VFR traffic without seriously restricting the abilities of these desiring or requiring flight under instrument flight rules.

The Federal Aviation Agency—despite strong representations made by the air carriers—recognized that there had been a dramatic upsurge of non-air-carrier VFR traffic along the airways and into airports and that this increasing volume of traffic was being compressed into a 700-foot band of airspace during times of critical weather and overpopulated areas near airports.

Making the air safety problem even more complex was the fact that an increasing number of tall TV towers—some extending from 1,500

feet to over 2,000 feet above the ground—were being erected throughout the country.

The regulation, as adopted, will permit freer and safer access to the satellite airports surrounding large cities and will give assurance to the pilot flying by visual reference that he will be able to fly over tall towers without fear of encroaching into the airspace which may be used by aircraft flying under instrument flight rules.

Two of the proposed rules, later adopted, considered special traffic regulations for Idlewild Airport in New York City and for the Washington National Airport. Besides considering methods for better traffic flow, the proposals were also based upon noise generated by civil and military jet traffic and by heavy four-engined piston-powered transports.

There is little room for argument that procedures for better traffic flow and for noise abatement are highly desirable. It is to be hoped that a special regulation will not be needed for every major airport in the country but that some basic and uniform standards can be adopted that may be applied to all major airports.

Among other regulations adopted were those calling for the setting aside of a large, high-altitude airspace in which the FAA could conduct an areawide positive control of all aircraft. Known as "Operation Pathfinder," the FAA has been conducting positive control of all aircraft suitably equipped without a requirement that the aircraft follow narrow, prescribed airways, but rather could deviate for reasons of weather or for reasons of traffic control from a straight line course, and at the same time remain under constant surveillance of air traffic control and under their guidance.

This area traffic control concept will, if successfully proven, permit greater use of the higher altitudes by both military and civil aircraft and provide greater freedom in the maximum use of the air space.

Perhaps one of the most significant steps taken during 1960 in the area of rule and regulation making was the FAA's decision to hold conferences with airspace users and the aviation industry prior to issuance of a notice of proposed rulemaking.

Two such large-scale conferences were held in Washington; the first was held on August 3 and extended for 3 days; the second was a 1-day meeting held on August 31.

Numerous other briefings were held throughout the year on matters ranging from proposed military exercises to proposed deicing standards for light aircraft.

Whether the users learned more about the FAA or the FAA about the users is moot. Nevertheless, a great amount of information was freely exchanged, further discussions and explorations were assured between Agency personnel and industry, and, in one particularly significant communications area, issues were resolved to the satisfaction of Agency, user, and manufacturer.

The opening up of these avenues of communication between the Agency and those regulated by the Agency was one of the most significant changes to be accomplished in the past year.

It is also to be noted that the Agency has announced plans for two user industry conferences to be held in March of this year.

The role that NBAA and its members have played in providing information, suggestions, and comments to the FAA have ranged from

participation in several FAA-industry groups examining diverse areas such as collision avoidance and proximity warning devices; and navigational charts, to detailed aspects of the air traffic control system and its operations.

In its relationships with the Civil Aeronautics Board, NBAA has had close liaison with those staff members of the Board whose duties are prescribed by title VII of the FAA Act entitled "Aircraft Accident Investigation."

We have noted with concern that the Civil Aeronautics Board has not—largely, we believe, from lack of manpower—been able adequately to carry out an important provision of the act with which they have been charged by Congress.

Section 701(a)(5) states that it shall be the duty of the Board to—

ascertain what will best tend to reduce or eliminate the possibility of, or recurrence of accidents by conducting special studies and investigations on matters pertaining to safety in air navigation and the prevention of accidents.

This is a vital function which is charged to no other agency.

This is a vital function which—if we are to progress at a more rapid pace in air safety—we believe should receive the most careful scrutiny by the Congress.

The Civil Aeronautics Board has—during the course of these headings—detailed their tremendous workload of the past several years. The dedication of the staff members of CAB in their aircraft accident investigation is, we believe, worthy of the highest praise and tribute. However, praise and tribute are not enough to compensate for the hours of overtime, the long periods away from home and office, the exposures to subzero weather and searing desert heat, to which these highly skilled technicians and investigators have devoted themselves.

The CAB needs help in skilled technical manpower. They need help in the field as well as in the offices. They need help in the compilation of statistics, in the preparation of accident reports, in the conduct of studies in accident prevention.

In short, they need help in order to carry out the direction which Congress has given to the Civil Aeronautics Board.

Senator, diverting from the prepared testimony, we have outlined here the role of NBAA in air safety outlining how our organization attempts in every way possible to be of advice and counsel to our members, to the FAA and the CAB, and the various methods by which we perform these functions.

Noting the arrival of the chairman of the subcommittee, I will eliminate more of this prepared testimony.

I will note, though, that NBAA each year presents safety awards to their member companies.

THE ROLE OF NBAA IN AIR SAFETY

Safety in the air may be considered in two areas of application. The first application is by the aircraft owner and the pilot. The second is in the operating environment which is controlled or regulated by governmental agencies.

In the first area, that of the application of safety standards by the owner and operator, NBAA provides to its members directly and to others in the operation of business aircraft a constant stream of information.

This information encompasses a wide range from a recommended standards manual which outlines suggested operational and managerial criteria for the operation of business aircraft to special reports and bulletins designed to give to both pilot and management the latest information on proposed governmental regulations, procedures or standards all of which involve—to some degree or other—air safety.

Bulletins also include reported aircraft and engine malfunctions, air traffic control techniques being applied by the FAA, reports from military agencies concerning specialized evaluations of equipment on aircraft which are also used in business aviation—in fact, anything which would give pertinent information to a pilot which would enable him to operate in greater safety.

The publications of the various military commands concerned with air safety, technical notes and directives published by several of the commercial air carriers, and the Air Line Pilots Association, reports from NBAA member companies, reports from the Civil Aeronautics Board and the Federal Aviation Agency—all of these and many more—are received and reviewed by the NBAA headquarters staff. These are made into digest when applicable and forwarded to NBAA membership. These digests have, for the past 4 years, also appeared as a regular feature of NBAA's official publication Skyways, which has a circulation of more than 38,000 copies which go each month to all segments of the aviation industry with an interest in business flying.

NBAA ANNUAL SAFETY AWARDS

Each year at its annual meeting, NBAA presents safety awards to pilots of business aircraft whose companies are NBAA members. These awards are based on the strictest of all safety criteria: No injury to pilot or passenger; no damage to an aircraft.

Recognizing that safety in the air relates directly to teamwork, from skilled maintenance technicians to top management policymaker, NBAA also presents awards to NBAA member companies whose aircraft have flown more than 1 million miles without injury to personnel or damage to aircraft.

In 1960, at NBAA's annual meeting in Los Angeles, Calif., NBAA was honored to recognize the achievements of these business pilots and their companies by giving awards to 217 business pilots for having completed a total of 215,106,812 miles under the rules of this exacting safety award criteria. Fifty-eight companies were given awards for having completed 149,875,112 miles in perfect safety.

By that we mean no accident to any passenger, or member of any crew. They are based on the completion of more than 1 million miles of this exacting criteria.

Applications for these awards are sent to every NBAA member company. The returns are carefully screened by a selected safety awards committee who have the applicant's permission to check with the applicant's insurance company. The committee also has access to CAB and FAA accident records for further checking.

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SPONSORSHIP OF MEETINGS AND FORUMS

NBAA encourages its member companies to participate in the informal traffic control and in the informal airspace meetings held by the FAA in many places throughout the United States. NBAA has, as a result, participation in the grassroots problems of every area in the country in which local problems of air traffic control and the use of airspace are considered.

As a contribution to the dissemination of the activities of the air traffic control meetings, NBAA publishes, on a quarterly basis, a summary of these meetings. These summaries are distributed to all NBAA members and, upon FAA's request, to all FAA ATC centers. It has been found through experience that the problems of San Francisco may also be the problems of Dayton, Ohio, and that through this interchange of information both FAA and our members may find common solutions to common problems.

NBAA also encourages its members to hold regional or area meetings to which are invited airframe and engine manufacturers, accessory manufacturers, Weather Bureau, FAA, and CAB officials to discuss problems with which they all are concerned.

NBAA staff frequently participate in these meetings as well as regional conferences or meetings sponsored by Federal or State officials or their organizations.

At NBAA's annual meetings we have had numerous programs and panels in which the air safety problems of current and future concern are discussed. These programed events have included the leading authorities both from Government and industry on subjects ranging from communications, navigation, maintenance, air traffic control, aviation medicine, aerodynamics, to detailed question-and-answer periods on specific aircraft or engines.

NBAA has also been honored at these annual meetings by the presence of our Nation's leaders in Government and industry. Many of them, including the distinguished chairman of this Aviation Subcommittee, have addressed our assembled meetings.

Because NBAA, as a basic policy, encourages exchanges of information and close liaison between manufacturers and consumers the annual meeting also includes a large exhibit area at which new products or services are displayed. In the past 3 years it has also been found valuable to include both static and flying displays of the latest types of business aircraft. In both exhibit hall and in the static and flying aircraft displays the aircraft user is able to evaluate the latest devices or equipment which may contribute, in some degree or other, to a safer operation.

NBAA'S TECHNICAL COMMITTEE

NBAA is fortunate to have a group of highly qualified and experienced chief pilots and heads of corporate aviation divisions who devote much of their otherwise free time in examining and evaluating proposed procedures and proposed regulations upon which the FAA frequently desires the association's views.

The technical committee's findings are coordinated with expressed views of other NBAA members companies and recommendations are made to the requesting FAA bureau or division.

The subjects which this technical committee has reviewed are many and varied. They range from the application of air carrier standards to privately owned aircraft for aisle width between seats to participation in flight simulator tests at FAA's Oklahoma City facilities which examined the feasibility of a new type of holding pattern entry.

Members of the NBAA technical committee, other NBAA member company pilots as well as NBAA staff are and will be available for many types of evaluations of equipment and procedures brought forward by Government and industry. Because of the wide range in types of equipment used in business flying and the diverse types of operations, we believe that NBAA can provide to interested parties a good cross section of the requirements, capabilities, and desires of a large segment of civil aviation in these evaluations.

OTHER NBAA POLICIES TO FOSTER AIR SAFETY

Realizing that many NBAA member companies have voluntarily taken as their operational guidelines many of the standard operating practices and procedures of the scheduled air carriers, NBAA has encouraged all of their member companies to carefully consider and to adopt air-carrier practices in the areas of pilot proficiency training and in operational criteria.

Coincidental with this encouragement in the areas of pilot proficiency training there have been established throughout the United States several privately owned and operated schools which specialize in refresher training for business pilots. One of these schools, for example, has invested over $1 million in flight simulators.

NBAA encourages their company members to have their pilots utilize these proficiency training schools, to take frequent check rides with FAA inspectors, to attend refresher or advanced courses in air traffic regulations, in meteorology, and in aircraft systems operations.

With the advent of the more sophisticated turboprop and turbojet equipment into the business aircraft inventory, the airframe and engine manufacturers have established thorough ground schools and flight schools for the business pilots and maintenance personnel to attend. These courses extend from 1 week to 6 weeks, depending upon the subject at hand. This same practice is followed by airframe and engine manufacturers, in varying degrees, with reciprocating-engine, smaller, aircraft.

DISSEMINATION OF ACCIDENT INFORMATION

Whenever a business aircraft whose gross weight is over 12,500 pounds is involved in an accident resulting in severe injuries or fatalities, NBAA staff endeavors to ascertain as quickly and as accurately as possible the circumstances of the accident. This basic information, detailing the aircraft involved, its equipment, the crew, the history of the flight prior to the accident, the reported weather conditions en route and at the time and place of the accident, is sent to all NBAA members.

Should significant information—such as part failures or aircraft system failures—be disclosed during the course of the CAB's investigation and resultant immediate action is required by FAA in the

interests of safety, NBAA is notified of this immediate action required and members notified of the FAA-approved action to be taken.

When the CAB has concluded its investigation and issues its formal determination as to the probable cause of the accident, a copy of this detailed CAB report is sent to each NBAA member company.

Annual summaries of all business-aircraft accidents involving aircraft over 12,500 pounds are provided to NBAA by CAB and in turn are forwarded to all members. These brief summaries of nonfatal and fatal accidents provide valuable information to the reader and serve as an additional reminder of the results of careless or unfortunate operations.

THE ROLE OF GOVERNMENT IN AIR SAFETY

As NBAA is composed of many companies whose views have a wide range, a detailed comment on this complicated area is not possible.

It may be said—as far as air safety regulations are concerned—it seems clearly established that, as in all aspects of life, certain specific rules, regulations, or procedures must be established. In the area of air traffic control, for example, we believe that clear-cut, understandable, air traffic rules must be written and enforced. They must be written with full understanding of the abilities of the user to comply without excessive cost, effort, or knowledge. They must not be written with the sole viewpoint of satisfying the requirements or capabilities of one segment of aviation or of the controlling governmental agency. And they must be enforced with intelligence and not vengeance.

In other areas of rulemaking and application, we believe that Government should specify the objective to be attained and not, necessarily, specify the exact, minute, step-by-step processes by which this objective must be attained. Some areas of maintenance, repair, or manufacture come under this type of objective-to-be-attained regulation.

Likewise, in the field of equipment on aircraft used in private industry as opposed to equipment used by common carriers, the Government has the responsibility, we believe, of determining minimum standards. However, the clear distinction between equipment standards for private and common carriers should be maintained. For those operating private aircraft who desire—and the great majority of business-aircraft operators do—to equip their aircraft with above-minimum-standard equipment, the manufacturers have provided a wide variety for selection.

That this business-aircraft owner and operator has, in the past, voluntarily chosen equipment of high standards, and in quantities in excess of minimum required by regulation, is well established.

There is another method of improvement in air safety which should be considered. We refer to the establishment of recommended procedures which, because of their minute details and varied applications, will not lend themselves to a formal and enforcible type of regulation.

For example, a proposal is now under consideration by FAA which would make it mandatory that any airborne equipment malfunction

affecting communications, navigation, or performance of the aircraft is to be reported to air traffic control.

I may depart here to say that part of this rule at the time this was written was under discussion, a segment of this entire subject has now been made a subject of Special Civil Air Regulation 445, and we do not refer in this to the special civil air regulation but to the proposal which was much broader in scope which was under consideration about a week ago.

Because of the infinite variety of these malfunctions which may occur under an infinite variety of flight conditions, the desired objective tends to become lost in legal phraseology to the point of becoming confusing, and, hence, unrealistic in application.

We are now talking about the original proposal, not what subsequently was issued.

If the FAA would urge all users of the airspace to make these reports as a good operating practice and not make the reports a subject of absolute regulation, it is believed that the objectives would be accomplished and those who fail to adhere to these practices would be the subject of admonishment.

I might also add that the Agency has the perfect right under the existing act to reexamine at any time any airman's certificate or any operator's certificate if they believe he does not follow the recommended standards or procedures which we believe might be used.

Attempts to place into effect detailed regulations which would govern every conceivable action or approved reaction of a pilot will, we are certain, tend to defeat a basic and cardinal principle of safety: the ability to use judgment and commonsense to meet an uncommon situation.

Thank you very much, sir.

Senator ENGLE. Thank you very much for that statement, Mr. Lawton, and, if it's agreeable with you and my colleagues here on the committee, we will defer any questions until we have an opportunity to continue the questioning of the CAB witnesses.

Can you be available?

Mr. LAWTON. I will be available.

Senator ENGLE. Thank you very much; we appreciate your pinch-hitting for us here.

Now, if the witness from the CAB would return to the stand?

Thank you, gentlemen. The Chair recognizes our distinguished subcommittee chairman.

Senator MONRONEY (presiding). Thank you, Senator Engle, for going on with the hearing. I was unavoidably detained on the speaker's rostrum and could not get here on time.

When we adjourned last night we were discussing the specific traffic cases of the New York City area with particular reference to the United-TWA crash which dramatized the situation of air traffic control in certain heavily congested areas.

One of the things I would like to ask of any of your experts, Chairman Boyd, who could answer it is this: Could this accident have been avoided if we had had perfected and in use three-dimensional radar?

STATEMENT OF HON. ALAN BOYD, CHAIRMAN, CIVIL AERONAUTICS BOARD, ACCOMPANIED BY MELVIN N. GOUGH, SR., DIRECTOR, BUREAU OF SAFETY; LEON TANGUAY, DEPUTY DIRECTOR, BUREAU OF SAFETY; ROSS I. NEWMANN, ASSOCIATE GENERAL COUNSEL; ROBERT FROMAN, ASSISTANT DIRECTOR, SAFETY BUREAU; GEORGE HALDERMAN, ASSISTANT TO THE DIRECTOR, SAFETY BUREAU; JOSEPH FLUET, CHIEF, OPERATIONS DIVISION, SAFETY BUREAU; JOHN F. PAHL, CHIEF ENGINEERING DIVISION, SAFETY BUREAU; PHILIP GOLDSTEIN, CHIEF, INVESTIGATION DIVISION, SAFETY BUREAU; MARTIN CLARK, SAFETY SPECIALIST, SAFETY BUREAU; ARTHUR NEUMANN, SAFETY SPECIALIST, SAFETY BUREAU; C. E. STILLWAGON, SAFETY SPECIALIST, SAFETY BUREAU; AND JOSEPH ZACKO, SAFETY SPECIALIST, SAFETY BUREAU, CIVIL AERONAUTICS BOARD—Resumed

Mr. BOYD. Mr. Zacko was discussing the technical aspects of air route traffic control in connection with this accident and I will ask him to continue, sir.

Mr. ZACKO. Senator, having never used three-dimensional radar, I think this question could best be answered by the Federal Aviation Agency.

Senator MONRONEY. I don't think they have used much of it either. I mean, it is still in the developmental stage. I thought you might be able to comment on the principles if we had electronics that could have shown to the LaGuardia approach controller that this was a collision course at the same altitude that this plane was on. Warning might have at least been given to the plane with which the controller was in contact, and could have given him a 180 to get him out of the way.

Mr. ZACKO. Perhaps I should state it this way: I am quite certain if the air traffic controller working the LaGuardia approach control position had any indication of the altitude of the aircraft that he observed on radar he would have given TWA evasive measures.

Senator MONRONEY. At that point at least he was on the limited area in the approach radar and had he known that the two were on a collision course at the same altitude, he undoubtedly would have contacted the plane he was vectoring to get him out of the way.

Mr. ZACKO. Surely.

Senator ENGLE. Do I understand that the radar controllers in that instance did not both have the two airplanes on both screens? I understood from reading the newspaper reports that one controller had the United, but the fellow who had the TWA on his screen did not know what that pip was that was on a collision course on the screen at least, with the TWA airplane.

Is that correct?

That there was some handoff procedure there where they got balled up and they did not actually have both of them, both the pips on both screens?

Now, the reason I ask that question is because I was going into San Francisco not long ago and we had those fellows there telling us from the time we got over Vallejo, we had a target off over the San Fran-

cisco Bay Bridge, a Boeing 707 that was making an instrument approach on Oakland airport.

Now, they told us that three different times and we were VDR, and, of course, we were gawking around trying to spot that 707. He was too high; we did not see him, but the thing that attracted my attention to it was that the controller in San Francisco had two pips on his screen. He had us on there and he knew who we were. He had the Boeing 707 on his screen and we were on a collision course but we were, oh, 2,500 feet or something like that coming down to the San Francisco airport; the Boeing was at 7,000 or 8,000. He did not tell that we were at different altitudes, but he told us, and he told the Boeing, and we were sure watching for that Boeing to see that we were not on the same altitude, so that we would run into each other.

The thing that puzzled me about that New York accident was that if they had had the same kind of operation going in New York as they had in San Francisco, somebody would have gotten out of the way, even on instrument weather or somebody would have told them to turn, because if these two pips are on a collision course on a radar screen and are obviously on a collision course, even if the controller does not know that they are not at the same altitude, for precaution's sake he would tell somebody to move, wouldn't he?

Now, why was it that when he had two pips on his screen on what was obviously a collision course, even though he did not know that they were at the same altitude, he did not notify both airplanes so that somebody can change his altitude or change his direction?

At least, if I was in the soup on a collision course with another airplane and I did not know what his altitude was and he did not know what mine was, I would sure get off a collision course, even though we did have different altitudes, so, will you explain how it was that they did not both have the same thing portrayed on their screen or at least apparently did not both know what the two pips were?

Mr. ZACKO. Senator, this is a little bit different situation. Inasmuch as you have two facilities that are involved in this particular accident, one facility had established identification with the aircraft that he was vectoring, being Trans World Airlines, to the La Guardia Airport.

The Idlewild approach controller did not establish identification with United.

Now, the system as it is set up today does not provide for vectoring of aircraft around unknown targets. On the average day a controller views the scope he may have as many as 40 or 50 aircraft within his vectoring airspace that he has no altitude information on or no destination information, and from practical experience I know that this would be a physical impossibility for the controller to vector aircraft around every target that he sees on the scope.

So, the procedures say that you will vector such aircraft around known IFR traffic.

Senator ENGLE. But when all your traffic is IFR they ought to be able to vector around.

All the traffic in that area was IFR at that time, wasn't it? Now the situation I mentioned in San Francisco, we were all VFR as far as I know, unless the Boeing was on an instrument flight plan, and he may have been, even in VFR weather, but we were not; we were on

a VFR flight plan and we checked with the San Francisco control center when we came into the area and they constantly advised us of the position of the Boeing.

Now, it seems to me that if you have a control area and all aircraft within it, because of the weather conditions, are on IFR, that they ought to know which one is which.

My understanding was they had separate screens.

Mr. ZACKO. That is correct, sir.

Senator ENGLE. And that the fellow handling the United, he knew what the United was and he had that pip identified on his screen, the fellow on the TWA had that pip identified, and he knew what his pip was, but the two never got together, but the airplanes got together.

Mr. ZACKO. Well, United—no, the controller that did not have United on the scope——

Senator ENGLE. You mean——

Mr. ZACKO. He did not have the United identified, the approach controller working the Idlewild approach control sector did not have United identified on the scope.

Senator MONRONEY. Would the Senator yield?

Senator ENGLE. Yes.

Senator MONRONEY. Last night before we adjourned it was brought up that the United plane on center control, area radar, had been cut loose before he was picked up by the Idlewild approach radar, that there was instrumentation available to the area radar controller to have identified United's plane position with reference to the ground and with reference to Preston holding the pattern where he was supposed to hold, but that under the customary procedures they are looking backward to prevent collision rather than looking forward.

They are trying to maintain space separation of known traffic that they are working. The point that we were discussing was why the area controller did not, since he had given him instructions to hold at Preston, watch to see that he did hold at Preston. This plane was going at 445 knots an hour in this crowded pattern, well beyond the speed limits which are prescribed for that, and the testimony at the public hearings of United was that evidently the United plane had already passed the Preston holding point at the point in which the area radar operation had cut him loose and wished him a good day.

Therefore, the discussion last night was why, since the availability is there on the area radarscope to have identified this plane passing position with reference to Preston, why the area controller did not watch to see that he went in it.

The answer of the witnesses was that this is not their present duty to do that; that they are watching to assure separation of those planes; that they are working in that normal approach, and once he is told to go into a pattern he is just checked off and forgotten until he is picked up by the approach radar.

When we pressed for the answer as to why the area control radarman did not watch, they said, Well, it would have slowed the system down on his acceptance which brought about some discussion then as as to whether we are forcing the system to carry traffic beyond that which can be safely watched and monitored continuously with a positive radar hand-off, at least, from the area radar to the approach radar.

The custom is that once he has been told to go into the holding pattern it is no more the business of the area radar controller and it is none of the business of the approach controller until he is told to come out of the holding pattern and then he gets his radar vectoring.

Senator ENGLE. Yes, and if he makes a mistake and overshoots his holding pattern, he is right in somebody else's traffic and nobody identifies him; isn't that right?

Mr. ZACKO. That is correct.

Senator ENGLE. That is a very bad system and it ought to be changed.

Senator COTTON. Mr. Chairman, I waited rather patiently for several days to get to this particular accident. I was anxious to hear about it and I was not here last night.

Just so that I may follow this questioning, may I get one thing clear: something that is apparently plain to everyone but me?

Senator MONRONEY. Certainly, I am all through.

Senator COTTON. As a plane approaches New York, for instance, where there are several airports, when you refer to the area radar that is the radar and the observer or the controller that takes into consideration the hold field of aircraft up to a certain point and then at that point those that are going to Idlewild are taken over by the Idlewild radar and those going to LaGuardia by the LaGuardia radar. Is there a point where the area stops and the particular field takes over? Is that the situation? I cannot get in my own mind clearly this reference to the area radar and the approach radar.

Mr. ZACKO. We have the area traffic control center which provides separation for aircraft en route. This was all aircraft operating IFR out of the air traffic control system. This facility provides this separation. When they get to their terminal areas then we have the approach control facility which provides the separation during the approach to the airport for these aircraft operating under instrument flight rules in this system.

Senator COTTON. Well, if I understand your reply, then, my understanding was correct. The area control system takes over a broad space as they are approaching the general area, and at some point it lets go and it separates those that are going to Idlewild, those that are going to LaGuardia, and those that are going to some other airport, and at that point they are supposed to be taken under the control of the radar at the particular airport. Is that right?

Mr. ZACKO. They are supposed to be taken under control by the approach control facility, but not necessarily by radar. They may or may not use radar.

Senator COTTON. It may be just simply direction back and forth, orally, right?

Mr. ZACKO. That is correct, sir.

Senator COTTON. But there is a point where the area lets go and the individual airport control facility takes over?

Mr. ZACKO. That is correct, sir.

Senator COTTON. And just to get myself abreast of the rest of the committee, there was a failure between those two stages that apparently contributed at least to this accident; is that it?

Mr. ZACKO. Sir, we are getting into the realm of analysis at this time.

Senator COTTON. I will withdraw that question.

I just wanted to catch up to you gentlemen, that is all.

I think I have.

Senator MONRONEY. In other words, there is an apparent gap where area at a long distance, 200-mile radar cuts loose when he gives this man the final instructions to go into the holding pattern. There is no surveillance, the testimony developed yesterday, to see that he was actually in the pattern waiting for the approach radar, the short-range radar to tell him to come out and to vector him in.

So, we have a gap and this brought about the discussion that has spotlighted this accident, about the ability of the system or future additions to the system, to effect a positive radar handoff.

What I would like to ask, Is there any way, employing the present equipment, where a positive radar handoff could have been made from the area or the center radar to the approach radar?

Mr. ZACKO. Yes, sir; there was.

Senator MONRONEY. And this would have required, as you said yesterday, a slowing down of the system in its acceptability and its acceptance of aircraft?

Mr. ZACKO. That is correct, but I think we have to go into it a little bit differently.

These procedures have been set up, as you know, radar does not operate 365 days a year, 24 hours a day. There are times when radar is off the air and it is not even utilized, so, therefore, this system as it is presented today is supposed to be able to accept these aircraft whether or not radar is being used.

Now, when we did not have radar the same system was used to get these aircraft into the New York area on a clearance limit and altitude separation, and if the radar should go out the aircraft is still supposed to be able to get to his clearance limit and hold in accordance with the clearance that he has received.

Now, I am sure the Board realizes that the aircraft are becoming faster, the systems are being harder to cope with, the facilities are rapidly becoming saturated where this is almost becoming an impossibility.

Senator MONRONEY. But you could have effected a positive radar handling of it—it could have been done under the present mechanical equipment?

Mr. ZACKO. Yes, sir.

Senator MONRONEY. Is there any equipment available off the shelf today which could be pressed into service to help avoid a situation like this one?

Mr. ZACKO. Well, Senator, for many years we have been hearing about various new developments that have been tried, data processing reading, radar, wide use of DME, and so far we haven't seen much of this in operation except at the experimental stations. I think our our air traffic control system is just about the same as it has been for the past 10 years, except that we have gotten faster airplanes and more airplanes, but I am sure the Board would like to see these new developments come into practice at these high density airports. We have discussed this with the Federal Aviation Agency people and, of course, all this takes money and men.

Senator MONRONEY. How long ago was DME brought in? You mentioned DME—this is the distance measuring device which would have

given the pilot an additional fix on his holding pattern, would it not, if the DME had been on the ground and used—and I understand it is available in that area—but it was not available in the aircraft.

The fact of the matter is very few of our commercial planes, our transport planes, are equipped for DME at this time.

Had DME been available on the ground and in the cockpit, would this have given him a second fix that he would have other than perhaps his radio equipment, half of which was gone?

Mr. ZACKO. Sir, again we are getting into the area of analysis. The pilot was advised that he was 16 miles west of the vector 123. He had this information. It was transmitted to him by Air Traffic Control. DME would have told him precisely the same thing.

Senator MONRONEY. Yes; but it would have also told him when he made his turn into 125 how far he was going to vector. Particularly if he had flown over the Robbinsville omni he would have had an additional fix he was getting off of his one omni.

Mr. ZACKO. This is correct.

Senator MONRONEY. And this is available in the area, DME, on the ground?

Mr. ZACKO. Yes, sir.

Senator MONRONEY. But it is not, of course, installed on many planes as yet.

What value did you find—and this, of course, I think, is of interest because this committee was pressed very hard for it in our hearings a year ago—from having information from the flight recorder in this case?

Mr. ZACKO. We found the flight recorder most helpful. It provided a considerable amount of very valuable information.

Senator MONRONEY. In other words, this was off only by the visual or the contact with the tower as it was off only a matter of a very few seconds, was it not, from the visual path or the other path of the plane and the configuration of its flight and its speed at various points?

Mr. ZACKO. That is correct, sir. I would like to add that we have a project under study now where we are evaluating 45 such records from these flight recorders in an effort to determine the procedures utilized for high speed, jet-type aircraft, and the high density area.

Senator MONRONEY. And you are doing that off the reading of other flights that have been in this same area?

Sir, we have 45 such flights. Our Engineering Division is now in the process of evaluating these records.

Senator MONRONEY. Were you satisfied in the examination of the tapes which you examined on this flight of the voice intelligibility of the control pilot tapes. I mean, was it clear from replaying the tapes of the conversation during the flight from Allentown to the time the plane was lost that the pilot was given understandable directions from the control tower?

Mr. ZACKO. Yes, sir, we feel that his clearance as received shouldn't have left any doubt in the pilot's mind as to what was expected of him.

Senator MONRONEY. Apparently from yesterday's testimony there was a question in my mind where your interpretation was that the pilot was given a minimum altitude of 5,000 at Preston in a rather

rapid descent which did cause, apparently, speed acceleration far beyond the allowable limits in that area.

In the summary of the tapes that you later read it was not at all clear to me that the pilot would have understood that he was cleared for anything other than a definite 5,000 feet at Preston and not a minimum of 5,000.

I did not understand from the tapes that you read that he could have slowed down his descent and could have established 11,000 over Preston had he wished.

Mr. ZACKO. Well, sir; the question of delay came up in these transcripts, and the pilot asked the air traffic control facility what his delay would be. ATC responded by saying, "The delay at Preston will only be in your ability to get there at 5,000."

Now, if the pilot wanted to arrive at Preston at 5,000 this meant he could depart there with no delay. If he wanted to get there at 8,000 his delay departing Preston for Idlewild could have been his descent in the Preston pattern until he reached 5,000 feet.

This is a clearance that is commonly given in the air traffic control system.

Senator MONRONEY. You are satisfied that the pilot understood that he could have been at any other altitude above the 5,000 had he felt that to reach the 5,000 would have brought the speed beyond the allowable speeds in that area?

Mr. ZACKO. I am satisfied that the pilot understood that the minimum altitude that he could proceed to Preston was 5,000 and that he had, depending on whether or not he wanted to take a delay, this choice.

Senator MONRONEY. That certainly wasn't clear to me as we were going over the summary of the tapes.

Perhaps there are some other questions. I don't wish to monopolize this line of questioning. I wanted to start another line of questioning.

Senator ENGLE. May I ask one question before you leave that?

Is there any reason when an area is under instrument conditions and everybody is on instruments, that you cannot have radar identification and positive control of all aircraft operating in the area?

I am not talking about the situation where you have instrument flights filed, but you, in fact, have VFR conditions. I have been out here at the Washington National and looked at their screens and you could see airplanes all over the place because the boys off of Washington and Virginia and every place else were up flying around, so you would have a lot of unidentified aircraft. But because there were VFR conditions these fellows could see where they were going and the controller had the responsibility of maintaining separation and bringing in the fellows who were actually under instrument flight rules as they would be, say, off of Anacostia and off of Bolling and to some extent off of National. Now, that is understandable, and I can see why the radar controllers could not, under those circumstances, identify all those pips, but where the whole area is under intrument conditions the question I am asking is, Why is it that they don't know what all those pips are, and why can't they determine what they are?

Mr. ZACKO. They could, sir, but, again, I wish you would ask these questions of the Federal Aviation Agency. They understand the full

limits of their entire system and I am quite sure that they will be able to explain as to why they could or could not do that.

Senator COTTON. I don't want to embarrass you, but I assume that your reluctance to answer that question of Senator Engle is simply because you prefer to have the question answered by the other agency. You know the answer, don't you?

Mr. ZACKO. Yes, sir.

Senator COTTON. I am trying to get into the situation. The CAB couldn't intelligently investigate an accident—and we are now in this field of where there is a conflict—whether there has to be a confusion, let's say, between the two agencies. You couldn't intelligently investigate an accident and draw conclusions from it unless you knew the answer to his question now, could you?

Mr. ZACKO. No, sir.

Senator COTTON. So that you simply prefer that we take our answer from the FAA?

Mr. ZACKO. Inasmuch as you would have to take many things into consideration, we don't know the entire complement of the air traffic control people. There are many facilities that don't have radar and are programed to have radar. We don't know what the budget is for providing radar to these various facilities. It would be almost an impossibility to have positive radar control at one facility and then fly a hundred miles where they don't have radar. This would mean every facility would have to be radar equipped in order to provide this sort of radar separation and positive control.

Now, I don't know whether the Federal Aviation Agency at this time is ready to accept this responsibility.

Senator COTTON. Will you forgive me if I ask other questions?

Senator ENGLE. Yes, go ahead.

Senator COTTON. If the situation has developed so it is not feasible to know over a congested area like New York or Washington, all the aircraft that are within the area, to identify them and control them, situations develop to that extent and there must be moving of airfields or something to relieve it otherwise, this is bound to be a death trap no matter what you do. It seems to me as a layman that that is the conclusion when you say it is not feasible or practical for the controller to know and identify all the craft that are within a certan area. We are getting to the point where something has to be done or it is just a death trap.

Mr. BOYD. Sir, if I may, I would like to point out something that I am sure is in the forefront of the minds of all of us, and that is that actually what we are discussing here is a safe system of air route traffic control. We are not talking about a situation where our air route traffic control has gone to pot. I am not trying to deny the seriousness of this accident in New York, nor to indicate that the situation cannot be improved, but I think we should keep in mind at all times that what we are talking about is improving a good system, not tryng to bail out something that has just fallen to pieces in front our eyes.

I can't get into the technical aspects of what this radar can do. It has the physical capability of doing considerably more than is done today, but this involves the concept of an air route traffic control plan.

Senator COTTON. Well, I appreciate that and I don't want you to think, sir, that my question implied that the whole system had broken

down or implied any criticism of either agency. I am trying to listen to this testimony as a layman, unlike some of my colleagues who are flyers and know a lot about the technicalities and terms. I am 60 years old and the FAA says I can't learn to fly now. [Laughter.]

I probably won't have any practical experience until I get my wings and a harp but I am trying to comprehend this and it is just a little difficult because it almost seemed to me, Mr. Chairman, that both agencies ought to be sitting at the table at the same time if we can't follow through and get some illumination on this.

Senator ENGLE. Will the Senator yield?

Of course, the very point he makes is a good one. The CAB has the responsibility to determine the cause of accidents. Now, we had a situation up there where it was possible for an airplane to get lost that was supposed to be under positive control and go barreling across these radar screens in the form of a pip and nobody knew who it was. Now, that is just wrong and every instrument pilot coming in there with that whole area socked in was under an instrument flight plan and as a consequence they should have known what every one of those pips on those screens was. You didn't have the Piper flyers out there messing up the screen. You just had so many instrument flight plans in there, and the purpose of positive control is to take care of the situation when somehow or other the pilot doesn't go where he is supposed to go. If he had gone where he was supposed to go he would have been in Preston and everybody would have been riding their slot and everything would have been hotsy-totsy, but we don't provide this expensive radar equipment for the purpose of giving FAA controllers ringside seats on midair collisions.

We expect them to do something about it when those pips are starting to run together and that pilot sitting up there in that cockpit has a right to believe that when he is under positive control that he is under positive control and that he will be notified if something goes haywire. We don't know what occurred in this instance; we just don't know. I was reading this book called Probable Cause, about an accident that occurred out there in Albuquerque. These instruments sometimes go haywire, when you are sitting up there in the soup. You like to think when you are on a radar screen that the controller knows who you are and where you are. Now, the question I asked is, How can the CAB make the determination of the cause of an accident when you say you don't know whether or not it is possible or practical under complete instrument conditions and when everybody is supposed to be on an instrument flight plan, or not there at all, to be able to tell what each pip is on the screen. That is the question I asked and that is the thing that is puzzling my friend from New Hampshire here.

We can't understand either why you can't answer the question.

Mr. BOYD. Senator, the fact of the matter is, the probable cause of this accident does not depend on any extent of what is the physical capability of the radar equipment to which you allude. The question of probable cause resolves itself around the capabilities of the equipment. Now, as to what are the physical capabilities of this control.

We have in the CAB people who understand fully what the physical capabilities of this equipment are.

Senator ENGLE. In automobile accidents we have a doctrine called the last clear chance, and assuming everything else, when you get down to finding the probable cause of this accident it is possible that you would say that if the FAA controllers had been on the ball like the ones were out in San Francisco who kept talking to us every 5 minutes about an airplane that was approaching on a collision course with us, that the last clear chance would have been that the FAA controller should have known what that pip was, was capable of knowing it with the equipment he had, and should have given somebody a direction to turn.

Mr. BOYD. Well, of course, Senator, you are dealing here in an area of very limited time, for one thing. You are also dealing with a situation where you have two aircraft on different radio transmission and reception frequencies. You also have a situation which has been alluded to earlier, that we do not transport, within our air route traffic control system, comprehend on radar altitude of aircraft.

Senator ENGLE. I understand that, but when the CAB makes its findings I hope that the CAB will tell us what can be done to straighten this situation out. Now, the fact of the matter is, as I said earlier, that when on a radar screen two pips are on a collision course and the controller does not know whether they are at the same altitude or not, just common, ordinary sense would indicate that he ought to tell those two airplanes that they are on a collision course perhaps at different altitude, just as I was speaking of the situation in San Francisco where we were at 4,000 feet descending—the Boeing was at 8,000—but we were told three times.

Mr. BOYD. Senator, I would like to try to make one thing perfectly clear from the standpoint of the CAB, and that is that if in establishing its probable cause on this accident the Board ascertains that the physical capability of the radar equipment was involved or should or could have been involved, undoubtedly this will be reported and I can assure you, sir, that we will make—and we expect to make—some very substantive recommendations.

We are getting into an area, though, where it is not proper for anybody at this table to speculate on what could be done because we are dealing in the accident itself with what was done. Now, we have got two things here. No. 1 is to establish what was done and, No. 2, to recommend what should be done. I can tell you, sir, that we expect to carry out our duties in that regard.

Senator ENGLE. I understand that, but General Quesada made a statement before he left office that he hadn't changed the procedures at all in New York and that they found the procedures adequate and the equipment adequate. Now, the CAB is going to have to pass on that and I call your attention to that fact, that some of us think that the capabilities of the equipment and the personnel were not adequately used; otherwise, you wouldn't have airplanes that are supposed to be under positive control running into each other.

I hope that you make a determination of that and that you come up with some kind of recommendation that will make it possible for a pilot to know when he is coming down through the soup and everybody in the area is under instrument conditions, that his airplane is identified and if for some reason or other some gismo in the cockpit goes haywire or somebody slips, that the function of positive control

will be to save the pilot from error and not to give, as I said, the controllers a ringside seat on a midair collision and then tell us what happened afterwards.

Mr. BOYD. I can assure you, sir, that we expect to do just that, and that our analysis of this traffic control system and the equipment available is not going to be based on what anybody says it is doing or should be doing. We will make our own judgment on that matter.

Senator ENGLE. The Senator from Oklahoma.

Senator MONRONEY. This is one of the primary reasons that CAB was written into the act as the arm of Congress—to be independent and pass independent judgment in their finding of probable cause. In that finding they can possibly detect vacuums or gaps in the system where suggestions, even though they might change procedures of FAA, could be legitimately and properly made for air safety. Is that not a correct statement of the duty of the CAB?

Mr. BOYD. Yes, sir, that is true. I think that history will reflect that we have made such recommendations in the past which have brought about procedural changes.

Senator MONRONEY. And your reluctance at this point to go fully into what changes should be made is merely because you have not completed assembling all of the data and facts that go into the making of this decision?

Mr. BOYD. Yes, sir, that is true. I should point out in this case that we are dealing with a situation that requires the most complicated analyses of the capability of various articles of equipment, not only airborne but ground equipment, and we cannot shoot from the hip on this situation.

Senator MONRONEY. Along that same line, the reason that this is a peculiar and a spectacular, tragic accident is that you are dealing with air traffic control and air traffic systems, not over one single isolated airport but of a complex of four busy airports using the same limited amount of airspace. For that reason, while the ground equipment of one airport might be able to accept a certain amount of traffic were it isolated and alone, that with the traffic pattern into these four busy airports you do have a very great complication of target identification and planes operating under various controls as to their approach or as to their overflight of this whole area. Is that correct?

Mr. BOYD. Yes, sir, that is certainly correct and I would like to point out that such recommendations as the Board may make in regard to this accident are bound to have an effect on a great many other airports in this country. I refer to the statement Senator Engle made earlier. You have the relationship of the Oakland and San Francisco airports; you have four or five airports in the Los Angeles area; Fort Lauderdale-Miami; Fort Worth-Dallas; the two major airports in the Chicago area. This is not a situation where we can just say we are going to put a microscope on the New York traffic pattern and treat it as separate from all these other situations. If there is something that can be improved it is going to have to apply pretty generally around the country.

Senator MONRONEY. We approached it last night. Does authority rest in the CAB to limit traffic into an area by order of the Board to prevent the overcrowding of airspace and to make more safe, although more slow, the working of the system?

Mr. BOYD. You asked, sir, whether the Civil Aeronautics Board has that authority. I should say in answer to that that it is our belief that under titles 3 and 6 of the Federal Aviation Act that the FAA probably has that authority. From an economic standpoint the Board can specify the point to be served by an air carrier and can even go so far as to designate the particular airport through which service will be rendered. This authority is set forth in section 401 of our act, but section 401 also provides:

> No term, condition, or limitation of a certification shall restrict the right of an air carrier to add to or change schedules, equipment, accommodations, and facilities for performing the authorized transportation and service as the development of the business and the demands of the public shall require.

I should point out, sir, that we did receive an adverse decision on this issue from the U.S. court of appeals in the large irregular carrier case where the Board had limited the certificates of supplemental air carriers to an operation of 10 flights per month between any 2 points in the United States.

In our view this is purely an air safety question which, so far as we can see, would come within the purview of the authority of the Administrator.

Senator MONRONEY. In other words, under your economic regulations, assuming a hypothetical case, you could not order x number of flights diverted from, say, Idlewild into Philadelphia, or into Logan Airport at Boston, or into Albany or some other terminals?

Mr. BOYD. That is very probably true, Senator. I should point out the Supreme Court has not passed on this question.

Senator MONRONEY. Was it appealed to the Supreme Court?

Mr. BOYD. Yes, sir; but the matter is under a stay at the moment pending the decision of the Congress on legislation for supplemental air carriers.

Senator MONRONEY. This question will probably belong to FAA. If you do not have the safety function to say that the system is oversaturated and cannot handle as safely as the needs of safety require a volume of traffic coming in, then it would be up to other forces of Government, perhaps FAA, to order reduction of flights into certain terminal areas?

Mr. BOYD. Yes, sir; I think that is correct. I should point out another situation, Senator, that we have not had an opportunity to research, but it could possibly create a problem were this procedure to be utilized, and that is that in its bilateral executive agreements with a number of foreign nations this country has granted air rights to foreign governments to particular cities and it is entirely possible that we could get into some difficulty in our international affairs if we were to require a foreign carrier which has certificate rights to New York, for example, to divert to Baltimore, and certainly I know we would get into trouble domestically if we said "This will only apply to domestic carriers."

Senator MONRONEY. Well, if, for the purposes of adding to safety, some agency of Government at some point must have the right to turn off the valve if you are pushing more stuff through the pipe than the pipe can take without bursting——

Mr. BOYD. Yes, sir.

Senator MONRONEY (continuing). And this is the way I am trying to pinpoint what is going to be the maximum limit.

Now, with the increasing number of flights, both international, foreign carriers, and domestic, plus the fact that as I understand the law, there is nothing you can do to refuse to separate any of these saturated airports' private aircraft traffic that desires to come in. You can hold them off until you are ready to bring them in, but they can still be somewhere in the approach or the flight patterns to land where they declare they desire to land?

Mr. BOYD. Yes, sir; that is correct.

Senator MONRONEY. This adds another complicating factor to what you finally determine to be the maximum load that can safely be carried; is that correct?

Mr. BOYD. Yes, sir.

Senator MONRONEY. You have the foreign agreements; you have your domestic competition, and thirdly, you have your private aircraft that could not be bound under the law, as I understand it exists today, with the limitation of the use of an already overcrowded airport?

Mr. BOYD. That is correct, sir.

Senator COTTON. I wanted to make sure that I understood. Referring only to domestic aircraft, do I understand that it seems clear, fairly clear, because of decisions to which you have referred, the CAB could not say to American Airlines, "You can have only X number of flights into New York instead of"—you have got to cut the number of flights you are putting into New York; is that right?

Mr. BOYD. Yes, sir; that is my understanding of the law.

Senator COTTON. Now, if I understand correctly further, you said that it was—you seemed to imply it was questionable but not clearly determined, whether you could say to American Airlines, "You can only have so many flights into LaGuardia, but you must put your additional flight into Idlewild or somewhere else."

Could you say that? Do you have the authority to do that?

Mr. BOYD. Yes, sir.

Senator COTTON. Now, unless it is improper to get you to express an opinion with regard to another agency, does FAA—still referring only to domestic traffic—does FAA under the law, according to your understanding, have the right to say to an airline, "You shall reduce the number of flights that you are sending into New York or Boston"?

Mr. BOYD. On that specific question, Senator, I would say, no, they do not have that right.

Now, I think the situation would be different if there were some way they could say that to all airlines or all aircraft operators——

Senator COTTON. Including foreign?

Br. BOYD. Yes, sir.

Senator COTTON. Would either the CAB or the FAA have the right to make a temporary order and say that until either contingent on time or on some outside act—in other words, for a period of 8 months you must curtail your number of flights into Boston, or you must curtail your number of flights until the airport in question has installed such and such equipment, or devices?

Mr. BOYD. Yes, sir. There are a number of communities in this country now where scheduled air carrier service is not permitted because the FAA has found that the facilities are not adequate, and I think that there is a situation which is a temporary situation in this

sense, that the FAA will permit an air carrier to operate into any airport once it meets certain provisions.

So I would say on the temporary aspect, definitely, after a finding—I am sure there would have to be some sort of a finding that the situation today does create a safety hazard.

I don't thing this could be done——

Senator COTTON. I want to get this clear in my mind. They would not be able to control the density of traffic.

In other words, if I understand you correctly, FAA could say to "X" airline, "You shall discontinue service into 'Y' airport until certain improvements or certain enlargements have taken place."

They could not say, "You shall send in only three flights a day until this change is made"?

Could they limit it rather than to discontinue it for a period?

Mr. BOYD. I think probably, Senator, that they would be able to limit it.

Now, I speak as no authority on this subject, I assure you, sir. But I am inclined to think further that if there were a finding by the FAA that a particular airport or area could support the operations of only so many aircraft a day, this would have to be on a temporary basis.

Senator COTTON. Now the other half of my original question was this: Could the FAA or the CAB—but I assume that we are now in a situation where you could not—could the FAA limit for a period of time—6 months, 8 months, 1 year—arbitrarily the density of traffic simply on the ground that it was too dense in that area and something had to be done about it without direct reference to the safety devices, conditions, facilities of the airport? Simply find that in some airport that the density of traffic has become so great that it is difficult to handle it with complete safety; therefore, you are going to limit the number of flights for 1 year pending studying the situation?

Mr. BOYD. The only honest answer I can give you, Senator, is that I have no idea whether they have that authority.

Senator COTTON. Well, if there is a question, CAB certainly does not have that authority?

Mr. BOYD. No, sir.

Senator COTTON. Well, if CAB does not have authority to simply say arbitrarily—and if FAA does not have the authority to say arbitrarily, "We are afraid the density of traffic here is getting beyond us; we can't make a finding that it is because there are not enough runways and there are not enough safety devices, or whether there ought to be another airport or supplemental airport, but we want in the interest of public safety to preserve the lives of the traveling public to restrain this density for a period of time," if they don't have that authority somebody ought to have it, shouldn't they?

Mr. BOYD. Yes, sir; I think so. I think that would be a good thing, if the situation in the eyes of the Congress or of the interested aviation agencies is such as to require that.

Senator COTTON. Well, need it be such as to require it today? It might require it some time—I know that I am begging the question of this complication of foreign traffic; I am aware of that fact in these questions—but regardless of whether it is necessary today with the expanding air traffic and the problems of safety if we as a Congress are going to do our duty there should be some authority somewhere

to restrain and to control the density of air traffic in some particular spot, should it become necessary before coming back to Congress and having a few people killed while we are getting a bill through?

Mr. BOYD. Yes, sir; I would agree that should be done. I should say, however, that while you cannot equate safety with dollars the exercise of such a power would undoubtedly create havoc with what we know as scheduled air carrier operations today.

Senator COTTON. Would you amplify that a little bit?

Do you mean the difficulty or the almost impossibility of fairly allocating the restraint as between competing carriers; is that what you have in mind?

Mr. BOYD. That is a part of it. A more significant part of it, however, is that—let us take the New York area for an example. When a collar is put around this area, and we say only so many per day can operate through this, this not only affects the operation of the air carriers or general aviation or whoever in New York, this spreads throughout the entire United States, and depending on whatever the situation legally is with foreign carriers, also there, as well as in Canada and Latin America.

Senator COTTON. Well, every question I have asked has been asked with the understanding that this could not be done without some solution of the foreign carrier problem, and I realize to that extent this is purely hypothetical.

Mr. BOYD. Yes, sir; I understand.

Senator COTTON. But you would not take the position, would you, that even in the interest of the whole field of air traffic, of all the economic factors and all the convenience and everything else that is involved, that it would be improper, or even admitting that the problems would be very great, in the interest of safety, to have a governmental agency able to reduce the stream temporarily, at least, while expedients are considered and adopted to take care of increasing traffic for the sake of having the public feel that they can travel with the utmost confidence and safety?

Mr. BOYD. No, sir; I want to reiterate my previous statement very explicitly.

I believe that such a power would be a very helpful thing.

Senator COTTON. And from practical experience—and this is a very tender subject to mention—but the tremendous pressure of the airlines and of the public seeking to expand their business, the tremendous pressure on the governmental agency as it is on the Congress, would be such that it would be very unlikely that any governmental agency would exercise that restraining power unless it was extremely clear, beyond any reasonable doubt, that it were necessary to do that?

Wouldn't that have that tendency?

Mr. BOYD. Yes, sir; I think that is altogether true.

I have no reason to think that anything other than the highest sense of responsibility would motivate the action of anybody who might be involved—Congress, FAA, or the CAB.

Senator COTTON. I am sure of that, but the pressure would be all the other way, so that it would insure the function only being exercised when it was really extremely necessary.

Mr. BOYD. Yes, sir.

Senator COTTON. Thank you.

Senator ENGLE. The Chair understands that Mr. Boyd has an appointment and in deference to his obligations we will recess at this time until 2 o'clock.

Can you come back at 2 o'clock? Did you want to ask some more questions?

Senator MONRONEY. Not of Mr. Boyd. I think we could maybe clean this up after 2 o'clock with some of his technicians and move on to the FAA.

Senator ENGLE. Would you like to have the FAA back today or put them off until tomorrow?

Senator MONRONEY. I think it depends on the other members of the committee.

Senator ENGLE. Off the record.

(Discussion off the record.)

Senator ENGLE. Without objection, then, the CAB witnesses, except for the Chairman, Mr. Boyd, will be requested to return at 2 o'clock. We will finish the questioning of the CAB witnesses and defer the hearing on the FAA witnesses until tomorrow morning.

Would that be convenient with you, Mr. Pyle?

Mr. PYLE. Absolutely, Mr. Chairman.

Senator ENGLE. We will start with the FAA tomorrow morning at 10 o'clock.

Without objection, it is so ordered, and the committee stands in recess until 2 o'clock.

Thank you, Mr. Boyd.

(Whereupon, at 12:04 p.m., the committee was recessed, to reconvene at 2 p.m. of the same day.)

AFTERNOON SESSION

Senator MONRONEY. The Subcommittee on Aviation will resume its hearings.

At the time we adjourned at lunch we had practically completed the phase with the CAB on the New York accident.

There are two or three others that we would like to get information on that we have not yet covered. I think this will wind up all of those where there was any significant, extensive loss of life.

The accident on the 14th of July 1960 at Mount Gilbert, Alaska, to a Pacific Northern passenger plane, a "Connie," in which 14 lives were lost, and the notation is "Collided with the mountain." Is there someone on your staff that is prepared, Mr. Gough, to testify on that?

Mr. GOUGH. Yes; there is, sir.

The investigation is complete and depositions were taken in that case and Mr. Goldstein will tell you about it.

Senator MONRONEY. You may proceed, Mr. Goldstein.

Mr. GOLDSTEIN. Excuse me, sir; I am trying to get some notes together.

The accident which you refer to involved Pacific Northern Airlines flight 201, a Lockheed Constellation, which was scheduled from Seattle to Anchorage with a stop at Cordova. The flight to Cordova was routine. It departed Cordova at 0415 and was cleared to Anchorage, low frequency range via direct Egg Island, Amber 1, maintain 10,000 feet.

The flight was instructed to contact Anchorage air route traffic control on 118.9 megacycles. The flight contacted Anchorage and advised that they were off Cordova at 0417. They were climbing to 10,000 feet, estimating Hinchinbrook at 0425. At this time flight 201 was cleared to maintain 9,000, which the flight acknowledged. Flight 201 was next heard to report to Anchorage ARTCC as being over Hinchinbrook at 0427, 9,000 feet, on instruments and estimating Whittier at 0447.

The flight was instructed to contact Anchorage approach control on 118.1, and then the flight advised that they would like to have 11,000 feet if it was available. The flight was advised that Anchorage could approve 11,000; however, there were two other flights inbound to Anchorage which would be descending.

Flight 201 was asked when he would begin his descent; 201 advised Anchorage to disregard the request.

Anchorage ARTC then exchanged some traffic information between 201 and other inbound Pacific Northern flights on 118.9 megacycles. This was the last contact between Anchorage ARTCC and Pacific Northern 201.

During the investigation it was learned that the U.S. Air Force radar at Middleton Island had tracked this flight and had noted that it was off course and headed toward high terrain.

Now, the Defense radar and the FAA had an agreement which was called a joint agreement between the Fifth Region, FAA, and the Alaskan Air Command in relation to the USAF radar advisory service in Alaska. This agreement stipulated that whenever an aircraft is observed by an air defense radar unit to be progressing off course, and or approaching hazardous terrain or any known condition which may jeopardize the safe conduct of the flight, the radar unit will immediately notify the pilot using guard frequency. Whenever this direct contact is made the radar unit will immediately inform the appropriate ARTCC through a ADC of the circumstances and action taken. If direct communication cannot be established immediately the radar unit will continue its calls and simultaneously notify the associated ADDC of the situation. The ADDC will relay the information to appropriate ARTCC for transmission to the aircraft concerned.

Now, this wasn't done in this case. Although they tracked the flight almost up to the point where it crashed, they didn't notify anyone in accordance with this agreement.

Senator MONRONEY. This was military personnel manning the——

Mr. GOLDSTEIN. The Middleton radar site was military.

Senator MONRONEY. The air defense radar system and they were, under the regulations, supposed to notify the flight if they could reach him?

Mr. GOLDSTEIN. Yes.

Senator MONRONEY. You said notify them on guard radio. What does that mean?

Mr. GOLDSTEIN. That is a guard frequency. I am not familiar with that frequency. It is a standby frequency.

Senator MONRONEY. There is no frequency that you are certain to get through to the plane; in other words, an open frequency that would

go through regardless of whether the man was tuned in to another control tower frequency or not?

Mr. GOLDSTEIN. No; if he wasn't tuned to a guard frequency or emergency frequency which we use in the States of 121.5, he wouldn't hear it then.

Senator MONRONEY. In other words, if the pilot had his radio on Anchorage this flight going in the direction of Anchorage, the military radarman could have assumed or guessed that he might be on the Anchorage tower, and then knowing what that Anchorage tower's wavelength is could have attempted to contact him on that frequency; is that correct?

Mr. GOLDSTEIN. No, sir; they had a procedure set up whereby they would notify Air Traffic Control of this flight proceeding off course if they couldn't get in touch with the flight themselves.

Senator MONRONEY. The only way he could have gotten in touch with the flight, since there is no all-wave system that would cut in on any wavelength that he might have his cockpit radio set, that the only way they could have gotten in touch with him was to presume he would have either been on Cordova, his last destination, or on the destination ahead at Anchorage, was it not?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. And failing in that, then he would have had access to notifying the area Air Traffic Control and they could have had their various communicating stations try all of their wavelengths; is that correct?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. But there is no evidence that any of this transpired, is there?

Mr. GOLDSTEIN. No, sir; the Middleton radar never notified anyone, the flight or ARTC, that this aircraft was progressing off course.

Senator MONRONEY. What was the weather?

Mr. GOLDSTEIN. At 0400 the Cordova was 2,800 feet, broken clouds, visibility 15 miles, surface wind from the east-northeast at 15 knots. Flight 201 neither asked for no received a weather briefing by the Cordova U.S. Weather Bureau Airport Station. No weather briefing for the flight from Seattle to Anchorage was furnished by the U.S. Weather Bureau at Seattle.

Senator MONRONEY. Are there any regulations that require scheduled transport planes to be briefed on the weather before they leave?

Mr. GOLDSTEIN. Yes, sir. All scheduled flights are to have a weather briefing prior to departure but it does not necessarily have to be by the U.S. Weather Bureau. It could be by the company's own meteorologist.

Senator MONRONEY. Did this company have meteorologists at Cordova and at Seattle?

Mr. GOLDSTEIN. I know they did not have one at Cordova. I am not sure about the other two locations.

Senator MONRONEY. But the Weather Bureau did have? It was available to him at Cordova?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. The 2,800-foot ceiling, broken—would that have obscured, in your judgment, the mountainous terrain, or would it have been visible?

Mr. GOLDSTEIN. Well, the mountainous terrain that he collided with was quite a distance from Cordova. This was Mount Gilbert up northeast of Anchorage.

Senator MONRONEY. How far off course is this mountain?

Mr. GOLDSTEIN. Sir, I will have to refer to a chart here.

Sir, if you would care to look at this map, I think it would be a little plainer to you. It shows the radar plots as the flight progressed. [Document was handed to Senator Monroney.]

Senator MONRONEY. At the time of 0415, is that Greenwich or is that Alaskan time?

Mr. GOLDSTEIN. Alaskan standard time.

Senator MONRONEY. So that normally would have been daylight; is that correct?

Mr. GOLDSTEIN. Yes, sir; it should have been.

Senator MONRONEY. In other words, looking at this chart, his direct course from Cordova to Anchorage would have led him over the sound and the small islands and in over the arm of Cook Inlet on in to Anchorage where he would not have had any outstanding obstructions; would he?

Mr. GOLDSTEIN. That is correct.

Senator MONRONEY. But going up over Cordova, this mountain is what elevation, 7,644? No; it is 9,620.

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. This appears to be even more than 25 miles off; isn't it?

Mr. GOLDSTEIN. It is 25 to 35 miles off course.

Senator MONRONEY. Observing the map you have just given us, there was a radio beam and an airway that he could have stayed on. Even a direct line of flight or even a compass course would have taken him over safe terrain; would it not?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. Have you reached any conclusion on this accident as yet—any findings?

Mr. GOLDSTEIN. No, sir; we have not. This was an accident, due to the dangerous conditions at the site, that we were unable to get in and examine the wreckage. This crashed under a snow ledge on Mount Gilbert and it was determined to be too dangerous for anybody to go back into it.

Senator MONRONEY. And neither the wreckage nor the bodies were brought out?

Mr. GOLDSTEIN. There was one body brought out. They made one trip into the scene and brought this one body out and the rest were left there.

Senator MONRONEY. Was it high up on the mountain, near the summit?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. Well, this is going to be quite difficult to ascertain, whether there was malfunctioning of navigational equipment. It is hard to believe that that would have thrown him, with his normal navigational equipment, or even with a compass setting, that far off; would it not?

Mr. GOLDSTEIN. Yes, sir; that is quite an error.

Senator MONRONEY. Was there any information other than the information at Cordova of 2,800, broken, of the weather in between on the direct line of flight that he would have taken at that period of time?

Mr. GOLDSTEIN. If I recall, the pilot reported that he was on instruments at 9,000 feet a short time before the accident occurred.

Senator MONRONEY. If he was on instruments, why wasn't he on the beam in finding out where he was?

Is there any way the normal dot-dash or the beam signal could be thrown off in the malfunctioning of a radio?

I would not think there would be.

Mr. GOLDSTEIN. Sir, we still have this accident under investigation. We have checked the ground facilities; the ground facilities were operating normally at this time.

Anchorage and the Cordova facilities—we don't have an answer for it now.

Senator MONRONEY. Was the pilot an experienced pilot in the Alaskan run?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. Do you have any idea how many years, how many hours, he had?

Mr. GOLDSTEIN. I have the crew history here. I will have to look it up.

Sir, I cannot locate the crew history here. However, in the operational report it indicates that all crew members participating on flight 201 were found fully qualified and properly certificated for this flight.

Senator MONRONEY. You do not know anything about the previous accident history or any other difficulties that any of them had been in?

Mr. GOLDSTEIN. No, sir; I don't have any information on that.

Senator MONRONEY. I see.

Mr. GOLDSTEIN. We could obtain that and put it into the record if you desire.

Senator MONRONEY. You could testify, could you not, to the fact that there is no way, or is there any way, that this man could have taken another course and have been listening to the signal of another radio course to mistake it for his direct route to Anchorage?

The map shows no other course. He would have to be flying either magnetic compass setting to even be navigating in that area; wouldn't he?

Mr. GOLDSTEIN. Yes. It is hard to give a reason for the aircraft being this far off course with the aids that he had available to him, both in the aircraft and on the ground.

However, we are studying this to see if we can come up with a reason for the aircraft being off course that far.

Senator MONRONEY. You have had no experience of where any ground equipment would throw the beam off that distance?

Mr. GOLDSTEIN. No; I don't recall a case where we had that much displacement.

Senator MONRONEY. There has been some complaint that certain unlicensed radio or booster signals may have some effect on the radio directional beams.

Mr. GOLDSTEIN. Yes, sir; that is true.

Senator MONRONEY. You have investigated those?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. But you have not been able to ascertain in this case whether that was true? You checked the beams, I guess, several times after the accident, to see if they were operating normally?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. And, again, coming back there is no way that his radio, picking up, tuned to the frequency of this particular route signal, could have possibly been transmitting erroneously?

Mr. GOLDSTEIN. Well, there is always the possibility of a radio malfunction, a receiver malfunction.

Senator MONRONEY. It would go out, then, wouldn't it?

It would not be giving you an on-course signal?

Mr. GOLDSTEIN. Possibly not an oral signal but an ADP signal could be erroneous.

Senator MONRONEY. What is an ADP signal?

Mr. GOLDSTEIN. It is an automatic direction-finding equipment.

Senator MONRONEY. On his omni, you mean?

Mr. GOLDSTEIN. No; this is a low frequency.

Senator MONRONEY. A bird dog?

Mr. GOLDSTEIN. It is a bird dog.

Senator MONRONEY. But if he had his radio on to detect his regular course, then he would have been getting his dot-dash, on course, and there is no way that would have been possible transmitted erroneously because it has to give the signal that it picks up?

Mr. GOLDSTEIN. That is correct. If he was listening to the signal instead of flying the bird dog, why, he would have probably been able to pick this error up.

Senator MONRONEY. And the weather was, aside from the known facts of 2,800 broken, that is all you know?

There was no bad weather, willie-waughts, anything forecast in that region or area?

Mr. GOLDSTEIN. No severe weather; however, the mountains, I believe, were reported obscured by clouds.

Senator MONRONEY. I see.

Senator Thurmond?

Senator THURMOND. Thank you, Mr. Chairman.

How long had it been since a previous plane had flown this same course and followed the beam?

Mr. GOLDSTEIN. Sir, I don't have that information.

Senator THURMOND. In other words, within a reasonable time of this accident, before this accident occurred, did a plane fly this course, and did a reasonable time after the accident, a plane fly this course?

Mr. GOLDSTEIN. Sir, this is one of the major airways into Alaska and I am sure within the preceding period of a few hours there were several aircraft that used this same course, going both ways.

Senator THURMOND. But you have not verified it?

Mr. GOLDSTEIN. It is probably in the record here. However, I don't have firsthand knowledge.

Senator THURMOND. It seems to me that would be right important; it might indicate that so far as the beam was concerned, it did function before and afterwards, which then indicated there was an error on the part of the pilot or a deficiency on the part of the equipment in the plane.

That is all, thank you, Mr. Chairman.

Senator MONRONEY. Senator Engle?

Senator ENGLE. I would like to ask one question.

Why is the omni at Middleton Island rather than over here where the low frequency range is at Hinchinbrook?

He would get a direct bearing off his omni, whereas if he is trying to fly outbound and he reads ADF on the back heading he might have gotten mixed up.

Mr. GOLDSTEIN. Well, sir, he was cleared on Amber 1 to Anchorage, which is a low frequency airway. He was not—the Middleton omni does not define that airway.

Senator ENGLE. That is correct, but what I asked was why the omni on this other area on the red 103, is that the heaviest traveled one, is that it?

Mr. GOLDSTEIN. Sir, you would have to ask the FAA why they placed the omni there; I would not have knowledge of that.

Senator ENGLE. They cannot have them every place, of course, but do you know which route is the heaviest one traveled?

Mr. GOLDSTEIN. I don't know right offhand, no, sir; we could get that information for you.

Senator ENGLE. That is all, Mr. Chairman.

Senator MONRONEY. Your last radio contact was at what point?

Mr. GOLDSTEIN. At 0452 on 118.1 PNA advised that he would like to have 11,000 feet if it was available.

Senator MONRONEY. Where would we have been at that point? I mean, did he report any position?

Mr. GOLDSTEIN. No, sir; he did not report a position.

Senator MONRONEY. He did not report a position?

Mr. GOLDSTEIN. No, sir. He was up in the vicinity of the crash site at that time.

Senator MONRONEY. At that time?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. There is a checkpoint at Whittier?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. And this is where he contacted the Anchorage tower, I guess, for the change of altitude?

Mr. GOLDSTEIN. Yes, sir; he contacted the Anchorage approach.

Senator MONRONEY. Without giving his position or anything about where he was?

Mr. GOLDSTEIN. Yes, sir.

Senator MONRONEY. Does the CAB have any hope that when the weather changes or anything it will be possible to recover the plane?

Mr. GOLDSTEIN. Sir, we were advised by the local people up there that we would never get into the scene of the accident. It is on a live glacier.

Senator MONRONEY. Any further questions, Senator Engle?

Senator ENGLE. No.

Senator MONRONEY. We will pass on, then, from this to one that we have never—a type of accident we have never had to investigate before. This involves the Chicago helicopter in which 13 people lost their lives. It is what is listed as a structural failure.

Could you help us out on that?

Mr. GOUGH. Yes, sir. In the case of the Chicago helicopter, the S–58, that investigation is complete and the hearing has been held. Mr. Clark is prepared to tell you about that.

Senator MONRONEY. You say that investigation has been completed?

Mr. GOUGH. Yes, sir.

Senator MONRONEY. The finding of probable cause has not yet been arrived at?

Mr. GOUGH. No, sir.

Mr. CLARK. Do you wish me to go ahead, Senator?

Senator MONRONEY. Yes, sir.

Mr. CLARK. The flight was a scheduled passenger flight between Midway and O'Hare Airport and the city of Chicago. There was a crew of 2 aboard, and 11 passengers, all of whom were fatally injured on the flight.

At 2115 on this day, July 27, the aircraft arrived at Midway from O'Hare Airport. The passengers stepped out and the aircraft was refueled at 2125; 11 male passengers boarded the aircraft, 7 passengers occupying the front compartment and 5 the aft compartment.

At 2130 the aircraft was airborne and on its way to O'Hare Field. Only routine radio transmissions were made between the flight and the ground stations and after the aircraft departed the control zone and was en route, no more radio transmissions were made.

The weather at the time, incidentally, was a clear sky. It was evening, of course, and the visibility was 8 to 12 miles. The route between Midway and O'Hare is 17 nautical miles and is designed for flight over open area suitable for rotation landings in the event an emergency requires such a landing; and requires the flights to cruise at 1,500 feet above the ground at night.

Eyewitnesses who observed the aircraft immediately before and during its descent stated that it appeared to be cruising along as the others do in a normal manner. One witness thought it appeared to be at a comparably lower altitude. Suddenly a sound similar to the cracking of a bull whip was heard and the aircraft started to descend rapidly.

The engines sounded to all witnesses as if it were backfiring and whipcracking, and the whipcracking sound continued.

One observer stated the landing lights were on and the whole aircraft was rotating. Another witness saw the tail section break off. None of the witnesses observed any fire aboard the helicopter until the impact with the ground.

The wreckage itself landed in the Forest Homes Cemetery which is on the route between Midway and O'Hare Airport. The wreckage covered an area about 2,800 feet long and 1,120 feet wide.

As I indicated before, the tail section broke off and one of the main rotor blades separated in flight and was found a considerable distance from the main wreckage. Examination of the blades showed that it had fractured 102 inches outboard from the center of the rotation. There was no evidence of the fractured blade having hit any foreign object in flight. The fractured blade had been and is still being subjected to exhaustive laboratory study and related testing.

The fractured face and the part remaining with the aircraft was partially obliterated by ground impact and fire, but the fractured face on the part that was found in the tree, separate from the main

wreckage, was unmarked. Examination of this portion of the blade confirmed very definitely that it was a fatigue type of failure. This is a progressive failure that was involved in the fracture. The final break, of course, was a static one after the fatigue had progressed to the point where the whole cross section was weakened.

Approximately 57 percent of the cross section of the blade was affected by this fatigue cracking.

The investigation, of course, then centered on the blade itself—the inspection procedures, the design of the blade, the manufacturing processes, and what not.

Our investigation showed that this blade had been involved in a quick start in June of 1958——

Senator MONRONEY. In a what?

Mr. CLARK. A quick start. This is a condition which can occur sometimes when the clutch on the helicopter suddenly engages and whips in the blade. If this occurs, and, of course, there are provisions in the design to prevent this under normal conditions, if this occurs the blade then can be damaged in such a way that the aft pockets on the blade become crushed and the blade, of course, has to be repaired.

A quick start had occurred in June of 1958, and the blades, including the one involved in this failure, were sent back to the factory for repair and overhaul.

This is a normal procedure. The pockets are stripped off, the blade examined, it goes through the regular inspection procedure in the factory to determine whether the blade should be scrapped or can be repaired. If it can be repaired, suitable repairs are made and it is then shipped back to the owner.

In this case this was done.

The blade then accumulated considerable more hours on it and in May of 1960——

Senator MONRONEY. You say this happened in 1958?

Mr. CLARK. 1958, yes, sir.

Senator MONRONEY. I see.

Mr. CLARK. I might add the blade at that time was not on this particular helicopter. As you might suspect, these blades are very often rotated from helicopter to helicopter for convenience reasons of the operator.

But in May of 1960, after the blade had seen 1,509 hours and 29 minutes of service, it was again sent back to Sikorsky for inspection and repair as a result of a writeup in the flight log where there was some indication that the blade might have been warped and had not been tracking properly.

At this time, several pockets were removed and replaced. The blade was again sent back to the operator for use and service.

I have been using this word "pocket." You may not understand what I have in mind.

The blade itself is composed of a D-section of aluminum—a hollow aluminum formed in the shape of a D-section. On the trailing edge of the D-section are bonded on honeycomb pockets to form the continuous airfoil of the blades, so the honeycomb pockets are not structural material. All the strength of the blade is in the D-section.

Senator MONRONEY. Sort of a trailing edge?

Mr. CLARK. It's a trailing edge section; yes, sir.

The blade was then sent back and put into service and at the time of the accident it had accumulated 1,786 hours and 6 minutes service when this failure occurred.

Senator MONRONEY. You mean from the time——

Mr. CLARK. From the time it was new. It had then built up that time when the failure occurred.

In reviewing the design of the blade itself, we found that the blade was approved as all blades are under the provisions of the Civil Aeronautics Regulation 6 in this case which requires that the manufacturer show that the blade has satisfactory fatigue life. A procedure has been set up by the FAA and is used by manufacturers to show that the blade meets a satisfactory service life.

Sikorsky followed this procedure and established that the fatigue life of this blade was something of the order of 3,260 hours, I believe the figure is.

The regulations or the manual material then requires that you use only 75 percent of this calculated fatigue life to determine the service life of the blade. In other words, in this case the operator was limited to 2,450 hours. At that time he had to retire the blade from service under these Civil Aeronautics regulation procedures.

The blade, as I said, failed at 1,786 hours. This, of course, puzzled Sikorsky and puzzled FAA and a considerable investigation has been underway since to try and poinpoint the exact cause for this particular failure.

A number of tests have been run. A number of tests are still scheduled to be run. The only thing I can say at this time, Senator, is that the exact, precise cause for this fatigue failure is not known at the moment.

Senator MONRONEY. Had you any previous history of fatigue failures on these blades?

Mr. CLARK. No, sir, not at least in this particular area of the blade.

Senator MONRONEY. You don't know whether the military had any?

Mr. CLARK. No; the military didn't have any failures of this particular blade on the S–58. There have been some fatigue failures in other models of the helicopter, I believe, the S–55, I think.

Senator MONRONEY. This is a very heavy one; it has a very heavy motor.

Mr. CLARK. Yes, it is a 12-passenger helicopter.

Senator MONRONEY. Had the company maintained the helicopter in a satisfactory condition and met all the inspections? I think there are a lot tighter inspections on helicopters than there are on fixed-wing aircraft. They have to be checked over much more frequently, do they not?

Mr. CLARK. Yes. The operator had set up a very elaborate inspection procedure program as you have indicated and this was approved by FAA. However, I think as a result of this investigation this whole inspection area on helicopter blades is, at the present time, undergoing closer scrutiny. The Board, following this accident, made several recommendations to the Administrator and some of these recommendations related specifically to the inspection procedures used by the operator in this instance.

These are in our book 2, tab G, on page 9.

Senator MONRONEY. Would you read those to us?

Mr. CLARK. I can read the summary here. It is a memorandum to the Administrator on October 6, 1960, recommending consideration of more detailed inspections in service and reevaluation of fatigue life substantiation of helicopter blades.

FAA advised October 14, 1960, the points raised will be considered by their Bureau of Flight Standards.

We also had another recommendation, which is noted on page 7 of that same tab G. This related to the need for insuring compliance with the seat-belt requirements in scheduled helicopter operations, particularly when flight attendants are not required to be on board the aircraft.

There was some indication from our human factors investigation here that the seat belts had not been fastened by the occupants. As you might remember, I said the tail of the helicopter broke off and several of the passengers spilled out at that point.

So this, then, became an area of concern that we felt it desirable to recommend to the Administrator that action be taken to firm up in this area.

Senator MONRONEY. How far away from the crash did you say you found this supposedly fatigued rotor blade?

Mr. CLARK. I believe some three thousand feet, Senator. I have it here.

Senator MONRONEY. Is it presumed or does your study show that this was where the first disintegration of the plane took place?

Mr. CLARK. Yes, it would appear so from the flight track of the helicopter. The helicopter seemed to be on course, the course that it usually flies, and the first part in the wreckage trail on the ground was the helicopter blade; then the tail section of the helicopter; and then the main helicopter components themselves in the cemetery.

Senator MONRONEY. Now, losing the blade would have rendered the helicopter unable to come in on a dead-stick landing, would it not, and its autogyroing down? Would it not have destroyed this capacity?

Mr. CLARK. This is a point I think you can get some discussion among the engineers as to whether the helicopter might be able to maintain control, but I think the consensus is that it would not. In other words, with just the three remaining blades it would be sufficiently out of balance to present such a control problem that the pilot probably could not cope with it.

Senator MONRONEY. The thing that puzzles me, then, if the rotor blade would first come off of the plane, is it the theory that the vibrations set up by the rotation of the disabled rotor system vibrated enough to tear the tail off the plane?

Mr. CLARK. I think this would be a fair assumption, Senator; yes.

Senator MONRONEY. You do not suspect any structural weakness in the tail assembly, but more or less the catastrophic action of the imbalance in the rotor blades putting the plane in such an attitude that the tail would have come off regardless of its soundness?

Mr. CLARK. That is correct. There had been some relatively minor cracking difficulties in the tail sections of these helicopters, and these had been taken care of by previous airworthiness directives of the

FAA. We examined those areas on this helicopter and they were not involved.

Senator MONRONEY. There is no metal fatigue involved or any loose bolts or nuts or attachment of the tail to the plane in any of the wreckage that you found?

Mr. CLARK. No, sir, except for the plane rotor blade itself.

Senator MONRONEY. The final report on this accident has not been made?

Mr. CLARK. That is correct.

Senator MONRONEY. I mean the CAB's findings.

Mr. CLARK. That is correct.

Senator MONRONEY. Is this not the first regular certificated helicopter operations involving casualties?

Mr. CLARK. Yes, sir, it is.

Senator MONRONEY. Senator Thurmond?

Senator THURMOND. The last question Senator Monroney asked you was the one I was about to ask you.

Have you had any other collisions similar to this in helicopters made by the same company? In other words, had you been put on notice in any way that there was a deficiency in this type helicopter? Since there had been no others, you have answered the question, I think.

Mr. CLARK. There have been no deficiencies relative to these particular rotor blades. In other words, there are no other failures of the type that occurred in this accident.

The Army, I might add, at the same time as this accident had a reported failure in one of their blades, but this involved another type of failure distinct from the failure involved in this particular accident. They happened concurrently and we coordinated closely with the Army and partly from the information developed during the investigation of the Army blades the airworthiness directive that the FAA ultimately put out incorporated features to examine for the defect found in the Army blade as well as for the defect found in this blade also.

I might add, Senator, to allay any concern on the particular helicopter, the life of these blades, as I said before, was 2,500 hours. The present requirements under the airworthiness directive is a retirement life of a thousand hours, which is considerably less than it was before. So the operation today, at least as it relates to this difficulty, is certainly a safe one.

Senator THURMOND. Thank you very much.

Senator MONRONEY. Thank you very much.

We will pass on to two collisions that occurred.

The first one: the collision on the 20th of April at Hickory, N.C., where Piedmont Airways, with their F–27, had a midair collision with a Cessna; four fatalities.

Mr. GOUGH. Yes, sir.

I would like to call on Mr. Zacko for that one, please.

Senator MONRONEY. Thank you, sir.

Mr. ZACKO. Senator, this accident involved an air carrier type aircraft and a light, twin-engine business-type aircraft operating into an airport not served by an air traffic control facility. At the time of the collision the weather was VFR, both aircraft were operating under the visual flight rules.

Previously, the light twin aircraft had been operating under the IFR rules or instrument flight rules, and had canceled some distance from the airport.

The collision occurred approximately one-quarter of a mile from the end of the runway. The aircraft were landing south and both made a pattern to the same runway; they were not aware of each other. There was no exchange of traffic made. However, the light twin-engine aircraft contacted the UNICOM station at the airport advising them that he was in the vicinity of the Hickory Airport. The air carrier aircraft contacted the FAA flight service station—correction, the company, and he asked for known field traffic. The company advised him that they had no knowledge of any local field traffic.

In addition, the F–27 worked the company. In addition to this the 310 also worked the flight service station and the UNICOM, so there wasn't any exchange of traffic, so they were not aware of each other. The Cessna collided with the F–27 slightly to the rear on the left side of the aircraft and the Cessna spun to the ground. The F–27 pilot made a successful landing, with extensive damage being incurred upon the F–27 aircraft.

As a result of this accident we made several recommendations to the Administrator, the FAA, one being the exchange of known VFR traffic through the flight service station serving these airports, and two was the standard traffic patterns for high speed aircraft and light aircraft at uncontrolled airports.

Senator MONRONEY. In other words, the Piedmont F–27—was it making a straight-in approach rather than flying the regular approach pattern?

Mr. ZACKO. Well, at the time of the accident, sir, there wasn't any regular approach pattern established.

Senator MONRONEY. I know, but it is customary on these uncontrolled airports to fly a pattern, you approach the field, you circle the field and come back in to the approach to be sure there is no conflicting traffic. I have noticed several times in flying around Oklahoma that while we do this with a Comanche that you may look down and find coming out of nowhere on the straight-in approach to an uncontrolled airport, some feeder line plane that is trying to make its schedule and doesn't want to waste time by flying the normal safe rectangular pattern to come in for its landing.

Was the F–27 making a straight-in approach?

Mr. ZACKO. The F–27 was making a straight-in approach. The Cessna aircraft did make one complete circle of the field.

Senator MONRONEY. In other words, in the normal flight procedure for uncontrolled airports this was a correct approach, was it not?

Mr. ZACKO. Yes, sir.

Senator MONRONEY. There is no regulation in the FAA regulations requiring, however, that commercial planes do make a rectangular approach before landing?

Mr. ZACKO. No, sir.

Senator MONRONEY. In your recommendation I see that you—I think quite wisely—provided for an exchange of this traffic. I have experienced this myself and the fact that you will get no word of the approach of a scheduled feeder line plane into an uncontrolled

airport from the UNICOM—and I presume, observing the pilots and their apparent unawareness of other traffic in the area, come barrel-housing right on in without looking or apparently wondering whether they are going to cut right in to you on a landing pattern after you have flown your triangle course. You say, "Reply received, draft release issued by FAA." This means that they have required this interchange of information?

Mr. ZACKO. They have issued a notice of proposed rulemaking wherein this requirement is set forth.

Senator MONRONEY. It is not yet a fact.

Mr. ZACKO. It has not yet become regulation to the best of my knowledge, sir.

Senator MONRONEY. I am sure it hasn't because my experience happened about a month ago. It seems to me that this is a very wise decision and it also seems that in uncontrolled landings a margin of safety could be added by flying your rectangular approach to survey the whole area to see if there is any traffic in the neighborhood. Many of these fields that the feeder lines go into not only fail to have any control tower operators or the uniform reporting by UNICOM or the company, to notify the two planes of conflicting traffic, but also they do not have taxiways on which the plane, once landing, may dillydally on the runway before it gets the runway clear after it has made its approach.

While we have not had many of this type of accident it seems to me to be one that deserves a particular amount of attention and study by the CAB and also by the FAA to do what they can to—particularly on visual landings, if the pilot of the commercial aircraft uses all the visual aid that he can in surveying the traffic around the neighborhood. A Piper Cub can be as dangerous to an airliner as another DC–3 or F–27.

The Board has not yet made its final report. Is that correct?

Mr. ZACKO. That is correct, sir.

Senator MONRONEY. There was another midair collision at Orlando, Fla., on the 1st of October, 1960, between an M–404, that is a Martin, isn't it—and a Beechcraft, in which apparently the pilot of the Beechcraft was lost?

Mr. GOUGH. Yes, sir. That investigation itself is not complete and there are no reports on it as yet, but Mr. Cyrocki of the investigational group will tell you about it.

Mr. CYROCKI. Mr. Chairman, we have preliminary information in our Washington files here. The field office file is much more complete than this, but since the investigation has not been completed, this entire file is still located in our field office.

The general type of accident was a midair collision while two aircraft were in the traffic pattern at the Orlando Airport occurring, as you stated, October 1, 1960.

The weather at the time of the collision was good, about 15 miles-plus visibility reported. The collision involved an Eastern Airline Martin 404, on a scheduled flight from Jacksonville to Orlando, and a Beech Bonanza, privately owned. The aircraft had departed Orlando Airport a little earlier and had dropped off a passenger at some unknown field and was returning back to Orlando.

The Eastern Airlines Martin 404 initially departed the Jacksonville airport on an instrument flight plan; however, he canceled out his instrument flight plan as he approached the Orlando airport and was operating under visual flight rules.

The Beech Bonanza was the first aircraft reported to have called the tower for landing instructions and was cleared for a righthand, base leg landing to the northwest. The Martin 404 called in shortly after the Beech and was cleared on a righthand, down wind, No. 2, to follow the Beech Bonanza.

Traffic at the time was very light and the Martin 404 entered the downwind leg traveling in a southeast direction at an approximate altitude of 1,100 feet and traveling at approximately 130 knots.

The Martin 404 captain stated he was looking for the Beech Aircraft but never actually observed the other aircraft until such time—immediately prior to the collision.

He was aware that a Beech aircraft was in the traffic pattern and that he was No. 2. However, his observance of this aircraft, as I stated, was just immediately prior to the collision. It was later determined that the relative angle between the two aircraft was such that the line of vision from the Martin 404 to the Beech Bonanza was within 3 to 4 degrees of the rising sun at that time.

This occurred at approximately 8 o'clock in the morning, and the Beech aircraft would have been coming in the same direction as the sun.

The collision itself occurred just about the time the Martin 404 was about to turn onto his base leg.

The Beech aircraft passed in front of the Martin 404 and had almost cleared the Martin 404; however, the right wing of the Martin was contacted with the Beech.

The Beech aircraft immediately went into the ground shortly after the collision. The Martin 404 continued in the traffic pattern, requested immediate landing, was given immediate landing instructions. The tower personnel indicated that at no time prior to the collision nor at the time of collision or impact did they observe the Beech aircraft.

This is basically the information we have available in our Washington file.

Senator MONRONEY. Were the two planes in the sun from the control tower as well?

Mr. CYROCKI. Yes, sir. However, not to the same degree as a line of vision between the Martin and the Beech. I indicated a 3° to 4° separation possible between that line of vision. The line of vision between the tower and the two aircraft should have been much better.

Senator MONRONEY. Were both of the two control tower operators on duty at that time?

Mr. CYROCKI. I don't have that information available at this time, sir. I don't how many were on duty. The investigator in charge does have that information, I am sure.

Senator MONRONEY. It is customary in most of these airports where the traffic is not too great to give visual assistance from the control tower, if possible, as to converging traffic that does not have the normal separation.

Both of these planes had radio and were in radio contact, apparently, with the tower?

Mr. CYROCKI. Yes, sir; that is correct.

Senator MONRONEY. But there is no evidence of any warning or anything that they were coming in to a similar course?

Mr. CYROCKI. Other than that the Martin 404 captain specifically requested other traffic in the area and he was given the Beech aircraft traffic.

Incidentally, the Martin 404 captain indicated that he did observe another aircraft in the area; however, investigation later revealed that this was a Cessna in the general area and there was a possibility that the captain mistook the Cessna for the Beech.

Senator MONRONEY. As a matter of fact, both planes had knowledge of each other, even though the Beech Bonanza did not necessarily receive the—he was given No. 1 landing position, but he undoubtedly would have been on the control tower on his radio and would have heard the Martin given clearance behind him, No. 2.

Mr. CYROCKI. At this time, sir, I am not certain that both aircraft were operating on the same radio frequency. They could have been on different frequencies.

Senator MONRONEY. It would have been most likely to. You would not be apt to have more than one frequency in the Orlando tower, would you? There is very little likelihood that until he had completed his rollout he would have switched to ground control?

Mr. CYROCKI. That is right, sir.

Senator MONRONEY. He undoubtedly would have received this information of conflicting traffic but did not ask for further identification of his position regarding this?

Mr. CYROCKI. That is correct, sir.

Senator MONRONEY. And neither did the Martin plane?

Mr. CYROCKI. No, sir; that is correct.

Now, the frequency at which both of them were communicating on is available in our Miami file; I don't have that information here. The wreckage of the Beech aircraft was examined thoroughly and I am sure that they have the frequency picked off the equipment.

Senator MONRONEY. Was there only one person alone in the Beechcraft?

Mr. CYROCKI. That is correct, sir; the pilot.

Senator MONRONEY. Any record on him? Has he had a number of hours, or what was his license classification?

Mr. CYROCKI. Sir, I don't have the crew history before me here.

Senator MONRONEY. Do you have any questions?

Senator THURMOND. Thank you, Mr. Chairman.

According to the figures here only one person was killed; is that correct?

Mr. CYROCKI. That is correct, sir; the pilot of the Beech.

Senator THURMOND. How many people were in the other plane?

Mr. CYROCKI. There were 24 passengers, sir, and 3 crew members, the captain, copilot and the flight attendant.

Senator THURMOND. What was the elevation?

Mr. CYROCKI. At the time of collision?

Senator THURMOND. Yes.

Mr. CYROCKI. Approximately 100 feet.

Senator THURMOND. And they all got down safe and none of them were hurt?

Mr. CYROCKI. That is correct, sir. The Martin 404 continued in its traffic pattern, turned on the base leg and landed safely.

Senator THURMOND. That is all.

Senator MONRONEY. In other words, from the testimony here on all of these scheduled airline accidents all save one occurred at control tower airports; is that correct? Some of these, of course, were outside the landing area, such as Bolivia, North Carolina, and Holcroft, and others, but those involving collisions at or near the airport were all under control save the one at Hickory, N.C.?

Mr. GOUGH. That is right; except for the one in Alaska that struck a peak.

Senator MONRONEY. This was beyond the terminal area also.

We have one more midair, in-flight collision during landing, the one that occurred November 4 at Sacramento, a Capital nonscheduled line and cargo service, a C–64–F, and a Cessna.

Do you have any information on that?

Mr. GOUGH. No, sir; that is part of our field backlog; that investigation has not been reported from the field office yet.

Senator MONRONEY. You have nothing in from the field on that?

Mr. GOUGH. No, sir; nothing in from the field except these figures.

Senator MONRONEY. This concludes the scheduled certificated air carriers.

I would like to devote a little time, if I might, to the general aviation accidents.

These number very high—over 800, I believe, in the total number of casualties. I notice in section W of the book which we have are detailed the numbers of accidents, percent of total accidents to the number of accidents here.

There is notheing to indicate the degree of fatality, although the accidents are of themselves indicative of their frequency.

You have this pilot-factor category where you list 1,013 accidents or 77 percent of the total accidents.

I wish you would give us a little more information of how you categorize the causal factors of these accidents.

While you are looking that up, we will suspend for just a moment. I have to make a telephone call.

(Discussion off the record.)

Senator MONRONEY. Are you ready to resume?

Mr. GOUGH. Yes, sir.

Senator MONRONEY. In other words, what we would like to get at, you show these accidents based on 1,317 cases analyzed, representing approximately 35 percent of the total accidents here as the possible casual factors. The record also would show that in the fatal accidents, of the total number of accidents in general aviation, 4,540, there were 438 accidents in which fatalities occurred and the total number of lives lost was 835. This is shown in the table B in your accident report.

You analyze 35 percent of this total number of accidents. Apparently that would include the entire list of 4,540.

First, we would like to have you define what an accident is: whether this includes the fender bumping cases, for example, where minor

brushes on taxiways, or accidents on the ground and other things of that kind, that would involve a fine, perhaps, of a hundred dollars or so, are involved.

Mr. GOUGH. Yes, sir; you have asked a number of questions and I will try to carry on with all of them for you.

The chap in charge of our data analysis isn't here, I regret, and he could give you a much plainer answer than I.

Senator MONRONEY. If you would rather the committe did let this go over to another time—in other words, this always involves a very important phase of aviation and if you feel that your man that is in charge of investigation of general aviation accidents would care to write up the categories—first, a definition of what an accident is, what it takes to get on the list; secondly, how you arrive at the pilot factors versus the other factors. For example, I casually note that 77 percent of the accidents are listed as pilot factors, and yet only 16 percent are listed as weather factors.

Now, my personal experience in some of these accidents that I have had occasion to check indicate that weather and pilot factors are often brought together to where a pilot finds himself in weather beyond his control, and that had he made the right decision to do a 180, 15 minutes earlier, he wouldn't have been in that fix, but this blending of the pilot error by not making the 180 and getting out of the weather is perhaps in some way misleading.

So, if you would rather have your man who specializes in these accident cases of general aviation, the committee would be perfectly willing to defer this to a little later time.

Mr. GOUGH. Well, I thank you, sir; and I would like to do that.

There are one or two small things, though, that I think in the interim might help and I would like to mention them.

Senator MONRONEY. Yes, sir.

Mr. GOUGH. The exhibit that you mentioned, under "V" in book 1, which is the casual factors for general aviation accidents in 1960, you quoted the 1,013 accidents in which pilot factor played a part, 77 percent of the total accidents. The asterisk there indicates that this was of the 1,317 cases.

Senator MONRONEY. This is a good sample, though.

Mr. GOUGH. Yes, sir.

Now, in exhibit 2 in section L, there are a number of exhibits showing the general aviation accidents and how they were analyzed: Their location, their date, the aircraft, the injury, and the probable cause. These give a pretty good indication of how these numbers were determined.

I thought I would like to call that to your attention. I would be very happy to continue with getting another report as you suggested.

Now, the definition of an accident and an incident, I think, is section D of the book, and exhibit 2, which has been done in anticipation of that question, in which the aircraft accident, the aircraft accidents incident to flight and not incident to flight are defined.

Senator MONRONEY. In your list of accidents that you give us in the 4,000-odd accidents in general aviation, 4,540, in which 438 were fatal accidents, does this number of 4.540 refer to accidents in flight or does it refer to all aircraft accidents?

Mr. GOUGH. That is all accidents.

Senator MONRONEY. It seems to me that it would be helpful to this committee and to the cause of safety, not that we are not concerned with ground accidents, but the answer to the ground accidents is a lot easier to find and to correct than the accidents to the aircraft incident to flight. When you have your specialist in this field report, I think if he could separate these number as to the ground accidents and the so-called fender-bumping and others from the accidents in flight, we would have some better way of figuring out the total accident record of general aviation.

We would further like to know, as you come back, a little more breakdown of the executive aircraft operations as opposed to the other business uses of aircraft such as the aerial applicators and other activities where the accident rate necessarily is greater. I know in the business aircraft operation, out of 16 accidents in 1959 there was 1 fatality, and in 1960 there have been 11 accidents in which there were 2 fatal accidents, including deaths totaling in 1959, 10; and in 1960, 7. If you could give us a little more information on the way these are broken down it would also be helpful when you come back.

Mr. GOUGH. Yes, sir; you are talking there of exhibit U in book 1?

Senator MONRONEY. Yes, sir.

Mr. GOUGH. Yes, sir.

Senator MONRONEY. Thank you.

This, then, will conclude our hearings for the day.

We thank you for your patience and for the effort that you have made to bring us up to date and we will look forward at a later time to getting this. This will not be tomorrow. We expect to have the FAA go on tomorrow morning at 10. Consequently, we can excuse you men to go back to some of your vast pile of unfinished investigations and unfinished determinations of probable causes.

We thank you for your patience and for your efforts to enlighten the committee.

The committee will stand in recess until 10 o'clock tomorrow morning in this room.

(Thereupon, at 3:32 p.m., the subcommittee was adjourned, to reconvene at 10 a.m., Thursday, February 23, 1961.)

AIR SAFETY

THURSDAY, FEBRUARY 23, 1961

U.S. SENATE,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
SUBCOMMITTEE ON AVIATION,
Washington, D.C.

The subcommittee met, pursuant to adjournment, at 10:05 a.m., in room 5110, New Senate Office Building, Hon. A. S. Mike Monroney (chairman of the subcommittee) presiding.

Senator MONRONEY. The Subcommittee on Aviation will resume its hearings.

Today we are favored by the testimony of Mr. James T. Pyle, Acting Administrator of the FAA, and by several of his associates.

Mr. Pyle, if you would introduce those who will be assisting you in this testimony, for the purpose of the record, we will allow you to proceed in your own way.

STATEMENT OF HON. JAMES T. PYLE, ACTING ADMINISTRATOR, FEDERAL AVIATION AGENCY, WASHINGTON, D.C.; ACCOMPANIED BY DAGGETT H. HOWARD, GENERAL COUNSEL; PAUL T. PREUSS, ASSISTANT ADMINISTRATOR FOR OFFICE OF PLANS; DAVID D. THOMAS, DIRECTOR, BUREAU OF AIR TRAFFIC MANAGEMENT; DR. JAMES L. GODDARD, CIVIL AIR SURGEON; J. H. TIPPETS, DIRECTOR, BUREAU OF FACILITIES AND MATERIEL; OSCAR BAKKE, DIRECTOR, BUREAU OF FLIGHT STANDARDS; JAMES L. ANAST, DIRECTOR, BUREAU OF RESEARCH AND DEVELOPMENT; AND FORDYCE W. LUIKART, ASSISTANT ADMINISTRATOR FOR PERSONNEL AND TRAINING

Mr. PYLE. Thank you, Mr. Chairman.

Let me first, then, introduce those who are with me here at the witness table.

On my right is Mr. Daggett H. Howard, General Counsel of the Agency; to his right is James L. Anast, Director, Bureau of Research and Development; on my left is Mr. Oscar Bakke, Director, Bureau of Flight Standards; and to his left is Mr. David D. Thomas, Director, Bureau of Air Traffic Management.

Mr. Chairman, we have others here who are technicians in various fields and I will introduce them if we have to call on them for testimony.

Mr. Chairman, if it be in order, I would like to proceed with the reading of a prepared statement after which we will make ourselves

available to you and your members for any questions that we may be able to answer.

I would like to make it very clear that it is a pleasure to be here with you to report on the progress we have made in the FAA during the second year of our existence.

In my own view, periodic hearings of this nature can be of immense value to an agency such as ours. They keep us on our toes, and provide the necessary bond between agency and Congress which insures continuing adherence to your air safety aims. They help considerably to prevent that slackness of approach which sometimes afflicts an agency with the passage of the years. At the same time, the public is assured that their interests are not being neglected, and the industry involved is reminded that the purpose and intention behind safety requirements are still very much alive.

As we all know, the Federal Aviation Act of 1958 was not aimed at any particular abuses. Rather, it was aimed at establishing an effective means of keeping regulatory pace with a dynamic industry and bringing the full strength of the Federal Government to bear in providing needed services and fostering the growth of aviation. We are gratified that this subcommittee has not lost sight of the latter aspect in calling for a report on the Agency's achievements in research and development.

To go to the specific subject matter of this report, you have asked us to avoid repetition of the review conducted here last year—in short, to supplement that review. In doing this, we have assumed that the subcommittee did not intend a sketchy or incomplete presentation of the facts. Accordingly, we have prepared more detailed exhibits, in addition to this summary statement, which may be helpful to you and the members of the committee. With your permission, Mr. Chairman, we would like to submit them for the record. Needless to say, we shall, of course, be glad to furnish any additional information the subcommittee may wish to have in the course of these hearings. If this would be in order we would like to submit them.

Senator MONRONEY. This will be accepted for the full record and at such times as we need additional information in the printed record we will ask for its placement in the record as the testimony develops.

Mr. PYLE. Thank you, sir.

The present aeronautical environment: There is little to add to what we all have heard so many times about the rapid growth of aviation since World War II, a growth that has accelerated even more rapidly in the last 10 years. We have prepared a simple exhibit for the record giving the statistics of this growth, but I would like to pinpoint here what this growth has meant in terms of the problems it presents to the flying community and the FAA.

The major problems encountered in the aviation environment today certainly differ from those of its formative period. Airplanes that could fly, an adequate supply of airmen, mechanics, traffic controllers, development of maintenance techniques, airports, airways—all, in turn, were milestones in their time. Today, in addition to the need for continuous improvement in the familiar old areas, we have new problems, compounded by high performance and differing speeds of aircraft, altitudes of flight, the vast numbers of aircraft, burgeoning

instrument flight operations, congestion at terminal areas, and all the complexities inherent in handling millions of flight operations.

Some idea of the magnitude of change can be gained from figures on composition of the scheduled air carrier fleet. In December 1950, the scheduled air carrier fleet consisted of 1,109 aircraft. Less than half, 485 to be exact, were four-engine aircraft. The rest consisted of 606 twin-engine and 18 single-engine aircraft. Eleven helicopters were in use. There were no jet transports. There were, all told, 422 pressurized aircraft, while 687 were not pressurized.

As of September 30, 1960, the fleet consisted of 1,824 aircraft, an increase of over 64 percent. There were 1,158 four-engine aircraft, more than the entire fleet in 1950. The turbine powered aircraft numbered 404, including both pure jets and the turboprop aircraft. There were 1,436 pressurized aircraft. The number of helicopters in use rose to 24.

Senator MONRONEY. Right at that point, Mr. Pyle: These figures showing the amazing growth that they show and the high performance aircraft that they reveal, they still do not include the foreign aircraft that are servicing various American points on international agreements, do they?

Mr. PYLE. No; they do not, sir.

Senator MONRONEY. So, you would add another, perhaps, substantial number, particularly of high performance aircraft, that further show greater and greater progress and development of these high performance aircraft, but still become a problem of concern of the aviation safety agencies dealing with them.

Mr. PYLE. This is absolutely correct, Mr. Chairman. They add to the complexity, for instance, and the congestion in the terminal area by their very numbers.

The tremendous growth in general aviation is reflected in detail in the exhibit. It is easy to overlook the fact that some of our general aviation aircraft today operate at speeds which the most advanced military fighters were striving to achieve in the days of World War II.

The increase in air traffic volume is perhaps even more startling. In 1950, 172 towers handled 15,971,152 aircraft operations. In 1960, 288 control towers handled 25,774,152 aircraft operations, an increase of over 10 million operations.

Incidentally, I might point out that there are only 31,500,000 seconds in a year, so you can get an idea of the operations—a little over one every second operation.

Air route traffic control centers handled 334,819 instrument approaches in 1950. In 1960, they handled 954,355 approaches.

Senator MONRONEY. Do you have in your figures in the book, or could you make them available to the committee, the number of carrier operations in the high density airports and on the high density air route traffic control centers? I think it would be quite illuminating because, as we go along with these hearings, I think they are showing more and more that we are developing rather serious problems in these high density areas that are not necessarily shared by all of the 288 control towers.

In other words, you have the extremely high density and you have areas which experience only two or three air carrier operations each day.

Mr. PYLE. Mr. Chairman, these figures are contained in the Federal Aviation Agency's statistical handbook which is part of the exhibit.

Senator MONRONEY. It is broken down as to the——

Mr. PYLE. Number of operations by category of aircraft.

Senator MONRONEY. I think we would like to have them read into the record, if you could briefly do it at this point. I don't mean to interfere with your organization of the testimony but I believe that it should be spotlighted as we go into your testimony as to where the trouble areas are developing and where the extraordinary efforts of the FAA must be made to do something about it.

Mr. PYLE. Mr. Chairman, in response to your suggestion, which I fully concur with, on page 26 there are the statistics of the FAA operated airport traffic control towers in rank order of air carrier aircraft opeations, 1958 and 1959.

Chicago Midway, ranked No. 1 in both years——

Senator MONRONEY. Excuse me. What page?

Mr. PYLE. Page 26, Mr. Chairman; top of the page.

Senator MONRONEY. That is this book here?

Mr. PYLE. Yes, sir.

Senator MONRONEY. All right, I have it.

Mr. PYLE. Now, in 1959, there were 345,170 air carrier operations. In 1958 there was a somewhat lesser amount, 337,421.

Washington National, in 1959, was 2d, 249,414; Los Angeles, 3d, 234,446; the two New York airports: Idlewild was 4th, 209,043; New York La Guardia, 5th, 206,032; Miami, Fla., 6th, 178,174; Atlanta, Ga., 7th, 166,346; Newark, N.J., 8th, 151,779; Dallas, Tex., 9th, 144,988; San Francisco, Calif., 10th, 139,754.

Senator MONRONEY. I think we will include the balance in the record.

At this point, however, in rounding off the figures for the New York area where there are three big airports—and they are all using the same airspace—so they present a common problem whether they are listed as they are here as No. 3, 4 and 8, but I round it off at somewhere near 566,000.

Mr. PYLE. That is correct, sir.

Senator MONRONEY. Which means this is the volume that is going into the limited airspace in this one particular area. This, of course, will be of some concern to us later as we reflect on the air traffic control problems that were spotlighted by the United-TWA crash very recently.

You may proceed.

Mr. PYLE. In 1950, the bulk of air-carrier operations was conducted below 15,000 feet, the normal limit of nonpressurized flight.

I might point out, incidentally, Mr. Chairman, from a nonpressurized standpoint, except over the Rockies, 10,000 is the limit.

The normal limit of pressurized flight was 24,000 feet. Since 1950, we have seen a tremendous change in the proportions of flight made at the higher altitudes.

The airways system also underwent significant change in this period. In 1950 there were 70,253 miles of airways based on 378 low medium frequency 4-course radio ranges. 371 VOR's—very high frequency omnidirectional radio ranges—were in place but

little use was being made of them; and for this reason no airways had been designated for them. By the end of 1960, however, there were 725 VOR's and a total of 180,531 miles of airways based on them were in use. With this, we have been able to reduce the LMF airways system to 39,000 miles. This is primarily to meet a military requirement, Mr. Chairman.

Senator MONRONEY. This means within the past 10 years you have more than doubled the number of miles of your radio beam and your highways of the air, you might say, and they have been modernized from the low medium frequency ranges to the very high frequency omnidirectional radio ranges; is that correct?

Mr. PYLE. That is correct, sir.

Senator MONRONEY. This has been a major overhaul, at least in this phase of the directional control of air traffic?

Mr. PYLE. And it has the advantage for the pilot, Mr. Chairman, of static free radio aid and also an infinite number of courses to and from the stations, whereas the old four-course range, of course, only had four—unless you used an automatic direction finder.

The major problem in the 1950 aeronautical environment was the terminal area. Traffic congestion in a few major terminal areas was the primary cause of delays, confusion and disarrangement of traffic throughout the entire system. Only seven airport surveillance and seven precision approach radars were then in operation, and they were used on a limited basis. ILS was available at only 96 locations; and, in general, air/ground communications were woefully insufficient, due mainly to lack of adequate airborne multichannel communications equipment.

Under these circumstances, an average of only 13 to 17 landing aircraft could be accommodated per hour.

This, Mr. Chairman, I point out is at one airport. The terminal area situation has, in general, been greatly improved.

Senator MONRONEY. Does that refer to——

Mr. PYLE. Instrument operations.

This has been done mainly by expanded use of radar, more efficient arrival and departure procedures, additional ILS equipment—including multiple installations at a number of locations—improved airborne and ground communications facilities—improved quarters for control facilities and increases in personnel.

In 1960 we had 51 airport surveillance and 19 precision approach radars in operation. The number of ILS's had increased to 177. In terms of capacity, the system handled a daily average of 70,614 landings and takeoffs, 1 per second; 25,857 instrument type flights, 1 every 3 seconds; and 2,615 instrument approaches, approximately 2 per minute. Fifty-nine airports had a peak day of more than 1,000 landings and takeoffs; 87 airports had more than 100 landings and takeoffs during their peak hour; and one airport, Chicago, averaged an operation per minute around the clock. Our system capacity has been enhanced by having available for use by our personnel 34 rapcon or radar approach control, which are Air Force installations, and RATCC, which are the Navy installations.

Senator SCHOEPPEL. Mr. Chairman, I would like to ask a question at this point. I would like to ask you, Mr. Pyle, what has been your experience with reference to the competency of personnel?

Have you had difficulty in adjusting personnel to these new changes or do you find personnel generally adequate to man these new operational advantages and improvements?

Mr. PYLE. Senator Schoeppel, we are fortunate in being able to recruit competent personnel, but we have a tremendous job of training to do. In fact, Mr. Thomas, whose bureau insofar as the controllers are concerned that I am talking about, has training requirements of somewhere in the neighborhood of 19,000 courses a year to either train recruits, upgrade controllers from assistant controllers to senior controllers. This is one area.

The second area is in that of the electronic technicians to maintain, keep the equipment tuned up and calibrated and operating and on the air so the pilot has it.

This is a tremendous responsibility which falls on Mr. Tippets in the Bureau of Facilities and Materiel. We have a tremendous training operation there, too. I could get the figures, but the training courses I would say are in the neighborhood of around 10,000.

This, incidentally, is all done at Oklahoma City at our Aeronautical Center, and, Mr. Chairman, we would be highly honored if you would bring the committee out there some day and give us a day to show this facility off and the job that is being done.

Senator MONRONEY. I know Oklahoma City would be delighted to welcome them, for we are quite proud of the installation and the job that it is doing there.

In mentioning the facilities, each forward step in the more sophisticated electronics system that you use, the radar and your omnis and all of the other things, thrust a greater and greater burden on Mr. Tippets' branch of maintenance because no longer can an ordinary household electrician be expected to know how to wire or to service or repair or maintain these wonder instrumentations that seem to be continually developing and added to the system.

Mr. PYLE. In answer to Senator Schoeppel, I think if we are having difficulty it is harder to get electronics technicians today because we are competing with expensive missile industry and the TV industry, but we are recruiting about as many as we need.

Senator MONRONEY. You will be prepared to testify later, however, on the direction that was given in the FAA Act for a report on an improved personnel system, retirement pay, hours of work, working conditions, et cetera, that was contained in the original act? We hope very much that the FAA will be able to come up early this year with proposed legislation in this area.

This committee is prepared to start hearings on such legislation at the earliest possible time. To enable us not only to improve the working conditions and to retain the efficient air traffic controllers, but also to help in future recruiting efforts of this nature to make the job more attractive. Of course, we certainly do not want to overlook, as we go on into the hearings, the work that is being done, to improve this situation.

We could, of course, draft a bill here, but it would be far better, with the intimate knowledge that you have of the personnel problems, to have the benefit of your studies, since the FAA agency was established with independent status.

Mr. PYLE. Well, Mr. Chairman, we will speak to this point. It is a very important one and I share your concern for this area. We have some real serious homework to do in this area, and it is in process and we will report on it a little later on in the hearings.

Senator MONRONEY. One of the problems, is it not, is the fact that you may be—when this act is passed, if you have managed to work out with the military the security requirements and the requirements that control tower operators and air traffic controllers to be eligible for assignment outside the United States or at strategic points very isoltaed within the United States, that the military would be satisfied with these arrangements and begin the phasing out of their military personnel in this work and the substitution therefor of civilian air traffic controllers?

Mr. PYLE. Well, this is our objective, Mr. Chairman, but it is a complex one. The assurance that you speak of is certainly a requirement to which the military services are entitled.

The other problem is the complexity of protecting adequately our personnel and their rights. Even to their constitutional rights, and this has not been easy.

We will testify on this point in greater detail unless you would like to get into this now?

Senator MONRONEY. No; I think we would like to go forward.

One point before we leave it. You now have how many air traffic towers?

Mr. PYLE. 288, I believe, Mr. Chairman.

Senator MONRONEY. 288? Then you have how many air route traffic control centers?

Mr. PYLE. Thirty-five air route traffic control centers, Mr. Chairman.

Senator MONRONEY. That brings you well over 300 installations. I understand if you took over all the military air traffic control towers, it would add perhaps 600 more to your members?

Mr. PYLE. It is in that area, Mr. Chairman.

Senator MONRONEY. You will have a magnitude of additional requirements, if, as, and when the military is brought into the system under civilian air traffic control?

Mr. PYLE. Physically there are about 19,000 military controller personnel handling their facilities.

Now, this perhaps will give somewhat of a false picture because they had a tremendous training program due to the continuous rotation of their personnel, and the fact that they do not in many instances reenlist.

Senator MONRONEY. When you take over, if you are able to take over, and they wish you to take over, this will result, however, in a considerable saving in the long run to the Federal Government by having men who remain longer, become more proficient, and therefore in the long run will lessen the drag on training facilities that are required now on the frequent rotation in and out; is that correct?

Mr. PYLE. That is correct, Mr. Chairman.

It would be a more efficient way of doing it, provided we could meet the requirements of the services, and this is the area we are trying to resolve now.

Today, we have three basic types of en route operation as opposed to two in 1950; and we may expect a fourth type, the mach 3 supersonic, first military, then civil, in the not too distant future.

I might point out, Mr. Chairman, right now we have supersonic operations on a limited basis with both the B–58 and the Century series fighters, but they are basically a short-type operation, they are not a continuous type.

The DC–3 and other nonpressurized aircraft operations are still very substantial, and, incidentally, I am sure you are aware, Mr. Chairman, this is a very important segment of the aviation community, some 75,000 general aviation aircraft from the small Piper Cub to the Viscount flown by United States Steel, for instance, and they fly better than 12 million hours a year.

So, this is a very important segment which we must take into consideration.

The general aviation aircraft, by and large, continue to operate up to approximately 15,000 feet; pressurized piston aircraft operate up to considerably higher altitudes; in other words, what I am saying, Mr. Chairman, is we have a three-layer cake, based on the performance capabilities of the aircraft.

In a special category, we also have a significant volume of helicopter operations at three locations—Los Angeles, Chicago, and New York.

I guess I got ahead of myself. I mentioned the three-layer cake, with the first layer extending from 15,000 to 24,000 feet and from 24,000 feet upwards.

Unlike 1950, jet aircraft are operating, in accordance with instrument flight rules, both in the higher stratum and in their climbs and descents through the two lower layers.

The average speed of air carrier aircraft rose from 181 m.p.h. in 1950 to 224 m.p.h. in 1959. Our data for 1960 is not yet complete, but introduction of many straight jets will make it even higher than in 1959.

I might point out, Mr. Chairman, that this is a technical term with which we are familiar. This designation has three important consequences. An aircraft operating in control areas must maintain 5 miles of forward visibility as against 1 mile in uncontrolled or off-airway airspace.

Secondly, an aircraft cannot be operated on instruments in a control area unless they are on a flight plan at an assigned altitude.

In other words, if they go into the clouds and lose their ability to fly on the see-and-be-seen basis with a minimum of 5 miles visibility, they have to go on an instrument flight plan.

As against in the off-airway area the simple requirement that they only adhere to the hemispheric rule in uncontrolled airspace.

The third point, that we as an agency must assume that the users of the airspace, most assuredly, the users of the airspace that they have the capability to meet their demands in terms of adequacy of service.

This is the obligation this imposes upon us.

Accordingly, aircraft operating in this controlled area airspace on an instrument flight plan are offered a positive flight plan. I might point out that VFR operations can still be conducted in the areas provided they meet the minimum visibility areas.

The floor will be lowered to 14,500 feet in April of this year. Restricted area climb corridors have been established to accommodate the operation of air defense aircraft. This, Mr. Chairman, is a cone, or a funnel laying on its side to permit aircraft of the Century series type to permit scramble on air defense alerts without having to worry about other traffic.

Senator MONRONEY. In other words, what you do on this cone of climb or cone of descent from the military bases either underpass or overpass the regular airways. They are not supposed to be flying across these airways.

Mr. PYLE. That is correct. It is only for departures; arrivals are taken care of only—let's say a 104 off of Andrews has to get out on an air defense alert; he then goes out through the climb corridor.

Senator ENGLE. May I ask a question, Mr. Chairman?

Senator MONRONEY. Yes.

Senator ENGLE. Why don't you get a corridor for these supersonic jets to come in? I have had some experience out at Andrews. I am happy to see that climb-out corridor and I stay well away from it, but they come in on the other end and I think a lot of pilots would like to know where they are coming in, too, because we can get clobbered just as easy with one coming in as we can with one going out.

Is there any reason why it is impractical to have corridors both for landing as well as takeoff?

Mr. PYLE. Senator Engle, I think your point is well taken, but I feel this responsibility to all users of the airspace we must discharge, and that is to keep to a minimum the restricted airspace.

Now, it is our objective that these aircraft be under control to the extent that they can operate safely in the airspace without endangering the other users. Perhaps Mr. Thomas would like to comment on this point further.

Senator ENGLE. What I am interested in is finding out where those jets are so I can stay away from there when I am flying my little June bug around the sky.

Mr. PYLE. I think Mr. Thomas can supplement my statement.

Mr. THOMAS. Senator, actually, there is not enough airspace to allow for corridors in all directions that would be necessary for landing and takeoff.

For approaching there are several different ways. The departure is a maximum performance, afterburner departure which not completely but largely makes see-and-be-seen impractical.

The arrival is not a maximum performance and we are approaching it with traffic patterns and also a speed limitation on arriving jet aircraft, whether it be civil or military.

It seemed to be a lot more practical than tying up additional airspace for things that are not used for all time.

Climb corridors are also available.

Senator ENGLE. It is a lot easier to go under or on top of them.

Mr. THOMAS. It is a lot more practical to go around them.

Senator ENGLE. I think you have approached the problem right. I think the first priority ought to be on the climb-out course because those airplanes going out of there are at an altitude that lots of times they cannot see, whereas coming in they can see a little better. But

as an advisory proposition to local pilots it would be helpful if we knew the patterns that these big jets follow.

To give you an illustration, I fly up and down the San Joaquin Valley all the time. There is Castle Air Force Base; they have these B–58's out there. I know just about where their pattern is and I stay out of it. But if I come chugging along there in my little Piper and get mixed up with one, it is not going to help me very much. If I don't know, and I know these air maps now are cluttered so bad you can hardly read anything on them, but I observed that when you have these special missions, this oil burner or whatever it is, we get an advisory in the regular manual that indicates to us where they are.

Now, out here you have regular approach corridors and both airports have approach and departure corridors. They have them off of Bolling and Anacostia and they have them off of National. We can get those and I do get them.

I know where they are, but the average pilot who just happened to be touring through the area, unless he looked at his manual he would not know.

I just suggest that as a piece of information that would be highly beneficial to what I call the general aviation pilot because from our point of view, what we want to do is to stay out of those areas, and the corridors are certainly clear enough and they are one of the finest additions that FAA has made to the current maps.

I want to suggest that we can get in just as much trouble if we get tied in behind a B–58 with its wingtip turbulence and that in a light aircraft as we can in one on a climb-out.

I just had to inquire around about Castle Air Force Base. I found out where they made their turns ordinarily and just stayed out of that area. And you can't always see them on those hazy days. It does not make me feel very comfortable.

So, maybe if we direct your attention to that and figure out some way, perhaps in the pilot manual, and give us an idea on some of these, if they have established patterns, I know they do have them here at Bolling and out of Andrews, too.

Mr. PYLE. Senator, your point is very well taken and frankly we have given a lot of thought to this, but I think one of the problems we are faced with, and some ingenuity may be the answer to it, is the fact that as you say, maps are so cluttered that they are almost to the point of being meaningless. We have a large-scale effort in trying to devise simpler methods of presentation for many of the problems that we would like to have the pilot informed on.

Now, there is one other area—perhaps Mr. Thomas can elaborate a little bit. We are coming up with an airport traffic pattern concept and this in itself will, by some appropriate designation on the chart, indicate where there are airport traffic pattern areas—military and civil—and this would be one form of pointing out to the pilot this is an area where you can expect a high density operation and around a military base it would naturally be jet.

Now this may partially meet the point you make. We are going to give it some more thought. I think your point is well taken.

Senator ENGLE. Thank you, Mr. Chairman.

Senator MONRONEY. In my part of the country they have an area of about 4 miles on each end of the long runways where jet traffic is

coming off. It's not the Century series; usually B–52's or B–47's, or KC–135's, and any time a private plane is at 3,000 or above you are in the clear.

Those pilots learn rather quickly to identify the ground area in reference to the clear zone—I mean above 3,000—and it has added a great deal of comfort to me in criss-crossing over Tinker Field to know that when you are above 3,000, within those limits, you are not in the way of approaching or takeoff because these are not afterburner aircraft that have to go up so rapidly.

Anyway, this rule, I think, could be expanded by a significant mark on your maps to inform the transit pilots of this system; then it will add a lot to know that if you are over a certain altitude within this range of the field that you are out of the way of approaching or landing or takeoff and landing of these jet military aircraft.

Mr. PYLE. I think Mr. Thomas might want to comment on your suggestion.

Mr. THOMAS. These are excellent suggestions. As a matter of fact, both Mr. Pyle and I are very familiar with Castle and Merced, having flown B–52's out of there. There is no problem between Merced and Castle because the pilots at both fields know the traffic patterns and know each other. Our problem relates to the stranger coming into the neighborhood. This is the reason we are attempting to set up a traffic pattern area which will be marked on maps and will be avoided by itinerant pilots.

I hope that this does something because our biggest problem here is getting the same information to you as an itinerant through there as the man who flies out of Merced every day knows in the back of his mind. If we can achieve that, we will do something.

Senator MONRONEY. Good.

Mr. PYLE. Mr. Chairman, we go on to describe the operation of the climb corridor. I think we have covered that. In the interest of saving time, I will point out there are 29 such corridors.

In June of 1958, a number of transcontinental routes and several shorter route segments were established as "positive control" routes between 17,000 and 22,000 feet. No VFR operations on, or when crossing, these routes are permitted.

Mr. Chairman, this is one of the suggestions that I think we must give you credit for when we had hearings on this problem sometime back.

All such operations must be on an IFR flight plan and with an air traffic control clearance. This concept will be expanded to additional routes and altitudes as rapidly as our increasing capabilities in the air traffic management system permit.

In 1958, with the advent of civil jet operations in the United States, we began a jet radar advisory service for air carriers which we have since expanded. FAA controllers, located at FAA facilities and Air Force air defense radar sites, follow by radar each such flight, advise the pilot of traffic, and steer the civil jet around traffic which appears to constitute a potential conflict.

This service is provided between altitudes of 24,000 and 39,000 feet on more than 37,000 miles of jet routes. Aircraft other than air carriers, desiring to fly within 30 miles of these routes within these altitudes must either have an operating radar beacon transponder to re-

inforce radar targets on ground radar scopes, or obtain prior approval. Of course, Mr. Chairman, this is almost entirely military traffic at this point.

Senator MONRONEY. But I'm still receiving complaints. I received one from one of the most distinguished men in aviation only last week that his jet flight coming in from Los Angeles, over Indio, had traffic above and at each side. When he asked the pilot about it, the pilot said that he was not advised of any approaching military traffic.

Now, this obviously is the same complaint we had last year that some of these military jets either do not have their transponder operative, or they just forget to turn them on. I think this is—if you are going to have them, then they must all be operative and all be working; otherwise you have a false sense of security since they are not illuminating themselves properly on the scope. It is something I think must be worked out with the military to insist that no plane takes off into these altitudes unless the transponder is operative and the pilot instructed to use it when he is in that area.

Mr. PYLE. Mr. Chairman, I agree 100 percent with you. In fact, I think I would like Mr. Thomas to comment on this and also correct we if I am wrong in making this statement.

We now have a rule that makes this a requirement, and, of course, any failure to abide by the rule constitutes a violation.

Senator MONRONEY. It is a violation of civil regulations but I have not received any complaints about the civil aircraft not having their transponders on.

Mr. PYLE. Mr. Chairman, I think the problem is one—it is a system problem that I would like Mr. Thomas to explain. I would like to point out, however, that if there be a violation on the part of the military pilot, I can assure you that their services take pretty drastic action. In fact, if it is sufficient, they are in worse than we are. The fellow usually loses his wings, so they are not sore when a military pilot has a violation and an enforcement action against him.

Now, Dave, perhaps if you would explain some of the problems that we have in this area because there are serious problems, Mr. Chairman, I think you should know.

Mr. THOMAS. There are quite a few in regard to the transponder and the beeper. In this particular instance a pilot could see another jet on one of the jet routes, advisory areas, and everyone attempted to do everything possible to comply with all the requirements.

The military have had regulations out requiring the operation of transponders even before our rule, and they enforced it very rigidly. There are several problems. One is that the only thing in an airplane that tells you whether your transponder is operating or not is a switch. There's no test, there are no lights, no indication, just the position of a switch that indicates whether or not it is operable.

Now to avoid this, the military do require an airborne check to the transponder as soon as they get off the ground and can get a check. They do fail and the pilot has no way of knowing there is a failure.

The second problem we have is whether any part of the aircraft shields the transponder antenna from the transmitter. We can track them a little better with radar, although we may not see some of the military jet aircraft. We do lose the civil jets with transponders as well. We have the other question that they can and do operate a

thousand on the VFR on top altitudes. We get into some question as to judgment between pilots as to the altitude the other aircraft was operating at. He might, in fact, be 1,000 feet from him when he sees him.

I would like to point out that the transponder with everybody doing all they can, does not necessarily show up every time on the scope.

Mr. PYLE. In that connection, Mr. Chairman, Mr. Anast advises me that we have under development a device that will tell the pilot whether his transponder is transmitting a signal. This can be used both on the ramp and in the air. However, this is not yet ready for a test.

Senator MONRONEY. In other words, the pilot would know from a repeating light perhaps in the cockpit that he is actually transmitting a signal over his transponder. This would, I think, be a very great help. If he sees it is inoperative, he can at least call in to the air traffic control and tell them that his transponder is out and please try to watch him on the shadow instead of on the transponder impulse.

Mr. PYLE. That is correct, Mr. Chairman.

A new service soon to be installed at three major terminal areas is the "visual flight rule radar advisory service." This service is designed to improve the safety of aircraft operating under VFR flight rules in the vicinity of busy airports. The controller in the tower will monitor traffic on his radar scope and advise pilots by radio of potential collision hazards. This program will eventually be extended to many other locations having airport surveillance radar.

In recognition that positive control services must be perfected and expanded, an "area positive control" project was undertaken on October 15, 1960. This involved provision of positive control within a radius of approximately 125 miles from our radars at Chicago, Indianapolis, and a site near Wright-Patterson Air Force Base, between altitudes of 24,000 and 35,0000 feet.

Both primary and secondary—beacon—radar are utilized. All aircraft operate IFR at an assigned altitude and are provided separation from all other aircraft in the area. However, some operations, such as local training activity, acrobatics, flight testing and certain tactical operations, do not lend themselves to this rigid control. Accordingly, blocks of airspace are, to the extent possible, provided for such operations. In effect we clear no traffic through these blocks of airspace so that these are performed without interference. Other traffic is controlled around or through this airspace as circumstances permit.

Experience with this initial area positive control will provide the basis for future expansion of poistive control to meet the needs of all airspace users. So far it is my experience that the concept is sound and does not put an undue burden on the user. We still have a lot of homework to do before we can expand this to other areas.

We are also well along on a greatly expanded network of VORTAC navigation aids to meet both civil and military requirements. As you know, VORTAC is a combination of the military UHF TACAN facility and the civil VHF omnirange VOR. At each location, the two facilities will be together and thus provide common routes, position reporting, and holding fixes for civil and military operations, which are essential to efficient air traffic control. To the fully

equipped aircraft, VORTAC gives the pilot a continuous, highly accurate position-fixing capability.

Although at the moment we have over 343 VORTAC's capable of providing a DME signal—I would point out, Mr. Chairman, in connection with these 343 we have 259 commissioned. We have 85 that are emitting a signal right now, but we are awaiting the flight checks and the training of additional personnel. These additional facilities will be commissioned by June 30 of this year.

We also have the procedures and separation standards in effect which are based on the distance measuring—DME—part of VORTAC, but the facts of life are only a limited number of civil aircraft are equipped to take advantage of such procedures. The military services, however, now have over 12,000 aircraft which have this capability. By July 1, 1951, the military plan to have all their aircraft TACAN-equipped, with the exception of a few helicopters, obsolescent transport, and several smaller utility type airplanes.

Senator MONRONEY. Right there, on this DME. If I understand correctly, there are less than 22 of our civilian scheduled air carrier fleet that is now equipped with these distance measuring devices?

Mr. PYLE. Mr. Chairman, I think we have a complete listing of the numbers equipped. I don't know up to this minute, but there is a list. Mr. Tippets has it.

Senator MONRONEY. If there is a report, I think we would like to have it in the record. This has come out as one of the factors that might have helped lessen the danger of the United-TWA crash at Preston.

Mr. PYLE. This is Mr. Joseph H. Tippets, Director, Facilities and Material Bureau. I think he has the figures on airborne equipment as late as we have them now. We will revise them if there are any changes as late as today.

Mr. TIPPETS. Mr. Chairman, the figures I have are orders placed by specific air carriers on one manufacturer. There may be orders with other manufacturers that I am not yet aware of.

According to my figures, American Airlines has on order 68, and has taken delivery of 46.

Continental Airlines has ordered three and taken delivery of three.

TWA has on order 81 and has taken delivery of 10.

Pan American has on order 18 and has taken delivery of 10.

Boeing Aircraft Co. has on order seven and has taken delivery of seven.

The FAA has on order for its own aircraft, 43. We have not yet had delivery. They are all produced and ready for acceptance test at this time.

Convair has ordered 60 and has taken delivery of 47. This is a total gross order that we know about of 280 with actual delivery of 113.

Senator MONRONEY. This has accelerated greatly in the past few months, has it not?

Mr. PYLE. Yes, it has, Mr. Chairman.

Senator MONRONEY. You have a rule that will require, after a certain date, certain types of transports to have the DME equipment. Has the FAA yet issued a rule making this a mandatory requirement in planes of certain type?

Mr. PYLE. Yes. We have asked industry, the manufacturers, the air carriers, and others interested to come in and have a complete review of this whole situation at a conference with the objective in mind of considering the advisability of making this mandatory equipment at some date in the future, depending on the capability of industry to procure and install this equipment.

Now, Mr. Chairman, I will try and get for the record, to supplement Mr. Tippets' information, those that are actually installed in aircraft. There are not too many of them installed right at the moment.

Senator MONRONEY. I notice Boeing and Convair apparently have large numbers on order. Is it the plan of these two companies at least to complete their 880's and their 990's or their 720's and 707's, to turn them off the line with this DME built into them?

Mr. PYLE. Yes, sir, this is actually ordered for their customers for delivery of the aircraft on their lines.

Senator MONRONEY. But it would be supplied only on the request and the payment of these planes as they come off the line? I mean, this is not a mandatory requirement that all new jet aircraft have them?

Mr. PYLE. This is not as yet. This will be determined at this meeting that we are going to hold with industry and the manufacturers and so forth.

I would point out that most, I think almost without exception, every jet has been manufactured with wiring provisions for distance measuring equipment as an integral part of the manufacture of the airplane.

Senator MONRONEY. So it's not a big modification job.

Mr. PYLE. It's primarily the installation of the equipment and the antenna.

Senator MONRONEY. Do you have any questions on that?

Senator ENGLE. No.

Senator MONRONEY. Have you checked the Service angle on it? Apparently the military, if they have 12,000 aircraft with that capability, have not had any great amount of service problems or much question about their reliability and operation.

Mr. PYLE. The service is markedly better than it first was when I first flew in military aircraft. As an example, we have it in our DC–3 aircraft here in Washington. I suppose I put in 200 hours using DME and we have never had a failure yet. So, its reliability is increasing all the time.

Senator MONRONEY. In other words, it gives you almost a positive orientation with your ground position?

Mr. PYLE. It's one of the greatest things, as far as I am concerned, to assist the pilot in determining his position in the air that we have today.

Senator MONRONEY. You have the VOR on the direction and you have the DME on the position with the ground. Then you have a positive fix and you can rely better on the reliance of the system because the man would know where he should be each hour or each period of time. Therefore, he can give a more definite ETA when he will be into these congested areas?

Mr. PYLE. This is absolutely correct, Mr. Chairman. In fact, if a pilot with DME misses his estimate by 30 seconds, he has mathematical problems because it is so accurate.

Senator MONRONEY. I see.

Mr. PYLE. There are approximately 700 VOR's in operation. By providing the necessary element of TACAN for the VOR's and others already planned, the number of VORTAC's will be increased each year until, by 1966, approximately 880 complete facilities should be available.

Since the 340 VORTAC's we now have are of immediate and important value as navigational aids for civil operators, but only as soon as DME receivers are installed in civil aircraft, we are currently considering an early requirement for installing such equipment. We have in mind particularly the need for having it on all high-speed airplanes. To explore this, we have scheduled a conference, to which I have referred, of all interested persons for March 22, 1961, here in Washington.

Radar has proven to be the most effective tool ever made available to air traffic control. In addition to our 51 FAA airport surveillance radar operated by FAA, our controllers operate 34 military airport surveillance radars.

Senator MONRONEY. I meant to ask you. They are having no problems of integration of military and civilian operators who work jointly in these facilities?

Mr. PYLE. No, sir; there are no problems. In fact, this has been a tremendous benefit the taxpayers have gotten out of these rather expensive operations. They are used for the control of both civil and military traffic. In a great majority of instances we operate and maintain these facilities for the military with our own personnel and we do all the approach control function, turning over the military aircraft to their own controllers for their precision or GCA approaches.

The 85 systems have been very effective in expediting traffic and providing safety to aircraft in the vicinity of busy airports. In en route areas 40 long-range air route surveillance radar systems provide coverage near high density terminals and out along high density routes. Data from 18 of these systems are used jointly with the military services. In other words, these are our radars that we are feeding into the system for the air defense for the military. Also, we make use of 43 military long-range radars in providing the jet air carrier radar advisory service which I mentioned earlier.

I would like to just interject a word of commendation to the Air Force and the Air Defense Command specifically, for having made these facilities available to us on a most cooperative basis and they have turned handsprings to help us in the control of traffic and this is a benefit the taxpayer gets from the multiple use, let us say, of air defense radar, or both defense mission as well as traffic control.

Senator MONRONEY. In other words, this use of the military radar screen—is paying off in service to the general public—probably a greater degree of service than the watchfulness that it has been providing in detecting approaching enemy aircraft?

Mr. PYLE. Yes, sir.

Senator MONRONEY. This runs, as I understand it, into the neighborhood of using a billion-dollar facility absolutely free, at least, insofar as civilian air traffic control is concerned?

Mr. PYLE. That is correct, sir. This means that we have only the expense of our personnel, their salaries and expenses while they are on duty at the air defense sites.

Senator MONRONEY. And they are maintained by the military or at military expense?

Mr. THOMAS. They are maintained by the military, sir.

Mr. PYLE. When our program is fully implemented, radar coverage will exist at all major terminals and throughout the airspace above 15,000 feet over most of the contiguous 48 States and at lower altitude on the high density routes.

Existing surveillance radars have certain inherent shortcomings which cannot assure continuous tracking of all sizes and types of aircraft under all weather conditions. The radar beacon does provide these capabilities. At present the beacon is installed at 26 long range and 5 airport surveillance locations, and we plan to so equip the others as rapidly as equipment becomes available.

Senator MONRONEY. Does this refer to the gap we have had between Denver and Seattle and Denver and Los Angeles? The amount we appropriated last time?

Mr. PYLE. No; those are areas we have to fill in with actual raw radar. This refers to the installation of secondary radar or that component that is tied in with the use of the beacon transponder.

Another shortcoming of present radars is the display. It is not large enough, not bright enough, and target quality and definition is only fair. To overcome these deficiencies, direct-reading scopes and obsolete projection systems are being replaced with new scan-conversion equipment as fast as we can get them in. This equipment converts radar data into a television presentation which can be viewed in normal daylight conditions. It will also display aircraft identity, altitude, and control status information when current development programs in this area are completed. This equipment is presently installed in 10 centers and 4 towers.

The direct center-controller-pilot communications system has now been largely completed. Through use of 272 remotely controlled communications facilities and 923 air-ground radio channels, center controllers can now talk directly to pilots throughout the airspace above 15,000 feet, as well as down to minimum en route altitudes near larger terminal areas and along heavily traveled routes.

This has eliminated many communications delays which formerly plagued both controllers and pilots when center communications were handled through a third party.

This, Mr. Chairman, is one of the things, I think, that makes instrument flying a real pleasure today. You do have instant communication with your controller who has responsibility for your flight. In the old days we had to depend, if you were flying airlines, on the company radio communicator who is in effect the relay station through which you referred your messages to the center and they in turn passed it back through them or through our own communications systems.

Well, you could average 3 minutes a message, sometimes. Now, it is instantaneous.

Although this capability represents a big improvement in meeting today's needs, there will be serious limitations on the capacity of an individual controller to meet tomorrow's volume of traffic by this means. Accordingly, our program, includes provision for the installation, several years hence, of an automatic air-ground-air communications system (AGACS). This system will mechanize much of the communications between pilots and controllers. Also, it will serve in conjunction with a data processing system now under development.

Of course, the basic thing, Mr. Chairman, is to transmit essential information on speed, altitude of the aircraft, to the controller and also to transmit certain simple, hand-type of messages, to and from the ground.

Senator MONRONEY. To get this straight for a layman like myself, does this mean that the pilot at a certain point can push a button and this information will go out?

Mr. PYLE. He does not even have to do this. This is automatically so. Perhaps Mr. Anast can explain it better than I can.

Mr. ANAST. This particular development has several forms. The most sophisticated one requires no action by the pilot.

On the ground and connected in with the automatic control computing system, a rollcall is made of each aircraft that has this airborne equipment. It will furnish information pertaining to its flight intentions, altitude, and so on.

The more simple installation, which is generally patterned after general aviation, requires action by the pilot. Mr. Denicke here has one of the latest airborne displays here which requires a certain action by the pilot so he can actually put in messages by hand and also report what he wishes to report within the format of routine air traffic control structure.

Mr. PYLE. Mr. Chairman, Mr. Denicke will also bring up something which has great appeal to me. This is a small teletype type—radio teletype is what it really amounts to—that messages could be transmitted to his pilot. He could have it on his instrument panel, he could read off his clearance as he gets it from this machine and there is no chance of error in this one.

He has it available to him at all times, in written form, not just his notes that may make.

Now, this is another development that we are working on, hard. You might be interested in that.

Senator MONRONEY. What does that do—print the flight information from the traffic control center in flight?

Mr. PYLE. Either in flight or as he is at the end of the runway getting his clearance. This, I would like to have right now.

Another major aim is to speed up the internal data processing function for traffic control. Experiments have shown that standard digital computers can help achieve this. Such equipment is in operation at six adjacent air route traffic control centers in the northeastern part of the country—Boston, New York, Washington, Cleveland, Pittsburgh, Indianapolis. Their use, however, is but an interim step toward introduction of a specially designed air traffic control data processing system now in advanced stages of development.

This is the data processing central, which will provide a more advanced semiautomatic data processing and display system to replace interim computers and the existing manual system in all major high density areas.

This may give some idea of the complexity of the aeronautical environment today, compared with 10 years ago, and the direction our efforts are taking to provide for the safe movement of aircraft. It is perhaps an oversimplied presentation, for we cannot hope to describe the innumerable details that must be taken into account.

There are a number of things we would like to do right away that we either cannot do that soon, or may be unable to do for some time.

In addition to making the best use we know how of available knowledge and tools, the Agency has undertaken a massive effort to create tools which we know would be helpful and which do not now exist.

RESEARCH AND DEVELOPMENT

The Government role in research and development for aviation is, of course, nothing new. What is new under the 1958 Federal Aviation Act is the concentration of responsibility and authority for this activity in a single independent agency which also has responsibility for the common system and for air safety.

Mr. Chairman, we owe you an eternal debt of gratitude for your sponsorship of the Federal Aviation Act.

The Airways Modernization Board was organized late in 1957, and the President transferred to it, from the Departments of Defense and Commerce, all their research and development functions pertaining to the common system of navigation and traffic control for military and civil flying. In late 1958, the Federal Aviation Agency inherited these functions. We may say in general that the Agency is charged with conducting aviation research and development for the Federal Government, with the exception of projects to meet requirements peculiar to air warfare which, of course, will always remain the responsibility of the Department of Defense, basic meteorlogical research which is basically the Weather Bureau's responsibility, and basic aerodynamics research, which is the National Aeronautics and Space Administration's responsibility.

I must say at the outset that our research and development program is so comprehensive that it cannot be given adequate treatment in a statement of this kind. Accordingly, we have included in the exhibits material which we think will give you a reasonably complete idea of the scope and intensity of the program.

Before going into details of the program, let me describe briefly how the Agency goes about determining what items or projects will be included in it. Under existing directives, primary responsibility for the program is vested in the Bureau of Research and Development. These directives require all bureaus having anything to do with navigation, traffic control, communications, and related—I am referring specifically to equipment, facilities, and systems—promptly to advise the Director of the Bureau of Research and Development of any conditions or requirements which indicate a need for improvement or modification of elements of the system already in service.

Apart from this input of requirements, under other directives the Bureau of Research and Development prepares its own recommendations for revamping or incorporating new elements into the air navigation system, and follows a carefully spelled-out procedure for obtaining comments and reactions from all other bureaus and offices of the Agency affected by the proposed improvement or having a significant concern with it.

Under these directives, provision is made for any differences of position to be resolved by the Administrator and Deputy Administrator. A number of other normal administrative procedures of the Agency also provide opportunities to bring any problems to the fore. These include the annual budget review process, which provides an ultimate means of resolving differences among the bureaus as to any projects that a particular bureau desires, which may not have survived the selection procedures otherwise provided. I am talking about selection of systems to be incorporated in the final system after development.

The Agency also employs a monthly reporting system, in which each bureau reports its deficiencies and highlights, with the reports reviewed personally in combined form by the Deputy Administrator, at a meeting with the heads of all bureaus and offices. Anything a bureau head regards as a deficiency in a program receives a full airing in a meeting of all the Agency's top officials. Additionally, the status of all programs is evaluated on a quarterly basis, affording still another opportunity to identify and correct program lacks and deficiencies.

I would like to emphasize that these procedures provide input of comments or criticisms from personnel at all levels and in all phases of Agency operations including, of course, those who work directly in the air traffic control system. Personnel with controller background and experience on duty in the Bureau of Research and Development are assigned as members of evaluation teams in all projects involving facilities or programs affecting controller activities and operations.

Senator MONRONEY. Is there any way that the air traffic controllers, with their vast amount of practical experience, can be heard beyond the scientists who run the research and development section?

Mr. PYLE. Mr. Chairman, let me point out—and this I come to later in the statement, but I think this is the appropriate time to bring it out—that of the technical personnel in the Bureau, one in four has controller background. Point 1.

Point 2: The very procedures which I have just referred to insure an avenue of communications up through the ranks of the Air Traffic Manager of the Bureau to Mr. Thomas, and then to Mr. Anast, or in the case of any let's say discussion between them, to the Deputy or Administrator.

So I feel quite assured that there are adequate communications media for the controllers' problems, the practical input of the controller who has the day to day responsibility of handling traffic, that his suggestions, improvements, ideas, are cranked into the overall consideration.

Senator MONRONEY. In other words, a man with an air traffic control background working in the R. & D., if he did go to Mr. Thomas or you, would not be allowed to become persona non grata and be

suddenly transferred out of the Agency and back into the Idlewild Air Traffic Control Center with all of its confusion and long hours?

Mr. PYLE. Not while I have anything to do about it, Mr. Chairman.

Senator MONRONEY. I know the air traffic controllers working in that section will be glad to hear that. It is sometimes hard to go higher when someone in the development stage turns down an idea which one may be thoroughly convinced, from his long experience, deserves a careful second evaluation.

Mr. PYLE. I think this is very important, and furthermore, we cannot afford to overlook any ideas, any ingenuous concepts that may be dreamed up.

Now, we get a lot of them that we have to discard, but we want to look at every one of them.

The other day up at Atlantic City, I was very pleased to find that their complement of technical personnel, 1 in every 2½ jobs is a controller, or an ex-controller.

Senator MONRONEY. One in every 2½ jobs?

Mr. PYLE. The technical jobs up there, the man has controller background, experience.

Senator MONRONEY. Fine.

Mr. PYLE. In other words, Mr. Chairman, it is my feeling that these procedures operate to insure the fullest opportunity to consider proposals generated in any element of the Agency. They also insure that the Bureau of Research and Development cannot, on its own, veto projects or improvements desired by other Bureaus of the Agency and that those Bureaus cannot, on their own, veto programs deemed important by R. & D.

To handle the many practical tasks of the Bureau of Research and Development, we have established what may well be the most comprehensive research center in the world devoted exclusively to aviation research in our fields.

This is located at Atlantic City and is being provided with every tool reasonably needed to support the current program.

These tools are either already in place or funds have been provided for their acquisition. Twenty-five aircraft from a Piper Tri-Pacer to various transport aircraft and military jets are part of this fleet of aircraft and, in addition, we have military aircraft on call—supersonic, KC–135s, and others—who come in and participate in individual tests in cooperation with the military services.

This aircraft complement has been provided for the necessary experimental testing.

The Bureau has already been staffed with over 1,350 of an authorized 1,600 personnel, including specialists in every phase of activity related to aviation, its operation, problems, procedures, equipment, and facilities.

In any program looking toward improved safety in aviation we must recognize a basic factor that greatly complicates our problems: the limitations of size, weight, and complexity for any piece of equipment intended to be placed on an aircraft.

Obviously, the ideal situation would be one in which ground equipment alone would do the navigation and traffic control job, leaving the flight crew free to devote its entire attention to operation of the aircraft.

I am afraid this is in the somewhat distant future.

Our primary aim today is to provide the pilot the greatest possible amount of precise information needed to takeoff, navigate, and land, and similarly to place the traffic controller in the best position to issue appropriate clearances.

An important area involves navigation. It goes without saying that proper and accurate navigation is still the best method of avoiding navigational accidents.

Anticollision devices might appear to hold much promise, but we must bear in mind that navigational accidents are not limited to airborne collisions. Moreover, the present state of the art does not make early development of an adequate device likely, whereas some significant developments in navigational aids have already been achieved and others are well on the way.

One promising development is the airborne VORTAC pictorial display. This actually gives the pilot a chart-picture of his position in terms of the geography below, in contrast with the needle and dial type of presentation he now has. This device was originally developed by the former CAA several years ago and is being marketed by manufacturers.

Perhaps Mr. Denicke could bring the two models that we have here. One is approximately a 12-inch presentation and the other is a smaller one which I think would be more adaptable, obviously, to general aviation use.

This actually works off the output or the signals from the VORTAC facility and it pinpoints your position on the map with real accuracy.

I have already mentioned DME—distance measuring equipment—which has now been available for some time and is, we think, of definite value. However, it is useless without airborne equipment, which has been installed on, as I pointed out, few civil aircraft at the moment.

At the same time, we must bear in mind that DME can be most useful only if all aircraft, not only carrier aircraft, are properly equipped. This poses the problem of developing airborne equipment suitable for use on aircraft smaller than those operated by the carriers—that is, for use by general aviation. We think we may have been successful in developing such equipment for early use.

Mr. Chairman, we have a model which has been developed of DME for use by general aviation. This is an important thing because, frankly, the cost of developing this is fairly expensive and we have therefore contracted for its development to assist getting a lower priced unit for the general aviation user.

Senator MONRONEY. Mr. Pyle, the DME equipment that would be used in the commercial carrier's plane would be in the neighborhood of $10,000?

Mr. PYLE. Could you answer that, Mr. Denicke?

Mr. DENICKE. Yes, sir.

Senator MONRONEY. So you can have several competing companies trying to develop a better or a more reasonably priced one in any of these fields?

Mr. ANAST. Yes, sir; that is the intent for spreading out the development.

Mr. PYLE. I also would like, Mr. Chairman, to point out that we had the same problem in the development problem in developing an airborne radar transponder suitable for use in general aviation. We have a development here, a model of which Mr. Denicke has.

I might identify Mr. Denicke as the Chief of our Requirements Branch of the Bureau of Research and Development.

Senator MONRONEY. This is for light aircraft, is it not, and then you have a larger transponder that is usable on the transports?

Mr. PYLE. Yes.

Senator MONRONEY. You don't have that here?

Mr. PYLE. We do not have a model of that here.

Mr. Chairman, the object, of course, is to develop one that would serve the purpose without being as complex—meet the various tight specifications which must be incorporated in air carrier type of transponder equipment.

Senator MONRONEY. This is just a civilian development of the old IFF—identification, friend or foe—that was used in wartime?

Mr. ANAST. This is an offshoot of the IFF equipment that was developed during the war. I might add that this still is a coordinated operation with the military and also internationally.

I would like to mention one thing, that the fundamental difference between this box and the transponder that is designed for the transport industry is that it will operate up to 15,000 feet and does not contain the technical provisions for operating higher, protection for the carriers operating above that altitude.

Mr. DENICKE. Yes. This is a commercial DME installation, and the list price of this is $5,800. This general aviation DME that has been developed for the Bureau of Research and Development weighs about 17 pounds and has been offered for sale at $2,250.

Senator MONRONEY. Thank you.

Mr. PYLE. I would hope, Mr. Chairman, that with its introduction, and hopefully a considerable number of purchases, this price might go down, as we get better development and more users.

Senator MONRONEY. Since it was developed by your Research and Development Center it can be licensed to several manufacturers who would be competitive in their efforts to attract business; is that correct?

Mr. PYLE. Yes; this is correct, but Mr. Anast might supplement that comment.

Mr. ANAST. This, like the general aviation transponder, was supported by the FAA in principle because we felt that the industry needed stimulation, otherwise the FAA really is not involved in the development of airborne equipment.

In these particular cases it was felt there was a need. In both cases of the development of the DME and the general aviation transponder we have made arrangements contractually so that all information is made available to all interested manufacturers in order to stimulate full support of aviation.

Senator MONRONEY. The patent rights, then, would rest with the public—there would be no royalty charge for their development?

Mr. ANAST. In these particular cases we have endeavored as a matter of principle to keep control of patents in order to protect aviation if it needed protection.

Senator MONRONEY. But it does not throw a burden on the manufacturer. He has the right to use these patents as long as they meet the specifications?

Senator MONRONEY. I see.

On this. I have heard from some people, who I think are well versed in the electronics field, that in the gap which we will have probably for several years between waiting for three-dimensional radar, that this could be manually set to give two codes at the same time: One, the identification of the plane, and then follow this by a code showing the altitude that the plane is flying.

Mr. PYLE. Mr. Chairman, without imposing on your time it might be helpful to get in on the record for yourself and for Senator Engle, if Mr. Thomas could perhaps give a brief description of some of the problems we have in the beacon area, the use of the beacon codes and so forth, it might be helpful. Could this be done?

Senator MONRONEY. Yes, sir.

Mr. THOMAS. Thank you, sir.

If we may——

Senator MONRONEY. I might say I am glad the electronic systems of the FAA seem to work better than the electronic facilities of the Interstate Commerce Committee.

Mr. THOMAS. We found it, Mr. Chairman; I had the switch off. [Laughter.]

We have some photographs which I think might be usable in connection with the transponders. These were photographs taken at Atlantic City by R. & D. They are a series of three photographs, one of which I will identify by a picture of a scope that will have a great number of dots on it.

The picture on the left is what we call fruit or interference. It can be identified with the time being shown as 1020 and 1021 taken on September 16, 1958. The top photograph has a lot of lines, material that looks like snow, and other types of video interference which is actually interference from too many beacons operating in the system without any way of suppressing the interference.

The bottom photograph shows the interference suppressed or defruited, as we would call it. It shows the difference in the display when the interference has been removed.

The second——

Senator MONRONEY. This is interference from what source?

Mr. THOMAS. From other beacons. This is purely beacons; this is not primary radar in any sense. The same number of beacon targets operating in each photograph.

As a matter of fact, the way most of our scopes are at the present time is this way: there is a development which we have at some locations—we call it defruiting—and this takes out the unwanted interference between the airborne beacon system that show up on the scope, with too many beacons on. If the interference cannot be eliminated it can ruin the scope so that the controller cannot read anything.

So we have to have very careful control of the number of beacons and the modes in which they operate.

Now, the second picture I will identify is a single beacon target and it has a wide clutter running generally from the northwest corner to the southeast corner. I will identify it—in the bottom over degrees it has 10, and a 5 showing after that, and a large amount of clutter. This is a time exposure of a single beacon target transmitting across the scope. There is no sizable suppression operating at this time. By side of depression, as you know, the raw radar, primary radar triggers off a transmitter in the airplane which returns this. That is why we call it transponder, and the side lobes of the radar can carry it off at more than one spot. This gives us a very broad return. When it gets close in it goes completely around the scope and this is what we call ring around.

This is a picture of what one target does as it progresses without side lobe suppression. The only one that I know of is now operating at Atlantic City. It is not now available although we are getting it as fast as we can. As a matter of fact, only in December did we get an agreement from the British on the type of side lobe suppression that will be used so that we now can consider it for the airborne equipment and the ground equipment as well.

The third photograph will show a single narrow band which is identical transit of the scope by an aircraft, but with the side lobe suppression feature installed. You can see this is a very neat and reasonable target to follow across the scope.

Now, under the present system we have three types of airborne beacons now operating and three types of ground systems now operating, each of which reacts with the other one slightly differently. We have the basic Mark 10 system which is the only IFL which is operating in some older aircraft. We have boarded on this system and are using it on the ground. We have the Mark 10 selective feature which is military and on military aircraft, and we are operating this on the ground.

Then we have the ATC radar beacon system operating in a few locations and the transponders that were displayed here today operate in that scheme.

The military mach 3 and the Civil Code A are identical and therefore the two are compatible, but with the equipment the identity and the display for the controller is quite different. So, we are some ways away from standardization, although by July 1 of this year we hope to have all the basic Mark 10 out of the system by agreement with the military.

Now, I would like to show how the beacon display looks on an active radar position, if I may.

Here, and I will send up some photographs of the New York scope which is a combination of raw radar and beacon presentation, this is an excellent scope presentation. There is no precipitation. There is a normal amount of clutter and it is about as good as we can get. It is a presentation of the FPS 8 at Idlewild as used in the center, and it shows the New York area with the large white illumination in the center being the ground clutter around Idlewild itself.

Senator MONRONEY. You say that is ground clutter?

Mr. THOMAS. Yes, sir.

The other dots on there may be ground clutter; they may be aircraft. It is rather difficult to tell from this photograph. Some of them that

show a blur are obviously aircraft. Some that do not show the blur may or may not be aircraft.

Senator MONRONEY. Is this transponder aircraft?

Mr. THOMAS. There are some of both on there. If you would look to the northern portion of the picture there is a rather large series of dashes right in the north central portion. That is a transponder equipped aircraft. It is not opening on the code that is selected at this particular time. I don't know what it is operating on. It is just some other code.

If you look almost straight across the picture at the bottom you will see two slashes together and that is operating on the code which was selected at that particular time; apparently the only aircraft so operating at that time.

If you will look northeast, there is a big blot, and I can't tell from here where the identity is, or whether this is a blur. This could be an aircraft identifying at this time because this is the way it appears—

Senator MONRONEY. In other words, when the area radar man asks flight 123, United, to identify itself, it lights up and fills in the space between the horizontal lines on the scope; is that correct?

Mr. THOMAS. On this particular scope. It does differently on different ground installations, but on the ATRBS it is obviously the one on the code, the parallel slashes, it would fill in between them, you would get one big solid illumination.

Senator MONRONEY. Then, the second code on the transponder would add clutter. When the plane identified itself, instead of just giving its number and acknowledging the call, he would give his altitude at that time to the air traffic controller and he would then have some idea of what altitude this identified target is at, would he not?

Mr. THOMAS. No, sir; not without voice communications.

Senator MONRONEY. That is what I mean, though. When he tells him to identify himself by voice communications, I am sure the pilot would say, "Roger," and he could say, "3,000 feet," or whatever altitude he's at, to give some indication of the altitude, couldn't he?

Mr. THOMAS. Yes, sir; he could.

However, we are not having trouble with the altitudes of the aircraft identified, it is the ones not identified that are giving us the trouble.

Senator MONRONEY. If he is at his altitude he is supposed to fly, the controller knows it.

Mr. THOMAS. We have to assume the pilot is flying the altitude he was assigned.

Senator MONRONEY. Was he on the letdown? He would be descending in this picture we have here, would he not, either descending or taking off?

Mr. THOMAS. He could be; yes, sir.

In this case, the controller knows the altitude limits to which he has been assigned, that he was cleared to leave, and he was cleared to land, and he knows he is some place in between those. If he needs information in the intervening time, of course, he can ask for it.

What I was trying to point out is that it would be technically possible—as a matter of fact, we are considering it—quoting altitudes with a beacon return. Right now we have no way of displaying this and we are not quite certain, since the controller can only decode one

particular band or specific setting at a time, precisely how this would be displayed.

In addition to this the controller frequently will turn over the beacon simply to clear his scope up, because as it gets extremely cluttered by too many beacon returns, or if you will notice these wide blobs in the area on the scope, since the scope is 160 miles across, one of these blobs is about 3×7 miles. This could cover all raw radar targets.

Additionally, we don't know where the aircraft is with relation to the target unless we can see the controller radar with it. There is a development to mark this which is not yet in the system.

Therefore, the controller frequently, in order to do precise work, will turn off the beacon in order to get a clear picture. He will turn it back on and use it as required. It is an extremely useful tool under the supervision of a controller to use it as they need it. It can be a damaging tool if it is used unwisely.

Senator MONRONEY. In other words, he can work the target either with the transponder or if he wants to know the actual position of the plane he can still pick it up in a light, relatively small-sized pip by flipping the switch; is that correct?

Mr. THOMAS. Yes, sir; this is correct.

Senator MONRONEY. So you would therefore cut out all transponders as you flip the switch to eliminate the transponder reception, then you pick it up only on the reflection of the radar people?

Mr. THOMAS. Yes, sir, he can operate his scope so he gets all transponders on any code. He can operate his scope so he gets only those which he has preselected and would not see any of the others. Or he can turn them all off and look at raw radar. He uses this all three ways, depending on his situation.

Senator MONRONEY. He goes back and forth, I presume?

Mr. THOMAS. Yes, he does. However, I am not too hopeful at the moment that we will immediately have a way of tying altitude into the transponder at this plane. It is too early.

Senator MONRONEY. Do you have a question on that?

Senator ENGLE. No, sir.

Mr. PYLE. Mr. Chairman, the point that I think is important in this discussion is the fact that the beacon has tremendous promise but it is still in the relatively middle stages, let's say, of development, and there are only very few properly configured installations in which we can make maximum use of this facility.

Mr. ANAST. The development of the beacon has been going on now for over 10 years. There are several features which will culminate this coming July and we hope to finish by October.

One is a marker for the center. If you note you cannot tell exactly where the echo is or where the aircraft is.

This is under development and will be finished this fall.

Then the altitude feature. I think you were referring to that earlier. We have two separate developments there. One at the P loft, so to speak, from the earlier military development. There is a development sponsored here following FAA studies and also there is a development in England by Smith's Automatic Pilot Co.

All of those developments will have been finished by this fall and ready for recommendation for national use.

Senator MONRONEY. The question has arisen several times if we were able to develop this on antiaircraft fire to determine the altitudes during the war, why is that system not now used? I am sure there is a good reason for it but I would like to know what it is.

Mr. ANAST. If I understand you correctly, the antiaircraft capability during the war detected aircraft by determining the distance upon which they were pointed almost directly upwards. It was reading the distance; if you go a high enough angle the distance was the altitude. That was not a feature that was in the beacon.

I am sorry, I don't understand your question.

Senator MONRONEY. In other words, for antiaircraft fire direction on Navy ships and others, you had a vertical reading, at least, in which the fire was directed by determining through this vertical radar the approximate altitudes, and the question has arisen several times, why isn't that system applicable to civilian use now?

Mr. ANAST. It is applicable and those features of the military developments have been incorporated in our own three-dimensional radar which we are testing at the moment.

To speak specifically to your point, radar which is directed toward a particular aircraft, as is contained in the antiaircraft system, is useful only to give you information on the one particular aircraft, and for air traffic control in general you wish to know the information on more than one aircraft.

Senator MONRONEY. I see.

Mr. ANAST. Over on the corner here is a very small model of the three-dimensional radar that is under test at the moment at Atlantic City. This is a pretty large operation. It is 165 feet tall. That height is necessary in order to give the accuracy or the discrimination between targets at 50 miles.

Senator MONRONEY. This is the antenna here?

Mr. ANAST. That is the antenna. You will notice this is a triangle and these triangles are formed by wave guides, all in parallel, so to speak, of horizontal linings and there are about 30 miles of wave guides in there and all of these connect to, I would say, 500 or some wave guides upon each side.

Now, each one of those wave guides is connected at a particular place to a receiver, and there are over 100 receivers on the ground that connect.

Now, in principle, without going into great technical detail, this furnishes a receiver that has fingers in the air, each 0.19°.

Now, to translate that out to 50 miles away from this radar, that gives a finger whose width is 1,000 feet, so that an aircraft who is illuminated by one of the standard FAA radars reflects the energy back from that radar and is received down through one of these fingers, thereby giving us information on which vertical angle he is and by knowing the range we can calculate out the exact latitude within a thousand feet.

This probably is the most precise radar, three-dimensional radar, in existence. It passed its first technical tests here last month, the 13th, and successfully read the altitude of a Piper Cub at 4,500 feet out to 20 miles.

We were very heartened by this development. We have stepped up the testing and are planning now for an accelerated prototype as a result of these early successes on the radar.

Senator MONRONEY. It did not have a transponder?

Mr. ANAST. It read it right from the aircraft itself. That might please Mr. Engle.

Senator MONRONEY. Mr. Engle will be glad to know that.

Mr. ANAST. We were going to start our tests in March and we actually were able to start the tests in February. It is rather a pleasure for and R. & D. fellow to talk about something ahead of schedule, but this is a little ahead of schedule.

Senator MONRONEY. What kind of a screen does it portray on?

Mr. ANAST. We have three different ways in which they can be displayed, all of which we know have some use to air traffic control. We will actually furnish the first model with several displays involving different principles and then through operational usage determine the final one for national use.

One of the displays would be what is known as the azimuth elevation that you see in the GCA scope, where you see one echo from the top and also from the side, and they are joined by a cursory line. That is known as the azimuth or the GCA type of display.

Another kind which is featured by the military in the SAGE development is the PPI display you see here, along with the information you will see a tag, such and such aircraft at such and such an altitude.

There is another kind of display in which the picture is shown from the top and around the edges another echo is shown whose distance out is dependent on the actual height.

So, there is not very much information gathered either by usage on three dimensional displacements but we will take three tracks and let the one emerge which has the most value to the traffic controller.

Senator MONRONEY. Obviously, you will never be able to present for the reading of it a one visual operation showing three dimensions?

Mr. ANAST. No, sir; this is one problem that is not yielding an answer through research and development as the so-called universal, three-dimensional display.

Senator MONRONEY. What priority do you place on three-dimensional radar?

Mr. ANAST. Top.

Senator MONRONEY. Proceed.

Mr. PYLE. Mr. Chairman, in that connection, perhaps I am sticking our neck out in this area, but it might be possible to have such a radar in operation in the New York area somewhere between 18 and 24 months. Before the tests proceed as we hope they will, based on our initial success, this does not look impossible.

Senator MONRONEY. And New York would be chosen because of its high density area as the place perhaps most needing it?

Mr. PYLE. Well, I think it probably could get a better reading out there than any place else.

Senator MONRONEY. If it would work there it would work anyplace.

Senator ENGLE. Would that give you the type of positive identification I was talking about yesterday?

Mr. ANAST. I will try to answer your question. I will go around it a little bit, Mr. Engle.

In the case of three-dimensional radar you are able to put a cube of space around a particular aircraft and thereby facilitate identity. In effect you can put a cube of space which is, oh, maybe a tenth of a mile

long, perhaps several hundred feet in depth, and perhaps a quarter of a mile in width.

Now, if you follow this, then you are able to maintain a track within your system of automatic tracking.

Now, we are unable to do this very successfully today because tracks, we are not able to tell their altitudes, and when tracks cross they can exchange their identity quite easily. As a matter of fact, even in our most sophisticated systems today the percentage of track retention capability is somewhat below a hundred, enough below a hundred percent so that there is some difficulty in using it as being fully reliable for air traffic control purposes.

Now, with three-dimensional radar available the tracking improves, goes from perhaps a 70 percent to a nearly 100 percent, even above 99 percent, so that you don't need, in principle, as times goes on, the necessity for a complete identification as you go. You put a tag on a target and you can rather depend on it staying there throughout its course of control.

I don't know where I have been responsive to your question.

Mr. PYLE. Senator Engle, I think one point—perhaps we are awfully close to this and we may explain this in rather technical terms. What Mr. Anast was referring to was the ability of the traffic control computing to follow this track. When the tracks cross without altitude information, do get mixed up and the computer can just as well charge off on the wrong airplane thinking it has the right one. If you get altitude information that would be obtained from this radar then the computer can retain the identify of the aircraft and even though they cross it could continue to follow the correct track. I think this is the point he was trying to make.

Senator ENGLE. The answer, then, is "Yes."

Mr. PYLE. Yes, my apologies. [Laughter.]

Senator MONRONEY. You may continue, Mr. Pyle.

Mr. PYLE. It is, of course, obvious that the existence of such equipment will logically raise the question of requiring its use. As we all know from experience, the problems of creating equipment are sometimes matched by equally difficult problems in requiring its use.

Continuing now with navigational aids, I would like to stress that improvements in existing facilities and equipment are also an important part of our program. In this connection, a Doppler VOR which greatly increases the accuracy of VOR signals has already been developed and is being introduced into the system.

Senator ENGLE. May I interrupt to ask a question before you get beyond the point?

Mr. Chairman, would that be all right?

Senator MONRONEY. Surely.

Senator ENGLE. How much do you talk to your controllers about this—the fellows who are sitting right out there on the scopes—when you are developing this information?

I have information that after the New York accident 45 controllers in the Washington tower signed a letter protesting the twin feeder fix operation in Washington, describing the method of operation as frightening.

Do you sit down and talk to those people?

Mr. PYLE. Senator Engle, I would like to answer it this way, and I would like also to have Mr. Thomas, who is Director of the Bureau of Air Traffic Management, respond further to it.

I think the answer to your question again is "Yes," we talk to them a tremendous amount. I imagine I have visited pretty closely all of the facilities that we operate, at least every airport which I have flown in or out of; either center, tower, or even communications facility for that matter. I think this is most important to keep a quick, easy line of communication available for thoughts coming in from the actual fellow who has the problem, the responsibility, and the practical experience of handling traffic on a day-to-day basis. This, through the Bureau, into the Bureau of Research and Development, is pretty much a channel of communications.

Now, with respect to the specific point which you raise about the complaining controllers, perhaps Mr. Thomas could explain that.

Mr. THOMAS. Yes, sir.

First, I would like to say that even last week we had all chief controllers in the United States and its possessions at Atlantic City showing them these things in a 3-day conference, just to go over in great detail some of the material we have touched on now.

There was a complaint by the controllers in the Washington tower regarding the entry of aircraft into the McLean and the College feeder fixes here in the Washington area. That was addressed to the chief controller of the Washington tower.

When it was first observed, the center started separating the aircraft by 500 feet on entry. There was no problem with them once they were in the stack, but it was the entry into the shack that worried the controllers.

When we heard about this we abolished the use of one of the stacks.

The action taken by the controllers was quite proper. Anything that they see that they do not like they should ask that we do something about it and we will do something about it. This one happened to get a great deal of publicity. I think the controllers were right in asking us to do something about it and we did something about it.

Senator ENGLE. Well, I am glad to hear that. I know hitting those fixes is hard and I understand that these controllers have said that airplanes overshoot the fixes. I was coming in here one night with the Air Force and we were told we were 5 miles east where we said we were. So they must have had a pretty good radar sight on us. It seems to me those fellows sitting out there sweating in that control tower—and I have been out there—you get a pretty good idea of what is going on and it gets them scared, and I am just in hope that the people on the top level listen to those fellows who are right down there with that all the time, because they know when dangerous situations develop, and they just hope that they don't get into a collision. But when they start talking I hope that they are listened to and that they are not gotten into trouble over it. I suppose that it could be regrettable.

There ought to be some direct liaison, so when these controllers get real uneasy about something and come up and start talking that people at the top would listen to them a little. I hope so, anyway.

Mr. PYLE. I agree, Senator. This is a very important thing. We can leave no stone unturned.

Senator ENGLE. What do you pay those controllers, by the way? About what do they get?

Mr. THOMAS. The average at Washington gets more than most, as a matter of fact. The controllers out here on the average are grade 12—11 and 12. The chief controllers are grade 14. I will have to look this up, but it is around $8,000 or $9,000 for the controllers and a little more for the chief controller.

Senator ENGLE. Do you give them an extra allowance for tranquilizers? [Laughter.]

Mr. THOMAS. No, sir.

Senator ENGLE. From watching them out there a day or two I suspect that they might need it.

Mr. THOMAS. The entrance grade as a trainee is grade 6, $4,830 a year, which they go to assistant as soon as they complete their training in 6 months, with $5,885, grade 8. The working controllers out there are 10, 11, and 12, that's from $6,995 to a grade 12, $8,995; 14, $10,635; Chief Controller, 16, $12,210 per year.

There is one thing I would like to add. This Washington stack problem was really a local problem more than it was a national problem. It did become national, but we are changing our organization to give more authority at the area level so that these problems could be handled directly and immediately and I should never hear about it, as a matter of fact. I should hear about the ones that are problems, but the problems should be solved at the local level.

Mr. PYLE. The point being, Senator, that the area supervisor would move in right away and correct it, there would be no problem.

Now, Mr. Chairman, if it would not be out of order I would like to respond to a point that Senator Engle has brought out because it is an important one. That is the matter of stress and strain under which this personnel work. We are very much concerned about it. We have instituted a complete program in our medical research program directed by Dr. Goddard of the Bureau of Aviation Medicine to get into the conditions of work, hours of work, the stress, the fatigue factors, all those things that add up to how long should a controller actually be on duty. Also, the very serious problem of retirement. It may well be the stress and strain of this job is such that the controller should be afforded the opportunity or he should have available to him, the option of retiring at an earlier date with full retirement privileges under the Government system.

I consider this a top priority program and one that is very important.

Further, we are buiding new center buildings. There is one at Oakland, actually; one going in at Los Angeles. They are designed to give the controller the best working conditions in which he could possibly do his job, perform his mission. Now, the expenditure for the building alone runs about $3 million. Now, there are wonderful facilities, the noise level is low, the best of communications equipment available, all scientifically engineered to enable him to do his job properly.

Lastly, we have got a program now in being, strictly a test or an experiment, in our Washington tower, whereby the controller is on duty actually only 6 hours, 1 hour for briefing—what is the situation in his setting, what are the NOTAMS he must know, the bulletins

that have come in since he has last been on duty. There are about 400 of these over a year period, better than 1 a working day. All this he would have the opportunity to do on Government time in a period of relative relaxation in a briefing room or something.

The same way he would be given an hour at the end of his shift to brief the controller that is coming on to take his position.

Now, this is something that we feel may be a requirement and we are feeling our way into this. This is strictly an experiment now. But we are not blind to the problems that the controller has. It is a serious one. We have to do something.

Senator ENGLE. Thank you very much.

Senator MONRONEY. I can't say too much for the work these gentlemen do, and I have been rather reliably told by people I believe know what they are talking about, that despite the great electronic help and the other devices, the greatest improvement in the New York area was the placing of a rug on the floor which lowered the sound level in which these people had to work. Sometimes when we search—and I have certainly supported scientific research—sometimes some of these answers can be found in very, very simple ways to make them much more efficient and effective in their job.

Mr. PYLE. I couldn't agree more, and I think some of the conditions under which the controllers have to work are just a disgrace. It is that simple. You just have to go into the Kansas City center to see that.

Senator MONRONEY. Did LaGuardia move that beaten-up World War II control tower by barge from Newark and are you now keeping the control tower operators cooped up in that one?

Mr. THOMAS. Yes, sir. [Laughter.]

Actually, though, Senator, the World War II Army tower that was moved from Newark will provide better working conditions than the tower now at LaGuardia.

Senator MONRONEY. That is faint praise, though, isn't it?

Mr. THOMAS. This is so they can take bulldozers to get rid of the building and build a new, modern tower. I think the one at Newark is the best in the world. This is a stopgap measure to get good facilities into LaGuardia.

Senator MONRONEY. Will that be expedited in the construction or will it have to wait?

Mr. THOMAS. So far we have been very fortunate in getting that material. I don't believe we will have this problem.

Mr. PYLE. Mr. Chairman, you mentioned the New York center, and I was pretty proud of that when I first came with the CAA, but it is loud compared to the noise level in the new center buildings which have been scientifically, acoustically designed to lower the noise level to the point where I am amazed, you can hear a pin drop.

Senator MONRONEY. I am glad to see that you are paying attention to these little details. In the old days when the control tower operators were under the thumb of Commerce you were not able to upgrade the man according to the density of traffic. Under FAA this has not occurred and is beginning to be appreciated, is it not?

Mr. THOMAS. Yes, they are graded by the volume of traffic they handle.

Senator MONRONEY. Before that they were not. Generally speaking, they were all practically at one traffic control level, regardless of the strain and the stress of that particular job?

Mr. THOMAS. That is correct.

Senator MONRONEY. I want to compliment you on getting that done.

Mr. PYLE. This has been a battle, Mr. Chairman, since 1956, when I first came with the Agency to get things straightened out.

We have more homework. We have problems in other areas; electronics technicians are another problem. We may have to get your support in reasoning with the Civil Service Commission to realize the problems with which we are faced to insure that these hard-working and devoted people are properly paid.

Senator MONRONEY. Yes. You may continue.

When we finish this air traffic control we will adjourn. There seem to be only two paragraphs of your statement and you go ahead and read those.

Mr. PYLE. We are also trying to improve communications. Radio voice communication is commonly assumed to be near perfect, but this is not the case. We have serious problems of range, interference from other frequencies, static, fadeout, dead spots, and so on. The very volume of voice communications is a problem, and it is, of course, because of this that we are seeking to do this by automatic techniques, the AGACS system to which I referred.

I also think it is important to point out that we are trying to do day-to-day improvements in the system which are not revolutionary in their concept.

Mr. Chairman, that would take us up to air traffic control.

Senator MONRONEY. And we will prepare to recess.

One thing I would like to say, though, is something I am sure you had in the higher density airports, but other airports have become more and more crowded to where it is continual bedlam as the control tower is giving instructions of incoming and outgoing traffic, and I think the thing you have instituted in even smaller airports of having them switch to ground control and take another frequency to eliminate this extra heavy load of the ground taxiing instructions from the instructions for the pilot when he is airborne is a very great help in smaller airports than the high density ones.

This has facilitated and left the air time and the radio time a little less crowded for the incoming pilots to get their landing instructions.

I think this is a very great step forward.

Mr. PYLE. In this connection, Mr. Chairman, we also have now at Washington National, Idlewild, and other high density airports, a channel for the sole purpose of delivering and reading back clearances, and this, of course, takes the strain off the ground controller. He is directing traffic on the ground, naturally; the local controller position handling the air traffic.

Senator MONRONEY. That leaves that wave length free for air communications to be less crowded and less jammed so you don't have to wait 5 minutes to get in contact with the tower.

Mr. PYLE. That is correct, sir.

Senator MONRONEY. I think that is a very good step forward and I am glad to hear it.

This committee will stand in recess until 2:30 this afternoon.

(Whereupon, at 12:20 p.m., the committee was recessed, to reconvene at 2:30 p.m. of the same day.)

AFTERNOON SESSION

Senator MONRONEY. The Aviation Subcommittee will resume its hearing.

Prior to our recess at noon, we were down to page 18 on "Air Traffic Control." You may proceed.

Mr. PYLE. Air traffic control: The problem of research and development in the area of air traffic control resolves itself into two major aspects; namely, the best possible traffic control system and the best possible equipment for operation of such a system. The limitations of the one will reflect the limitations of the other.

We would like first to develop those mechanical aids which give promise of early assistance to the traffic control system as it now exists or could readily and simply be adapted. Our long-range plan is to achieve what might be described as revolutionary kinds of equipment, tools which will make practical a far better system of air traffic control that today would be considered visionary.

In considering research for air traffic control, it should be noted that the basic needs the system now faces are twofold—tools to store and process the information we are now capable of getting as to the location, destination, speed, et cetera, of flight operations, and second, tools to increase the amount and precision of such information. In the latter connection we have already mentioned DME, VORTAC pictorial displays in the cockpit, and improved communications.

As for the first problem—how to handle the workload on the ground—we also think we have made significant advances. We are trying to cut down the paperwork and computations which must now be handled by traffic controllers manually. This would not only leave them free to concentrate on their primary duties but would eliminate possibilities of error.

In its ultimate form, the Data Processing Central, DPC, would be able to digest every conceivable type of information that would be helpful and come up, practically instantly, with the answer to any problem presented to it. It would continually process information automatically fed into it and give continuous information as to the location of aircraft, their speed, estimated times of arrival over checkpoints, their altitude, their weather environment, other aircraft in the vicinity, and so on.

I think, Mr. Chairman, what I am really describing is an automatic and effective assistant controller. There are the manual functions which you could almost characterize as the bookkeeping functions. The controller is still the keystone around which the system is built. His judgment as a human being and his commonsense we always will have to rely on.

Senator MONRONEY. But this is a new form of adding machine, comptometer, and everything else that will, comparable to office work, assist in doing the laborious duties by mechanical means?

Mr. PYLE. It is tailor made to meet the controller's requirements.

As a sort of stopgap measure, the Agency early in its existence sought to adapt computers already in existence. Commercially avail-

able computers were obtained and have been installed for some time in a few of our busier air traffic control centers on an experimental basis.

Operation of this equipment has been valuable in showing that special ATC computers are practicable and can be smoothly integrated into the current type of operations pending development and availability of the full DPC system.

We have already developed a new, semiautomatic air traffic control system computer now being tested at Atlantic City. It can handle most of the traffic controller's bookkeeping functions and is scheduled for operation in the new Traffic Control Center when it opens in October of next year.

Senator MONRONEY. Are you going to build that yourself or will that be built by somebody else?

Mr. PYLE. This will be built under contract by the General Precision Laboratory, Librascope, which is a division subsidiary of that company.

Senator MONRONEY. They build according to the design of the Atlantic City R. & D.?

Mr. PYLE. It is a transistorized, special-purpose computer.

Senator MONRONEY. You do not expect any more slippage in this date?

Mr. PYLE. No, sir.

I would like to point out, Mr. Chairman, that it is interesting that the estimated workload saving of the phase 1½ computer—this is what we are talking about in Boston—is about 50 percent, the saving to the controller of these various functions. Specifically, the radio controller, 29 percent of his time becomes then available by the application of computer techniques, becomes available for the duties; radio controller, 44 percent; position D controller, 25 percent; assistant controller, 57 percent. Of course, this has implications of savings in manpower in addition to giving the controller a valuable asset or tool with which to work.

Senator MONRONEY. He will have a little more time to watch, too, instead of figuring.

Mr. PYLE. That is right.

Our efforts have also been directed toward improving present-day equipment and making new and better versions. For example, we have made improvements in existing radar to give better definition, a brighter picture, more accurate estimates of speed and distance, and so on. Another major project has been three-dimensional radar, which we have already discussed.

Some types of information are particularly important to the efficiency of a traffic control system—aircraft identity, position, direction of flight and altitude. Actual altitude is not directly available to the controller today. Its availability depends upon information conveyed by the pilot, and of course we need this information from ground-derived sources.

This is what we call our airport height surveillance radar, AHSR, which is the model here.

We have already discussed the radar beacon transponder system installed on many military and air carrier aircraft. We have a major program underway for improvement in this beacon system. One of our goals is to obtain altitude information in a form which could be coded and transmitted automatically.

One of the seemingly promising areas for collision prevention is development of an anticollision device. However, in keeping with our approach to do what we can rather than wait for the ultimate in perfection, we have not concentrated simply on anticollision devices. Such devices must necessarily be looked upon as a last-resort approach to the problem. We must therefore concentrate on the establishment and operation of an air traffic control system which would preclude the need for such devices. Thus, our emphasis has of practical necessity been on this approach.

Frankly, we do not now have an effective anticollision device, so we cannot turn the problem over to a machine. Many types of devices have been suggested, and many theories offered as to how existing knowledge might be applied to develop such devices. The only difficulty is making them work as a practical piece of equipment.

Within a year we will have completed experimentation with an infrared warning device. In this connection, we may point out that we have analyzed many proposals for anticollision devices. One of our exhibits contains a list of 62 companies and 64 individuals who have submitted proposals for such devices. We will be glad to give the subcommittee any information it may request concerning our evaluation of these proposals.

Senator MONRONEY. I see you have an anticollision device here at the table.

Mr. PYLE. Yes, sir.

Senator MONRONEY. Someone may get the idea that this is ready as off-the-shelf equipment and wonder why it is not required. I think we had better have testimony on that.

Mr. ANAST. The large box that you see on the left, this is one-third of a piece of equipment developed by the Bendix Corp., originally started under the auspices of the Air Force and continued by the FAA. It is now being sent to our Atlantic City Test Center where it will undergo tests for the next few months.

It is known as a full collision avoidance system in which it evaluates the threat of potential collision and notifies the pilot to make an escape maneuver.

I might say that the principle on which this is based is not to determine the angle, the azimuthal angle at which the threat appears, but to go by a more stringent criterion, a more easily determined criterion, the range and the rate at which the range is decreasing. This becomes a fairly sure-fire indication of the potential collision.

Then, at the appropriate time, some 40 seconds in the case of fast-moving jet aircraft, it will notify the pilot to make an escape maneuver.

In this case the escape maneuver is either up or down.

Next to it you have a device which was developed by the Motorola Co. for the FAA, which is known as a pilot warning instrument.

On this display here, in very rough terms, notification is given to the pilot of the distance within 5 miles, and the azimuth within 30° of a potential collision.

This operation is based on the necessity of equipment being in the other aircraft as well. It is a cooperative system.

The infrared system which Mr. Pyle mentioned is now undergoing development and will be available in about a year's time, fully tested, and is based on the determination of the infrared radiation content

of the light, the anticollision light which is in our standard aircraft today.

This, again, is a cooperative system. In every case we have found it necessary, in order to get the data that is required, to use cooperative equipment. This requires equipment in each aircraft.

Senator MONRONEY. The big one requires equipment in each aircraft as well?

Mr. ANAST. This requires equipment. This is a system requiring equipment in the other aircraft. We determine the altitude by bouncing one of the signals from the ground, which makes it a slightly longer path measuring that distance and thereby determining the altitude.

Senator MONRONEY. This would not warn you of the approach of a nonequipment plane?

Mr. ANAST. In no case would you get warning from a nonequipped aircraft.

In finishing my comments on the anticollision problem, from an operational standpoint, it is very difficult to conceive of a total system based completely on anticollision devices, which is the reason, as Mr. Pyle mentioned, for the concentration on the ground control system which knows something of the intentions of aircraft. One of the fundamental pieces of information that is missing in the case of independent anticollision devices in the air is the knowledge of intention of the other person.

Senator MONRONEY. Would these be useful? I know that the smaller one would not appear to be useful in the area where the collision incidence is greater, that is, coming into a crowded airport. You will have a warning, say, at 5 miles and at various degrees, but that would be lighting up like a Chistrmas tree coming into New York.

Mr. ANAST. That is correct, Senator. As a matter of fact, we have likened it a little bit to cars passing each other on the highway very, very close, not creating a collision hazard, but so close that if you had no other information except proximity you might get the idea that you would be in a collision.

Senator MONRONEY. It might be a hazard as well as a blessing. In any crowded traffic area, the pilot would have lights all around the crowded spectrum.

Mr. ANAST. Yes. We are afraid, also, of a correction signal possibly creating more hazard by going toward another group that is not detected by your anticollision equipment.

Senator MONRONEY. You may proceed.

Mr. PYLE. I think, Mr. Chairman, one point that we must all bear in mind: Whereas this effort is being given a tremendous amount of attention, one of the leading manufacturers, another manufacturer, thought they had a pretty good system, and even went to some expense working on it only to admit it was beyond the state of the art and gave up.

So, we have a very, very complex problem here. I think we are only kidding ourselves if we say that this is something we can solve simply. We can't.

Senator MONRONEY. Before you get too far away from the data processing centers: What happened to the six that were authorized

by Congress for fiscal 1961, and what about the six that are proposed for fiscal 1962?

Mr. THOMAS. I think, Senator, you are referring to the business-type machines that we are using in the centers. The six that have been previously authorized are in operation. There are no plans now to expand the present business machine operation.

Senator MONRONEY. These are off-the-shelf computers adapted with minor change to the air traffic control processing?

Mr. THOMAS. Yes, sir. These are very standard business-type machine computers. They were not designed for traffic control in mind.

Senator MONRONEY. That was money that was available in fiscal 1961, is that correct?

Mr. THOMAS. Yes, sir. Those are rented equipment. They are not purchased equipment.

Senator MONRONEY. In 1962, the money you will ask for and get in the budget will be for the specialized R. & D. developed computers?

Mr. THOMAS. Yes, sir; insofar as purchase is concerned, and for the continued rental of the present equipment.

Senator MONRONEY. You will purchase the ones of your own design and rent the off-the-shelf ones; is that correct?

Mr. THOMAS. Yes, sir.

Mr. PYLE. Mr. Chairman, I think it might be interesting, in connection with your inquiry about the commercial-type, business, off-the-shelf computers, to have just a brief comparison between Librascope computers as compared to the others.

Mr. ANAST. It is very difficult to compare digital computers. There are various ways in which this can be done. I think in the case of the Univac computer, which is the business machines in use in the six centers at the moment, to compare it with the computer that was developed for air traffic control computation by the FAA, that you can say that is is from 40 to 100 times faster as far as its computational ability in adding and subtracting, multiplying, dividing, and so on.

It has an access to its memory which is several hundred times faster than the Univac machine, and it has a capability of storing some 500,000 words, which is a part of the function of the computer to recall and store information with regard to flight plans.

Senator MONRONEY. Does it have the ability to detect a conflict in the system?

Mr. ANAST. Yes; it does. It is able to detect conflicts and to display those conflicts to the controller, both symbolically on his flight strip display and also pictorially on his radar and conflict detection display.

Senator MONRONEY. In other words, if in the filing of several flight plans you would get into the position of a near collision or a near conflict of traffic, this would show up in advance of the arrival of the planes on their scheduled course; is that correct?

Mr. ANAST. Yes, it would. In addition, it does that and also features a characteristic that permits the controller to take an A and C separation which appears on his console, and by pressing two buttons relating to the flight strips of the two aircraft which are in potential conflict, and transfer this information to a pictorial display and to indicate where they should be at the present moment. Then a radar display shown in conjunction permits the controller to go from A and

C to a radar if he can identify where the aircraft should be with his identity and where the radar shows aircraft to be. He can turn to radar operations.

After he has cleared the conflict by steering one past the other, or whatever action he may take, he then can return to A and C operation.

This particular feature, which uses radar as a device to relieve congestion rather than as the fundamental tracking device, is a unique feature of the particular development we have now.

We are also pressing the development and reprograming of the SAGE computer, so-called ANFSQ 7 computer, which was designed and is now being used for air defense. We have had a program for several years on trying to get maximum utilization for both air traffic control and for air defense purposes. We will finish significant tests on this computer, which is in Boston at the present time, by October of this year.

Senator MONRONEY. What has been the approximate cost of the data-processing central project?

Mr. ANAST. The development of the hardware has been approximately $27 million to date.

Senator MONRONEY. $27 million?

Mr. ANAST. Yes, sir.

Senator MONRONEY. Is it being shared by the military?

Mr. ANAST. The data-processing equipment, which is the mainstream of our development, is paid for entirely by the FAA. The work being done by the Mitre Corp. relates to programing on the same computer. It is paid for half by the military.

Senator MONRONEY. Have you made studies beyond the R. & D. of surveys regarding the capabilities of data-processing control?

Mr. ANAST. I am sorry.

Senator MONRONEY. Have there been any other surveys of the capabilities of this beyond your Atlantic City efforts? Has the industry been called in, ATA, airline pilots, air traffic controllers, as to the feasibility of this beyond those that are actually working in the Atlantic City installation?

Mr. ANAST. Oh, yes. As a matter of policy we have operational advisory groups that review our total research and development program and give us the inputs from their operational experience. This includes the air traffic controllers; this includes people who are members of the ALPA, AOPA, and all of the user groups, including the military.

Senator MONRONEY. You have six centers at present using them. Where are they located?

Mr. THOMAS. Indianapolis, Washington, Chicago, Cleveland, Pittsburgh, New York, and Boston.

Senator MONRONEY. And they are installed and in operation?

Mr. THOMAS. They are installed and operating now.

Senator MONRONEY. The six that you will have in next year, fiscal 1962, will go into six more?

Mr. THOMAS. No, sir. There are no expansions in this present business machine type in fiscal 1962.

Senator MONRONEY. I thought you said earlier that the new ones——

Mr. THOMAS. I am sorry. The new type devices will go into Boston, data-processing central.

Senator MONRONEY. There will be only one at that point to be tested?

Mr. THOMAS. Yes, sir.

Senator MONRONEY. So we will probably not be buying any computers other than this one in the coming year; is that correct?

Mr. THOMAS. That is correct.

Senator MONRONEY. To be sure we have a bugproof system worked out.

Mr. THOMAS. Yes, sir.

Senator MONRONEY. After that you will try to place these in all your air traffic control centers?

Mr. THOMAS. That is correct, sir.

Senator MONRONEY. As rapidly as these funds become available.

You may proceed.

Mr. PYLE. We have also examined methods to make aircraft more conspicuous. Final recommendations on anticollision paints will be made by April of this year, and final recommendations on color and configuration standards for anticollision lights will be made in about 6 months. We hope, within a year, to have completed evaluation of airborne equipment to create artificial contrails.

This is taking advantage, Mr. Chairman, of the unique feature of jet engines. Under certain atmospheric and temperature conditions they will leave a trail in the skies which many of us have seen. We would like to explore this and perhaps have permanent contrails at all times of jet aircraft so that other pilots can see them. It is a very effective way of detecting an oncoming airplane or crossing.

Let me emphasize one point here. There are so many areas to be explored, so many solutions to be sought, and so many experiments to be conducted, that reports of successes along the way should be soberly viewed. Often hundreds of successes with a single problem of aeronautical research may be required to achieve a significant advance.

I would like to add one further word of caution, Mr. Chairman. We want to be sure that in the evaluation processes we scientifically determine the capability, whatever device we are looking at, to insure that we don't let our weight down on it and it lets us down. This is very important and this is, of course, the responsibility and the mission of the Facility Experimental Center at Atlantic City. We could make expensive and dangerous mistakes if we didn't ascertain and assure ourselves that what we are working on is practical, does the job that needs to be done, and then we go into the problem of designing the equipment, writing the specifications to insure proper equipment in line with our requirements, and that the specifications insure reliability also.

So this is not something that you can just shortcut: Something looks good and you put it in the system immediately. This is a point I would like to emphasize.

Senator MONRONEY. I am fully aware of this.

In that connection, we have some information which has come to the committee—whether correct or not, I do not know—that on two recent surveys, one internally and the other by a contractor, there was an indication that the data-processing central computer being developed does not have the capacity to perform even the basic functions performed by the rented computers.

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I wonder what comment you have to make on that.

Mr. ANAST. I do not think that is true. At least I don't know about it. The information that I have, we are actually studying the requirements for air traffic control computations, is that it is quite capable of handling the traffic in the largest center in the world in 1975, and it will be able to handle as high as a thousand flight plans per hour.

Mr. MONRONEY. Have there been two surveys made, one independently by an outside contractor and one internally?

Mr. ANAST. I don't know of one that has this information in it. I will certainly go into it.

Senator MONRONEY. In other words, we are putting in a considerable portion, if we are spending $27 million, on data processing, and it is a fine thing if it works; if we are getting adverse surveys which apparently from this information, correct or incorrect, I can't say, that it may not be able to perform that which you are hoping it will perform.

Mr. ANAST. No, sir, we are not concerned about that. This information, I assure you, is not correct.

Mr. PYLE. Mr. Chairman, if there is any truth to this, this is the first we knew about it. It would be most helpful if this could be identified. We could pursue this. If there is any, even suspicion of this possibility, we want to get right on top of it.

Senator MONRONEY. If these two surveys were made, you would know about it, or you could find out about it?

Mr. PYLE. I know nothing about this and the Director of the Bureau knows nothing about it.

I think in all fairness—this is only human nature—I am sure that the suppliers of the present computers are taking a look to see why theirs can't meet the requirement, and this is natural. We expect this. I am sure that they probably are taking a dim view of some of our work, but this is the kind of thing that we have to evaluate technically and scientifically, and I have no concern as to our program.

Senator MONRONEY. Have you a list as to how many projects have been worked on by R. & D. that are now in place in aircraft or now in place in the system?

Mr. ANAST. We have not prepared such a list for this presentation. It certainly could be furnished for you.

Senator MONRONEY. I think it would be good to have this in the record. We are aware, of course, of the system that we are looking for in the future, but while we are planning and designing the superhighway over here, we have got to keep the old road open and we cannot let any ditches get across the middle of it. We have to perhaps straighten out a few curves on the old one while we are waiting for this new system to be completely improved.

For that reason, we are interested in such things as positive radar handoff. This concerns the committee considerably. There is still a vacuum between the cutoff area radar and the time approach radar takes hold.

Some suggestion has been made—and I have even talked to electronic manufacturers who feel that the state of the art would permit, with very little innovation, an actual identification by a bright point of a pip on the screen of the area controller to the point where he identifies the plane for the approach radar controller.

Do I make myself clear?

(The information referred to above follows:)

FEDERAL AVIATION AGENCY MODERNIZATION PROGRAMS AND PROJECTS COMPLETED SINCE AUGUST 1957

INTRODUCTION

The Bureau of Research and Development of the Federal Aviation Agency is the successor to the Airways Modernization Board which was organized in the fall of 1957 under the authority of Public Law 85–133. The AMB and the Civil Aeronautics Administration were amalgamated to form the Federal Aviation Agency in January 1959.

Acting on the recommendations of the Curtis System Engineering Study published in 1957, the Airways Modernization Board in January 1958 embarked on a 5-year modernization program dedicated to phase II research and development using "the existing state of the art" for systematic modernization of the Nation's aviation facilities. In the first few months of its operations, the President transferred all the significant traffic control research and development activity and funds from the Departments of Defense and Commerce to form the first truly unified national research and development program devoted to civil and military aviation.

In the meantime, acting again in consonance with the Curtis recommendations, the CAA accelerated its modification program applying engineered improvements to close the gap in aviation facilities with existing hardware and equipment.

In an effort to expedite the introduction of engineered improvements into field use, performance specifications were submitted to industry which required redesign and engineered improvements. Typical of some of the improvement areas are:

Development of a TACAN monitor.
Improved amplitron and other radar refinements.
High-speed teletype.
Improved radar microwave links.
New consoles for flight service stations.
Improved flight progress display consoles.
Voice recorders with 22 channels.
Improved all-band VOR antennas.

A new flight monitoring system was developed. This system is being installed in FAA aircraft and will be used to check navigation aids throughout the country.

Other items in the same general category include the new jet flight simulator at the Oklahoma City Aeronautical Center, bright radar displays, and a conveyor belt for distributing flight progress strips to control positions.

The foregoing examples are not intended to represent the entire effort in engineered improvements and inservice development, but, rather, are offered to indicate the nature of the type of activity to which reference has been made.

It should be noted here that the introduction of new and improved equipments in many instances required changes in air traffic control procedures, air route configuration, flight regulations, etc. Simulation techniques have played an important role in this entire evolution.

The Bureau of Research and Development and its predecessor, the Airways Modernization Board, have in the past 2½ years introduced into service many significant items.

AIRPORTS

In the area of airport modernization, new high speed taxiway exits have been designed and are now installed at Idlewild, Dulles, and Andrews Air Force Base. In the process of designing the new high-speed runway exit, a small, compact and inexpensive runway/taxiway light was developed. This light, known as the Pancake light, can be conveniently installed in existing concrete at the nominal cost of less than $100 per light. These lights have been installed at Idlewild, Dulles, and the following Air Force Bases: Andrews, Lockbourne, McCoy, and Fairchild.

The Bureau has completed the evaluation of five visual glide slope indication system. Systems evaluated included the Navy mirror; Air Force meatball; Australian Cummings-Lane crossbar; Westinghouse tri-color; and British RAE

Calvert system. The Calvert system has been adopted as the U.S. standard and the FAA fiscal year 1962 budget provides for the installation of 40 Calvert systems. Also, the Air Force has indicated that the Calvert glide slope will be installed at a large number of their bases.

Instead of providing the pilot with ceiling and visibility readings which are often taken miles away from the landing approach lane, the FAA has developed and installed new measuring devices to furnish the pilot with up-to-date approach light contact height (ALCH) and runway visual range (RVR). The information is transmitted directly from measurement devices over wire to a small computer in the control facility and the controller is furnished with a constant read-out of these important ALCH and RVR measurements.

FAA played an important role in the development and application of airport surface radar known as Airport Surface Detection Equipment (ASDE). This equipment is operational today, or being installed in the busier airports throughout the country.

Improvements to the instrument landing system (ILS), both ILS Localizer and Glide Slope, have increased the accuracy of the system greatly and will help bridge the gap until a true all-weather system can be implemented.

The Bureau of Research and Development is in the final phase of development in many other airport improvements. For example, several emergency aircraft arresting devices have been evaluated. Tailhook arrestments of the Convair at speeds up to 100 mile per hour have been conducted and this testing indicates that using such a device would inflict minimum discomfort on the passenger. A tailhook is being installed on a Boeing 707 to test the feasibility of tailhook arrestment of large jet aircraft.

The Bureau has conducted a thorough evaluation of approach and runway lighting, and a national standard runway lighting configuration will be recommended to the Administrator this month. The one recommended is known as the Three, Two, One Configuration, and gets its name from the fact that the first thousand feet beyond the runway threshold has three rows of lights on each side of the runway centerline; the second thousand, two rows; and the third thousand, one row; and for the remainder of the runway, only centerline lights are used.

NAVIGATION AND AIR TRAFFIC CONTROL

The new FAA-developed Doppler VOR (very high frequency omnirange) provides an accurate navigational reference for areas in which siting has in the past been a problem. Doppler VOR stations are presently installed at Rikers Island in New York, Jackson, Miss., and at Atlantic City, N.J.

Combined VOR/TACAN (VORTAC) stations have been designed and are being implemented throughout the Nation. VORTAC has recently been adopted to be the international standard short-range navigational system.

Initial tests of the new "3-D" Radar, Air Height Surveillance Radar (AHSR-1) have been very encouraging and it is planned to have this "3-D" Radar in New York in 18 months. The AHSR-1 will have a resolution of 1,000 feet out to 50 miles from the radar site.

In transoceanic air traffic control, separation maintained between aircraft today is at least 30 minutes. The Bureau of Research and Development is in the final phases of evaluating the feasibility of using VOR and TACAN installed aboard Coast Guard weather ships to, in effect, extend VORTAC coverage seaward. Testing results to date are very encouraging and by early this summer an operational plan for implementation of this service should be completed.

The small general aviation DME (distance measuring equipment) developed for the FAA is today an off-the-shelf item that will greatly simplify the private pilot's navigating task.

The Air Force deserves the credit for initial efforts to develop Rho/Theta (azimuth and distance) pictorial displays, but the FAA has played an important role leading to the provision of these displays as commercially available items today.

The FAA has developed the characteristics for radar beacon (secondary radar) transponders capable of suppressing side lobes. These characteristics are based upon three-pulse side lobe interrogation in which the airborne transponder will distinguish whether the interrogation is from a side lobe or not. That is to say, using this new technique, the airborne transponder does not respond to side lobes and this then eliminates the display of annoying false beacon returns on the controller's radar scope. The FAA developed characteristics for interrogators, antennas, simple decoding equipments and defruiting equipment.

"Defruiting" refers to ridding the radar scope of unwanted interference caused by other airborne targets. The three-pulse beacon has been adopted as the national standard and a recent agreement with the British permits industry to proceed full speed with beacon production. A new transponder has been developed for the general aviation pilot and will be ready for test this summer.

The Bureau of Research and Development is also introducing improvements to primary radar. New parametric amplifiers under test will increase the overall range and performance characteristics of radars. A recently developed K-band transmitter tube is being sponsored jointly by the Army Signal Corps and the FAA. This new tube will have a longer lifespan and its overall reliability will be considerably better than tubes in service today. The K-band tube will be available in a year. Considerable effort is also being spent to develop equipment to reduce radar interference.

New bright radar displays with alpha-numeric characters and bright, bright displays for use in tower cabs are being tested today for early implementation.

FAA-developed high resolution television for remoting of flight progress strips is being tested at the present time.

New flight data entry devices have been developed to enable the airlines, military, and other airspace users to insert flight plans directly into the computer.

The Bell 300 communications switching system has already been installed in the Oakland and Atlanta Air Route Traffic Control Centers. The system provides a convenient panel from which the controller can communicate with the outside world, with other controllers, and with airborne aircraft. Frequencies are changed by the push of a button.

Personnel transceivers already under test will relieve the controller of the annoying telltale wires he must drag around today.

Equipment for improving the intelligibility of the voice has been developed and will be implemented into the air traffic control environment as soon as it passes the FAA tests.

New computers, the first ever designed specifically for air traffic control, have been undergoing programing and testing at the FAA Atlantic City Bureau of Research and Development Center for over a year. Consoles to display the information processed by the new computers are also under test at the present time. The new computers, the new flight plan entry devices, bright radar displays, and automatic updating flight progress tabular bays will all be operating in the new Boston Center when it opens in October of next year. Other functions of the semiautomatic air traffic control system such as conflict prediction, flow control and sequencing of aircraft landings, will be introduced into the system as soon as they have passed the FAA tests.

AIR DEFENSE-AIR TRAFFIC CONTROL INTEGRATION

Work has been underway since January of 1958 to determine the feasibility of integrating air defense and air traffic control in an effort to eliminate duplication in functions and achieve maximum joint use of existing facilities. The Bureau of Research and Development, the Bureau of Air Traffic Management, and the Air Force recently cooperated in an evaluation of the use of SAGE direction centers to provide radar advisory service to aircraft above 24,000 feet (Project Trailsmoke). The results of this evaluation indicated that the SAGE centers can be used to provide radar advisory service, and the agency is now studying the economic and operational factors involved in implementing such a service.

RESEARCH

Research projects have been completed in many areas. One important area to which considerable effort has been devoted involves the community airport relationship. Work has been conducted to evaluate the community reaction to airport noise and to determine actions required to minimize the ill effects of jet engine noises on surrounding communities.

In another significant research project, airport lighting and marking were thoroughly studied and a comprehensive report has been sent to all airport operators to be used as a guide in airport design.

Simulation has played an important role in Bureau research activities. Unique simulation devices are used to study conspicuity designs for aircraft, aircraft exterior lighting configurations, airport lighting and marking, and a host of other problem areas.

The simulation laboratories at Atlantic City have been used to study new air route structures, including approach and departure routes, for implementation in Frankfurt and Berlin, Germany; Alaska; Oakland and Los Angeles, Calif.; New York and a host of other areas. In these studies, controllers from the area concerned are brought in from the field to participate in the simulation program.

A three-volume report has recently been published by the Bureau which deals with the role of human factors in the design of air traffic control facilities. The subject matter contained in these volumes is being condensed and will soon be available through the Office of Technical Services of the Department of Commerce. This study has already contributed to the design of the Dulles control tower and other control towers and approach control rooms.

TEST AND EXPERIMENTATION

The Bureau of Research and Development in July 1958 created the National Aviation Facilities Experimental Center at Atlantic City, N.J. Today the center is a modern, progressive facility housing three of the Bureau's Divisions. The center is complete with modern simulator and computer laboratories; an extremely accurate space positioning range; new experimental radars; air traffic control data acquisition, processing, and display equipments. Runway 31 is the test bed for new designs in airport lighting. This 6,000-acre laboratory is staffed by experts from all walks of the aviation community, all dedicated to providing the Nation with the safest and most efficient aviation facilities in the world.

REPORTS

In the past 2½ years, the Bureau of Research and Development has published nearly 300 technical reports. These reports are distributed to all appropriate users of aviation facilities.

Time will not permit the listing of all the reports published by the Bureau since August 1957; however, the following list will give the reader a feel for the scope of the Bureau's program:

"High Speed Communications Equipment."

"Final Engineering Report for Hyperbolic Coordinate Converter."

"Studies and Investigations of ATC Systems."

"Study of the ATC Radar Beacon System Characteristics."

"Analysis of the Usefulness of Coded Information in Visual Collision Avoidance."

"Airport Runway and Taxiway Design."

"Analysis of Meteorological Requirements."

"Study of Altitude Reporting Via ATC Radar Beacon System."

"Transport Aircraft Cockpit Voice Recording."

"Radio Doppler Detectors for Airport Ground Traffic Control."

"Estimates of Aviation Activity, General Aviation and Air Carrier."

"Dynamic Simulation Study of Criteria for VOR/VORTAC Route Structure Planning for Chicago Control Area."

"Evaluation of a Proposed Coastal Airway Configuration for the New York/Atlantic City Area."

"Dynamic Simulation Tests and Systems Study of IFR Operations in Los Angeles Area."

"Runway Touchdown Zone Lighting for Dulles International Airport."

"Air Traffic Activity Forecasts Through 1975, Continental United States."

"A Statistical Summary of High Altitude Operations in the New York ARTCC."

"Operations Analyses of Air Traffic Demands and Delays in New York ARTCC."

"Chicago Terminal Area Air Traffic Analysis."

"Oakland Terminal Area Air Traffic Analysis."

"Atlanta Terminal Area Air Traffic Analysis."

"Air Vehicle Performance Characteristics."

"Airport Visual Displays."

"Operations Analysis of Air Traffic Delays in the New York and Washington ARTCC Area on August 1, 1958."

"Navigational Accuracy Demonstrated With the Instrument Landing System."

"An Analysis of the Separation Between Dual Instrument Runways."
"Analysis of Southern California Flight Test Problems."
"Helicopter Operations Program Phase II."
"Project TRAILSMOKE Flight Advisory Service Test."
"Human Factors Considerations in Design of Airport Traffic Control Quarters."
"Dulles Airport Capacity; Analysis of Prandt Drift-Off Runway; Analysis of Monroe Triple Flow Airport Configuration."

CONTRACTING METHODS

The policy of the FAA regarding patent rights in inventions, conceived or reduced to practice under FAA contracts, is such that in those contracts under which the Government pays a part, or all, of the costs of research or development, the FAA retains, for the benefit of the United States, rights to data and patent rights, in reasonable proportion to the contributions of the Agency and the contractor. The policy is to recover the FAA's contribution toward such research and development through royalties to the Government upon commercial exploitation of the products developed thereby. If under an agreement the Government obtains patent rights, the contractor is offered license rights to his product.

Stated simply, the basic reason for this policy is the belief that what the Government pays for the Government should get; when we pay for research or developmental work, we should get the product of that work; and frequently the most valuable product of research or developmental work is an invention.

The Agency has a related policy of recovering the costs of its development programs from contractors who commercially market equipment substantially similar to that initially developed under an FAA contract. This right of recovery applies even when no patents are involved. This policy is quite new and, to the best of our knowledge, is unique insofar as U.S. Government agencies are concerned, although the British Government has had a similar policy for some time. The following quote is typical contract language implementing this policy:

"RECOVERY OF DEVELOPMENTAL COSTS

"A. The Contractor shall pay to the Government up to 5% (as may be determined by the Contracting Officer to be fair, reasonable and equitable) of sums hereafter received by the Contractor when it sells, or leases, and up to 33% of all sums received as royalty or payment for technical data under contracts authorizing others to sell, or lease any equipment which is substantially the same in design as, or which is directly derived from, that developed by the Contractor in the performance of the work called for under this contract, whenever such equipment is made, sold or leased to others than the Government or any Agency thereof by the Contractor or its privies. Recovery by the Government under this Article shall be limited to its unrecovered cost for the development of this equipment.

"B. Payments under this Article shall not be so high as to destroy the Contractor's competitive position for the product involved, provided that the product is otherwise reasonably priced and efficiently and economically produced.

"C. The Contractor shall report to the Government all sales, leases, royalty and licensing agreements, and all receipts therefrom, which might reasonably be considered to be subject to this Article, and the Contractor shall promptly and, at reasonable intervals, render accurate, certified accounts thereon to the Government."

This policy will permit the Government to shift the burden of paying the cost of specific developments from the general taxpayer to those persons, foreign and domestic, who make primary use of products of publicly sponsored research and developmental work. It also serves to support our patent policy in those cases in which nothing patentable results from the contract, but where the contractor gets a competitive "jump on the market" through the experience and know-how it acquires in developing a product. This policy permits the public to share this advantage with the contractor.

CONCLUSION

The foregoing remarks concern themselves basically with research and development efforts of the Federal Aviation Agency which have already resulted in improvements to air traffic control and navigation, or will do so in the very

near future. It should not be presumed that information offered thus far is intended to be a résumé of the FAA research and development program. For example, the Bureau of Research and Development is currently managing an aviation weather research and development program to improve aviation weather data acquisition, distribution, processing, and display. An aeronautical safety research program is well on its way. The all-weather helicopter program is well along in its second phase. Sixty new radar target generators have recently been installed at Atlantic City, making possible the simultaneous display of nearly 200 simulated airborne aircraft. Using a refraction technique, known as "Forward Scatter," the Bureau hopes to be able to increase the range of VHF/UHF communications to over 600 nautical miles. Five all-weather landing systems are being evaluated at Atlantic City.

To guide its planning, the Bureau of Research and Development maintains a strong requirements group with representation from every major group of the airspace. Airlines, military, and general aviation advisory groups meet regularly with Bureau personnel to discuss programs, requirements, and plans.

Mr. ANAST. Yes, sir.

Senator MONRONEY. Do you have any comment on that?

This does not come from rumor. I have had experienced electronic manufacturers say that they feel the state of the art is such that with very little rewiring or redoing, that these scopes can show exactly the handoff as it becomes a positive instead of a nebulous one from area to control tower.

Mr. ANAST. I think the people who are telling you that are quite correct. I would like to talk about that for a moment but I would like to preface it by saying that the main stream of research and development has been a 5-year program, and we are at the tail end of our third year in this regard. So that by January 1963, or the year 1963, you can expect the major stream of improvement as a result of the bona fide R. and D.

At the same time the FAA has pressed on, on shorter term developments, based on purchase of things which can be bought from the shelf.

In regard to radar handoff, this radar handoff has been one of the major features of the air defense system—SAGE, but is able to do this par excellence.

They can, with their system, show aircraft identified by altitude and by intention and quite a number of other bits of information, and associate with a track of a radar.

In order to do this, they have quite a system. In order to achieve radar handoff on a systematic basis, it has to be part and parcel of a larger system.

Radar handoff as such, as a particular device to attach to, say, individual radars which were not designed either for bright display or for communication between one radar and another, it is something that has to be developed.

It was thought in the FAA that this could be bought off the shelf, and money was programed in fiscal year 1961.

It turned out this was not quite available, and what was immediately available, or practically available, was something that could work between scopes operating from the same radar, thus not applicable to the problem that we are faced with when we transfer information from a radar in a center to a controller in a center with his radar to a tower which is looking at another radar.

When that problem is brought in, this brings in some complexities and brings in some additional precision that is required that is not available with equipment.

To indicate to you how much is involved here, we recently have embarked in our Bureau on a handoff device tied to the existing radar.

This is a development which we have embarked on which will make available in the field a prototype model in approximately 12 months. This is not something that you can achieve immediately.

Secondly, I might add that in our basic data processing central, radar handoff is part and parcel of this entire development and will be available in the Boston center in the fall of 1962—next year, when it is installed and operating there.

Senator MONRONEY. As I understand this positive radar handoff, the bright display was developed by the old CAA center when it was in Indianapolis, and had been tested and worked at that point; is that correct?

Mr. ANAST. It worked on a single radar, as I recall.

Perhaps Dave would like to talk to that.

Mr. THOMAS. I think we are talking about two developments. At the experimental center at Indianapolis there was a device for radar handoff which was developed, which would involve a radar light guard which was quite similar to a small electric soldering iron where a controller could look at a scope, press the tip of it, the pip that he saw, press a button and a bright spot would appear on all other scopes served by that same radar with that same range for handoff purposes.

It was evaluated at Indianapolis and it was installed here in Washington, the Washington tower, and evaluated, and it was concluded that it was not suitable even for the purpose for which it was intended, first because it was extremely difficult to center the target correctly and be sure that one had the right one.

The controller concluded that it would be better merely to describe the target, one to each other, rather than attempt to use this device, and therefore it was rejected. We have a report on that.

With regard to bright display, the current bright display that is used, which is a television technique, to make the radar bright and take us out of the cave and put us into a little more well-lighted room, was actually developed by the French, which was imported to the experimental center at Indianapolis. This is what we are using at the present time. There are developments in that field.

Senator MONRONEY. This is the long-range radar that you have in the New York Air Center?

Mr. THOMAS. Yes, sir; and in towers, too. We can convert any radar essentially from radar-type display to a television-type display, and display esesntially on a television studio monitor like a home set. It is a very convenient way of doing so.

Senator MONRONEY. Can you put this bright spot on that scope, on that radar?

Mr. THOMAS. I don't believe that the display in itself has anything to do with the bright spot. We can do this either way. One of our problems is that when we go from one radar system to another radar system we are looking at the aircraft from a different slant range.

The radar does not measure distance over the ground; it measures distance from the antenna to the airplane. In other words, an airplane at 40,000 feet is 8 miles away as far as the radar is concerned, and so shows it.

If an airplane were 40,000 feet over Herndon, and a radar at Martinsburg—there is not, but if there were one there looking at it—and one at Washington looking at it, they would have it at two different places.

Senator MONRONEY. I am not so concerned with that. I am concerned with United approaching Preston and this handoff at that point, whether, if there is known instrumentation in the bright display, where this target could have been carried in and observed going beyond Preston by an area man, or at the point if he had not already passed Preston have been turned over and given a positive radar handoff to the control tower at Idlewild?

Mr. THOMAS. Electronic means there is not today, and this is an electronic contract Mr. Anast was speaking of that we hope to have in 12 months.

Senator MONRONEY. In 12 months?

Mr. THOMAS. Yes, sir.

Senator MONRONEY. The old system that was developed at the CAA center would not be adaptable?

As I understand, that was an electric pencil?

Mr. THOMAS. Yes, sir.

Senator MONRONEY. I thought there was a new one which they had devised, a sort of a joystick application, with which you could follow internally the progress of the plane as the control tower man brought it along, keeping it circled and in the scope.

The question was, to my mind, could that be wired into the approach control from the area control?

Mr. THOMAS. This is the development that is underway at present time essentially. We have the problem of registration between two radars looking at airplanes from different perspectives and therefore giving different locations, too.

Senator MONRONEY. This is on the same airport I am talking about.

Mr. THOMAS. But they are separate radars.

Senator MONRONEY. But they are not too far separate. In other words, it seems to me like it would even pay, if a positive radar handoff is required, to have this on the scope even in the control tower so that the air traffic controller bringing it in would be able to pick him up positively on his approach radar then from reference to perhaps the long-range radar that is piped in. Maybe it is a captive or slave television set working there, but some way to perfect a positive handoff.

Mr. THOMAS. Sir, we want this desperately.

Senator MONRONEY. What?

Mr. THOMAS. We want this desperately. I sound like I am arguing against it but I am not. We want it and we need it very bad. We do not know whether the device will work and we are trying to get it.

Senator MONRONEY. You don't think there is any shortcut?

Mr. THOMAS. I don't, sir.

Senator MONRONEY. All right. You may proceed.

Mr. PYLE. I would merely point out in this area, Mr. Chairman, that we have been about 2 years on this job of traffic control, and we are not here to report that we have accomplished any miracles. I think Mr. Thomas said we do have some desperate needs but we havent' accomplished them all as yet. We are trying hard and we think we have made some progress.

Airports: A remaining major area of research relates to airports. Here, we are dealing with two principal problems, visibility and landing aids. A full list of current work in the airports area is attached as an exhibit, and I will simply highlight some of this work here.

Among many individual projects, the program includes the evaluation of approach, runway, and taxiway lighting; the development of arresting gear which will minimize the danger of end-of-runway overrun accidents; and the development of informational displays which will reduce the amount of controller-pilot radio conversation.

An example of activities in this area is the recent completion of our evaluation of five visual glide-path indication systems at our Atlantic City Center. The purpose of this device is to enable pilots of landing aircraft to follow the optimum glide slope by visual reference to guidance lights and thus avoid undershooting or overshooting the runway. Heavy jets have an especially critical problem in this regard because of their sink rate and poor acceleration characteristics. In addition, the undershooting pilot creates a community noise problem, especially when he applies corrective power. And, of course, the obvious area of real importance is overwater approaches and on a dark night.

What we have got here, frankly, is a visual instrument landing system.

We have looked at the five systems evaluated, including the Navy Mirror; Air Force Meatball; Australian Cumming-Lane Crossbar; Westinghouse Tri-Color; and British RAE, which stands for Royal Aircraft Establishment. The RAE system has been adopted as the U.S. standard, and an implementing system is underway.

Senator MONRONEY. Do I understand that you now have three stations?

Mr. PYLE. That is correct. And we are now implementing that just as fast as we can get them produced.

Senator MONRONEY. Go ahead.

I intend to ask you when you are going to get them on La Guardia, but I will wait until I find out how much it will take.

Mr. PYLE. This system is composed of an array of 12 rectangular-shaped boxes, each containing a light source. The top half of the light is covered by a red filter, and the bottom half of the light is white. The lights are positioned in such a way that, in the approach, the pilot sees all 12 lights as white when he is above the glide slope. If he is below the glide slope, he sees all 12 lights as red. When on glide slope, the closest six lights are white and six lights farther up the runway are red.

I would like to point out in this connection, Mr. Chairman, that we also feel that this has distinct application to the general aviation area. By just cutting down, instead of 12 we might have 4—2 beyond and 2

in close—and thereby have a cheaper device that could be used at all general aviation airports.

Senator MONRONEY. This doesn't seem to be too expensive an installation, even if you put the whole works on.

Mr. PYLE. We have some figures on that.

Mr. ANAST. The cost of operation, of course, includes the cost of cabling and control cabling, to turn it on and off, for example. It is something like $40,000 per installation. It depends on the intricacy of your control cabling.

Senator MONRONEY. $40,000 is a lot different from a $5 million airport, and lives, and so forth. This is one of the best bargains we have heard about all day. I think the record showed that 46 percent of all of our carrier accidents occurred within the general region of the airport, primarily in landing events.

It certainly seems to me that now that the question of what kind and what equipment is to be used, the question is how fast can you get it made and how fast can you get it up at the end of runways.

Mr. ANAST. If you divide that by 6 or 12, we may be able to get a cheaper version for general aviation which has the same principles of operation, so that one landing at a larger airport or smaller is confronted with the same visual signal.

Mr. PYLE. Mr. Chairman, Mr. Tippets has the information of which you speak.

I couldn't agree more with you, Mr. Chairman. This is a badly needed device. We did fairly expensive experimentation with this because of several requirements that we felt were absolutely essential. One was the ability to see fairly far out on a good day and, therefore, you had to have a light that the pilot could readily see.

The Australians had the Cumming-Lane system. This was thought to be the answer. I am delighted we tested this other device because it is far superior to the Australian system. When you get down below 200 feet the Australian system tends to fall apart, and this is the area where you need it most, right down close to the airport.

This system holds together right down to touchdown. I have flown it under all sorts of conditions and I am sold. We will get it as fast as we can.

Senator MONRONEY. Does it work in daylight as well as darkness?

Mr. PYLE. Yes, sir; and this is most important, because, particularly in the noise abatement area, for daylight use to keep the planes as high as possible within proper operational capabilities for the pilots to handle it, we can keep it high over the communities.

Senator MONRONEY. How far out from over the runway—for instance into Rikers Channel—do you have to go to put this in?

Mr. PYLE. It is alongside the runway, Mr. Chairman. It is not out.

Senator MONRONEY. In other words, you don't have to go out?

Mr. PYLE. No, sir.

Senator MONRONEY. We don't have to rely at Midway on getting easements of the property owners to have some kind of an approach lighting system?

Mr. PYLE. No, sir. It is 500 feet on each side of the point of touchdown.

Is that right?

Mr. ANAST. Closer than that, actually. But it is within the perimeter. In all cases it is within the perimeter of the airfield and alongside of the runway.

Senator MONRONEY. It presents no obstructions such as a tower would, as the old system required?

Mr. PYLE. No, sir. It is right on the ground.

Senator MONRONEY. This supersedes and does away with the old centerline?

Mr. ANAST. No, sir.

Mr. PYLE. This is merely an indication to the pilot of his angle of approach to the airport. It will be set probably at between 2½° and 3°—2.75 is about the average, I guess.

Senator MONRONEY. This would not be then in substitution of the present system which is used on the south end of Washington National, for example?

Mr. PYLE. No, sir. This supplements that. This is in addition, and is used particularly during daylight VFR weather. It is very important. And, of course, at night in VFR weather. It still presents a problem to him, even with approach lights. This is a very important added device that helps him in setting up the proper rate of descent to the airport.

Senator MONRONEY. Where conditions were available, you would use this to supplement the present centerline approach light; is that correct?

Mr. PYLE. There will be instances when this will be done; yes. Of course, if he has approach lighting and ILS, he doesn't really need this. However, there will be other planes that might come in, or weren't operative.

The importance of this, though, Mr. Chairman, is on those runways that don't have these aids—runway 22, runway 31, runway 13 at La Guardia, for example.

Senator MONRONEY. And it would be visible how far out?

Mr. PYLE. Five miles. This is what we were striving for: 5 miles out, even in daylight, at the outer marker.

Senator MONRONEY. How will that show over an 8-foot 2-inch dike?

Mr. PYLE. No problem.

Senator MONRONEY. How does it show? After all, if it is on the touchdown point of the runway, do you have a glide pattern that will show over that dike?

Mr. PYLE. Yes, sir. The dike is 160 feet short of the runway. So that would not in any way blanket even the forward part of the light.

Senator MONRONEY. Go ahead.

Mr. PYLE. Mr. Tippets has figures on this, if you care for it, on the installations.

Mr. TIPPETTS. The Senator asked about our program. You asked one question and alluded to one answer. Maybe I can clear up the La Guardia situation.

At present, as Mr. Pyle indicated, the decision on this type of light was just made in late fall. We are now buying the only two sets available from the manufacturer, and they will go on runway 13 and runway 31 at La Guardia when the new runway is opened, which will be July or August of this year.

We have in our program next year a request for some 40 of these units at the highest priority locations across the country.

Senator MONRONEY. Why only 40?

At how many airports do you have approach lighting on both ends of your instrument runway?

Mr. PYLE. We don't have them on both ends, Mr. Chairman, but we do plan to put apporach lights wherever there is an instrument landing system. At the moment we have about 160 in our program. We expect to go up to as many as 280 ultimately.

These lights——

Senator MONRONEY. You are talking now about the centerline approach light?

Mr. PYLE. Yes, sir.

With respect to these lights, over the next 3 or 4 years we expect to put in as many as 200 installations.

With respect to La Guardia, to be sure I have this clear, on runway 22 that you spoke of a moment ago, these do not go on there. We have gone further there. We have put 855-foot, high-intensity approach lights with the center ball flashing light there, and these will be turned on and put in operation about the middle of March.

This has been accomplished over the Rikers Channel about that far. We can go further into Rikers Channel when we decide what ultimate use will be made there.

Senator MONRONEY. What about the Army Engineers? Have they ever come up with an answer?

Mr. PYLE. This is a matter between the Port of New York Authority and the Army Engineers, and I am not aware of its current status.

Senator MONRONEY. Could we help to get them together maybe by having the Army Engineers come down here and tell us why Rikers Channel is so sacred that it can't be violated with a few pylons?

Mr. PYLE. We have urged them to get together and offered our help and support, and I am sure we are ready to help now. We have gotten this far, to put in stub light systems with high intensity lights.

Senator MONRONEY. This will help some. I thought if this supplements the high intensity center ball line that we might be able to afford this $40,000 to add this to runway 22. That is one of the best known runways in the country, and not for good reasons. It would seem to me that anything else that you can slap on that runway would be very helpful.

Mr. TIPPETS. Mr. Chairman, the Port of New York Authority has, while waiting for these runway installations, put in runway identification lights. These are two high-intensity lights at the end of the runway that put out quick pulsating high-intensity illumunation. This is also at the end of runways 13, 22, and 31, all three of them. So there is that added feature to this runway.

Mr. PYLE. Plus the fact we have a dual direction precision approach radar there now.

When did that go in? That is dual direction DAR. It has been in operation about 6 or 8 months.

Senator MONRONEY. Radio beams?

Mr. PYLE. Radar. Precision approach radar—GCA.

Senator MONRONEY. Go ahead.

Mr. PYLE. Another key program involves runway lighting. Based on earlier work, a standard has been established, and is being implemented, for approach lighting which leads the pilot to the runway. The selected arrangement will also eliminate the "black hole" problem. Final recommendations are now being prepared for a standard runway lighting configuration. This work was greatly expedited by suggestions from the airline advisory group. Final action will be taken after users and airport operators have had a full opportunity to offer their views on the recommendations. You will recall that in our testimony before this committee in January 1960 we said a solution would be recommended in about 12 months. We are just about on schedule.

I would like to add a word here, Mr. Chairman, about the cooperation we are getting both from the military as well as the air carriers flying these lights. I was there one night flying them myself. There was a crew there from United Airlines, busy flying as we were, and submitting their recommendations and evaluations. This is very helpful.

Senator MONRONEY. When you get it it will be fairly standardized so you won't have to adjust to 6, 8, or 10 different systems coming in.

Mr. PYLE. That is correct. I am talking, Mr. Chairman, specifically about the lighting in the runway itself.

Senator MONRONEY. But your approach lighting is going to be fairly standardized, and then your new system that you just described will be fairly standardized, will it not?

Mr. PYLE. This is correct. We have a standard on approach lighting which has been signed on by the air carriers, military, general aviation. We will do the same in this area so we will have a standard installation in all of our airports. Then, of course, we will go into ICAO with this as a recommended worldwide standard.

Senator MONRONEY. The RAE system now has been approved by the users as well as the scientists, and we are ready to go on it?

Mr. PYLE. That is correct.

Senator MONRONEY. There is no further evaluation required; it is merely a matter of money, and I trust that you will ask for enough to get something done on this because it is in an area in which everybody can appreciate the safety factor. It is far more important in many ways than some of the things that cost many, many times more and add greater complexity to our safety program.

Mr. PYLE. I agree, Mr. Chairman.

We are also actively seeking a means of deceleration whereby heavy multiengine jet and other large aircraft can safety abort takeoff attempts. Our effort is to achieve a solution suitable to common civil-military heavy aircraft operations. Our evaluation with a Convair has been completed, and we are now planning tests with a Boeing 707.

Senator MONRONEY. There have been two or three accidents in takeoffs where these jets have clammed into these steel deflector fences, where they have to rev their motors up to full power, and apparently the blast will burn up some automobiles or something passing on nearby roads. When the wind is in that direction, that is all right, but where you have to go the other way it becomes a hazard at the end of the runway. Is there any way that you can solve that?

I don't think obstructions on the end of any runway, even though you have 10,000 or 12,000 feet, are good aviation practice. Yet you find more and more of these airports now at the end of the runway building these 6-foot steel and concrete barricades to deflect the blasts.

There must be some better way of doing this, at least making it out of plastic or something which could be heat resistant and still not destroy an airplane if it plows into it.

Mr. PYLE. Two thoughts occur to me, Mr. Chairman: one, the frangible or breakable system or material might be one solution. Even at some cost it might be possible to raise or lower them. I don't know whether this is a feasible one. Maybe Mr. Anast has some additional ones.

Senator MONRONEY. I think this is terribly important because you are talking in one context about nylon arrestors or some type of arrestors to safely stop the plane, and yet the practice is growing up to where you have a barricade that will not safely stop the plane. Maybe if you could sink the barricade into the ground and raise up an arrestor when the takeoff is in that direction, that we might be saving some $5 million planes and maybe many, many lives that could be lost in some of these takeoff accidents.

Mr. ANAST. We have done a considerable amount of work in this area, both from the research side and the practical testing side. We have investigated things such as filled swimming pools at the end of runways, where the aircraft would decelerate if it overshot the runway.

We have asked NASA, for example, in this particular case, to do some model testing, which they have done.

We have received proposals from industry in this regard, including a flexible kind of a mat over a kind of swimming pool at the end of the runway.

We have also tested barriers that pop up in front of an aircraft at the time that it is required to decelerate on an emergency basis.

We have looked into the nylon type of net that catches aircraft at the end.

All of these suffer from some kind of a disadvantage that might decrease the safety rather than add to it. In the case of the net, for example, it catches on the equipment that sticks out from an aircraft and tears it off. In saving an aircraft you do some damage.

We have found that the most practical one so far appears to us to be the tail hook.

Senator THURMOND. Like on aircraft carriers' planes?

Mr. ANAST. Exactly. It came from that principle, as a matter of fact.

On either side of the runway is a device which has a cable stored up in winches, and has a means of applying friction. There is a cable then stretched across the runway at a very low height, at a height low enough so that a wheel could pass over it without engaging it or disturb the aircraft. However, the aircraft has a tail hook extended. The hook will catch much the same as on a carrier and bring the aircraft to an even decelerated stop.

We have measured this and we have succesfully done this with a Convair 340. In all of the tests conducted there was no more than a half g. applied.

We are now moving to a 707 aircraft, and we are going to apply this to the 707. If successful, it will probably be the basis of a recommendation to the industry and to the Administrator for general utilization of this technique.

Senator MONRONEY. It will probably pay for itself in lowering the insurance rates, I would think, on the 707's and these other huge aircraft which are of such great weight that normal braking or even reverse thrust will not bring you to a stop in time.

Mr. PYLE. I think this is most important, Mr. Chairman. It is a development which we will put a lot of priority and hard work on. These aborted takeoffs are serious business.

Senator MONRONEY. You are planning to, as you study the arresting gear, to study very carefully and come up as rapidly as possible with some way to remove or render less obstructive the blast fences that are becoming standard equipment at the ends of runways?

Mr. PYLE. I would like Mr. Bakke to speak to that.

Mr. BAKKE. Mr. Chairman, you are probably aware that the blast fence at Idlewild, which was involved in the accident involving Aeronaves, is being and was investigated. In connection with that investigation certain recommendations are now being prepared to accomplish precisely this.

Senator MONRONEY. Have you conducted any studies as to the possibility of depressing of roadways and maybe building just an overpass over the road for protection of the people on the road, both from overrunning aircraft at these very busy airports, and for deflecting or protecting them as well from the blast at the warmup?

We used to build underpasses under railroads when there weren't many railroad trains going. We could perhaps afford to have an underpass under these busy runways, particularly where you use jets.

Mr. BAKKE. I might make one further observation before that particular question is answered, Mr. Chairman.

With respect to the Idlewild situation, you are probably aware of the fact that the last 1,000 feet of that runway is over and constitutes landing margin in addition to the margin prescribed by regulations. So there is a good long piece of runway not usable under normal circumstances on the in-airport side of the blast fence.

Mr. PYLE. I think the point you make is a very valid one, Mr. Chairman. We will take a look at that. In some areas this has been done. I am not aware of any right now.

Mr. Chairman, I would like to close this portion of the discussion of research and development with the invitation that I would be delighted if it would be practical from the standpoint of yourself and the other members of the committee to come up to Atlantic City and see what we are doing. I think in a day we could give the committee members and the staff a pretty good presentation of the work that is going on, some of the objectives we are trying to achieve, the status of the programs, and a good look at the facilities. It would be our privilege if we could arrange such a visit.

Senator MONRONEY. I think it would be a very fine thing for the committee if you could ever find one single day that you can cap-

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ture all of us together at the same time at the same place without conflicting engagements. We are busy men.

Mr. PYLE. We can do it even on a weekend. This will be no problem to us. We will be open to any schedule that is practical from your standpoint.

Senator MONRONEY. We would like very much to see it. That would be very helpful to us.

Mr. PYLE. I would like now to turn to accident investigation.

Under the act, the Civil Aeronautics Board is charged with investigating and reporting civil aircraft accidents, and determining probable cause. It is also charged with making such recommendations to the Administrator as, in the Board's opinion, will tend to prevent similar accidents in the future. Upon request of the Board, the Administrator is authorized to investigate accidents and report to the Board, but not to determine probable cause.

The Board, under the latter provision, has requested that the Administrator conduct the investigation of all nonfatal, non-air-carrier accidents which involve fixed wing aircraft with a gross takeoff weight of less than 12,500 pounds.

I would like to point out, Mr. Chairman, that there is a practical reason for this arrangement that has been made with the Board, and from which they delegate certain responsibilities to us, and that is the fact that they do not have an extensive staff, whereas we do have of course a staff all over the United States in district offices, inspectors performing their normal inspection function.

We have 167 maintenance personnel and 224 operational inspectors deployed in 93 district offices. And in addition to their functions which they perform for us, they also perform that function of accident investigation, reporting—and this is merely the reporting of facts on the basis of which the Board determines the probable cause. We act as their agents basically.

Further, the Agency provides very extensive assistance to the Board in the investigation of all other accidents.

Under this arrangement, the Agency conducted the investigation of slightly over 85 percent, or 3,654, of all civil aviation accidents in 1959 and assisted the Board in investigation of the remaining 15 percent. The figures for 1960 are not available at this time, but we believe that they are substantially the same, and we will furnish them for the record if you would like.

Responsibilities in joint accident investigations are set out in an agreement drawn up in 1957:

(1) The accident investigation is under the control and direction of the CAB investigator in charge.

(2) The FAA will provide a representative known as the FAA accident coordinator to serve during the investigation and to be responsible for other FAA personnel assigned to the investigation team.

(3) There is to be a complete exchange of information between the two agencies.

(4) The FAA personnel will participate with the CAB in gathering facts and investigative information. However, the FAA personnel will withdraw from witness interviews when the witness refuses to talk for fear of enforcement action.

(5) When it becomes necessary for the FAA investigators to obtain additional facts not needed or required by the CAB, this will be done after clearing with the CAB investigator in charge. In obtaining all information of this

type, the FAA inspectors must make it clear that they are not acting under CAB direction.

Frankly, Mr. Chairman, I think this is a practical and satisfactory working relationship. We would like to emphasize again our complete awareness of the fact that the determination of probable cause of civil aircraft accidents rests with the Board.

Mr. Chairman, I would like to pause here, for a moment, to point out to the committee one area of potential confusion between the responsibilities of the Board and the FAA in the field of accident investigation and accident prevention.

It is especially the latter area of accident prevention which could cause some serious difficulties.

As your subcommittee knows, the primary mission of the CAB is economic regulation of civil aviation. It is additionally assigned certain responsibilities in accident investigation and determination of probable cause.

The primary mission of the FAA is the safe operation of aircraft and the prevention of accidents. We have thousands of employees engaged in every phase of this mission, and they are widely deployed throughout the United States and even throughout the world.

In our opinion it would be extremely wasteful of governmental resources, both in manpower and money, to have duplicating capabilities of this kind in two separate agencies. The FAA is in a position to provide a tremendous amount of assistance to the Board on a day-to-day basis; and, in an emergency, we can provide assistance in great depth. This is because of the flexibility which a large agency like ours inherently possesses.

The same is true with respect to special aeronautics projects and studies. In our massive daily effort in the field of accident prevention, we necessarily engage in many such studies ourselves. Here again, in the interest of avoiding unnecessary duplication of effort and unnecessary duplication of staff, I believe that there should be, and actually there is, close coordination between the Board and FAA, and that joint studies, utilizing the already very large safety resources of the FAA, would be preferable to developing separate, overlapping effort in two agencies.

I merely wished to point out the potential for wasteful duplication that is present, if both agencies are not alert to the basic difference beween their functions.

Senator MONRONEY. Before you leave that, this is an area where actually I think the intent of the act is to place the rulemaking and the other safety actions required under the law of the FAA in a prime responsibility for air safety. However, we carefully studied, in the preparation of the FAA Act, on the basis that two hands are better than one, that a pilot and copilot are better than only one pilot, that in the careful, independent investigation that the CAB is required by the law to make there will be lessons learned—or the investigation has no purpose—in which aviation can be made safer. It is a tragic thing that only out of tragedy sometimes can we get the real dangers, that sometimes by good luck or by expert performance of man or aircraft are avoidable. To waste this fund of information and to not have it usable or summarized in a way that would be helpful not only to the FAA but to the Congress itself would be unthinkable. There

is going to be a little gray area in there. But I am convinced by the testimony that we have had that the simple matter of writing a report that the Board will finally approve and find the probable cause is not quite enough for the many thousands of man-hours, the nights and days and Sundays and winter and summer that go into the careful evaluation of these accidents.

This, I think, is the no man's land that you are concerned with, and Congress is not attempting to set up a rival agency to second-guess everything that is being done by another agency. I do think we need to take every single lesson and pinpoint it and focus it, if possible, so that it gets through not only to be considered in your safety activities, the things that your boys come up with on the accident, but also an independent view.

It is like a conference, and I know that you confer. In the process of an accident investigation it is hard to tell who is a CAB member and who is the FAA member, they work so closely together, and to a very effective purpose.

In the end, what I would like to see done is a pulling together of this information in summary form and calculated to help you, to help the Congress, and to help the industry because all three are vitally concerned with knowing everything they can which needs to be shorn up, improved, modified, or changed, or corrected to make the next accident unnecessary.

Mr. PYLE. Mr. Chairman, I completely concur with the points you make, and that is that I think it would be unworkable. For instance, if you remember at the time the act was being discussed, its formulation was being discussed, the point was made that parhaps the accident-investigation function should be turned over to the FAA. This would have been unworkable, impractical, and improper, the point of having a separate group investigate the accident and make recommendations to the Administrator, which must be carefully evaluated, and in all instances are carefully thought out and well-conceived recommendations. We don't always agree with them. This is a matter that we then work out with the Board.

However, the only point that I am addressing myself to is the fact that I don't feel that we can make the best use of the taxpayer's dollar in this area if we set up a separate group studying special projects. This is an area where I think we can work together rather than having duplicatory efforts made.

Senator MONRONEY. I think their function would be to perhaps point out special project areas from their information that they have come to a separate conclusion on, which may or may not necessarily correspond with your conclusions, and that then it is your duty to find and fix these.

I don't think it is the duty of the CAB to reexamine the approval of aircraft, or many things of that kind. I think that is a resopnsibility which rests solely with the FAA.

I think the flight procedures and regulations and minimums to be established are the duty of the FAA.

In conducting these, they need to pull together a little more than a simple finding of the probable cause that we get out of the tens of thousands of man-hours of efforts that went into the study of each of these major accidents.

Mr. PYLE. We get many valuable recommendations from the Board's staff, carefully thought out, helpful recommendations which we then incorporate into maybe an airworthiness directive, a change of procedure, or whatever may be called for. These are invaluable to us in our work of accident prevention.

Senator MONRONEY. I would like to say right here that I feel that the Agency under General Quesada, under your leadership, when you go into it the first day after an accident, if an order goes out after your estimation of something that had happened that needs to be immediately corrected, you would be doing less than your duty to fail to do this on the assumption that this is likely to have contributed to the accident, to make that order effective immediately and then look it over and review it in the light of experience at some later time when the industry can comment on it.

I was very pleased to learn that General Quesada ordered immediate—and properly so—action against birds on airports because, obviously, he was smart enough and industrious enough to go up there and see the physical evidence of the Electra crash at Logan Airport. To have waited and ignored birds from then until the final finding of the probable cause was made by the CAB would have exposed our certificated carriers and others with turbine motors to a danger that is now being met at least in part by prompt action.

Mr. PYLE. Further, Mr. Chairman, as a result of this accident we executed a contract with the Fish and Wildlife Service of the Department of the Interior, Bureau of Sport Fisheries and Wildlife, specifically, and they have come up with a pamphlet which will be shortly distributed to all airport operators, dealing with this very problem, and recommendations as to solutions that they can follow. This is a specific and direct result of the very point you made. I would like to submit this for the record.

Senator MONRONEY. I would like to have that. How long is it? How many pages?

Mr. ANAST. Ten pages.

Senator MONRONEY. It is worth putting in the record.

(The matter referred to is as follows:)

[From Wildlife Leaflet 429, January 1961, Branch of Wildlife Research]

BIRD HAZARD TO AIRCRAFT

(By John W. Aldrich, Chandler S. Robbins, and Walter W. Dykstra, biologists, Branch of Wildlife Research)

Birds have long been recognized as a potential hazard to aircraft. During the early days of aviation when airplane speeds were relatively slow, damage from bird strikes usually was minor and largely confined to broken windshields and occasional damage to the fuselage. However, since World War II and the introduction of jet aircraft the problem has become more serious. In addition to greater damage resulting from impact with birds at high speeds, the ingestion of birds in jet and prop-jet engines has become a hazard.

During the past decade many birds became accustomed to the noise and speed of piston-driven aircraft and formed the habit of using airports without danger to themselves or to aircraft. With the advent of jet and turbo-jet engines, however, the tremendous suction into air intakes has become an added factor. Furthermore, some birds have acquired the habit of resting on portions of runways not normally used by piston-driven aircraft. The longer runways and more complete use of runways required for jet planes thus pose a new problem; birds have not developed the ability to avoid a jet-powered aircraft.

The Bureau of Sport Fisheries and Wildlife is undertaking a study of this problem in cooperation with the Federal Aviation Agency, the Air Transport Association, and local airport management personnel. It is anticipated that the investigation will provide data on the nature and extent of bird strikes and that new measures will be developed which can be used to minimize such hazards. Meanwhile, airport managers are urged to make observations on the occurrence of birds in the vicinity of airfields under their jurisdiction. Such observations should be reported to the Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, U.S. Department of the Interior, Washington 25, D.C.

The information in this leaflet has been compiled with the help of representatives of the Federal Aviation Agency, the Department of Defense, the Air Transport Association, local Audubon societies, and airport management. Their cooperation and assistance are gratefully acknowledged.

HISTORY OF THE PROBLEM

Records of bird strikes during the early days of aviation are fragmentary. During World War II military agencies recognized that sea birds constituted a hazard at bases on oceanic islands, notably at Midway Atoll in the North Pacific and Ascension Island in the South Atlantic. Sooty terns and albatrosses were the principal troublemakers. The problem still exists although corrective measures have decreased the hazards appreciably. For example, land-leveling operations at Midway have reduced perceptibly albatross soaring activities over the runway at that airfield. A number of incidents have also occurred in the United States where the presence of gulls was associated with the close proximity of dumps to airfields and where small birds were attracted by weed growths adjacent to runways. Similar problems have been encountered in Great Britain involving plovers, pigeons, and crows. In the States, most of the recent strikes have involved sea gulls. A few included swallows, hawks, pigeons, ducks, geese, and starlings. The largest number of bird strikes have occurred during the summer and fall months, as expected, since these are the times of year when bird populations are at their peak. The greater number of strikes in the fall further reflects the autumnal bird migration.

BIRDS IN FLIGHT

Much remains to be learned about the altitudes at which birds fly under various weather conditions at different seasons of the year. The following is a general summary of bird flight information as known at present. Although primary emphasis is given here to coastal areas and major water courses, heavy concentrations of waterfowl and other large birds also occur over a number of wildlife refuges in various parts of the United States. Persons interested in potential hazard areas in specific States should contact the Bureau of Sport Fisheries and Wildlife and State conservation departments for details relating to local bird concentration areas.

Songbirds generally fly within 5,000 feet of the ground. At night these small birds commonly fly as widely scattered individuals rather than in dense flocks; at times, however, concentrations may build up at night over shorelines when prevailing winds have a tendency to drift the birds toward the ocean or the Great Lakes. During daylight hours some species of songbirds fly in dense flocks.

Concentrations of large-sized birds are more frequent in coastal than in inland localities. Unfortunately, many major airports have been constructed in tidal locations—even on reclaimed land partially surrounded by tidewater. This automatically creates serious and complex problems because of the variety of birds and the heavy transient populations that pass through coastal areas even when the airport itself offers no particular attraction.

From what is known of the geography of bird abundance in the United States, the Atlantic, Pacific, and gulf coasts and adjacent marshes would be potential hazard areas below 6,000 feet, day and night, from late August through late April. The hazard would continue locally through the summer on the coasts of Maine, New Hampshire, and Massachusetts (gulls up to about 4,000 feet); Connecticut to North Carolina (terns, chiefly below 500 feet; gulls in some areas up to 4,000 feet); South Carolina to and including Texas (pelicans, terns, and herons, chiefly below 500 feet; gulls in some areas up to about 4,000 feet); and on the Pacific coast and offshore islands (gulls and cormorants up to about 4,000 feet). The majority of coastal birds are within 5 miles of shore, but tens of thousands of large, low-flying shearwaters (mostly below 500 feet) may be

present, especially off the central and southern California coast, June through August.

Chesapeake Bay, the North Carolina sounds, San Francisco Bay, and Puget Sound have high concentrations of waterfowl and gulls from October to mid-April, and much lower numbers through the summer months.

The Great Lakes, especially their shores and islands, are used by waterfowl (particularly during August-November and March-April) and gulls (locally in June-July, widespread during rest of year but less common in northern half in December, January, and February) and may constitute a hazard up to about 4,000 feet.

The Mississippi, Missouri, and Ohio river valleys are used, day and night, by large numbers of waterfowl and gulls, especially during the migration seasons, March-April and September-November. The lower half of the Mississippi River and adjacent streams and marshes are used extensively by waterfowl throughout the winter months. The great majority of the birds are below 3,000 feet in winter and below 6,000 feet during migration.

CONDITIONS THAT ATTRACT BIRDS TO AIRPORTS

There is no habitat, either natural or manmade, that will not attract certain species of birds at some season of the year. For this reason, the objective when planning to reduce a bird hazard is to render the airport and its vicinity less attractive to those species that are a potential hazard—not to strive for the impossible goal of a birdless community.

Birds that occur on or over airfields probably are there for one of five reasons: (1) In search of food or water; (2) roosting; (3) resting or loafing; (4) nesting; or (5) passing by, which includes traveling between roosting, feeding, and resting areas as well as active migration.

Food.—Most airport areas provide an abundance of food in the form of weed seeds, grass seeds, berry-producing shrubs, earthworms, grubs, and other insects. Many airports have inadequate refuse disposal systems, such as an active dump on their property, or there may be a large municipal dump, or sewage outlets nearby. Some have ponds or other permanent bodies of water near or even between active runways; many have temporary rain pools that at certain seasons of the year may persist for days at a time.

Roosting.—Cover in the form of tall reeds, shrubs, trees, or weed patches may provide convenient roosting places. They may even attract birds such as starlings or blackbirds from many miles away. An infrequently used runway may serve as a night roosting place for a flock of gulls. Ponds may provide roosting places for waterfowl and other water birds at night. Almost any area that is free from disturbance may provide a suitable roosting site for one or more species of birds.

Resting or loafing.—Gulls stand around for hours at a time between flights to feeding areas. Most shore birds (sandpipers and plovers) feed primarily on exposed mud flats in tidal areas. At high tide they rest in large flocks on beaches, golf courses, spoil banks, or on other open areas such as those created by dredging operations. Blackbirds and starlings frequently rest in the tallest vegetation near their feeding areas.

Nesting.—The species of birds nesting on an airport depend upon the habitat and the amount of disturbance present. Once nesting of a species has been established, the same individuals can be expected to return year after year. Some of their surviving offspring can be expected to return and nest in the same area. The nesting density that ultimately will be reached depends upon the particular species, the type of cover, location, and the amount of disturbance.

Migration.—The annual migration of birds northward in spring and southward in fall brings a variety of birds past almost every airport in the country. The migration dates vary from species to species and from area to area. The abundance of a given species may vary from year to year, depending upon weather conditions and other factors. On nights when a heavy migration coincides with low overcast, fog or drizzle, many small birds may be attracted to ceilometer beams. Some airports in the immediate vicinity of cities may have a late afternoon and early morning flight of many thousands of starlings passing over en route between a city roost and a rural feeding area. Airports in tidal areas may have flocks of shore birds traveling back and forth over the runways in moving from one exposed flat to another.

REMEDIAL MEASURES

If it is determined that a potential hazard exists due to the presence of birds, the first step is to identify the species involved and the factors that attract these birds to the airport. The second step is to determine whether a particular bird problem is temporary in nature or whether it will persist or recur. Many situations involve migrating individuals that are readily dispersed from the area and will not return once they have been frightened away. In other cases, the birds may be resident species which feed, rest, or roost on the airport grounds. The third step is to decide which remedial measures are most practical.

When a heavy concentration of a particular bird species constitutes a serious hazard, it may be necessary to give preference to immediate but temporary relief methods. On the other hand, if situations exist that currently or may in the future attract birds in dangerous numbers, steps should be taken to make the habitat on and in the vicinity of the airport less attractive to them.

Most concentrations of birds that occur during the spring and fall migration seasons are comprised of species that will be present for only a few days. Scaring devices generally are effective in these instances. On the other hand, summer or winter resident birds may gradually learn that scaring devices are relatively harmless, in which case other methods must be employed to reduce the hazard.

As long as attractive conditions exist on airports, birds will continue to take advantage of the situation. Much can be done to make such areas unattractive. The following are a few of the steps that can be taken toward a permanent rather than a temporary reduction of concentrations.

(1) Elimination of dumps and other unsanitary conditions. Any dump or sewage disposal area in close proximity to the airport can be a definite hazard because of the large number of gulls, starlings, and other birds that are attracted to waste food. Even careless disposal of relatively clean trash may attract birds for short periods.

(2) Potential roosting sites for flocking birds should be destroyed. Tall reeds, weeds, or brush may attract thousands of starlings and blackbirds, especially in fall and winter. Such cover may serve as roost sites for blackbirds and starlings, as well as for rodents and rabbits, which in turn attract birds of prey.

(3) Berry or seed-producing shrubs and weeds that are attractive to wildlife should either be removed altogether or replaced by less attractive species. If a line of shrubs is needed for a snow fence or a windbreak, it should be kept free of weeds. Use of shrubs which produce abundant fruits or seeds of known value as wildlife foods should be avoided insofar as possible.

(4) Ponds and other bodies of water should be drained or otherwise eliminated. Shallow impoundments in the immediate vicinity of runways should be well drained and the depressions filled to reduce even temporary rain pools to a minimum. Many species of birds are attracted to water for drinking and bathing purposes.

SCARE DEVICES

Research on bird control, particularly in connection with agriculture, has resulted in the discovery and manufacture of a number of devices which, if used correctly and under the proper conditions, have proven successful in repelling temporarily a number of species of birds. The following types of devices and materials are on the market and should be considered for applicability to airport bird problems if conditions warrant. This list is incomplete and does not include all manufacturers of scare devices and materials, nor does it imply Government endorsement of the products mentioned.

Automatic acetylene exploders.—Machines that ignite acetylene gas to produce loud explosions at regular intervals by dripping water on calcium carbide or from a tank of compressed acetylene gas. They are not injurious to birds, but the loud reports may be objectionable in residential areas:

Exide Thunderbird or Scare Away, Reed-Joseph Co., Highway 1, Greenville, Miss.

Zon, B. M. Lawrence Co., 244 California Street, San Francisco 11, Calif.

Exploding shotgun shells.—This is a 12-gage shotgun shell containing, instead of pellets, a king-sized firecracker which is projected a distance of 100 yards or more before exploding:

B. M. Lawrence Co., 244 California Street, San Francisco 11, Calif.

K. K. Hori Co., Inc., 5833 Perry Drive, Culver City, Calif., or 100 West Chicago Avenue, Chicago 10, Ill.

Pyrotechnics: Fireworks.—Firecrackers, inserted at intervals in slow-burning fuse ropes, have been useful in keeping birds away from agricultural crops. Dealers marked with an asterisk make and distribute completed ropes of firecrackers designed to explode at periodic intervals. The dealer marked with a number sign specializes in cotton fuse rope:

*Alpha Enterprises, Inc., Post Office Box 12242, Houston, Tex.

#J. E. Fricke Co., 40 North Front Street, Philadelphia 6, Pa.

*Red Devil Fireworks Co., 5415 East Century Boulevard, Lynwood, Calif.

Firecrackers, salutes, skyrockets, roman candles, and other devices have been used to drive birds from crops and to discourage roosting. These are standard items and may be purchased from regular firecracker manufacturers.

Birds gradually become accustomed to noise; therefore, it is best to move the exploders around occasionally and operate them only when necessary. They should not be operated during the dark of night but should be started at daybreak and dusk. Exploding shell crackers should be used occasionally in between explosions of the acetylene exploders. The number of exploders needed will depend upon the size of the airport and the severity of the bird problem.

Many States and cities have laws or ordinances prohibiting the use of fireworks. Investigate local city ordinances and State laws regulating the possession or use of fireworks or explosives, also local fire laws.

OTHER WILDLIFE

Rabbits, deer, and moose also have been involved in collisions with aircraft moving along runways. Specific information regarding their control or management is available through field offices of the Bureau of Sport Fisheries and Wildlife and State conservation agencies.

RESEARCH

Intensified studies are being initiated (1) to obtain more information on the extent and nature of the bird problem in all sections of the country; (2) to test commercial materials and devices marketed or proposed for use in bird control at airports; (3) to determine the potential usefulness of sterility-producing agents and selective lethal chemicals; (4) to investigate sonic, ultrasonic, and electronic media as bird deterrents; and (5) to observe bird behavior and responses in problem areas. It is anticipated that these long-range studies will bring about the discovery and development of new and improved control techniques.

TECHNICAL ASSISTANCE

Technical consultation regarding bird control may be obtained from regional offices of the Bureau of Sport Fisheries and Wildlife. These are listed below:

Region 1 (California, Idaho, Montana, Nevada, Oregon, Washington): Interior Building, 1001 Northeast Lloyd Boulevard, Portland 14, Oreg. (Belmont 4–3361).

Region 2 (Arizona, Colorado, Kansas, New Mexico, Oklahoma, Texas, Utah, Wyoming): Federal Office Building, 517 Gold Street, SW., Box 1306, Albuquerque, N. Mex. (Chapel 7–0311).

Region 3 (Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin): 1006 West Lake Street, Minneapolis 8, Minn. (Federal 9–3612).

Region 4 (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Virginia): 620 Peachtree-7th Building, Atlanta 23, Ga. (Trinity 6–3311).

Region 5 (Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, West Virginia): 1105 Blake Building, 59 Temple Place, Boston 11, Mass. (Capitol 3–2961).

Region 6 (Alaska): Box 2021, Juneau (phone 6–3546).

Remains of birds involved in aircraft strikes, including fragments removed from jet engines may be sent to the Bird and Mammal Laboratories, Bureau of Sport Fisheries and Wildlife, Room 61, U.S. National Museum, Washington 25, D.C., for identification. Fleshy remains should be frozen or preserved in formalin or alcohol before shipping. Dry remains require no special treatment.

Many species of birds frequenting airports are protected by Federal or State laws. Their legal status should be determined before any lethal controls are attempted. In some cases the laws contain provisions to obtain permits to destroy those individual birds which are causing depredations or are injurious to the best interest of society.

Mr. PYLE. At the same time we also recognize the responsibility of the Agency, both day-to-day and long range, for air safety. To discharge this responsibility, we must respond quickly to information obtained from accident investigation. Quite often, such actions will and must precede receipt of recommendations from the Board or the issuance of the formal report of probable cause, which normally takes some months.

Some of the specific corrective or preventive measures which we must be in a position to act on quickly and on an informed basis are:

(1) Issuance of airworthiness directives to correct an unsafe condition in aircraft.

(2) Issuance of maintenance and operational alert bulletins to correct unsafe practices.

(3) Consideration of new safety policies, procedures, or rules.

(4) Adoption of closer safety surveillance programs.

(5) Reexamination of flight personnel as to proficiency or medical aspects.

(6) Enforcement action.

The Administrator has taken one or more of these steps on many occasions. A good example was action taken subsequent to the Lockheed Electra crash at Tell City, Ind. One of the preventive measures taken at that time was the issuance of an emergency directive restricting the maximum speed of the Electra. Action was also taken to direct deactivation of the automatic pilot. Further, field inspectors were instructed to conduct an immediate operational check into the flight procedures of those airlines operating Electra fleets. The Agency also required immediate wing structural inspections, and special inspections when heavy turbulence was encountered or a hard landing was experienced.

We do not wish to minimize the value of information furnished to the Agency by the Board.

Senator MONRONEY. May I ask, this was done in a matter of days, wasn't it—a matter of a very few days?

Mr. PYLE. Yes, it was. Mr. Bakke can perhaps give the exact timing. I was not in the country at the time.

Mr. BAKKE. Your question, sir, is with respect to the Tell City accident?

Senator MONRONEY. Yes.

Mr. BAKKE. We were at the scene of the Tell City accident the day after the accident occurred, and 5 days after the accident had the airworthiness directive containing the five-point program concerning which we advised this committee at the time, namely, an inspection of all Lockheed Electra aircraft. And in connection with that inspection, institution of an operations inspection of all aircraft en route in order to check inflight procedures, and the beginning of a very substantial reinvestigation of the type design, bringing, for instance, NASA into the picture as a consultant to the Agency in order to be certain that nothing had been overlooked in this reevaluation of the type design.

These steps were initiated within approximately 5 days after the accident.

Mr. PYLE. We fully recognize that the Board's work is necessarily a tedious and often long-drawn-out process involving the aid and assistance of many groups and persons. The very thoroughness of the process makes it time consuming. As of February 1, 1961, only one of the formal reports of probable cause for the 17 fatal air carrier accidents which occurred during calendar year 1960 had been issued. We are often in a position of having to move promptly when an unsafe condition is revealed by an accident, whether or not it proves to be the probable cause; and I am sure the Board fully understands why this is so.

I would like to emphasize, Mr. Chairman, that my remarks are not in anyway to be inferred as a criticism of the Board; merely that we have certain responsibilities that we must discharge on a prompt basis, as you have pointed out. I think Mr. Gough put it very properly in his testimony: We have to keep the streetcar on the tracks. This is our objective, working closely with the Board and deriving information and helpful information from their reports.

Senator MONRONEY. You are familiar with the accident hearings. I am somewhat familiar with them and your staff is. This properly, perhaps, belongs more in the Civil Aeronautics Board area, but I am becoming increasingly concerned with the turning of accident investigations which are for principal purpose of detecting the probable cause so that corrective measures can be taken to prevent the next one, into a lawyer's field day in which the attorneys for the insurance companies, for the carriers, and the prospective lawyers for the plaintiffs in damage suits, turn these hearings less into an actual accident investigation and more into a pretrial conference for the accumulation of data that, having been produced by sworn testimony often in the accident investigation, will be useful to the conduct of defense or prosecution of damage suits at a later time.

I know the testimony is not admissible as it is, but a witness having given it at one time under oath is fairly well bound by the limits of what he has said previously.

I don't know what can be done about this, but I think something is going to have to be done at some point to hold the hearings more in a position of a safety investigation. I even had at one point in your New York hearings a young attorney who said, "I have several of these plaintiffs signed up for a lawsuit, and if these insurance carriers' attorneys are going to be able to participate and suggest questions that will be asked in the line of testimony developed, I want to have that same right."

It was just as plain and simple as that. We have got to be careful or these hearings are sooner or later going to jump the track and are going to be expanded to a point where they will be not serving the original purpose but will be serving a completely different purpose entirely apart from the factfinding that they were intended to do.

Mr. PYLE. Mr. Chairman, I agree thoroughly with the point you make. I think, frankly, this thing has got to the point where we are endangering the very specific purpose for which these hearings are held. We are making it impossible for the hearing examiners to

conduct their business and get the facts necessary to a determination of the probable cause.

I can only say I agree thoroughly.

Senator MONRONEY. I think it would be quite proper for both the CAB and the FAA to make suggestions to this committee, if necessary, at our request, and I would so make the request, for procedural changes that might limit the hearings to men of technical competence and capability, and not associated directly or indirectly with attorneys for the insurance companies or attorneys for the prospective plaintiffs in the case.

Mr. PYLE. I will certainly convey your remarks to Mr. Halaby. I think this is most important. We will participate. I am sure Mr. Boyd is concerned about this, and we will pass on your thoughts.

Senator MONRONEY. You may proceed.

Mr. PYLE. Current safety program: It is important to emphasize that the Agency's safety program is based on many things other than the lessons learned from particular accidents. Many corrective and preventive measures are taken as a result of our findings in what we consider to be an equally productive area, the investigation of incidents. We also learn of problems and deficiencies from day-to-day information reported by our inspectors. In addition, special safety studies and investigations of broad problem areas often lead to adoption of safety measures of many different kinds.

There are, of course, dramatic instances, as in the case of the Electra wing failure, when an accident investigation yields a store of aeronautical knowledge which might not otherwise have come to our attention. That case, incidentally, represents what was probably the most intensive effort ever undertaken to determine the cause of an accident. The FAA presented the matter in great detail last November to the House Subcommittee on Transportation and Aeronautics. We have copies of the statement made by the Agency on that occasion and would be glad, with your permission, to submit them for the information of your subcommittee.

I believe they are contained in the exhibits, Mr. Chairman.

Senator MONRONEY. Yes, I believe so.

How many pages? That is 12 pages. I would like to have that placed in the record at this point.

Mr. PYLE. This is the Electra?

Senator MONRONEY. Yes.

(The résumé follows:)

RÉSUMÉ—LOCKHEED ELECTRA ACCIDENTS AND CORRECTIVE ACTION TAKEN

(1) September 29, 1959: Buffalo, Tex.: Structural failure in flight.
(2) March 17, 1960: Cannelton, Ind.: Structural failure in flight.
(3) March 25, 1960: Airworthiness directive:
  (*a*) Speed restriction.
  (*b*) Deactivate autopilot.
  (*c*) Special refueling procedures.
(4) March 25, 1960: Federal Aviation Agency directs Lockheed to reevaluate Electra.
(5) April 15, 1960: Fleet inspection; no significant findings.
(6) Early May: Definition of "whirl mode" developed and related to both accidents.
(7) June 1960: Reaudit program. Found airplane generally in compliance with Civil Air Regulations; no cause for accidents.
(8) June 1960: Beginning of LEAP program.

(9) July 27–29, 1960: Civil Aeronautics Board hearing, Los Angeles, Calif. No significant controversy.
(10) November 30, 1960: LEAP modification approval: speed still restricted.
(11) December 31, 1960: LEAP approved; unrestricted operation.
(12) LEAP modified Electra deliveries; one per day. Sixty-four aircraft completed to date.
(13) July 1961: All Electra aircraft will be modified.

REPORT ON REEVALUATION AND MODIFICATION OF ELECTRA AIRCRAFT

This report summarizes one of the most intensive investigations ever to take place in the aviation industry. It began September 29, 1959, when a Lockheed Electra turboprop transport crashed at Buffalo, Tex., under circumstances which could not be explained. While the investigation of the Buffalo accident was taking place, a second crash occurred at Cannelton, Ind. This second crash, which was due to a structural failure almost identical to that suffered by the first airplane, made it clear that immediate and positive action was required.

While the Civil Aeronautics Board was responsible for the official investigations of the accidents, it was the responsibility of the Federal Aviation Agency to direct the reevaluation of the entire structural design criteria of the airplane. The Civil Aeronautics Board, the National Aeronautics and Space Administration (NASA), other airplane manufacturers, airlines, and other groups all cooperated closely with the FAA, the Lockheed Aircraft Corp., and Allison Division of General Motors, the manufacturer of the Electra engine, in the reevaluation. It proceeded as follows:

On March 23, 1960, the FAA called a meeting with the president of each airline operating Electras and representatives of Lockheed and Allison to completely review the program. The technical assistance of the NASA and its complex of wind tunnels was requested by FAA at the start of this engineering and research investigation, and the NASA has provided the most outstanding cooperation and assistance throughout the program.

On March 25, the FAA initiated a five-point program which included:

(1) EMERGENCY AIRWORTHINESS REGULATIONS

Reduction of the originally certificated normal operating speed of 373 miles per hour to 259 miles per hour. The speed restriction provided an additional airload margin of 50 percent between the maximum loads expected in normal operation and the structural capability of the airplane. The new lower speed provided an ample margin for maneuvers needed for the safe operation of the airplane. Also, the new operating speed permitted a more rapid slow down to rough air penetration speeds required whenever turbulence is encountered. The autopilot was deactivated until it could be proven that it was blameless in the accidents and to permit the incorporation of FAA required improvements to eliminate porpoising, which had been noted in the original installation. Operators were instructed to conform precisely to the aircraft manufacturer's refueling procedures in order to prevent overstressing wing components caused by overpressurization of the tanks with the pressure fueling system.

(2) EMERGENCY MAINTENANCE SYSTEM

FAA inspectors made thorough structural inspections of the entire wing of all Electra aircraft. Daily checks were made of the engine reduction gears to detect any possible damage to these gears. Any aircraft which went through severe turbulence or which made a hard landing was given a thorough structural inspection before flight was again permitted. When inspection revealed evidence of inadvertent overpressurization the tank was completely drained and internally inspected prior to further flight.

(3) SPECIAL AIR CARRIER OPERATIONS INSPECTIONS

FAA air carrier inspectors were directed to conduct accelerated inspections on Electra flights in air carrier service. Particular emphasis was placed on ensuring that the flight crews were instructed on the new speed limitations and that they were familiar with flight techniques and procedures contained in Electra flight manuals.

(4) FLIGHT RECORDERS

The FAA required that flight recorders be installed in all Electra aircraft. These devices insure a permanent record of airspeed, altitude, direction, and acceleration and are crashproof.

(5) ENGINEERING AND RESEARCH INVESTIGATIONS

Most important, the Lockheed Aircraft Corp. was directed by the FAA to undertake a program of engineering and research investigations which were, in effect, a complete reevaluation of the Electra design. Although no specific causes had been announced by the CAB for the Electra accidents, a thorough technical review of all engineering aspects of the design was conducted by Lockheed and the FAA. This included a flight-test program to demonstrate the soundness of the airplane with respect to loads imposed by maneuvers and air gusts. Particular emphasis was given to the ability of the wing to dampen, after it was disturbed and loaded by air gusts.

The control system was completely evaluated to determine the effect of possible types of malfunction, and a complete review of the basic engineering data on strength and stress analysis was made. Over a million engineering man-hours have been spent by Lockheed, Allison, NASA, and FAA in this reevaluation. Voluminous engineering reports were prepared by Lockheed, assisted by other companies. All were studied and approved by the FAA.

An accelerated flight-test program of a highly instrumented Electra aircraft was immediately started, to obtain sufficient data to demonstrate the aerodynamic and structural characteristics of wings, nacelles, and control surface assemblies. Maneuvers, natural gusts penetrations, and flutter response tests were conducted over a range of weights, speeds, and fuel loads sufficient to ensure that if any possible and, heretofore, unsuspected abnormal structural effects were present, they would be revealed.

The following conclusions were drawn after extensive flight testing:

(1) The original design loads used for all maneuvering conditions were correct and accurate as proven by measured flight loads and stresses.

(2) During an abrupt pullup maneuver, the airplane's stability characteristics are normal.

(3) No abnormal characteristics are present in the Electra for such evasive action maneuvers as rolling pullups. This was clearly demonstrated and recorded in time-history curves obtained from the most sophisticated instrumentation during maneuvers.

The Electra was flown through areas of heavy turbulence to measure and determine what affect air gusts had on the wing and fuselage structure. The recordings of gust velocities and airplane response represented extensive rough-air flight time; more than half a million data points were read and processed.

This gust flight program, one of the many segments of the overall technical reevaluation, was one of the most extensive and far-reaching investigations of its kind in the history of aviation. New knowledge was gained which will benefit the entire aviation industry in the development of methods of analyzing airplane stresses.

The Lockheed Aircraft Corp. was directed to conduct a thorough evaluation of the airplane control system including the autopilot characteristics giving consideration to the influence of possible malfunctions, failures, and induced effects to insure that sudden destructive forces are not reasonably probable. As a result, FAA approved a series of changes to the control system, including the autopilot. The changes are now reflected in an FAA-approved service bulletin which is an integral part of the overall modification program.

The most important part of the analysis was obviously that related to the basic proof of structure itself. In the design of all airplanes, it is necessary to use estimated aerodynamic loads for the purpose of calculating stress in the structure. Due to the fact that the flight test program was so extensive, however, it was now possible to validate the estimates with actual measured aerodynamic loads. This process permitted a reaudit of the basic proof of strength employed in the structural substantiation of the Electra. This included:

(1) Integration of validated data obtained in the flight program.

(2) Review of existing statistical data on magnitude, frequency, and characteristics of atmospheric gusts as applicable to the Electra.

(3) Reinvestigation of flutter and divergency analysis, including consideration of abnormal situations arising as a result of typical likely failures, such as damaged gear box support structures, complete loss of one engine, and damaged wing structures.

(4) Wind tunnel investigations to obtain basic aerodynamic data both for normal airplane configurations (including propeller induced effects on airflows, forces, and other phenomena, and including varied propeller inflow angles) and for abnormal conditions arising as a result of typical likely structural damage or failure.

As a result of these studies and tests it was concluded that under certain conditions of engine nacelle or powerplant damage, a phenomenon, known as "whirl mode," could occur. A brief explanation of this phenomenon and the problems of flutter and damping may be in order.

As a wing is "excited," i.e., loaded intermittently as might occur when encountering air gusts, it is necessary that the wing return automatically to its previous position. Good damping requires that a motion of this sort die out rapidly. The damping forces are those which take energy away from the oscillations. A small amount of damping comes from internal energy absorption in the metal structure and energy absorbing parts such as rubber engine mounts, but the greatest damping comes from designing the structure so that the aerodynamic forces on the airplane resist the motions and thus absorb energy from the oscillations. Conversely, if a major change occurs that permits the air forces to aid the motion, the oscillation grows. This condition is known as flutter.

The Electra wing has good positive damping which inherently prevents flutter. The studies and tests conducted during the reinvestigation show that while the control system could not induce wing oscillation, the wobbling of an outboard propeller could. In a normal airplane such propeller misbehavior cannot occur. However, if certain structural failures occur in the outboard powerplant installation, the stage could be set for a wobbling propeller condition.

Since a propeller has gyroscopic characteristics, it will tend to stay in its plane of rotation even though it may be loosely mounted. A list of possible external forces would include atmospheric turbulence, abrupt aircraft maneuvers and sudden engine power surges. When such a force is applied, the propeller reacts 90° out of phase with the applied force. Assuming the propeller is displaced upward by some force, the structural resistance of the mounting system applies a nose-down pitching moment. The propeller disk, when viewed from the rear, will then turn to the left due to precession. The yaw stiffness then causes a nose-down pitching, which is in turn resisted structurally, resulting in the propeller disk yawing to the right. The yaw stiffness on that side then causes a nose-up pitch, to complete the cycle. This effect has been termed the "whirl mode," and its direction of rotation is opposite to that of the propeller.

In a normal healthy airplane, the "whirl mode" could operate only within the limits of flexibility of the engine mounts, and it was damped out very quickly. However, if some structural element of the powerplant, the powerplant mounting system, or the nacelle was in a damaged or weakened condition, so that the stiffness of the propeller supporting system was reduced below normal, then the "whirl mode" would not damp out rapidly at high airplane speed. Powerplant installation damage did not significantly change the conditions under which the "whirl mode" might have been initiated, but it made that phenomenon, which is not hazardous in itself, become threatening in three ways. First, the greater flexibility of a weakened installation could allow the "whirl mode" more freedom and it could become more violent. In an undamaged installation, stiffness increases rapidly as deflections approach the mount limits, but in a damaged installation this characteristic might be altered. Second, in a weakened installation the strength level was reduced, and this, in combination with the increased force and violence of the "whirl mode," could lead to further damage, progressively, and thus further reductions in stiffness. Third, and most important, this changing "spring constant" situation was a condition wherein the frequency of the "whirl" mode" on a damaged and overly flexible structure could have reduced from its natural value (which is safely above the fundamental natural vibration frequencies of the wing) to lower values which approached the wing's natural frequencies. As the "whirl mode" progressed in a damaged installation, the frequency of the mode could have approached the natural frequency of the wing which

would in turn tend to perpetuate the "whirl mode." The oscillations would then be coupled at the same frequency. This is a form of induced flutter, forced by a powerful harmonic oscillation to occur at a lower airspeed than that at which flutter in the classical sense can develop. This condition could produce a catastrophic failure through severe oscillatory divergence. A situation could develop where damping diminishes and each oscillation of the wing becomes greater until the wing structure failed.

Identification of the whirl mode phenomenon, therefore, became the key to the mystery which had baffled the aviation industry for months. The correction of the various wing, powerplant and nacelles deficiencies was, in retrospect, relatively simple once the problem was identified. The Lockheed modification program designed to correct these deficiencies was submitted to the FAA and has now been approved.

Briefly, the modifications are as follows:

(1) Additional mounts have been added to stabilize the propeller should any mount fail, or should breakage occur between the gearbox and the power section.

(2) The nacelle structure has been strengthened considerably by the addition of reinforcements and diagonal braces.

(3) The wing strength has been increased by—

(*a*) Increasing the thickness of three lower surface "planks" and one upper surface "plank."

(*b*) Reinforcing the front spar and the wing lower surface.

(*c*) Strengthening 18 ribs in each wing by additional diagonal braces and reinforcements.

Dramatic flight tests were completed during the latter part of December on an Electra modified in accordance with the program.

The FAA required that the test be accomplished to show the results of one of the severest structural failures that could be conceived; specifically the failure of the torque shaft and the torque shaft housing. The shaft and shaft housing were, in fact, removed prior to flight. The airplane was dived at speeds up to 418 miles per hour in this weakened condition. Severe flight loads were imposed by the pilot to record strains on the critical parts of the structure. Instruments revealed complete absence of the whirl phenomenon or any other adverse condition. The flight tests, which included endurance flying and a rigorous 100-hour program of runups, takeoffs, and landing, coupled with high-speed dives, to prove out the effect of the new mounts on engine wear were completed on schedule.

In order to provide for operation of LEAP modified airplanes, Lockheed requested that the LEAP configuration be approved at the restricted speeds as soon as possible. This was accomplished at VNO equals 225 knots by approving Lockheed Service Bulletin 500 on November 30, 1960.

The evaluation of the LEAP configuration was completed and the airworthiness directive was revised to permit LEAP modified aircraft to operate at unrestricted speeds on December 31, 1960.

The Lockheed Co. is presently modifying Electra aircraft at a rate which will permit all of the Electras to be modified by July of 1961. All work is taking place at Lockheed's Burbank, Calif., headquarters under the most careful control by Lockheed and FAA. As each airplane is completed, its speed restrictions are automatically removed. It is expected that airlines will return to the high speed schedules as soon as they have a substantial part of their fleet modified.

In summary, the FAA believes this extensive reevaluation, proven by an intensive and thorough flight test program, fully justifies the removal of speed restrictions on modified Electras. The strength of the modified Electras, when operated at higher speeds, is well above the requirements of the FAA for structural integrity.

The Agency has employed every means available to it, including the expert technical assistance of the National Aeronautics and Space Administration, generally recognized as the world's leading authority in the aeronautical sciences. In addition, the services of leading aeronautical experts from our aviation industry at large have been employed. Every available scientific and technical resources has been brought to bear to assure the traveling public of the airworthiness of the Electra, before permitting it to return to its originally designed operating speed.

Mr. PYLE. Normally, one accident does not yield information of such great value. I am sure the subcommittee will understand that more often accidents are caused by deficiencies well known and understood in terms of human failure.

A series of identical or very similar accidents can, of course, establish a trend and reveal to us the necessity of moving on some broad front of air safety, such as maintenance standards or pilot proficiency. Often, the need for greater surveillance or stricter enforcement may be demonstrated. These are valuable lessons, but the need for such measures is just as often revealed by information from other sources.

Most of our normal efforts are devoted to trying to anticipate the probable causes of accidents and doing what is necessary to prevent them. This is a day-to-day, rather plodding job, compared to the drama and impact of the occasional major accident. Nevertheless, it is still the best way known to assure safety.

This is illustrated by a highly important activity of the Bureau of Flight Standards which is absolutely essential to accident prevention. The Bureau is responsible for flight checking 2,600 air navigational facilities used by civil and military aircraft in the continental United States, to insure navigational reliability.

This is done with a fleet of DC–3, Convair and B–57 aircraft, equipped to measure the signal of each facility accurately. TV–2A aircraft are also used for radar flight checks. The workload includes flight checking 219,000 miles of airways from just above the surface to 40,000 feet, including nearly 200 instrument approach procedures, 5,000 holding patterns, and 55,000 intersections and flight procedures.

A number of out-of-tolerance conditions in air navigational facilities and procedures are detected and corrected in this manner during the year. Even with all available aircraft working on a continuous basis, this workload could not be entirely accomplished during 1960. In 1961, with modified Convair turboprop aircraft with multiple electronic equipment, we shall handle a heavier workload through development of a "Grid System" of flight checking.

In addition, two C–135—basically KC–135—high altitude jet aircraft will be able to check more facilities than were previously handled by the B–57, to provide more capacity at high altitudes where of course the civil jets and military jets are operating.

I might say, Mr. Chairman, that I think this is a rather dramatic example of how we can use technology which we have learned through the years to added advantage. We can position these aircraft now in space, plus or minus 400 feet, in range from a station. This means that our aircraft are actually more accurately positioned than are the maps which we have to rely on as to where the facilities are located.

The Coast and Geodetic Survey has to redo the maps at considerable cost when we find the facilities are not in proper position on the ground.

Senator MONRONEY. You talk abut multiple surveillance. You have developed electronics equipment, I think, in your check planes where they can by making one flight check several routes with accuracy at the same time, can they not?

Mr. PYLE. Yes, sir. This is the grid system whereby the airplane flies a predetermined track. Actually it flies a checkerboard pattern across the United States, east and west, and north and south. He may

check systems facilities on one pass, come back and catch it on the other side, and top and bottom.

By assigning certain tracks to the aircraft we can check all the facilities at a minimum of cost. The data are recorded and then put into computers. We find in very short order the condition of the various navigation aids that have been checked and institute corrective action immediately.

Senator MONRONEY. How do you like that Convair turboprop conversion?

Mr. PYLE. We are just in the process. The first airplane has just gone in.

Mr. BAKKE. The first airplane went in for modification 2 weeks ago. Our analysis of the performance of the airplane led us to the conclusion that there was no other way we could do the job. We are very happy with the prospects of the conversion. We have not flown the airplane as yet.

Senator MONRONEY. This steps the speed up a great deal?

Mr. BAKKE. Yes, sir; considerably.

Mr. PYLE. The greatest advantage is that we can get it up to altitude in 8 minutes as against 32 or 33 minutes with the reciprocating engine. We also plan to put into operation a performance and evaluation system for analysis of all flight checks, to evaluate the airways system and point the way to development of new navigational techniques.

At the same time, we shall work on further standardization of aeronautical instrument charts and flight information publications, to make sure—most important, Mr. Chairman—that the pilot and the controller will always be using the identical charts and information. These charts and publications are the end product of all flight checking, and our efforts are to no avail unless they reflect completely accurate and up-to-date data.

In other words, Mr. Chairman, we are anxious to avoid the situation which does happen, unfortunately, sir, where the controller gives the pilot an intersection which is not on the pilot's map. This we hope to avoid.

Another current Agency program is aimed at finding means to improve present safety requirements governing the manufacture and use of replacement and modification parts. Little can be done in this regard without close identification of the parts, and one approach under consideration would be to require that all replacement and modification parts be identified as coming from an approved source. We intend to pursue this project vigorously.

We are also seeking means to obtain the maximum benefits from flight recorders. For many years, the aviation industry has recognized the need for a chronological record of certain flight data. We believe flight recorders should be improved, particularly to increase the amount of information they can record and facilitate the decoding of such information.

One of the exhibits includes an abridged version of our presentation at a flight safety foundation seminar in November 1960, asking cooperation of the aviation industry to speed further development of the airborne flight data recorder. An industry conference is set for March 7 on this subject.

Senator MONRONEY. This flight recorder—I heard it analyzed at the New York crash—is a remarkable instrument, but we are using only a certain number of inputs.

Have you considered stopping up the number of inputs in order to give you additional information off the same equipment?

Mr. BAKKE. Yes, sir. At the moment we are recording five parameters. For example, speed, g, altitude against time. One of the matters which we plan to discuss at our March 7 conference with the industry is the question of how many other parameters we can usefully include in the flight recorder system.

We are actually inviting flight recorder manufacturers in, and others who have skills in this area, to tell us what the state of the art will permit at this time. This is the question we are trying to determine: Can we usefully require additional parameters in the light of what is available and what is marketable today?

Senator MONRONEY. Are you also asking these manufacturers to perfect means to make the charts more readable?

In other words, one of the things that I think could have the greatest possible yield is for these tapes to be available to the service managers of the companies to detect hard landings or malfunctions in flight that do not cause an accident and might even be escaped by the pilots on the pilots' swawk list.

As an X-ray of the plane's performance over a certain number of hours it would seem to me that you would have a far greater yield than to merely use them only in the case of a catastrophic accident; to have them available as a part of the checklist of the maintenance and overhaul procedures on these aircraft.

Mr. BAKKE. Sir, we have already asked that that be done. In the original flight recorder, which was required in the civil air regulations approximately 5 years ago, the Board at that time decided that this recorder would have to be required on essentially the basis that now exists, simply because it felt that it could not prolong the process any further.

It had as of that time engaged with the industry in approximately 10 years of discussion, conversation, development, service, test, and so on, to produce the kind of recorder that you describe. But it had eluded us all until that time.

More recently the Federal Aviation Agency adopted a regulation which added the turbopropeller aircraft fleet to those aircraft on which the flight recorder shall be installed. At that time there were two dates established in the Civil Air Regulations, one which as I recall was in October of last year, and the other the end date of which was in May 1 of this year.

The purpose of those two dates was to permit a carrier which could come in and indicate to us that he had under procurement some advanced recorder types, that we would permit him this additional time in order to get the devices such as you describe.

I believe that the only answer for a real quick read-out is an electronic or magnetic recording system which will permit us to take the head from the flight recorder in the airplane and actually get an immediately recording read-out with a printed copy in a matter of very short order.

We have seen devices which are capable of doing this. However, the manufacturers who possess the necessary skills to produce equipment like this have not seen fit to market such equipment at this time because they do not consider that an adequate market exists. This is one of the things that we want to explore further with the industry at our March 7 meeting.

Mr. ANAST. In order to back up this work by our Bureau of Flight Standards, in many cases we have gone to nonprofit organizations, the Battelle Foundation Institute, in Columbus, Ohio, to determine the parameters which can best be measured not only from the point of view of an accident but from the point of view of determining incipient failures which can be detected in advance. This was started about 6 months ago and we expect very shortly to have the report furnished to our Bureau of Flight Standards.

Senator MONRONEY. It is interesting to note the flexibility of American industry where the one most in use now, the Waste King, was made by a garbage disposal company. It shows that we can really convert lots of things into more sophisticated use.

Mr. BAKKE. Mr. Chairman, I might make one other observation, and that is that there is one additional element to be recorded which we think is perfected and sufficiently developed to propose a requirement at this time as the result of another report which we have had from the Bureau of Research and Development, and this has to do with the voice recorder, the requirement for which is also to be discussed at the March 7 meeting.

Senator MONRONEY. On these flight recorders, as I remember this being read back, everything seemed to run from the "wheels up" stage. Is that correct, or is it just the point that you start reading the tape? Because in such accidents as the Mexican aircraft being wrecked on takeoff, these tapes, which I understand were recovered in the Mexican plane, can be valuable in telling us what happened even though maybe the wheels were not up.

Mr. BAKKE. Actually we learn from experience on this one. We had the requirement initially that the flight recorder was to run continuously after the landing gear, the solenoid switch, was actuated, which would mean from wheels up to wheels down.

Unfortunately, however, this missed the most critical portion of the takeoff flight path. So the industry was alerted to the fact that we wanted a switch, a toggle switch included in the aircraft preflight check or pretakeoff check, in order to insure that through the actuation of this switch we could get the recorder running earlier.

Unfortunately the next design that appeared in the airplane was one that was not actuated by the landing gear scissor switch and as a result, in the case of one accident at Seattle the pilot forgot to turn it on and we did not get any flight recorder record at all.

The present requirement includes both. In other words, it is necessary that the equipment be capable of actuation on the ground prior to the start of the takeoff roll, and it is required that the system be so actuated.

However, in the bare possibility that even this may be missed, if the pilot neglects to turn it on it will come on automatically at the time the gear is lifted off the runway.

Senator MONRONEY. To get the history of the rollout for takeoff?

Mr. BAKKE. That is exactly it.

Senator MONRONEY. You will have to have it activated, but it is on the checkout list that he is supposed to turn on?

Mr. BAKKE. Yes, sir.

Senator MONRONEY. You did recover the tape on the Mexican accident?

Mr. BAKKE. No, sir. To my knowledge there was no flight recorder tape on the air on the Aeronaves accident.

Senator MONRONEY. I understood there was.

Mr. BAKKE. On the Aeronaves? No, sir; I believe not.

Senator MONRONEY. That was my understanding.

I may be wrong.

Mr. BAKKE. The Civil Aeronautics Board would have possession of it. They may be able to confirm it. I believe there are some who are here. To my knowledge it was not recovered.

Senator MONRONEY. Perhaps I misunderstood. I thought they had mentioned that they recovered it.

Are all foreign airlines flying into the U.S. airports required to carry the flight recorder on the same type of planes that we require domestically?

Mr. BAKKE. They are not required to carry flight recorders by U.S. law. Almost all carriers—I cannot state positively that every one does—all of which I have knowledge do carry flight recorders consistent with our requirement, but not subject to it.

There may be some differences and we have an unfortunate difference in the case of the Sabena accident in Brussels, for instance.

Our information is that all of the Sabena aircraft carry flight recorders of U.S. manufacture, with one exception, and that one exception was a flight recorder produced by a manufacturer not in the United States. It was that other flight recorder that was installed in the airplane involved in the accident at Brussels. Unfortunately this recorder was of a photographic type and the film was exposed as a result of the accident and accordingly no flight recorder record was had of the Sabena accident. We think this is a real tragedy. We could have learned much from it. Unfortunately, this is not the case.

Senator MONRONEY. Thank you.

Mr. PYLE. Mr. Chairman, I would like to go back to a point which you made with which I thoroughly concur, and that is that I think it is most important—and I make this more or less as a personal observation—that it is most important that we have quick read-out type recorders that enable us to find out what happens in various flights, and enable the operator to find that out.

You speak of a hard landing. This turbulence experienced for instance during a flight, particularly during heavy turbulence, these things are a valuable record to an operator to insure proper maintenance in the operation of his aircraft.

These are the kinds of things we are going to take a hard look at in our conference that is coming up on March 7.

Senator MONRONEY. Thank you very much.

You may proceed.

Mr. PYLE. While stressing the fact that accidents are by no means the only productive source of safety data, I do not wish to minimize the value of information we have gained from particular accidents.

No important safety trends seem to have been reflected by the major air carrier accidents of the past year. Nevertheless, some of them taught us extremely valuable lessons. You may be interested in some of the measures FAA has taken as a direct result of accidents during the past year.

The situation following the Electra crash at Boston on October 4, 1960, is a case in point. There, we intensified an effort already begun, before the crash, to attempt to solve a problem all of us knew had existed for some years—the dangers of bird ingestion into aircraft engines.

We expanded our search for means to keep birds away from runway areas, and cautioned airport operators to work closely with bird authorities and our field personnel, to guard against this danger. Our statement on the Electra crash, before the House Subcommittee on Transportation and Aeronautics, to which I have previously referred, includes a detailed treatment of the bird problem.

We also submitted the item as an exhibit on the contract.

In another case, the midair collision over Staten Island on December 16, 1960, the facts indicate possible need for several measures. For example, additional controls of the speed of aircraft in terminal areas may be indicated. Here, the DC–8 was apparently doing over 500-miles-per-hour groundspeed while its normal holding pattern speed was 207 miles per hour. We are also requiring reports to Air Traffic Control on all in-flight malfunctions of airborne navigational equipment, so that our controllers will be able to provide maximum assistance to aircraft hampered by such equipment failure. I have already mentioned the conference we are calling to explore a mandatory requirement for airborne DME equipment.

Senator MONRONEY. The requiring of reports of malfunction of airborne navigational equipment, this is all that you are requiring, as I understand it. They merely notify the air traffic control system or the approach control man. Do you think that it should be left to the pilot, or must be left to the pilot to decide under those conditions whether he would be under radar guidance for the completion of this landing?

Mr. PYLE. I am not sure——

Senator MONRONEY. As I understand it, a man could have lost, as this one apparently did, half of his navigation equipment. He knew he could have received radar assistance had he requested it. The point that I am wondering about is does this rule of reporting go far enough, or should it require also then that under such circumstances the pilot would be required to accept this additional safety help?

Mr. PYLE. I would like Mr. Thomas to speak to this, Mr. Chairman. Before he starts I would like to point out that this was a special civil air regulation, and its effect was to move into an area which we felt required immediate action; namely, to report specifically malfunctions that we could define easily and readily: navigation equipment, automatic direction finders, communications equipment, ILS equipment, and so forth.

I think there is a necessity, and we propose to come out with a more carefully considered and more comprehensive regulation which will be the subject of a proposed notice of rulemaking in which we will then get the comment of industry, pilots, and others. We will bring into

consideration the very points that you bring up, or the point that you bring up. Perhaps Dave would like to comment further on this.

Mr. THOMAS. If I may, sir, the special civil air regulation which became effective on February 17 is rather simple and straightforward. It requires a pilot to report any loss of VOR, TACAN, ADF, or low frequency navigation capability, or complete or partial loss of ILS receiver capability, or impairment of air-ground communications capability. We have made it very simple.

In doing so he is required to give his identification, tell us the equipment affected, and the degree to which the capability, his capability to operate IFR in the air traffic system is impaired, and the nature and extent of the assistance desired from Air Traffic Control.

The controllers are required to pass this information on and to render such assistance as may be indicated. The reason for not making a specific type of assistance mandatory, such as radar, he may not be in radar coverage. Or his impairment may be in fact a loss of an ADF receiver over Denver when he is landing at Baltimore and probably wouldn't use it until he got to the outer marker and he may be VFR at this time. The situation can change.

The assistance given him would be radar assistance, not holding him at an intersection, if this were involved, rerouting, or perhaps radar navigation to the point of landing.

We thought we should leave some room for the pilot and the controller to determine the type of assistance that would be given.

Senator MONRONEY. I think perhaps for the start this is correct. But it still comes back to me that this pilot knew—you didn't have to tell him half of his navigation equipment was out, he knew that he could get radar assistance but he didn't ask for it.

Will the mere reporting that his radar is out give you the proper corrective action unless he is to be under a regulation requiring him to use it in these particular congested areas or under IFR conditions? If it is a clear day and he can see and make a visual approach, I would think it would not necessarily apply. But under instrument conditions you would not improve that which the pilot already knew. Of course you would have alerted your people in the control tower who could have radar on him. But whether he would accept their vectoring or not is another question.

Mr. THOMAS. Sir, I think that it would have improved the situation a great deal, and I am inclined to think he would have accepted the radar handling that might have been offered.

We have had quite a good deal of experience with this with the military, not so much on airborne losses but with the variety of equipment. Some of them are TACAN equipped, some VFR equipped, some have both VFR and ADF. As a part of routine, military file equipment capability and the controller handles them accordingly. There would have been quite a substantial difference in handling this had we known.

Mr. PYLE. The point that we would like to leave with you is the fact that we do have to take a comprehensive look at this whole area to be sure to come up with something that is practical and understandable to the pilot, because in our effort to be all-inclusive we might come up with something that would be almost impossible for the pilot to understand. This would not be a help to him.

Senator MONRONEY. I agree, and there may be very good and valid reasons why it should be left optional with the pilot. I think it is something we should hear from the pilots on when they come up here.

Mr. PYLE. I am sure they will give us the benefit of their thinking.

Senator MONRONEY. What I am trying to do is escape from one man's judgment which sometimes can be bad. Maybe he is in a hurry to make a schedule or feels competent to make a landing when maybe the man on the ground, knowing the weather and the conditions of traffic in the neighborhood, might wish him to take a radar-controlled landing or ILS.

Mr. THOMAS. Sir, I think it may be a little bit clearer: If the controller knows the deficiency, I doubt if he could escape special handling if he wanted to. I think this would alert the controller.

Senator MONRONEY. This would help at least. And even had the transmission been made to the approach radar man that this was out, he would probably have been watching for him more closely at Preston.

Mr. THOMAS. I don't think there is any question but what it would have helped.

Senator MONRONEY. He might have picked him up when he went into Vector 123.

Mr. THOMAS. That happens daily. It happened last night. It happened at the time this was going on. It is a routine part of traffic control.

Mr. PYLE. Mr. Chairman, if it would be in order, I would like to submit this special CAR for the record at this time.

Senator MONRONEY. I would like to have it printed. Is it short enough?

Mr. PYLE. Yes, sir.

(The Special Civil Air Regulation follows:)

TITLE 14—AERONAUTICS AND SPACE

CHAPTER I—FEDERAL AVIATION AGENCY

[Reg. Docket No. 656]

SPECIAL CIVIL AIR REGULATION SR-445

REPORTS OF NAVIGATION AND COMMUNICATIONS EQUIPMENT MALFUNCTIONS

Under this special regulation, pilots in command of aircraft being operated in controlled airspace under the instrument flight rules (IFR) must report immediately any malfunctions of navigation or communications equipment to Air Traffic Control.

Part 60 of the Civil Air Regulations contains the Air Traffic Rules and prescribes in section 60.2 that the pilot in command of an aircraft is directly responsible for that aircraft and "shall have final authority" as to its operation. This authority includes the responsibility to utilize available facilities at his disposal when a malfunction occurs which curtails the pilot's ability to navigate by reference to ground radio aids or communicate with ground facilities while operating under instrument flight rules.

Information regarding the airborne malfunction of a component which may affect the ability to navigate or communicate shall be made available immediately to Air Traffic Control in order that the system shall be alerted to the fact that the pilot may not be able to fully comply with the requirements of the system, or that an emergency situation may develop. Such immediate notification will permit a more complete utilization of the resources of the system.

For many years, it has been a common practice for pilots to report malfunctions of communications or navigation equipment to Air Traffic Control. However, there have been instances wherein an equipment malfunction has not been communicated to Air Traffic Control and where subsequent handling of the aircraft might conceivably have been more effective if the circumstances had been properly reported. It is, therefore, no longer feasible to continue the reporting relationship on a voluntary basis for IFR operations in controlled airspace. Accordingly, this regulation is being promulgated.

The exact nature and degree of assistance available and appropriate from the air traffic control system will vary considerably. In areas where extensive ATC radar surveillance capability exists, it will be possible to provide greater assistance than in areas with little or no radar coverage. The volume of IFR traffic under ATC jurisdiction will also be a factor in the handling of the reporting aircraft. It should be emphasized that the efficient provision of ATC assistance is dependent upon a complete understanding between the pilot and the controller as to the nature and extent of the assistance needed, as well as the nature and extent of the services available. If it is possible to maintain radar and communications contact with the pilot, the controller can render considerable assistance during en route operations, during entry into holding patterns, during holding, and during the approach and landing.

It is important that the distinction between the ATC "special handling" of aircraft with malfunctioning equipment and the "priority handling" of aircraft in emergencies be noted. "Special handling" means that the air traffic controller will provide the maximum amount of assistance, consistent with the equipment at his disposal and the proper performance of his control functions with respect to other IFR aircraft. Should the circumstances warrant greater attention and priority handling with respect to other IFR aircraft, the pilot should declare an emergency in accordance with section 60.2 of part 60.

This regulation requires reports concerning the loss or malfunction of VOR, TACAN, ADF, or low-frequency navigation receivers, the total or partial loss of ILS receiver capability, and any malfunction affecting air/ground communications capability.

The application and results obtained from this regualtion will be closely monitored and its benefits evaluated. After a reasonable period, a notice of proposed rulemaking will be issued, proposing an amendment to part 60 to incorporate the salient points of this special regulation, as modified in the light of experience gained.

Since events have recently occurred which estabilsh a requirement for the immediate adoption of this regulation for the safety of air commerce, I find it contrary to the public interest to comply with the notice and public procedure provisions of the Administrative Procedure Act and that good cause exists for making this special regulation effective immediately.

In consideration of the foregoing, the following special Civil Air Regulation is hereby adopted and is effective February 17, 1961:

1. Applicability. This special Civil Air Regulation applies to the operation of aircraft within controlled airspace under the Instrument Flight Rules of part 60 of the Civil Regulations.

2. Malfunction reports. The pilot in command shall report immediately to Air Traffic Control any inflight malfunction of navigation or air/ground communications equipment as listed below:

(a) Loss of VOR, TACAN, ADV, or low-frequency navigation receiver capability; or

(b) Complete or partial loss of ILS receiver capability; or

(c) Impairment of air/ground communications capability.

3. Substance of reports. Each report required under paragraph 2 hereof shall include the following:

(a) Aircraft identification;

(b) The equipment affected;

(c) The degree to which the capability of the pilot to operate IFR in the air traffic control system is impaired; and

(d) The nature and extent of assistance desired from Air Traffic Control.

(Secs. 307 of the Federal Aviation Act of 1958; 72 Stat. 749; 49 U.S.C. 1343.)

JAMES T. PYLE,
Acting Administrator.

Issued in Washington, D.C., on February 13, 1961.
(To Federal Register February 14, 1961.)

Senator MONRONEY. You may proceed.

Mr. PYLE. Another illustrative case is the takeoff crash of a Curtis Super C–46 at Toledo, Ohio, on October 29, 1960. Investigation indicates that the aircraft was overweight and had an improper engine installed. The flight crew had exceeded flight time limitations; and the pilot took off in nearly zero-zero weather conditions. Many of the circumstances called for vigorous enforcement action, which has been taken. As a matter of fact, the operating certificate of this carrier was not renewed when it expired. In this connection, it is interesting to note that the pilot had previously had his certificate revoked by the FAA, but was still privileged to fly because our order had been stayed by his appeal to the CAB.

Senator MONRONEY. This was an automatic stay, was it not?

Mr. PYLE. Yes, sir.

Senator MONRONEY. It wasn't action by the CAB. This, I think, is written into the law where he does have the right to appeal and a right to fly, regardless of the charge. Is that correct?

Mr. PYLE. Unless we institute emergency revocation action.

Senator MONRONEY. You can institute that?

Mr. PYLE. Yes, sir.

Senator MONRONEY. This, as I understand it, was the filing of fake reports, fake crews that were not flying and thus flying longer than the hours permitted.

Mr. HOWARD. Mr. Chairman, the offenses for which we sought our revocation in this case were a long series of what you might call attempts to cover up flight time limitation violations by crew members of this carrier. The individual involved was in charge of keeping the records for the carrier.

Senator MONRONEY. We will come back to this case a little more thoroughly when you complete your statement. There are several things we want to ask about powers that might be needed to prevent accidents of this type.

Mr. PYLE. All right, sir.

Although our safety requirements had already prohibited this flight under the prevailing conditions, this case has led us to examine the possible advisability of closing down airports altogether under certain extremely minimal weather conditions. We also asked the House Subcommittee on Transportation and Aeronautics, during our December hearing before them, for guidance as to congressional policy on the advisability of wider use of our emergency power in revoking airman certificates.

And I might say in this connection, Mr. Chairman, any thoughts that the committee would have in this area we would welcome. I think this is one where we have to be extremely careful. We can abuse our powers very easily to the disservice of the pilot. By the same token we can be too careful in not instituting it when necessary. Any thoughts that the committee would have would be helpful.

Senator MONRONEY. You do revoke some certificates under emergency powers?

Mr. PYLE. Yes, we do.

Senator MONRONEY. For instance, drunkenness in flight or things of that kind would be subject to immediate revocation, emergency revocation?

Mr. HOWARD. They certainly would, Mr. Chairman.

If I might, I will attempt to describe our policy very simply here. In the first place, the deficiency which we would find was the cause for revocation on an emergency basis must be very clearly evidenced. In other words, it is not a speculative thing; it must be supported by strong evidence. Normally it would be in the areas of physical deficiencies.

Senator MONRONEY. Let us take a 5-minute recess.

(A short recess was taken.)

Mr. HOWARD. Mr. Chairman, I might go back a little bit and repeat part of what I said. The first real point is that we must be assured in our minds that the deficiency or the nature of the violation has been clearly and positively shown by the evidence. We don't do it on some speculative case that we have against the pilot.

Secondly, we normally do an emergency revocation only in a case where the pilot's deficiency is acute. In other words, a mental or physical deficiency, or a demonstrated lack of proficiency that is so bad that we know that he should not be in the air. That is in simple terms the policy we follow at the present time.

Mr. PYLE. Mr. Chairman, if it is in order, I will go ahead.

Senator MONRONEY. Yes.

Mr. PYLE. Let us now turn briefly to air safety in the field of general aviation. Achievement of safety in general aviation requires Government and industry attention to the same basic factors of aircraft airworthiness, airman competency, adequate maintenance, and compliance with other regulatory requirements. However, applying these factors to general aviation presents a different problem from that presented by carrier operations.

Carrier operations are integrated, and a management decision can be translated into action and transmitted to hundreds of airmen and aircraft and thousands of flights with relative speed. In general aviation, decisions must be made by the many thousands of individuals involved.

Accordingly, greater reliance must be placed on discharge of individual responsibilities by the aircraft owner and pilot. He must be both capable of assuming and discharging responsibilities and, perhaps more important, willing to do so. The incentives for his doing so are quite strong, involving as they do his own life and his considerable investment in the aircraft he owns and flies. Greater reliance on individual responsibilities is also required because the Agency finds, with the large number of general aviation aircraft and operators, it cannot hope to provide the same degree of surveillance in this area as it can and does in the air carrier area.

We feel the most productive area for improving this segment of air safety lies in upgrading private pilots' capabilities of making sound judgments, assuring that he takes proper precautions in preparing himself for flight, and sharpening his piloting skills. Not all safety hazards are foreseeable, but those which are should be foreseen. It is and will be our policy to aid the general aviation pilot in doing this.

The Agency presently publishes a great deal of material which is of assistance to the private pilot. Our facilities are completely available to him at any time. Our people participate in many meetings

and conventions designed to improve flying safety, and they are always available to discuss safety problems. We always stand ready to work not only with the individual pilots but with the many associations in general aviation who seek to provide assistance in achieving safety.

In line with this approach, we adopted in 1960 a regulation requiring applicants for private and commercial certificates to demonstrate, in flight tests, their ability to maintain altitude and directional control of their aircraft solely by reference to instruments. This was not designed to make instrument pilots of them, but to give them a minimum capability of saving their lives if they are inadvertently caught in adverse weather.

Incidentally, Mr. Chairman, this I think is an important assist to the pilot in taking off at night where he takes off into an area where there are not lights. This I think has caused many accidents, the inability to orient himself and to maintain the attitude of his airplane by reference to instruments. It is VFR flying but it still is a dangerous condition.

Senator MONRONEY. Or where they get caught after sundown and maybe away from their destination, and they try to stretch it an hour or two but do not have orientation of their instruments and can get into bad trouble.

Mr. PYLE. This I am sure has accounted for many accidents. It is hard to prove it.

We are presently considering the desirability of requiring newly certificated pilots to demonstrate a capability to execute ground control approaches in the event they get caught in an emergency situation. We have flight tested "talk down" terms. These, combined with some practical experience in this area, could very well prevent accidents and save lives. Along this same line, to improve the private pilot's level of skill and assure his capability of complying with safety requirements, we are studying possible regulatory changes in the following areas:

(1) Raise the standards for flight instructors and increase their capabilities.

I would like to comment briefly, Mr. Chairman. In my opinion the excellence, the caliber of flight instruction, determines to a great extent the whole rest of the pilot's life, his flying ability throughout the rest of his flying career.

Senator MONRONEY. And the length of his life, too, sometimes.

Mr. PYLE. That is right. We put a lot of stress on good flight instruction and to maintain the excellence of this very important factor.

(2) Identify improved training methods and training aids.

(3) Require transition checkouts for type, make, and model for some of the higher performing aircraft.

(4) Improve means for checking and avoiding fuel contamination.

(5) Require a pilot planning a cross-country flight to obtain, familiarize himself with, and use appropriate aeronautical charts.

(6) Require minimum fuel reserves, particularly for night and cross-country operations.

(7) Improve the performance and insure the continued proficiency of pilots operating under IFR.

This is something that I feel we must move into quickly. It is particularly important for the simple reason that an individual who is not flying for hire as a commercial pilot, and is therefore not in air carrier work, does not have to demonstrate his proficiency on instruments for the rest of his flying career. This is just wrong. The military services require a yearly flight check, and the air carrier—ATR pilots—do it every 6 months. We are going to have to come up with some system to insure that IFR pilots who are flying either commercially or in business aircraft, are proficient and current in the procedures and can actually handle the airplane.

Senator MONRONEY. He might be flying air taxi or charter or something like that as a fixed-base operator, and while he did pass it 2 years ago, he may not have made another IFR landing and might be rusty. Is this the point?

Mr. PYLE. This is the point.

Senator MONRONEY. One thing I don't see here and I think it should be brought about, as you raise the standards of flight instructors, one of their duties would be to convince the 50- or 100-hour pilot that he is not a transport pilot and not an instrument pilot, that weather is still his greatest hazard and to stay out of it. I have lost some personal friends who were the finest people in the world. But with new aircraft and in reading the ads that "You too can fly, just like driving a car," they started out without knowledge of their inability, or perhaps they overestimated their ability, I should say, to handle adverse weather, and you have some great tragedies in this field. It seems to me that you could do something perhaps to reach these people through the flight instructors; that a part of the instruction should be the giving to the student the knowledge of his capability and to convince him as he becomes more proficient in ordinary straight flying that there are still a lot of things that he can't fly through, or that his plane should not go through.

This is a tragedy, 846 deaths, I think, in general aviation, perhaps a low record for miles flown, but still 846 awfully good people. Something can be done, I think, to prevent a lot of this. And I think the mental attitude of the pilot toward his own capability at the point where he is just beginning to fly—after he has flown maybe for 500 hours, he will realize some of these things and maybe have to go through some of this rough experience to realize how incapable he might be of controlling that plane.

It seems to me that there has got to be a more aggressive general aviation safety policy instituted by the FAA such as was used in the military during the war, such as the cartoon story.

It seems to me that another thing that is badly needed is to try, at least where you have Weather Bureau facilities, to have them prepare a weather map showing the cloud cover, the precipitation, the areas, and posted about every 4 hours in the general aviation lobbies or hangars; because too often the pilot doesn't wish to take time to call the tower and get the weather, and he gets airborne, thinking that he can reach the station after he gets airborne and find out what it is at the other end.

It just seems to me that you are going to have to take a more aggressive stand in maybe some small department to promote aviation safety a little better than we have been doing it.

Mr. PYLE. I agree thoroughly, Mr. Chairman, and I know Mr. Bakke has this in mind for his program for the coming year.

There are several problem areas here. First, whereas we can get at the student pilot, the private pilot who is coming up for a certificate, and the commercial pilot, the big problem is with the older pilot, and this is one where we have to attack, as you suggest, by an education program. This we are in the course of doing.

There is one other area that I would call your attention to, and that is going back to this proficiency problem of instrument pilots. They are flying in the same airspace as the other air carrier aircraft, heavily loaded. And their inability to follow the procedures or to get lost in this area is a definite safety hazard. We have just got to do something to insure competency on their part.

I would like to point out one further point in connection with your suggestion as to getting further information which the pilot can use for the purpose of flight planning. We have instituted a large program in our flight service stations which are communications stations, briefing the specialist at the station to be a weather briefer so that he can be of service to the pilot. Perhaps Dave might describe that very briefly.

Mr. THOMAS. We have greatly intensified in the last year the weather services in the flight service station, both pilot weather reporting and consolidation of those reports when we rebroadcast them, and weather briefing.

We have a special course in that aeronautical center at Oklahoma Center where we are now sending our people. In addition to that, we started a flight following service by the flight service station for VFR pilots who file flight plans, and we pass estimates on from one station to another, so there is always someone on the lookout who can broadcast changes in adverse weather, notices to airmen or anything that the pilot might not know about.

However, in this case the pilot has to come to us. He has to file a flight plan and make himself available. We are trying to publicize this as much as we can, the air service that he can get.

Senator MONRONEY. If you had signs or picturegrams, things of that kind, in the facilities used by general aviation—and it is usually only one hangar on most fields—to say, "If you are flying, get the weather ahead," then the number he calls, this man might say, "What is your destination?" Maybe it is from Teterboro to Oklahoma City and the man would say, "Your route would be far better through Nashville than it would be through Columbus. There is some bad stuff over the mountains." You can't stop him from going, but you can at least give him the route that would be most likely to get him through; and yet lots of times these boys take off with only the local weather. They don't bother to get the Weather Bureau. Sometimes you can't get it on the telephone, the lines are so busy.

They start off and expect to get it after they take off.

This way you have no clue as to what route they are going to take. You don't know where to look for them if they finally don't arrive at their destination.

I think such a program needs to be encouraged, not for filing a flight plan but a flight route that they intend to take. In coaching

them on that you could shuttle them at least to the more probable weather possibilities.

Mr. PYLE. In my opinion we have been somewhat negligent in my opinion, Mr. Chairman, in making known to the general aviation pilot the services that are available to him. We have started an intensive program to do just this. This will go part way to curing the very problems to which you refer.

I would also like, if it is appropriate, for Mr. Bakke to mention another program that we are actively pursuing, the air-share program, if it be in order.

Senator MONRONEY. Yes.

Mr. BAKKE. Mr. Chairman, unfortunately our Madison Avenue "P. R." types got ahold of this program and thus the title "Air-Share."

Very briefly, it is intended to be a field activity, area views. And share the benefit, so to speak. Basically it is an attempt on our part to push the process of communications with general aviation folk out of Washington with its very limited general aviation audience and out into the field so as to give as much of a grassroots participation in the making of regulatory policy. So it is, in effect, arranging meetings throughout the country for the purpose of talking about some of the problems that we are discussing with you today.

In the process, however, of doing this, we plan to bring some of our safety statistics, some of the charts we would like to show you, and also to get folks from air traffic management and from R. & D. to come with us to these sessions in order to explain to the general aviation folks the services we have available, the type of facilities which are under development, what the state of the art consists of today, what our biggest problems are in general aviation, and then what policies should be adopted in order to meet these problems to achieve an effective solution. These will probably result in this year a series of about a dozen meetings throughout the country. They will be basically to bring them in on our rulemaking processes, but secondly—and just as important, we think—a means whereby we can accomplish our promotional obligations as well.

Mr. PYLE. There are other items, Mr. Chairman, under consideration, but these are illustrative.

We are also considering regulatory changes directed specifically at improving maintenance of aircraft, both carrier and general aviation, since a substantial portion of accidents appears traceable to maintenance problems. One such change would establish maintenance standard orders by which the Agency would prescribe maintenance quality. They would be issued to cover those items in specific areas where experience has proven a problem exists. A companion proposal contemplates issuance of maintenance directives. These would be aimed at requiring performance of specific maintenance on aircraft to correct known unsafe conditions.

In order to assure that maintenance problems are known and identified, we have issued another proposed change in the reporting of daily mechanical difficulties encountered in air carrier aircraft. The carriers have for some years been making such reports; but each carrier has reported only those items which, in its opinion, required reporting. Under the proposed rule specific items would require reports. In this way, more comprehensive, uniform and meaningful information on maintenance incidents would be obtained.

Consideration is also being given to extending this concept to general aviation aircraft, although there might well be different standards applied.

Senator MONRONEY. Have you ever thought about the difference between maintenance from one fixed-base operator to another? I have noticed, as I go around the field a good deal, one will go through every checklist and every procedure to see that every part of the plane that can be fully checked on the ground will be fully checked, or that maintenance is done with great detail and efficiency; and the other person will say that the plane is ready to fly and maybe the landing gear won't come up, or a lot of other things.

It seems to me there is a widespread difference in the quality.

I know this is hard to enforce, but I wonder if you ever thought of maybe awards to fixed base operators for excellence, to begin to bring in an appreciation of those that are superior. I don't know whether it could be equitably done, but I believe you could probably on almost any airport find those who are doing an exceptionally good job and maybe give a little bit of special attention to them.

Mr. PYLE. I think this is a very good idea, and I think we will look into this one. I don't know what the legal problems might be.

Mr. BAKKE. One observation on our surveillance responsibility. There is a general view that the FAA, large as it is, is just swollen in its ranks so far as, say, maintenance inspectors are concerned. I think it would be interesting for the committee to know that so far as inspection personnel of the sort that you mention, who would accomplish maintenance surveillance, that we have in our employment in the FAA today just about the same number that was in the CAA 10 years ago when aviation was just a small fraction of what it is today. We try as best we can to keep on top of this problem of surveillance.

So far as numbers are concerned, we are increasingly falling behind.

I think some such device as you suggest would be very useful for us to consider.

Mr. PYLE. Another item which may be of interest to your subcommittee is a program to increase the chances of survival in accidents. This is not a new effort, but is a continuation of effort on the part of this Agency, its predecessors, and others, such as NASA, CAB, the Flight Safety Foundation, and the military services. The project is broad in scope and includes exploration of means to reduce or eliminate the hazards of fire which frequently accompany aircraft accidents. Attention is likewise being paid to aircraft structure design, employing energy absorption techniques which have been developed. We are also seeking to improve methods of evacuation of aircraft and facilitating rescue efforts.

In this area, Mr. Chairman, really what we are talking about is crashworthiness. This has been, in my opinion, a neglected area. I think we have got to move into this. We are building facilities at Atlantic City to move into this area and continue a lot of the work done at the Technical Development Center at Indianapolis, and to expand upon their efforts on a more pretentious scale.

Information gained in accidents is being analyzed and used to improve chances of survival. In this and other areas, the problems are not simple. For example, methods of preventing crash fires were

developed which were based on a fire-inerting system. This is designed to blanket the source of fire with an inert material which will prevent ignition. However, installation of such a device must be such that it would not itself endanger the safe operation of an aircraft. It is obvious that, if the system were inadvertently actuated while in flight, it could result in complete loss of engine power. A considerable amount of work remains to be done to assure its reliability.

This is the kind of work that we are shortly to start at Atlantic City.

Mr. Chairman, this completes my prepared statement. We hope we have covered—it says here, "even though briefly"; I am not sure it is brief—the matters in which the subcommittee has expressed interest.

If there are any questions you would like to ask concerning the material in this statement, the exhibits we have submitted, or any other areas of interest to you, we will be glad to answer them.

I would welcome, further, Mr. Chairman, the visit of the members—yourself and your committee, and the staff—to any of our facilities, centers, towers, Atlantic City, Oklahoma City—to look into the kind of work that we are doing. We are proud of it. We think we are on the right track. But we would also welcome suggestions to improve our efforts to make it more meaningful.

Senator MONRONEY. We appreciate that invitation. If we can ever round them up at one time, we will do it.

Two short questions, and then we will defer any further questions until tomorrow, when we would like to go into some of the specific accidents that fall into these four categories. We won't ask you to review all the information, but we would like a little more discussion on the New York United-TWA crash. These two I would like to get in the record tonight. De don't have to be too long about it.

Can the Federal Aviation Agency close an airport because of failure to install safety equipment?

Mr. PYLE. I would like Mr. Bakke to supplement what I am going to say, Mr. Chairman.

Basically, the Federal Aviation Agency evaluates an airport on the basis of the requirements of that particular operation that would take off. I am speaking specifically of the length of runway, lighting facilities, and minimums to operate from that airport. The authorization to operate from that airport is based on all the factors which make it either safe or unsafe.

Mr. Bakke might want to supplement my statement. It is not very specific.

Mr. BAKKE. I think the straight answer to your question is, Yes you may. I think that in air carrier regulations we already provide the processes through which we do exactly this for air carrier service. These are contained in parts 40, 41, 42, 47, and so on. As a matter of policy, however, we have adopted no comparable regulations so far as general aviation is concerned. So that as a matter of regulatory policy at the moment there are no rules which have the practical effect of denying access to an airport because of limitations in facilities.

Senator MONRONEY. But you do have the power to take the air carriers out of those airports, and deny them the right to land?

Mr. BAKKE. We do; yes.

Senator MONRONEY. In other words, for the failure to remove a large obstruction at the end of a runway, or the failure to provide adequate runway lengths or to keep the hardtop in repair, or failure to install necessary safety devices at the end of runways, and things of that kind.

Mr. PYLE. Yes. There is a specific provision in part 40, for instance, which requires that the carrier is burdened to show—and "show" by definition means to demonstrate to the satisfaction of the Administrator—that the airport and its environs are continually safe for air carrier operation.

Senator MONRONEY. The next question: Can the FAA limit a field to a certain in-take of aircraft—I mean, as to numbers? Can you say that there shall be this many landings, and no more; that the traffic system will not accept safely a greater number than at a point where you determine you're crowding the margin of safety which you are forcing the system to accept?

Mr. BAKKE. As a practical matter, I think we do precisely this, although I think it would be best to ask Mr. Thomas to comment specifically on the process through which he limits traffic in and out of an airport to achieve this objective.

Mr. THOMAS. Mr. Chairman, we do not set a specific number and advertise this as the number which will not be exceeded at an airport. However, in regulating traffic to the runway we do, in effect, limit it to the runway capacity. Under instrument conditions and for IFR flight plans we institute flow control procedures which may have the effect of keeping airplanes destined to New York on the ground at Chicago, Washington, Baltimore, even overseas.

The problem becomes a great deal more complicated with the non-IFR traffic not operating on flight plan, under good weather conditions. Our approach there is simply to deny them landing clearance.

There has been some experimentation among the airlines themselves—actual practice, rather than experimental—of setting the number of schedules at La Guardia. The problem which has arisen so far in setting the number of schedules with one class of operator has no effect on another operator. For example, with business aircraft, Government, and military coming in at the same time. So I think we regulate the flow of traffic to whatever it will handle at the time, rather than setting an advance limitation on any specific airport.

Senator MONRONEY. I was thinking in terms of 2 or 3 years before they began to use Friendship. There were a number of air carriers that wished to fly into Washington with schedules which they could not take. They felt that the arrival times were completely saturated and would add congestion and narrow the safety margin. I don't know who had the authority. Perhaps you, by the operation of Washington National, had the authority in that case to say they couldn't come in with more schedules.

With regard to another airport, independently operated from FAA, I wonder if you have the right to say that more schedules may not enter only this airport but also this airspace where maybe three or four airports may be located and there is all the traffic that the system will bear.

Mr. HOWARD. Mr. Chairman, this is a somewhat divided or separate question as between economics and safety. I think the Board

has already testified to the effect that they do not have the power to limit or change or affect schedules under the present law. We do not have that power in economic terms, either. We could not say to American Airlines that they cannot schedule a flight at 6 p.m. out of Washington National Airport. But what we can do, and I think that Mr. Thomas has indicated that we can do, is to control the actual movements out of Washington National Airport. And we do this on a safety basis.

I think that it is true that if a number of carriers concentrate their scheduling at a certain hour that it creates problems.

Senator MONRONEY. Where did that "if" get in there?

Mr. HOWARD. When they do. When they do. This obviously puts a certain amount of pressure on our system to provide the necessary services for them to meet this schedule. But I don't believe that we, in fact, respond to that pressure by putting too many aircraft in and out of an airport at a particular time.

Senator MONRONEY. That is why sometimes you have 2-hour late departures during these rush periods, I think. This is an informal way, and somewhat disappointing way to the air carrier users, of saying, "You have six flights out of Washington at 5:30 in the afternoon to New York, but try and get out at 5:30 for New York."

So the schedule doesn't bear any relationship to the time, because you will not let these planes take off in sequence greater than the system can carry.

Mr. PYLE. This is true, Mr. Chairman, but I would like to comment to this point.

I think we need this authority. I question whether we have it. For example, we have made a detailed study of this problem at certain airports and we find no less than seven or eight departures, all at 7 p.m. Even with two runways you won't get more than two airplanes off at 7 p.m., and five will be late. To me this is a ridiculous situation.

Furthermore, at certain airports we can foretell under instrument conditions what we can accept at this airport. Yet we are continually being expected to handle 50 percent more than that airport can possibly handle.

Again, I think there is a need, a very specific need for control of schedules. I would hope that it would be arrived at cooperatively, but that doesn't seem to happen. I think the time has come when we must do this.

Mr. Howard may want to correct, from a legal standpoint, some of my statements.

One of the problems we are faced with—several problems. One is economic, that we must be careful in so doing that we do not impose an economic burden. Second, we have the point Mr. Boyd made that there are international implications, for instance for the control of the number of schedules at Idlewild. And the third situation that you end up with is that described by Mr. Thomas, whereby the carriers either voluntarily or by requirement reduce the number of operations only to find general aviation filling not only those spots but others.

So this is a very, very complex ball of wax, frankly.

Senator MONRONEY. It certainly is.

Yet, ignoring any specific case, there is a limit beyond which you can move 5–X number of planes into an airspace which can handle safely 3–X numbers of planes. Unless the FAA has inherent powers under air safety to say that we must limit this airspace between these crowded hours, you will reach an untenable situation where safety will be seriously involved.

Mr. PYLE. I think I would like to correct one point.

In that connection, Mr. Chairman, we would not permit any more IFR operations, for instance, into the airspace than the system can handle. Of course, what happens is that the passengers in the airline are inconvenienced.

Senator MONRONEY. This is a disorderly way of effecting the result which you have to enforce. But there must be an orderly way in which flights can be consolidated, perhaps, or something of that kind, so that we wouldn't have every airline with half-filled planes trying to get into the crowded airlanes at the same hour.

Mr. HOWARD. If I may add to this, Mr. Chairman: I don't want to be a lawyer for the Civil Aeronautics Board, because I am counsel to the Federal Aviation Agency. But I do think there are some provisions in the Federal Aviation Act which are available to the Board to help solve this question.

I would mention, for example, that for a carrier to advertise that it has a 7 o'clock departure and for, perhaps, four other carriers to advertise the same thing, means that at least four of those carriers are not really representing to the public their true schedule.

This is an area which could be looked into.

Senator MONRONEY. That is so intangible, however, because nobody is going to get off at 7 o'clock unless it is just by accident. Some plane will always come in. You will be held at the end of the runway warming up for incoming traffic. It is just a physical impossibility. You could penalize the airline for a situation like that. This again would be a disorderly way.

What I am reaching out for is the need of the industry to find a way of policing itself as to the number of flights that can be safely accommodated, and one-time flights, probably, without the necessary holding at the airport or in the holding pattern waiting to come down.

Mr. HOWARD. I think that in practical terms this does get back to the economic side as against the safety side. Because we can control the actual operation from the safety standpoint, and do.

The real question, or the hard question to solve, is which of certain carriers shall have what you might call good schedule times. This is a more economic matter, as I see it, and something that perhaps if the committee is considering legislation will be more appropriately placed in the CAB than the FAA.

Senator MONRONEY. This is not just economics. This is safety. There is some point where the air becomes unsafe, where it is oversaturated with aircraft, as at peak hours now.

There must be some way of regulating it.

Mr. PYLE. I would like to suggest, Mr. Chairman, that I think your point is a very valid one, and it is one which has concerned me for a number of years. It may be that this is something that the Board and the Agency ought to get together on and see if there is not some way to resolve it.

We may have to come up with some suggested legislation.

Senator MONRONEY. I would go farther and talk to the air carriers because I think they are involved.

Mr. PYLE. I have done this for years, Mr. Chairman, and I get nowhere.

Senator MONRONEY. You have to get serious about it.

Mr. PYLE. I did get serious.

Senator MONRONEY. I understand that several lines have agreed and other lines won't. You have the problem of general aviation picking up whatever airspace the commercial people yield. But it is time to get together on this thing. It may be necessary to have to tell general aviation that certain airports in the few very high density areas can accommodate only the commercial transport with their passengers, and to supply them with adequate, usable, convenient, well-built airports for their use. You have to do something about this crowded airspace. It can't be just left to a competitive condition that if let run its course is going to sooner or later—maybe sooner—reach beyond the saturation point.

Mr. PYLE. I agree. We will institute something and report to the committee.

Senator MONRONEY. I would rather see the rule of reason applied without the threat of legislation. It is not pleasant to introduce legislation and have everyone think that you are trying to impinge upon the financial success of the scheduled airlines. But maybe they are flying a few too many schedules.

Actually when you do nearly $2 billion worth of business in a year, and you wind up with $4 million profit, this is not necessarily a successful operation. Maybe they are so determined that there are only a few traffic centers worth serving and the rest of them can go on milk runs. Maybe they might find some unmined gold a little farther out of these very high density airports.

Mr. PYLE. This of course would be an area where we would have to work closely with the Board. I agree with you, Mr. Chairman, that we should explore this area, and we will.

Senator MONRONEY. Maybe when we get the other witnesses here we might be able to have developed a line of testimony that might lay a precedent for the encouragement at least of cooperative action if it can be obtained.

Otherwise, we may face the possibility of putting the matter before the Congress.

Thank you very much, Mr. Pyle.

Can you come back tomorrow morning at 10 o'clock?

Mr. PYLE. Yes, sir.

Senator MONRONEY. For the information of those who have given us so much time and given up their holidays, the committee does not plan to meet on Friday afternoon, nor Saturday. We plan to meet at 10:30 on Monday and will also meet on Tuesday and Friday of next week. We hope we will be through with you at that time.

We are giving you notice enough so that other arrangements can be made for your free time.

Thank you very much. You have been very helpful.

(Whereupon, at 5:30 p.m., the subcommittee was adjourned, to reconvene at 10 a.m., Friday, February 24, 1961.)

AIR SAFETY

FRIDAY, FEBRUARY 24, 1961

U.S. SENATE, COMMITTEE ON COMMERCE,
SUBCOMMITTEE ON AVIATION,
Washington, D.C.

The subcommittee met, pursuant to adjournment, at 10 a.m., in room 5110, New Senate Office Building, Hon. A. S. Mike Monroney (chairman of the subcommittee) presiding.

Senator MONRONEY. The Subcommittee on Aviation will resume its hearings.

In order to accommodate some of the groups that have a number of people from out of town, even from overseas, we are going to move the FAA's testimony from the beginning to the end of the session. At this time we will hear Mr. Robert E. Commerce, president of the Air Line Dispatchers Association and his group. Will you come forward?

Next we will hear Mr. Charles McErlean, senior vice president of the United Airlines. And then we will go back to the FAA. We expect to adjourn at noon, and then to go over until next Monday.

We regret that we cannot get to others who are waiting this week. We hope we will not seriously inconvenience anyone who has been waiting over to testify.

STATEMENT OF ROBERT E. COMMERCE, PRESIDENT OF THE AIR LINE DISPATCHERS ASSOCIATION; ACCOMPANIED BY ERNEST A. BRESSIN; P. J. KLETT; L. P. EDWARDS; ROBERT F. EPP; M. C. MERRILL, OF THE AIR LINE DISPATCHERS ASSOCIATION

Mr. COMMERCE. Mr. Chairman, my name is Robert E. Commerce. I am president of the Air Line Dispatchers Association, Arlington, Va.

The gentlemen who are with me today are the members of the ALDA executive board who are in for a meeting.

The gentlemen on my far left—your right—are Mr. Martin Merrill; Mr. Robert F. Epp, from TWA; Mr. L. P. Edwards, from Northwest; Mr. Phil Klett, from United; and Mr. Ernest A. Bressin, from Capital Airlines.

We have submitted our prepared statement, Senator. I presume it is your desire that we just leave it in the record?

Senator MONRONEY. You can proceed in your own way.

Sometimes we find that we save time by reading the statement and then questioning you, rather than trying to put the statement in the record and then discussing it. However, whichever way you prefer to do it is all right.

(The statement of Mr. Commerce follows:)

Mr. Chairman, we are very grateful for the opportunity to appear before this committee to present our views at a time when you have determined to pursue a fresh, new approach to the problems of air safety.

We would like to commend the committee for insisting on a constructive new approach, especially in view of the fact that a new Administrator is at the helm of the FAA whom it is said has an open mind and a determination to make solid improvements in aviation safety.

Because of the function our members perform in the industry, that is, acting as guardians of safety and economics for the scheduled carriers, we are becoming increasingly concerned over the economic welfare of our employers. A carrier has failed, resulting in a merger. The aviation community anticipates more mergers, born of economic distress, not only among air carriers, but among airplane manufacturers. One carrier, feeling the pinch, has asked to be returned to subsidy.

While there are reasons relating to the general state of business which affect this, we share the blunt views of two former CAB Chairmen who insist that there is a direct relationship between airline safety and economic success.

The CAB has found that safety shortcuts brought on by financial hardship or unwise economies result in accidents which in turn destroy public confidence and bring us full circle to more distress.

In short, while we are firmly opposed to unnecessary regulation, we do not think that the present situation calls for relaxation of stringency where safety is concerned. We must keep these great aircraft filled with passengers if we are to have job security for our members, and we cannot do it if the types of accidents we have been having of late keep occurring.

It appears to our members that we have reached the point where the aircraft manufacturers have outstripped the industry they supply.

These fast, sophisticated, and wonderful airplanes with which we deal every day are many steps ahead of the environment in which they operate. It may be time to slow down and let the rest of the industry catch up.

We refer to (1) the capabilities of the air traffic control system to handle them, (2) the ability of the carriers to finance them, (3) the development of the airports that must accommodate them, (4) the methods of pilot, mechanic, dispatcher training upon which they depend, and (5) the state of the art in weather analysis that serves them, and so on.

In an attempt to be brief, we will merely touch lightly on these topics.

Air traffic control: The lessons learned from the tragedy of Staten Island are these (and let us express our great sorrow and keen disappointment on a crash of this type because it has taken us back no less than 2½ to 3 years in progress):

First, the air traffic system, despite the excellence of its personnel, has not caught up with the density of traffic nor the speed of the aircraft in its hands. Basically, as ALPA points out, there have been very few refinements except the introduction of radar. Controllers still post information received over telephones on strips. We still encounter lengthy delays, even in excellent weather, and these delays are killing us, economically.

What is wrong? The controllers' association says there is too much emphasis on long-range hardware and nothing in the way of immediate tools for the controller to use. The jet age got too much of a head start on the FAA. They further state that the training and selection methods of the FAA are not adequate to improve the quality of the controllers and to screen out the misfits. With this we must concur. Having been a controller, I know from observation that people who are not mentally or temperamentally suited for the work can remain in the system indefinitely and be transferred, or assigned to lesser tasks at slower facilities; in other words, hide in this giant agency. This is not right. It is a reflection upon the many thousands of highly skilled and well-adjusted controllers who work under all sorts of pressures and handicaps and commit very few errors.

Our organization has attempted to assist the controllers' association by furnishing data on job stress and tension, as well as suggesting proper wage levels. We wholeheartedly endorse their efforts to obtain earlier retirement and shorter hours.

The moral of the New York catastrophe should be: Let none of us, whatever our position in the industry or in Government, again turn a deaf ear to the voices of the airline pilots and the private pilots who have been preaching

that the present system of traffic control is less than safe. The potential for this accident was there all along, from the number of near-miss reports we were hearing about. We, as dispatchers, heard them. Airline executives were aware of them and urged the Government to do something.

Of course, we can appreciate the efforts of the carriers to maintain public confidence by not broadcasting these incidents to the press. However, it seems unthinkable and inexcusable that the Administrator would be a party to the "drying up" of near-miss reports by vigorously prosecuting those who furnished such helpful information.

Again let us emphasize, it was the various pilot associations that made the charges and warned us all. Perhaps other groups jumped on the bandwagon and sounded off later, but to them we say, the time for you to criticize and point out the deficiencies of the system has long since passed.

Financing the aircraft: This subject is too broad and too long to cover here. We have only one significant point. That is, let the Government recognize the fantastic investments and long-term commitments made by the scheduled carriers and protect these carriers from unfair competition. Protect them from the destructive influence of favoritism in route awards to airlines of our foreign neighbors. Protect them from tax discrimination. Reverse the flow of passenger traffic from domestic and U.S.-flag carriers to foreign lines, which will stop the flight of the U.S. dollar. And finally, require of the irregular carriers the same level of safety for their crews anud passengers as is required of the scheduled lines.

Airports: Not only must there be an expanded program of airport expansion to meet the needs of the forthcoming supersonic transport, but to catch up with the existing equipment that has already outstripped most landing fields. Failure to keep pace has meant great losses in revenue to the airlines, whose dispatchers and pilots must peel weight from planes to keep them legal for the restrictions imposed by inadequate airports.

The pilots' association has shown clearly, through surveys, that firefighting facilities are generally inadequate.

We know that you, Mr. Chairman, are quite outspoken in your criticism of the inadequacy of airport lighting and landing aids. To all this let us add our complaints. We are not satisfied with either the facilities available for snow and slush removal at most airports, or with the accuracy of the reporting. The burden too often falls upon our own airline personnel to ride herd upon these daily problems. Perhaps that is the best approach, to go out and do your own measuring to be certain it meets the criteria for your equipment, but it is a system that lacks standardization and smacks of poor airport supervision.

The local service dispatchers inform me that if we think it is tough for the trunklines at major airports, we should see what they go through trying to get an operation started in the morning. It is not a good situation. We cannot plan properly. For this reason, we call upon the operators of 24-hour-a-day airports to provide 24-hour-a-day responsible supervision, and to assure us of adequate snow and slush removal along with accurate reporting. This is a problem of safety and economics.

Training: Briefly, and addressing ourselves to dispatcher training alone, the situation heretofore has been very spotty.

Through surveys we have run in order to be helpful to the FAA, we have shown that on some airlines there had been no dispatcher training for 3 years. On one airline there had been none for 5 years. (On one carrier, the way they conducted jet training was to sit an instructor down alongside a dispatcher while he was working, dispatching a full schedule of trips, and teach him about the new plane and its intricate systems.)

The CAA and FAA inspectors were making no efforts to correct those deficiencies. The training programs outlined in the air carrier manuals were not being followed. Of course, this is not a balnket indictment, because some airlines go far beyond the letter of the law and provide excellent training.

Pilots, engineers and other groups had been bringing training deficiencies to the attention of the Administrator, as we had, so in time the FAA passed a rule requiring FAA approval of air carrier training programs. There has been an uncommon amount of delay in the implementation of this rule, since the first notice of rulemaking went out.

The former Administrator has enumerated the new training regulation, which went into effect in January, as one of the major accomplishments of his administration. We would be inclined to agree, but hasten to add that it is too early to brag.

Many of us are not too clear on the content of these approved programs, and it also appears that some lines are not going to begin training at once. Another early indication is that there is more emphasis on home study type of training, of the unsupervised kind, than there ought to be.

Further, as with any regulation, the vigilance of the FAA in enforcement will determine if we have an improvement over past deficiencies, or none at all.

Summing up: We have the makings of a good rule, but we are not sure yet what we have got that enhances our professional knowledge, or which adds to air safety. The actions of this Senate committee in reviewing the act each year are very reassuring to us in the industry. We are hopeful that the question of airman training will be reviewed by you next year when all of us will be in a better position to make an appraisal of the gains.

Weather services: Some of the finest people we know work in the U.S. Weather Bureau. They are highly intelligent and imaginative. We consider them good friends. It is particularly hard for us, then, to report deficiencies in the aviation weather services, lest that criticism be misinterpreted.

However, there are many shortcomings in these services arising out of present methods and systems, and we think the aviation industry cannot any longer progress unless something is done about it.

A recent newspaper article states that in 1959, all the Federal agencies spent $36 million on weather research. When this amount is measured against the $45 billion defense budget and the $2.5 billion gross revenue of the airlines, it is a puny amount. We say this because there is a great need for more accuracy in forecasting. We have given your committee our detailed views on the subject, so we will not repeat them in this hearing. However, it is evident that if the weather staffs of United Airlines and American Airlines, to quote two outstanding examples, are far ahead of the Weather Bureau in high altitude weather research and clear air turbulence forecasting, then something is obviously wrong.

Our members work under considerable handicaps in dispatching the Nation's airlines. On a very recent occasion, the diversion of two jet aircraft due to faulty forecasting cost an airline $35,000. These are the airline's figures. On another occasion, the cost was $100,000 per plane in list revenue. These are merely two cases among the dozens of such instances each month. The financial toll, if we had the figures at hand, would be staggering.

It must be noted that, on this Nation's airlines, only one-third of them employ meteorologists. On the other two-thirds, the dispatcher is the company meteorologist, a task he performs in addition to his other duties. We think he performs it well. We play a daily game entitled "Outguessing the Weather Bureau," but this is really not a fair statement because we do rely heavily on much of the material they produce. Their analyses and forecasts form the basis for our operational decisions. It is only that the lack of a system of quality control within the USWB requires us to go beyond their forecasts, to interpolate and to mold, and to fit our operational plans into what we really think the weather is going to do. There is a saying "If you can't out-guess 'em, outgas 'em," meaning in times of doubtful weather, pilots and dispatchers order extra fuel.

Better forecasting could reduce the economic penalty of carrying excessive gas, but the state of the art requires that we make no compromises with safety. If landing at destination is impossible, the dispatcher must be sure that he has an alternate to which the pilot can safely proceed. Happily, because of the system of operational control, scheduled airlines don't have accidents caused by the flight running out of fuel, or safe places to land.

We trust that you will see fit to endorse the recommendations we gave you for improved weather services, and that our friends in the USWB will have the funds necessary to implement a program of forecast research, and to hire the qualified meteorologists they need.

On behalf of the federally certificated dispatchers serving the Nation's scheduled airlines, we thank you and the committee most sincerely for the opportunity to discuss these topics with you.

Mr. COMMERCE. We know of the chairman's specific interest in the Arctic-Pacific accident at Toledo. We will address ourselves to that problem now.

Senator MONRONEY. We will be happy to hear you. This is something that the committee is concerned about. We have had practically no testimony on what to do about situations like this.

Mr. COMMERCE. Mr. Klett, from the Seattle office of United Airlines is with us. I would like him to describe the manner in which the question of airport runway visibility is handled at Seattle-Tacoma. We think that the method is unique and very valuable. It provides a double check on air safety. This method might well have prevented the accident in which you have your special interest at Toledo.

I would like Mr. Klett to describe how they do it there.

Mr. KLETT. Senator, it is true sometimes in Seattle we get fog from time to time. We have a somewhat unique way of checking or obtaining our visibility checks. On our north-south runway, which is our main runway, runway 34, we have a visibility measuring device called a transmissometer, which works well for our takeoffs. At times the wind is from the south and we must be limited to the runway 16. There is no transmissometer on that end. So it was arranged to have the local fire department, which is on call 24 hours at the field, to be checked out on measuring visibility. These men are on call to proceed with their fire trucks to the north end and sight down runway 16 by counting the lights and they are able to give us a visibility measurement for either takeoff or landings from that direction. This is merely a double check against personal observations of our crews, as well as the tower control men.

Soon I suppose we will have transmissometers on the other end. But until that time we do need a double check, and this is only one way of getting around to do it.

Senator MONRONEY. Are these transmissometers very expensive, complicated, or difficult to install on an airport?

Mr. KLETT. I understand they are quite expensive. I have no idea exactly how much, but we are somewhat limited by their installation around the area.

Senator MONRONEY. I know we have had some discussion in previous hearings that oftentimes the ceilings are measured as much as 2 miles away from the runway that is being used for landing, particularly at touchdown point on the runway. In many types of low visibility this is completely inadequate because it may be undulating and may be showing 500 feet at point of measurement 2 miles away from the runway, and be down to almost 100 feet ceiling at the runway that is in use at point of touchdown. There must be a better way, an economical way, by which these ceiling measurements can be obtained, as well as the ground vicinity.

What are your minimums at Seattle for ground visibility?

Mr. KLETT. Of course, minimums vary, Senator, with the type of equipment, and even from airline to airline. In the case of my own airline, for our pistons, it is 200 feet and a half mile. For our jets, 300 and three-fourths of a mile, using the ILS runway, which is 34 from south to north. Those minimums, as I say, are another interesting facet because they do vary from airline to airline. They vary from the time of equipment to type of equipment, and even on some airlines, as you probably know, they vary on the pilot's experience.

Senator MONRONEY. This presents somewhat of a problem. We have run into it in New York oftentimes where one or two airlines will cancel out and announce that the field is below minimums and don't go. Another airline has a different minimum and goes.

We were merely exploring whether there should be certain fixed minimums for each field and for the type of aircraft to see whether it would not be in the interest of safety to have them uniform. Also, under conditions where irresponsible people might takeoff in violation of the minimums, to actually have the airport manager physically detain the plane by moving landing equipment or service equipment in to block its entrance to the taxiway.

That is a problem we are very interested in and we are trying to get the attitude of the men who have to give the go signal on these planes and take the responsibility for sending them aloft with their rather precious load of passengers.

Mr. COMMERCE. We are very interested in your comments regarding the airport manager, Senator. As you read in our statement, we addressed ourselves to the problem of lack of 24-hour supervisory coverage at main airports. Whereas the responsibility might be properly placed in the hands of the airport manager, some provisions would have to be provided at many of these airports to see that there are responsible people who could exercise this authority. We don't want it in the hands of people who don't know what they are doing.

Senator MONRONEY. I quite agree. I was thinking out loud on it. This is the first time we have ever seriously discussed means, methods, or even policy on this matter, as to whether it would be satisfactory.

I am not concerned about a scheduled airline that has a full-time meterologist, a full-time dispatcher, studying all phases of weather, as I am about the man who comes in and with sketchy information decides that he can make it because he is such a hot pilot and he can get off with three runway lights showing, and pull out fast enough to be safe. Whether this is going to be sound enough for the future of aviation involving the performance of aircraft with their heavy loads of passengers is another question, and the committee is beginning to explore this.

Mr. COMMERCE. The question of whether or not the large irregular carriers should not have some supervision over their stop and go minimums as we have on scheduled carriers has always been a large question to us. We invite your attention to further study on the matter and we offer our assistance to show you comparisons of the types of operations that are conducted, and the similarity between many of the large irregulars and the scheduled carriers makes you wonder how it can be that there is no stop and go on these irregulars. It is not a problem now of just taking off and having limits, but it is supervision over the entire operation, which is sometimes loose, to use the kindest terms we can.

We would like to say that we appreciate the opportunity to submit this material to you. As you know, we have addressed ourselves to the question also of the weather services and how we are very much interested in seeing improvements in them, with perhaps greater budgetary considerations for the people in the Bureau who do such a fine job. We work with weather all the time in our capacity. I think that it appears to us that it is rather shameful that so much rests upon the weather service, and yet so little is being done in research on that line.

Senator MONRONEY. In your manual for Tacoma for piston aircraft you have 200 feet ceiling and ½ mile visibility and 300 feet ceiling

and ¾ mile visibility. Is there a requirement also in the FAA rules that there must be another alternate airport that would be open within 20 miles?

Mr. COMMERCE. Not within 20 miles. An alternate airport, depending on whether it is a twin-engine or four-engine type aircraft, the regulations require that when the visibility and ceiling are below certain values that an airport must be available within I believe it is 15 minutes flying time with one engine out from the point of takeoff to which the pilot could proceed and land if he encountered difficulty.

Senator MONRONEY. If you can takeoff from a field where a relanding would be difficult, there must be another field within 15 minutes' flight time?

Mr. COMMERCE. Yes, sir.

Senator MONRONEY. One that he could get into if he has malfunction, a loss of motor, or something of that kind?

Mr. COMMERCE. Those are regulations, sir, that are confined to the scheduled carriers. And there again we have the problem of how does it happen that they don't have it.

Senator MONRONEY. In other words, charter flights would not be limited to those requirements?

Mr. COMMERCE. The irregulars. The charter flights for a scheduled carrier would not have that, because when scheduled carriers operate charter flights they operate them just as they would their regular trips.

Senator MONRONEY. I am talking about the certificated non-skeds. They are not under the same rules that you are under?

Mr. COMMERCE. No, sir, parts 40 and 41 apply to the scheduled carriers.

Senator MONRONEY. Scheduled carriers only?

Mr. COMMERCE. Yes, sir.

Senator MONRONEY. So we have two different sets. This 15-minute rule is in the FAA rules, this 15-minute rule to another airport?

Mr. COMMERCE. Yes, sir. Those regulations you will find in the operations specifications section of the various air carrier manuals.

Senator MONRONEY. You have severeal witnesses accompanying you. I would like to know if they have different amendments on their fields or different means of handling the final determination that it is safe for ordering takeoff?

Mr. COMMERCE. If you have a specific question, sir. It is a fact, sir, that each carrier's minimums may vary, depending on the experience of the pilot, the length of time the aircraft has been in service, and the obstructions at the airport, the slope of the runway, the navigation facilities for the field. These are all factors that go into the making up of minimums. So they may vary. These gentlemen deal with other parts of the United States; they don't deal with aircraft in this area.

Mr. Merrill, for example, is from the Midwest. His company operates up to Minneapolis and out to the West where they have entirely different problems of terrain. We would like to offer to your committee continuing service in exploring this problem, if you would, sir. In the interest of brevity we would like to terminate our statement.

Senator MONRONEY. Again in regard to different airlines having differing minimum requirements, is there anything in the airline operations which makes this necessary or makes it advisable? In other words, I can understand if you have a set of minimums that were established by FAA for each field, it would still be permissible for airlines to require even higher ceilings or greater visibility. Some airlines I know apparently do that under the minimums established here at Washington National.

Mr. COMMERCE. Self-imposed restrictions.

Senator MONRONEY. Additional safety margins.

Mr. COMMERCE. That is correct, sir. Several of them do that. My personal experience has been that Capital used to require that pilots had to have 200 hours, for example, in order to use regular minimums, rather than the 100 that was required in the regulations. It was an additional safety feature.

Senator MONRONEY. We ran into this on transition to turboprop in the Rikers Channel accident where there is an additional 100-foot raise on the minimum unless you had a certain amount of time on that particular type of aircraft. The testimony developed that the company had waived this in this particular case. And while the pilot had only perhaps less than 20 hours on that particular type of aircraft, he had been allowed to land at the very minimum instead of requiring a 100-foot additional ceiling.

Mr. COMMERCE. That was American Airlines, Senator. We don't have anyone here from American. Mr. Epp is from TWA, and they use La Guardia. Perhaps he can tell what the system is on TWA.

Mr. EPP. That is the 100-hour rule in equipment. The jets are what we are using now, which are more appropriate, perhaps. On our jet equipment, Capital's minimums are 400 and 1 until he has accumulated 100 hours. Again 100 hours has become 300 and three-quarters. I would say this is fairly standard procedure.

This holds true with all equipment. We have always had restrictions. We have to have a current list of captains which is furnished to us by our chief pilot, and we have to check his name on the list to ascertain whether or not he comes under the 300 and three-quarters, or 400 and 1. It is a question of different minimums for different airlines. I think they use all the basic minimums or are permitted to do so. They vary their own minimums for different reasons.

Senator MONRONEY. You mean they raise them?

Mr. EPP. Yes, sir.

Senator MONRONEY. They never go below the minimum?

Mr. EPP. No. La Guardia Field is an excellent case in point. The crosswind component there with the construction that is being used—TWA, as an example, has always used a more restrictive crosswind component because of the construction there, particularly on ice or snow situations where the runway might be slippery.

We have always operated with an ultraconservative attitude at La Guardia under current restrictions. TWA in addition provides additional restrictions on us and counsels us to be very conservative with the crosswind component because of the shortness of the runway, et cetera.

Senator MONRONEY. What are the minimums for visibility and ceiling on La Guardia for landings and also takeoffs with an experienced pilot?

Mr. EPP. This varies on the equipment. As I recall, so many navaids at La Guardia go out, actually the minimums at La Guardia bounce up and down. I think it is 600 and 1 without the ILS, and 400 and three-quarters with the ILS in operation. That is 422 over there.

We have a short runway which the ILS is on, and they are building a new one across 13–31, the new runway. I don't think it is a question of minimums, my own personal opinion, as it is a question of evaluation of the particular circumstances that exist at the time. Under certain conditions 200 and a half-mile is a very adequate safe proper minimum, and under other conditions 1,000 and 1 mile would not be proper or reasonable. There are many conditions of that nature.

As Mr. Commerce pointed out previously, the question of adequate supervision on the airport manager's part is important. Unless he tells us what the runways are like I can't tell my captain what the runway is like. He doesn't want to go down and look if the weather is—whatever in his opinion are not proper minimums. So it may be perfectly legal to land at 200 and a half mile, but in his opinion, since he doesn't know what the runway conditions are like, he doesn't even want to look at it with the crosswind component and other factors entering into it. It is largely a question of judgment.

Senator MONRONEY. Then you have a judgment on the temperature affecting the takeoff?

Mr. EPP. Yes, that is correct.

Senator MONRONEY. And you men who dispatch the planes have to take into consideration every single factor before you give the green light to your pilot, who then also has the right, if he chooses, to say that he doesn't wish to go; is that correct?

Mr. EPP. That is correct. We plan flights, set it up, execute a flight plan, make out the necessary figures for the computation to be used by the load control agent, to in effect weight the aircraft because of the limits. In all of these matters a very definite judgment enters into it. It is our opinion that this judgment factor on the part of two experienced airmen is missing in the nonscheduled operation. They only have the one man's opinion.

Senator MONRONEY. They don't have the facilities necessary to calculate the temperature, the weight, and other factors involved.

Mr. EPP. That is correct. He also doesn't have the time, either. He shows up an hour before and he has to do everything in that hour, everything himself: analyze the weather, make his flight preparations, compute his flight plan and so on. In the case of the scheduled carriers we do a great deal of this for the captain in advance. We evaluate, we brief him, we discuss the situation with him. He has someone that he can talk to, whom his experience has indicated is a reliable individual. They weight the information we give them and they use other information also. To be repetitious, it is a question of judgment, experience, and so on. The scheduled carriers do have this with certified dispatches where the nonscheduled do not.

Senator MONRONEY. You have dispatchers at all your main centers, do you not?

Mr. EPP. We have dispatchers by and large at the centers where they function best, based on existing communication. It would not necessarily hold true of dispatchers at major centers, because of the

way it has grown. The basic thing with a dispatch office is communications.

Senator MONRONEY. Does this apply to landings as well as takeoffs?

Mr. EPP. Does what apply?

Senator MONRONEY. Does your authority go to landings as well as to takeoffs?

In other words, if you observed a marginal situation in landing, would you be contacting your incoming aircraft and diverting them to some field if it was safer if you considered the field below minimums?

Mr. EPP. That is correct. We can and do take positive action in working with our pilots, with jets again. Companies have installed direct pilot dispatch communications, which is a wonderful thing. It is just a question of picking up the telephone and saying, "Hello, Joe, are you there?" and there he is. We can discuss the situation and give him my opinion and my viewpoints. If I feel very strongly about the matter I will then just direct him to go to another airport.

Senator MONRONEY. Do any of the other dispatchers have any comments to make?

Mr. COMMERCE. No, Senator?

Senator MONRONEY. We would like to have your views regarding revised weather forecasts of the Weather Bureau.

Mr. COMMERCE. That is one that is very dear to our heart, the question of revised terminal weather forecasts. We recognize the fact that when the Weather Bureau issues a forecast for a station it does it on the best information available on its own analysis.

Terminal forecast is the guide which the dispatcher uses in order to determine whether or not the operation is apt to be safe. We have a problem, however, with regard to the accuracy of terminal forecasts, and there is a practice used by the Weather Bureau, and it might be a proper one but we have difficulty with it because of the revision of terminal forecasts when the weather goes sour.

We would very much be interested in knowing if the Weather Bureau, for instance, uses the revised terminal forecasts as its basis for determining the accuracy of its forecasts. If so, that is to us not a proper system.

The problem, Senator, is that if you have a flight going from Miami to New Orleans, and the forecast is for it to remain CAVU—I am thinking particularly of a National trip that never got there—New Orleans may fog in and it will maybe fog in before we get that revised terminal forecast. It is very little to a pilot or dispatcher if the trip is already en route. We have to have an alternative plan if that forecast is sick, if it fails, and quite often they do. It may be due to the fact that the Weather Bureau is hampered by funds and unable to set up a system of doublecheck on their own system.

Quality control is the word which is frequently used. We think that if this could be provided, the entire industry would be better off.

Senator MONRONEY. In other words, you feel it is communications rather than the information itself that the Weather Bureau does not have, and the communications are slow in reaching you, and before your plane departs, say from Miami to New Orleans?

Mr. COMMERCE. I would say, rather, that it is more frequently that the actual weather is reported before the forecast is changed, which makes it rather an aftercast. An aftercast is not of much use if you have an aircraft en route.

Senator MONRONEY. Sometimes you get sudden changes in weather, too. I mean a fog can blow in on a clear day with only the dew point being an indication of what is to come. You have your own meteorologists, too, do you not, at many of your terminals that help in studying this to second-guess the Weather Bureau?

Mr. COMMERCE. We do, sir, to a degree.

Several of the carriers have meteorologists. I would say that is confined to one-third of the Nation's carriers. Most of the carriers use the dispatcher as the company meteorologist. The word "second-guess" might not be a good one, but that is actually what we do.

Senator MONRONEY. Do any of the others have any suggestions on this phase?

Mr. COMMERCE. Mr. Edwards, from Northwest, would like to comment on that.

Mr. EDWARDS. Senator, in my opinion, my experience in it has been that I feel that the Weather Bureau has been using the same method of forecasting, the same procedures, I should say, of forecasting, for as long as I have been connected with aviation, which is around 22 years, and that they are not tailored to the needs of the users.

I feel that they have set up standards, procedures which they feel will get the job done. But we as the users are not feeling the same way. And perhaps there should be a change in asking the airlines, the private pilot-owners, the business people, the irregulars, just what service do you want out of us? and try to give it that way.

As Mr. Commerce said, if you have an airplane that is halfway to its destination and the destinattion was forecast to be good, and you have told your passengers that you expect to get into that place and it fogs in, they wind up 200 miles away. They are not happy and we are not happy. We need the airplane there for another trip, and it is very disconcerting.

Most airlines, most dispatchers just don't have the time to do their own forecasting to the extent to which they would like. They do the best that they can. But if the Weather Bureau is going to provide this service, we feel they should step it up and improve it.

Senator MONRONEY. I think what Mr. Commerce was driving at on his statement on the weather is that he felt that the accuracy of the forecast should be measured on the original forecast and not on an advisory that came out after it was apparent that the weather actually was at that point; is that correct?

Mr. EDWARDS. Yes, that is correct. That is my opinion, too.

Senator MONRONEY. Do you feel that the Weather Bureau now is counting their advisories as a part of their forecasts?

Mr. EDWARDS. I think Mr. Commerce was asking if they were. He was not sure, if that was used in determining the accuracy.

Senator MONRONEY. We will try to ascertain that. That is a very good point that you raise. Is there anything else on the weather or the takeoffs and landings that you gentlemen have to suggest?

Mr. COMMERCE. No, sir.

Senator MONRONEY. On page 4 of your statement you stated that:

> The moral of the New York catastrophe should be: Let none of us, whatever our position in the industry or in Government, again turn a deaf ear to the voices of the airline pilots and the private pilots who have been preaching that the present system of traffic control is less than safe. The potential for this

accident was there all along, from the number of near-miss reports we were hearing about. We, as dispatchers, heard them.

We would like to hear testimony along this line.

Is the pilot required to report to you the near-misses?

Mr. COMMERCE. How do they do it at United?

Mr. KLETT. Yes. The pilots have been requested to report near-misses not only to their dispatchers but to the Government as well. I cannot say with any degree of accuracy how often this has been followed. As Mr. Commerce has indicated, during debriefing, the crew will always mention to their dispatcher any instance of this nature which occurred in a flight.

How often he goes ahead and reports this formally, I don't know, but we do hear those near-miss reports more than occasionally.

Senator MONRONEY. Now there is no system by which those are funneled into the FAA for study or for possible action, is there?

Mr. COMMERCE. It is my understanding, Senator, that there is no requirement. We have never been instructed to turn them over to the FAA. There is no procedure. I believe that the carriers may have their own systems for forwarding this information.

Senator MONRONEY. It is our understanding that the reporting of near-misses has gone down rather sharply since the rules were changed somewhat by FAA and the pilots no longer make as many reports on instances which could be called near-misses as they did before.

Mr. COMMERCE. Hopefully, I hope that they may get back into that procedure again. I think that the pilots' testimony at previous hearings has indicated that they were fearful of doing this because of punitive action. This to us is reprehensible. We think that in order to help the system analyze itself, help the FAA take a good look at the system, that they should have the benefit of every incident, every near-miss report.

The only way that we think that you can guarantee their getting every report would be to provide some form of immunity to those people who are reporting it; a reasonable degree of immunity, let me say.

Senator MONRONEY. This, of course, is one of the touchy and sticky problems because a man involved in a near-miss might be off the space that he is supposed to be in, and by reporting it first, if he gets immunity, you have a rather sticky problem there to bring about justice in the matter.

It is one of those difficult ones, where you have to get some kind of a situation where the man who reports it would not automatically be convicting himself. I don't think in the long run that you could completely absolve him of any connection with it in the event that the investigation turns out that he was off of his location and the other plane was at the right altitude.

Mr. COMMERCE. Yes, sir; that is correct. I don't have an answer for it. I don't know what the system would be. But I do not think that it should go on any longer that near-miss reports are withheld from the FAA deliberately or accidentally, or for the lack of a system.

I feel sure—and I know people within the FAA who are responsible for this—that they wish to give us the best possible system that they can. I think they are being deprived of the necessary information.

Senator MONRONEY. Wouldn't we need a little more of a guideline in this to tell what is a near-miss?

In other words, two planes flying at different altitudes, both on course, perhaps, could be almost close enough at certain times to be called a near-miss and yet both of them were properly positioned in their territory.

Mr. COMMERCE. That is a matter of pilot interpretation, Senator. I think that most pilots will agree that what one man would call a near-miss is not, in the other man's mind.

Senator MONRONEY. Do you think a definition is possible, or that you would just leave it up to the man who thinks somebody else was just too close?

Mr. COMMERCE. I think a conflict should be pretty obvious The aircraft at the same altitude or on a collision course with you under marginal conditions, for example. Of course, the old question of see-and-be-seen, which is too lengthy for us to get into at this time is also there. We believe a near-miss is pretty well one that requires evasive action. That is our idea of a definition of it. I can see that there can be a conflict. If you are able to avoid that conflict, then it is not a near-miss. This is our opinion.

Senator MONRONEY. Are there any other suggestions that you would like to make?

Mr. COMMERCE. No, sir.

Senator MONRONEY. Senator Engle?

Senator ENGLE. I was attracted by the statement made on page 3, Mr. Commerce, of your statement, in which you say in the first paragraph:

> The controllers still post information received over telephones on strips. We still encounter lengthy delays, even in excellent weather, and these delays are killing us, economically.

Then you go on to say:

> There is too much emphasis on long-range hardware and nothing in the way of immediate tools for the controller to use.

It has been some time since I have been out to this traffic control system at the National Airport. But the last time I was out there they were working with these strips, and then hand-carrying them. It was probably as archaic a system—the only thing they could do to make it worse would be to carry it by dog team.

Do you mean to say that nothing has been done about that?

I understood at that time that they were trying to mechanize. Have you been out there?

Mr. COMMERCE. Yes, sir, I have. They have a new system of writing strips on machine.

There are provisions for sending those strips in to the center itself, sir. But you are correct when you say that occasionally it breaks down and they do have to be hand-carried.

Senator ENGLE. They were putting in the machines when I was last out there and that is over a year ago.

Mr. COMMERCE. They are in operation now. They are very fine. I have seen the operation, the support equipment upstairs, the electronic devices which they use for posting of the estimates. That is a good step forward but it has its drawbacks. The machines just cannot think.

If you have an erroneous air speed, I discovered, posted on the original strip, that erroneous air speed will be carried all the way through.

For example, if an Electra were to file a given air speed and somebody erroneously put it down as 160, that machine I understand would post it all the way across at 160 knots.

Senator ENGLE. I am talking about mechanics. Does the controller still post the information received from the telephone on strips?

Mr. COMMERCE. Yes, sir.

Senator ENGLE. In other words, if somebody calls up and gives this information, and then they put it on a strip, and then it goes in those slots——

Mr. COMMERCE. That is right. With the additional refinement that they talk directly to the pilots in the air.

Senator ENGLE. I understand that. I am talking about the mechanics of it. From the point where this information comes in. When I was out there they had these machines and they showed them to me. They had one of them operating. And it would whack out this information. I assumed it would be automatic. But that has not occurred.

Mr. COMMERCE. Automatic posting?

Senator ENGLE. Does that come from the machine and go right into the control room where the fellow is working with it? They had them stacked up in a basket, and some fellow would pick them up and cart them around the place.

Mr. COMMERCE. The FAA envisions, I believe, putting this information on the strip probably automatically.

Senator ENGLE. The machines were supposed to relieve that so that you did not have that kind of a supermarket operation there, where some people would go out, type it out, put it in a basket and a man would carry it to somebody else.

Haven't they cleaned that thing up?

Mr. COMMERCE. I can't say whether or not they are having any operational difficulties with it. Basically my point is that the system is the same, virutally, as it was 15 or 16 years ago, when I was a controller.

We used to post the information on strips, only we got it over the phones and did not have direct communication with the pilot.

Now we have the refinement of direct communication. We have radar. Basically we are sorry to say that it has not advanced far enough. The reason we believe so is we have talked to controllers and we have talked to the men in the Air Traffic Control Association, and they are of the same opinion.

Senator ENGLE. This sentence said "controllers still post information received over telephones on strips."

Who are they talking to on the telephone? It is not the pilot, is it?

Mr. COMMERCE. No, sir. For example, the aeronautical radio, the radio operator giving position reports. Or to the INSAC station, the flight service station, which is in communication with the aircraft, and of course the dispatch offices.

Senator ENGLE. Let's go through this to see how they do it.

The pilot coming in here calls the Washington Control Center?

Mr. COMMERCE. Yes, sir.

Senator ENGLE. Who does he talk to?

Mr. COMMERCE. He is talking directly to the controller.

Senator ENGLE. What does the controller do with that information?

Mr. COMMERCE. He posts it on a strip.

Senator ENGLE. That is why I asked about this information. I want to get the telephone in or out; one or the other. If the controller is talking directly to the airplane——

Mr. COMMERCE. I see what you are getting at—only through telephones. No, sir. The statement should have said "aside from direct communication with the strips."

Senator ENGLE. What does he do with the strips after he puts them down?

Mr. COMMERCE. Do you mean after they are finished?

Senator ENGLE. Yes. I am trying to find out how this actually works.

Mr. COMMERCE. I understand they drop them in a basket where they are removed from the holders and counted in the day's operation.

Senator ENGLE. Are they taken over then and given to the men on the radar scopes? Or the men who are actually handling the traffic coming in from that particular direction? Is that the way it is done?

Mr. COMMERCE. Do you mean while the flight is still in the air?

Senator ENGLE. Yes.

Mr. COMMERCE. Oh, no, sir. The man who is working that aircraft in the air, on the radar scope, is controlling him directly without posting him on a strip.

Senator ENGLE. You are talking about what a dispatcher does. If you are setting up a trip going out of Washington National, that is going to San Francisco, you set up that trip and then phone it over, is that right?

Mr. COMMERCE. Yes. The flight plan varies from airline to airline, Senator. In some places the dispatch office phones in the flight plan to the center. In some places it is done by the radio operator. In many cases it is done directly by the pilot. It is phoned into the center and if they have the facility for automatic strip writing they post it right then and there. If not, then they handpost it.

Senator ENGLE. Then you say, "There is too much emphasis on long-range hardware and nothing in the way of intermediate tools for the controller to use."

What you are saying is that they are aiming 10 years ahead and not taking care of the problem that is right under their feet at the moment; is that it?

Mr. COMMERCE. This is the complaint that is voiced by many controllers, sir; yes.

Senator ENGLE. You believe that they can do things that will mechanically improve this procedure now which does not depend upon the perfection of these long-range devices that they are putting together?

Mr. COMMERCE. Yes, sir.

Senator ENGLE. Would you care to suggest what they are?

Mr. COMMERCE. I believe they would like to have refinements in radar which would give them altitude information.

Senator ENGLE. I understand that. I am talking about the mechanics right there, of getting your flight plans in and getting them out. I assume that is what you were talking about here?

Mr. COMMERCE. Yes, sir. The information—the system that they are presently employing, I think they are heading in the right direction in many of these things, especially as far as the posting is concerned.

The controllers I think will be able to address themselves more properly to that question, Senator, specifically what refinements they want in the system today, rather than 4 or 5 years hence.

Senator ENGLE. Thank you very much.

Senator MONRONEY. Senator Thurmond?

Senator THURMOND. No questions.

Senator MONRONEY. We thank you and your associates very much for giving us the benefit of your testimony on this important matter.

Our next witness is Mr. Charles McErlean, senior vice president, law, United Air Lines.

STATEMENT OF CHARLES F. McERLEAN, SENIOR VICE PRESIDENT, LAW, UNITED AIR LINES, INC.

Mr. MCERLEAN. Mr. Chairman and members of the subcommittee, my name is Charles F. McErlean. I have been employed by United Air Lines for the past 16 years and have been a vice president for the past 5 years. My principal responsibilities are in the legal field.

On behalf of my associates in United and myself, I wish to express our sincere appreciation for the opportunity of appearing before you and expressing our views to this subcommittee. It is particularly gratifying to us to appear before the subcommittee chaired by Senator Monroney, from Oklahoma, who has dedicated himself to the advancement of aeronautics, especially in the field of air safety. We want to say to you, Mr. Chairman, that all of us in United Air Lines, and I am sure in the entire commercial air transportation industry, appreciate the time and effort which you have dedicated so unselfishly to this task.

It is not my intention to suggest that this committee undertake to determine the probable cause of the December 16, 1960, midair collision. Congress had delegated that function to the Civil Aeronautics Board and it should remain there.

There are, however, certain facts relating to the December 16, 1960, midair collision and other experiences which should be called to the attention of this committee for consideration and appropriate action. References to the facts of this most recent accident will be for that purpose and that purpose only.

Basically, we are concerned by the apparent refusal of the Federal Aviation Agency to accept its congressionally delegated responsibility in the area of air traffic control. Air traffic controllers must or should have an obligation to exercise the highest degree of care. However, the FAA has established internal regulations and procedures to permit FAA to disclaim responsibility in the event of a mishap involving air traffic control. To state that the FAA has been given complete authority by Congress to establish an air traffic control system needs

no documentation. We believe the FAA has failed to accept the high responsibility that must accompany its delegated authority.

In 1956, Chairman Oren Harris, of Arkansas, and Congressman John Bell Williams, of Mississippi, of the House Interstate and Foreign Commerce Committee, pointed out the necessity for fixing responsibility in the air traffic control system. We believe a serious problem in this area of responsibility still exists today. We hope the Aviation Subcommittee will examine the matter thoroughly and take effective steps to correct the situation in the interest of aviation safety and the safety of the millions of people who travel by air each year, as well as those on the ground.

A review of some of the experiences that United Air Lines has encountered in the past 5 years will demonstarte the point we are endeavoring to make before this subcommittee.

(1) Grand Canyon accident: On June 30, 1956, two passenger transport aircraft collided over Grand Canyon. The air traffic control system knew that the planes were at the same altitude, were on converging courses and were estimating the next reporting point at approximately the same time.

Congressman Harris and Williams, among others of the House Subcommittee, questioned why the ground controller did nothing to prevent the collision.

The excuse or explanation offered by the air traffic management was that the accident occurred in uncontrolled airspace and that, in spite of the knowledge possessed by the controller, the air traffic control group had no responsibility under those conditions.

(2) Las Vegas accident: On April 21, 1958, a passenger transport aircraft and a military jet aircraft collided in the vicinity of Las Vegas, Nev. The passenger aircraft was on an IFR flight plan flying straight and level in the middle of an airway at 21,000 feet. It was struck by a jet fighter aircraft performing a practice penetration procedure which had been approved by the air traffic control system but was unknown to other airspace users.

The excuse or explanation offered by air traffic management was that they had no responsibility because the accident had occurred in VFR conditions. Under such conditions, it was claimed, the obligation rested entirely with the pilots to see and avoid each other and no responsibility attached to the air traffic control system.

(3) Staten Island accident: On December 16, 1960, two passenger transport aircraft collided over Staten Island, N.Y. Both aircraft were on IFR flight plans, in IFR conditions, and had been radar identified. One of the aircraft had proceeded beyond the limits of its clearance, but at this time the reasons are not known and are under investigations by the Civil Aeronautics Board.

It appears to be the position of air traffic management that the air traffic control system has no responsibility in this case. FAA is claiming that there was no obligation under its internal procedures and regulations to provide the traffic control service which could have prevented the accident, although radar equipment and employees were available.

In these three major accidents, the air traffic control system has disclaimed any responsibility for what occurred. This last disclaimer in the Staten Island accident, in our opinion is the most alarming of

all. It involved a civil turbojet aircraft and a conventional four-engine piston aircraft. It occurred almost 2 years after the effective date of the Federal Aviation Act under which Congress gave complete authority to one agency to overcome the difficulties that had existed prior thereto. In addition, it occurred after Congress has granted for the past several years substantial appropriations for improved equipment, facilities and additional personnel so that an effective system could be established and operated.

The FAA has publicly indicated it was giving special handling to civil jet aircraft. In the first annual report of the FAA to the President and the Congress, dated December 31, 1959, it stated on page 16 under the heading "Special Service for Jets" as follows:

> The advent of jet passenger service and increased turboprop air carrier service made it necessary, during 1959, to utilize special Air Traffic Control techniques in the high altitudes. Special control was needed because of the difficulty in keeping jets separated on the basis of the see-and-be-seen concept. The FAA established 30 new high-altitude jet route segments for a total of 25,455 miles. Radar surveillance for these civil jet operations was accomplished when the military permitted the agency to man and utilize 38 air defense command long-range radars. These supplemented FAA's own existing long-range radar to provide radar advisory service. *This combined radar system enabled FAA to track all jet flights from takeoff to touchdown, with the exception of a small section in the Rocky Mountain area.* [Emphasis supplied.]

In the FAA's press release 60–1, undated, issued at Washington, D.C., it said among other things:

> *This combined radar system enabled FAA to track all jet flights from takeoff to touchdown with the exception of a small area in the Rocky Mountains West.* [Emphasis supplied.]

On January 25, 1960, Mr. David Thomas, Director of the Bureau of Air Traffic Management, testified before this subcommittee and stated at page 587 of the committee's record as follows:

> 7. Radar: FAA's radar program is a most intensive one, as radar is the most effective tool yet devised to provide better utilization of the available airspace and improved safety of air traffic.
>
> "Twenty-eight long-range air surveillance systems were in operation in 1959 *to provide extended coverage in areas surrounding high-density air traffic terminals and extending out along high-density air routes.* * * * [Emphasis supplied.]

On November 17, 1960, the Administrator, Mr. E. R. Quesada, in a speech at the National Press Club, entitled "The Government's Role in Aviation in the Sixties," stated:

> Many of you must know that as soon as we put the jet transport into service, we put it into an environment that was heavily inhabited by military aircraft. The military establishments have about 22,000 aircraft. Most of them fly at higher altitudes—the environment into which the new jet transport suddenly moved—and, without the application of a vast number of military radars that were made available to us to *track the jet transport from takeoff to touchdown*, I think that would not have been possible. [Emphasis supplied.]

This subcommittee will recall that after the Las Vegas accident, great emphasis was placed on the necessity of establishing en route radar surveillance, and considerable effort was expended in the ensuing months to accomplish this task. The problem of lack of radar equipment in the Air Traffic Control System was not in the terminal area. When the long-range radar became available to Air Traffic Control, it made possible the statement of the FAA concerning their ability to track all jet flights from takeoff to touchdown with the

exception of a small area west of Denver in the Rocky Mountain area.

These official public statements, and particularly the report of the FAA to the President and the Congress at the close of 1959, were an accounting of the FAA's stewardship. The statements that jet flights were tracked from takeoff to touchdown, with the one exception in the Rocky Mountain area, were certainly reassuring to the users of airspace, and presumably to the President, the Congress, and the public.

Since December 16, 1960, we have been told something quite different. I shall refer to the sworn testimony of Mr. D. D. Thomas, Director of the Bureau of Air Traffic Management. Mr. Thomas in summary testified:

(1) The FAA only requires continuous radar coverage of turbojet commercial aircraft when operating above 24,000 feet.
(2) The FAA is under no obligation to provide radar service below the level of 24,000 feet.
(3) At altitudes below 24,000 feet, radar service is provided at the discretion of the individual controller, dependent upon his workload at the time.
(4) When and if radar service is provided below 24,000 feet, it is normal procedure for one facility to terminate radar service before the next facility initiates such service.

There is obviously a great difference between stating that all civil jet flights are tracked from takeoff to touchdown and the practice of assuming no obligation for radar service below 24,000 feet and leaving such service as may be given to the discretion of each individual controller.

The refusal by top officials of FAA to accept responsibility certainly must have an effect on the type of responsibility the controller will exercise. A few facts concerning the performance of one of the radar controllers involved with the aircraft involved in the Staten Island accident on December 16, 1960, will bear this out.

United Air Lines flight 826 of December 16, 1960, was radar identified by the controller, who testified that he followed the progress of flight 826 on his scope by the use of a so-called shrimp boat as the target moved across the scope. Flight 826 was receiving radar traffic separation.

The radar controller changed the routing of flight 826 from the normal published routing to a shorter routing. Thereafter, the radar controller notified flight 826 that his radar showed 826 intersecting vector 30 airway which 826 had been instructed to intersect. The radar controller then gave the distance of the aircraft's location to vector 123 airway at the request of the pilot. This was done by measuring the distance of 826's target from vector 123 as it appeared on the scope. Thereafter, the radar controller had several communications with flight 826. The radar controller filed a written statement and also testified under oath. He stated that shortly before he instructed flight 826 to contact New York approach control, flight 826 was on vector airway 123 1 to 3 miles southwest of the Preston intersection as shown by his radarscope. This occurred between 1533 and 01 second Greenwich time and 1533 and 14 seconds Greenwich time. The radar controller thereafter told flight 826 that radar service was terminated.

Based on the flight recorder carried aboard the aircraft, the time of the collision was 1533 and 32 seconds Greenwich time. There is also evidence, based upon sounds heard by the radio at the La Guardia

Tower, that the collision could have occurred between 1533 and 33 seconds Greenwich time and 1533 and 39 seconds Greenwich time. It appears that the actual collision occurred sometime between 1533 and 32 seconds Greenwich time and 1533 and 39 seconds Greenwich time. It would be impossible for the United aircraft to have proceeded from 1 to 3 miles southwest of Preston to the point of collision in that time interval. The physical facts make it apparent that the United aircraft had already proceeded past the Preston intersection at the time the controller terminated radar service and yet the radar controller did nothing.

The U.S. Standard Manual of Radar Traffic Control Procedures, published by the Air Traffic Control System, provides at paragraph 2.2 for approaches as follows:

> Apparent deviations from standard or normal flight paths or other flight information observed on the radarscope should be transmitted to the pilot to be used at his discretion.

When flight 826 went past the Preston clearance limit, there was an obvious deviation, yet the controller, who had not as yet terminated radar service, made no effort to call and advise flight 826 of this fact. We are unable to understand why the same monitoring given approaches should not apply. It was for this reason that United has stated that, in spite of the fact that we do not know why flight 826 passed the Preston intersection, the accident would not have occurred had the Air Traffic Control System properly utilized the equipment, personnel, and facilities that were available to it.

It is claimed by the FAA that currently used radar equipment will not permit keeping track of traffic in holding patterns because altitude cannot be determined. It is difficult to understand why an aircraft identified on the radar scope and in contact with the FAA radar controller cannot be observed until it enters a holding pattern, and continue to be observed while in the holding pattern to determine that it does not stray.

Even though several aircraft might be in the same holding pattern at different altitudes, if any aircraft strayed, all could be notified. If only one aircraft was in the pattern or the area at the particular time, as was the case of flight 826 in the Preston area on December 16, 1960, there can be no question but that the controller should be able to observe it and give necessary warnings. It is recognized that a pilot must be capable of navigating his aircraft and flying it in accordance with the clearances issued to him. The fact that a pilot is so qualified does not mean that something could not happen to prevent him from properly so doing. In view of the large expenditures of taxpayers' money for radar equipment, it would seem elementary that radar should be used as a warning device if a pilot for some reason deviates from the standard or normal flight path.

It seems astounding to us that the decision as to whether to give radar service rests with the individual controller. Likewise, it is astounding to find that, if radar service is undertaken, it can be discontinued in the course of a flight at a crucial moment without any indication of such discontinuance from the controller.

Possibly some will advise this subcommittee that Air Traffic Control needs different or better equipment and that active research, development, and planning are underway to accomplish needed re-

equipment. We have no doubt that different and better suited equipment is needed and will be needed in the future. I am not qualified to comment on what this equipment should be or whether the research and development underway is correct and the best utilization of the budget appropriated is being made. Surely technically qualified persons will appear before this subcommittee who can adequately comment in these areas. Three things, however, have occurred to us that might be worthy of the subcommittee's attention. They are:

(1) Has the FAA so concentrated its personnel and appropriations on the long-term ultimate equipment that it has lost sight of the present or interim needs?

(2) Is there equipment available that could be used today to improve the Traffic Control System?

(3) Has the FAA made, and is it making, effective use of the personnel, facilities, and equipment that it has?

It is time that the Congress make it abundantly clear that the FAA in establishing and operating an Air Traffic Control System must assume full responsibility for the System and must effectively use the facilities, equipment, and personnel that have been made available to it. The Federal Aviation Act imposes on the air carriers the duty to exercise the highest degree of care. Should not others operating in the field do likewise so that the American public will receive that degree of care that will insure maximum safety in air transportation?

Mr. Chairman, that is the end of the first statement. I have sat here since these hearings opened Monday. I have heard certain things and if I have permission I would like to make a few comments and then I will be willing to answer any questions that I can.

Senator MONRONEY. We will be glad to hear them.

Mr. MCERLEAN. I believe that, since apparently the committee has asked for some fact reports of the December 16 accident, it is probably a shame that the hearing was held so quickly after the accident that there really wasn't time to complete all of the investigation, much more than is necessary.

Some of the things that it seems to us that have taken place don't actually tell this committee what happened. I heard some testimony here the other day concerning the control of United 826 which I hope the facts, as they are set forth in this written statement, will tend to clarify.

There was one statement made, and I am not quite sure whether it is clear in the record, that United's aircraft was cleared to descend to 13,000 feet as it crossed Allentown. That is not quite accurate. United's aircraft west of Allentown was at 25,000 feet. The controller called and gave a clearance to descend to 13,000 feet but the pilot inquired as to the Idlewild weather, saying, "I would rather hold up here if I am going to have to hold. Can you give me the Idlewild weather?" The controller agreed to do it, returned and asked him to change to another controller which turned out to be the last center controller that he did business with. He immediately did that and he was told that he could remain at 25,000 feet or descend at his choice. His choice was to remain.

He called and only after he got the weather and again telling the last controller at the center that he dealt with that he would

rather be holding up high if he was going to have to hold did he then descend.

There was also some question, Mr. Chairman, raised by you about whether this trip went over Colts Neck. This trip, 826, never had a clearance to go over Colts Neck. Its clearance was to Allentown to Robbinsville, then direct to Preston via Victor 123. He did get this change of clearance for this so-called shortcut from the controller to intersect Victor 30 which was only part way between Allentown and Robbinsville, and then proceed easterly along that route to Victor 123 and turn then and go up to Preston.

However, the record shows that the air route traffic control center, in passing on its estimate to the approach control, advised approach control that this aircraft would arrive via Colts Neck, something that the aircraft was never told, and which is in a direction somewhat different than the routing he had. He was coming more or less from the southwest, and the Colts Neck is southeast of Preston.

Likewise, approach control was advised this aircraft would arrive Preston at 38 minutes after the hour, and the record shows they were 3 minutes after the hour. So in spite of the change in routing cutoff—around 12 miles I think, of flying, and at least 1½ minutes of flying time—there was no change made in that.

Likewise there appears to have been a question in the minds of some members of the committee as to whether Flight 826 was required to be at 5,000 feet when it arrived at Preston. Its only clearance was to Preston. It had to get down to 5,000 feet before it could be transferred over, apparently, to approach control. But the record is plain that 826 could have arrived at Preston and lost any additional altitude in the holding pattern.

Some question was also raised here about the transmissions that occurred at 1533:20. That is the transmission in which the controller ended by saying, "Good day." The record shows that the response or acknowledgement of that transmission took place at 27 seconds. In other words, that was about a 7-minute transmission. This becomes somewhat important if you want to try to determine where this airplane was.

You must remember, as I pointed out, that the record shows——

Senator MONRONEY. You meant 7-second transmission?

Mr. MCERLEAN. That is right.

The record in this case shows that the controller said he saw this airplane southwest of Preston, 1 to 3 miles, which is a little difficult to fix the exact time because he said it was at the time 826 said he was leaving 6,000 feet. 826 said he was leaving 6,000 feet at 1 second after the minute. But the controller did not understand it and required a repeat, and it wasn't until 14 seconds after the minute that he got a confirmation that he understood. The transcript is very clear, but for some reason he didn't understand it.

That is when he apparently thinks he saw him, or said he saw him, and that then gives us about 20 seconds to not more than 25 to the point of this collision.

Flight 826 apparently had no trouble with its communications because, having said "Good day" to the New York enroute control operator at 1533:27, he called approach control at 28 seconds. The record shows that that time should be corrected by 2 seconds. An FAA wit-

ness said they found a 2-second error in the cloud, and that would make it 30 seconds.

So at most it took him 3 seconds to change his frequency, get an opportunity to communicate; and what did he say? "Flight 826 approaching Preston at 5,000 feet."

That is the indication this man had in his cockpit. He was then approaching Preston. He got a response of a very long communication that took all the way to 54 seconds after that 33 minute. I am sure he didn't hear it. This collision had occurred.

Why he didn't get it, or why that controller didn't call him, if he was watching it, giving the radar separation, which does not require the same amount of separation the normal method is not required between the two trips.

One other factor that I think this committee should know, if you are going to look at the facts in this case, and if I may in this one respect, I am going to mention something that is not in the record before the CAB, but I think at least 100 people heard this. As you know, the La Guardia area controllers saw these two targets come together. They were vectoring TWA. They take the position—and under the regulations that is the position I suppose that is warranted to them—that they warned of the traffic. They had no responsibility to vector TWA away unless TWA's captain asked for it. They testified this was a fast-moving target. That is why they concluded it was a jet.

We tried to find out how much through traffic goes through that area, and we got some rather peculiar answers. Some said, "Well, we get some, and it is infrequent," and it was very difficult to find out how much, if any, really through traffic comes through Victor 123 through the vectoring area for La Guardia. Unless it is very high traffic and there is no jet route across there it would have to be something below 24,000 feet if it was jet traffic.

One thing I think that was very revealing: On December 19 the controllers were permitted to meet with the CAB committees for the first time. That's 3 days after the accident. They had a meeting in the Federal Building in New York between the operating committees on each accident, and these controllers were brought in and they read their statements. The chairman of these committees, CAB investigators, were the only ones permitted to ask them any questions. The operating committees were permitted to sit there, and if they had a question they would submit it to the CAB representative and he would ask them if he thought it appropriate. In addition to that, others interested in working on the investigation were permitted to sit in the room and just listen so they could start to collect the facts in preparation for the completion of the investigation.

There were two controllers in the La Guardia Approach Control Center. One of them was working on the Linden stack and one of them working the Idlewild stack. The man working the Idlewild stack, he also saw this target, lone target coming across his scope. There were two men on each scope. One was supervising the other.

Senator MONRONEY. Is this the area controller, or is this the——

Mr. MCERLEAN. This the approach control at La Guardia. And the man I am talking about—his name escapes me—he was the controller who was supervising the scope that was handling the traffic out

of the Idlewild holding pattern that was used for La Guardia. There were two feeder fixes. One is Linden and the other Idlewild omnifacility.

Senator MONRONEY. Let me get this straight. You have two approach radar men in the tower at La Guardia?

Mr. MCERLEAN. Yes, two scopes and four men.

Senator MONRONEY. One man was working the Linden approach to Idlewild?

Mr. MCERLEAN. Right.

Senator MONRONEY. From La Guardia.

The other man was working the approach area from——

Mr. MCERLEAN. Idlewild to La Guardia.

There are two feeder fixes, one called Linden and the other called Idlewild, because it is a holding pattern apparently above the Idlewild omni, or in the vicinity of the Idlewild Airport. They were bringing trips in from both of those holding patterns that morning. One man from Linden and the other vectoring from the Idlewild.

Senator MONRONEY. How far away from Preston is the Idlewild holding pattern?

Mr. MCERLEAN. I believe it is right over the airport. I can't tell you that distance. I don't know it. I believe it is right in the vicinity of this air space above the Idlewild Airport or in close vicinity to it. In other words, it is the east——

Senator MONRONEY. That would be approximately 10 miles, then, from——

Mr. MCERLEAN. Sir, I don't know. I just can't answer that question.

But the point——

Senator MONRONEY. Have you a traffic map? Has FAA got a map of the New York area?

Mr. THOMAS. It is 25 miles.

Mr. MCERLEN. The point I am trying to get at is that this so-called unknown traffic coming across here, the controller who was supervising the scope and the controller actually operating the scope for the Idlewild holding pattern stated, when he spoke to this committee on December 19, that he was shouting at them concerning this traffic.

Now, if it was customary for traffic to be moving through there, I have grave doubt that any controller would have been shouting at the man at the other scope.

When it came to the hearing we could not get him to repeat that same statement he made there. For that reason I have grave doubt that very much traffic goes through that area.

Those are the things that I think this committee ought to really find out: How effectively is this system working?

Gentlemen, there were questions raised concerning the speed of this aircraft, during the latter part of the flight particularly. I would like to state that there is no regulation, no rule that was being violated by the speed of this aircraft, nor was this aircraft at any time requested to reduce its speed. You will note that the TWA aircraft was on two occasions requested to reduce its speed.

In addition to that, it was within the capability of this aircraft at the speeds that he was going to have properly entered a holding pat-

tern and reduced to the holding speed before he made one circle of the holding pattern.

Likewise, using only, for the time being, the figures that were used by the CAB chairman of the committee that studied the recorder, Mr. Pahl, who testified here, if you would follow the figures that he has, when this airplane was approaching Preston, as he thought, at the time he said he was approaching Preston he had substantially reduced that speed. At the time he actually went across Preston he had an indicated air speed of approximately 358 knots, and a speed across the ground of approximately 438 knots. At the time, the last reading made on the recorder, he was at 301 knots indicated, and 329 across the ground. He was bringing that airplane under control.

In addition to that, there is testimony in this record that the DC–8 aircraft is capable of being reduced from a speed of 350 knots to a speed of 200 knots in 45 seconds.

If that aircraft is turned into a holding pattern it will be somewhat further reduced in time by the bank of the turn. And if that is not sufficient, there is an approved procedure by using full reverse on Nos. 2 and 3 engines, and that aircraft could be reduced from a speed of 350 knots to 200 knots in between 20 and 25 seconds.

So that everything this airplane was doing was within the capability of the airplane. It was known to the FAA. They certificated the airplane. They checked out every pilot on his rating that the United Airlines is using on the DC–8.

Whether or not it might be better to have a holding speed, a reduced speed in this area, is another question. But I don't think that this captain should be charged with something that was not in existence prior to December 16, 1960, and which no one thought about. We must try to distinguish between what we would have done had we had the knowledge that he had prior to 10:30 on December 16th and what we think of afterwards, for we could all be good Monday morning quarterbacks.

Gentlemen, there was considerable testimony here—I shouldn't say considerable. There were some questions here yesterday about whether some authority should be put in somebody to change schedules, or limit schedules, or the time that schedules could be flown.

Without regard to whether that would be good or bad, gentlemen, I say that in my humble opinion there was nothing about this accident that should form the basis for any such decision, because if you will look at the facts in this case, this case was not because of excess traffic. This controller had one aircraft in the area and he was controlling only three aircraft. Now, if there is excess traffic someplace, let's not change the rule because somebody made a mistake, or maybe two people made a mistake. Maybe our captain made a mistake. I don't know. He went through the Preston hold fix for one of three reasons, I am sure. He certainly didn't do it deliberately: either because he had something wrong with an airborne instrument; 2, there was something wrong with the ground transmitting equipment; or there was something intervening between the transmission and reception in the aircraft. We intend to find out what that was. But that is a very elusive problem and it is going to take quite a bit of time, and I think the CAB are diligently working on it.

But in this case we have a case where I think somebody made a mistake, or maybe two people made a mistake. So I don't think there is any reason, based upon this accident alone, to have any such thing as someone trying to say what schedules are going to be flown or when, or whether the civil transportation should give up their time for military aircraft or civilian aircraft, as I say, based on this alone.

Likewise there has been some reference here that if United aircraft had been equipped with DME possibly this accident could have been avoided.

I think between what is stated here and what has been stated elsewhere, someone has attempted to leave the very plain inference that United Airlines has been negligent in buying equipment. I don't believe there is any equipment available that United Airlines has not bought that has been worthwhile to have on their aircraft. United Airlines as early as 1952 proposed the purchase of civil DMA, and tried to get the CAA to fix up procedures so that it could be successfully used. We were unsuccessful. We have had DMA in our aircraft on a test basis.

Until very recently there was one source of supply. It wasn't until last August that a TSO was written as to what would be the proper DME to have. The regulations on its use within the sytem I understand are effective February 1, 1961, and what DME's were available and purchased have had to be sent back for modification.

There are now two sources of supply. United has tested them both out, and United, for many months, has had its schedule as to how long the test would take, and when it would place its order. That was on our decisionmaking process for February 1961, and the decision has been made, and United is in the process right now of placing its order, and they will be delivered and installed on United's aircraft before this year is out, as far as the manufacturer can produce them.

Likewise there were questions here that this hearing on this accident apparently turned out to be a question of questions of liability by plaintiff's lawyers and insurance carriers' lawyers. I believe there were some of those men in the audience. No insurance carrier lawyer represented any party, so far as I know, and obviously no plaintiff's attorney was allowed to ask any questions. Each party to this investigation, as named by the Board, was allowed to be represented by a spokesman who could ask questions when the CAB got finished.

Mr Chairman, and members of this committee, I believe if you will examine the record you will find no questions asked or no material requested that did not relate in some fashion to what happened that caused this accident, and what could be done to prevent it.

If there is some worry that these people are in the audience, the only solution would be to have these hearings held in executive session. But when you hold a great big public hearing in a public ballroom and invite everybody in the public to come in, it is pretty hard to say that some fellow who maybe is going to represent a plaintiff or is maybe going to represent an insurance carrier who has to defend lawsuits which will arise, cannot sit there and listen. It is, likewise, he can buy this record, and there is being made for these people, on a silver platter, practically of the information that they may need in their subsequent lawsuits. But that same information is essential to the Board to consider in determining the probable cause.

I believe, Mr. Chairman, those are the only matters I would like to comment on so far.

Senator MONRONEY. Thank you very much, Mr. McErlean.

With reference to the Committee's concern as to questions and to the matter getting into the hearings that indicated some interest in lawsuits, this is not to suggest that anyone is asking questions, but that the attorneys for perhaps carriers and others were suggesting questions to be asked. It was an open hearing. I hope there will always be open hearings, because they involve very important matters of public concern. And to have an executive session would be unconscionable and I don't think anyone would suggest that.

In connection with your statement, you mentioned, of course, the very unfortunate accidents that occurred earlier: the Grand Canyon accident on June 30, 1956. This did lead, did it not, to a change in a rather historic system of handling traffic, and that is clearance on top without the necessity of going through the Air Traffic Control Center to verify the safety of that climb-out for a couple of thousand feet to get on top of the clouds.

One of the planes—I believe it was TWA, if my memory serves me correctly—was given clearance to go on top, which had been customary up to that time. Is that correct?

Mr. MCERLEAN. Yes, sir.

Senator MONRONEY. And it did strike the United plane in its climb-out.

Mr. MCERLEAN. The point, Mr. Chairman, is that before he was given that clearance he asked for a clearance to the same altitude United was flying, and it was denied him because United was already in the altitude. He then asked for the on-top clearance. It was granted to him and then he reported he was at the same altitude as United was, so he turned out to get the same thing by getting an on-top clearance.

Senator MONRONEY. As I understand it, he did not get the United altitude. He was given clearance to go on top, to go VFR and did not anticipate flying at this same altitude at which he knew United was. It happened by an act of God that these two planes happened to be in the same minute airspace as the climb-out on top took place. It was a most unfortunate thing, and the rules and regulations were promptly changed, this being about the first time, I think, that this had ever occurred.

This case demonstrates, I think, that we learn a great deal from accidents investigation. We know that in monitoring airways, with 25,000 or more miles, we are not going to be able to have it as safe as all of us would pray that it can be.

The purpose of investigations, I believe, and the hearings, and of this committee and of everyone else, is to try to ascertain the facts and to correct the slippage that can occur through human or instrumentation error.

The Las Vegas accident in the same degree disclosed that military traffic was not being cleared by the same control tower or the same traffic facilities in the Las Vegas area. That led to the Federal Aviation Act. In fact, it did put the military under control and we didn't have two separate traffic control systems, one not knowing what the other did. It was a careful investigation, with participation of everybody involved, that helped to bring that about.

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In the Staten Island accident, this is one of the most important, I think, because it is the first time that we have ever had an accident that has occurred with two planes under positive IFR control. There are many significant facts which you have brought out which the investigation of the CAB has brought out, and the committee's efforts to ascertain additional information, I think, will have an important bearing, we hope, in straightening out the air traffic system in the very congested complex of the New York City area.

One of the things that we are particularly interested in, of course, and the thing that led to the discussion which you condemn, as to the limiting of the number of flights, was the matter of the positive radar handoff.

I believe with present known equipment perhaps we could do what you say should have been done in the operation that day, and that is that the United flight was definitely spotted and cited and confirmed to be in the Preston holding pattern. This was not done, was it?

Mr. McERLEAN. Mr. Chairman, although we asked a lot of questions to try to figure out why a radar handoff couldn't have happened, I say that even if you accept that they were unable to have a radar handoff, this airplane went by Preston at a time the man was still supposed to be keeping some track of him, and said he was, long before he terminated radar service.

So that, even if you forget about a radar handoff in this case, if he had been doing his job, with one trip there, so he could terminate his communication transfer, he would have seen him go by Preston, aside from—I agree radar handoffs would be very good and the sooner we get them the better. We won't be saying "Radar terminating," as he did, but he possibly could have been following him closer had he been following the radar handoff system.

Senator MONRONEY. The whole issue of perhaps limiting some traffic is to make possible with a study whether it is possible with present equipment to insure this.

All the testimony that we have heard so far has been that this could be done, but it would slow down the acceptance of the system, and therefore to put that in as standard procedures, while it would have not necessarily slowed it down on this particular day and hour, that it would certainly limit the acceptance of the system into the New York area to have the area man physically watching this plane to see that he made his turn into the Preston holding pattern.

Everyone I have talked to who is familiar with this not only in Government but otherwise admits that this is a proven fact, and this is why the committee is exploring whether necessity requires that this be provided today, or in the immediate future, and would add to the safety features of the New York City area.

Mr. McERLEAN. I don't want to leave any impression that I am condemning the use of radar handoffs, or that we will not slow the speed of the trips into the New York area.

Maybe this accident calls attention to the traffic. But the facts of this accident itself are not solely a justification for such action.

I don't say that the action isn't necessary. All I am trying to make clear is that I don't think the facts as they developed up to this point, standing alone, are justification for saying we should have somebody controlling the schedules of either the scheduled carriers or of the operations of other users.

Senator MONRONEY. This committee has not recommended any action, but we are exploring to find out if we can add a measure of safety.

Mr. MCERLEAN. I recognize that.

Senator MONRONEY. That is the very thing you are testifying for, and that is a positive radar handoff. I think if we had had a positive radar handoff this accident would not have occurred. I think it would have been possible, had you had less acceptance of the system as a routine procedure, that the man could have told the American plane following some 30 seconds or a minute behind to hold at a different place, and while he watched this man go into the pattern. If we want that, we are going to have to pay a price for it, and that is to slow down the acceptance of the system under the present known techniques of radar control.

So I think what you say on the one side, that it would have been helpful had this procedure been in force, then you must admit on the other side that to put it in force you must accept a fewer number of planes being brought into that area so that that system could then work.

Mr. MCERLEAN. Right. And that happens in practice, today. They will slow you down and hold you as far west as Chicago or some place else, Mr. Chairman.

Senator MONRONEY. Their present procedure is not to do that if there is proper separation of the incoming planes. Under the present operation of the system—which I do not necessarily approve of, and I am just saying what has been a fact since the use of area radar and the approach radar—there is a gap in the system.

Mr. MCERLEAN. As I understand it from what our people told me and from what I heard Mr. Thomas answer the question here the other day, if necessary they invoke what they call full control, to try to limit the amount of traffic to the capability of the system at any one time. That could involve United or anybody being held back until the system is able to handle it in the New York area.

Senator MONRONEY. But they determine that the system is able to handle it if the controllers, the area controller is watching the plane behind, and is not necessarily concerned with his ground fix. The ground fix is supposed to be the responsibility—under the present system, at least on a well identifiable position such as Preston, which is habitually used—for the pilot to find and go into the holding pattern.

What the committee has been concerned with is the fail-safe system, so that if the pilot misses Preston there will be a man on the ground saying, "Whoa, turn around."

Mr. MCERLEAN. And they have been doing it.

Senator MONRONEY. Our testimony has not been that, and I heard nothing in the investigation that this is the practice, because the system is so demanding on speed and on acceptance.

Mr. MCERLEAN. Mr. Chairman, in this investigation Captain Wallace testified that when he flew United flight 830 into the New York area in the vicinity of 6 to 6:30 p.m. e.s.t. on December 16, 1960, he was called by the controller and told to turn into the Preston pattern. He responded that he didn't think he was there, but turned into it.

Senator MONRONEY. Was that before or after the accident?

Mr. McERLEAN. It was 6:30 p.m., the same day. That was after the accident.

Senator MONRONEY. I don't blame him for doing that, and I think it shows a quick response to a vacuum of control that was illustrated there.

Mr. McERLEAN. I think there are other examples where the controllers have called men and told them that they were off if they saw them.

Senator MONRONEY. That is right, and it is very helpful when they do.

Mr. McERLEAN. We are glad to have it.

Senator MONRONEY. But it is not the present system. It is not the pattern of operation, and mainly because I think you are crowding these airports and this airspace so much that you are going to have to slow down the system's acceptance if you want this extra degree of safety.

This is just an idea. It may not work out after we study it more thoroughly.

Mr. McERLEAN. We have learned some of these things since December 16. But we still wonder what Mr. Quesada and the Agency meant when they said they were tracking the turbojets from takeoff to touchdown.

Senator MONRONEY. This tracking and minute-to-minute surveillance is a question of semantics and I don't believe that Mr. Quesada felt that they were in view of radar scopes at all times likely as an uninitiate in this business did believe. That was news to me, when I realized there was a gap after this accident.

Mr. McERLEAN. And a lot of other people, Mr. Chairman.

Senator MONRONEY. There is a manual, isn't there, that explains this system?

Mr. McERLEAN. Sir?

Senator MONRONEY. There is a manual of operations that explains this system?

Mr. McERLEAN. There is a flight information manual available to pilots, supplemented by the Airman's Guide, and there are also internal manuals which I believe can be purchased although they are internal procedure manuals, the radar manual and I think they call them ATM manuals that set up internal procedures, there are circular letters that are written internally some of which do get circulated in the industry and some of which apparently do not. But I think a great many of them were circulated from time to time by the FAA, giving copies to the ATA, who in turn, so far as your transports are concerned, sent copies out.

Senator MONRONEY. I appreciate your added information and discussion.

At one point, and this is a very important feature of the accident, you said, just before you closed, that if there were something malfunctioning with his navigational equipment in the United plane. This has been of course one of the issues that has been raised as to whether or not, had the pilot had full implementation of all of his navigational facilities, he would have with certainty known when he passed over Preston.

Mr. McERLEAN. Of course I was referring to this other VOR equipment that he would have been navigating with after he reported someplace west of Allentown that the No. 2 VOR accessory group was inoperative. He did report that to United Air Lines as a routine matter.

That is the way they have been reported apparently for a great many years, so that the maintenance personnel could have replacement equipment available to put it aboard the aircraft.

I don't know the numbers of aircraft that are flying in this system. A great many of the military did for years, and are still flying with one VOR system.

The record in this case shows, by qualified pilot testimony, that the absence of one VOR only made a slight inconvenience because it meant that he had to tune back and forth, a matter of a second or two, to return the equipment.

When I said there was a possibility of maybe even the last one going out—I don't know, it seems to me there are three areas—the possibility of the balance of the airborne equipment going out, the possibility of something being wrong which has not yet been discovered, although the reports that were put in the record by FAA indicate that there was nothing wrong with the ground station, or the fact that there could have been something wrong with interference, not yet determined, between the transmission at the station and the receipt in the aircraft.

Those questions are being worked at by people knowledgeable in the field, and I think very vigorously.

Senator MONRONEY. But you do recognize that he had reported that he had lost one-half of his instrument system?

Mr. McERLEAN. No question about that.

Senator MONRONEY. Was that reported to the Air Traffic Control so that additional help could have been made available——

Mr. McERLEAN. No, sir.

Senator MONRONEY. For special surveillance as to his reaching Preston? It would seem to me that had the control tower known it, or had the area radar known it, they would have given it more than the routine attention and would have gone beyond the routine requirements in monitoring that particular flight.

Mr. McERLEAN. Mr. Chairman, it was not reported to the FAA at any time before the accident. It was reported in the same fashion that such malfunctions had been reported for years.

If you follow the track of this aircraft as seen by the recorder, he had no trouble navigating that aircraft after he made that report. He intersected Victor 30 without trouble, flew down Victor 30, anticipated a turn into Victor 123, and I believe the track as drawn by CAB people showed that he was never more than a mile from the very centerline of the airways.

Senator MONRONEY. But he would have had to determine his fix from taking the shortcut as he was ordered to do off of Victor 30, taking the shortcut which is perhaps 10 miles from the time he left Victor 30 to get his heading on Victor 123. Then to obtain his fix on Preston, he would have had to immediately switch in that short period of time to have his Omni at least showing Preston, would he not?

Mr. McERLEAN. Yes, sir. He would have had to switch to the 246 radial of Colts Neck omnirange, which is the one we believe he used,

which the normal pilot uses, because it is closer to the fix. Irrespective of where he did it, the pictorial indicator would have shown that it was in front of him or behind him, unless something went wrong.

You heard reference to test flights flown by United DC–8 subsequent to the accident. I believe the date was December 27, 1960, and every one of those flights was flown with the use of one VOR.

Senator MONRONEY. Do you permit the takeoff of a jet on the Chicago to New York run with one VOR?

Mr. MCERLEAN. No, sir.

Senator MONRONEY. Then you do consider it more than incidentally important to the safety of the flight?

Mr. MCERLEAN. We have two so that if one fails we have something left.

Senator MONRONEY. Is that the only reason or is it that two are better than one?

Mr. MCERLEAN. Two make the job easier than one, no question about that, because you can set them both up and prevent yourself from switching back and forth.

Senator MONRONEY. This, I think, is also an important part of our study, to find a fix in a very short range with very high-performance aircraft. This plane, as you say, shortly before the accident was going 438 knots. The manual I believe that you have shows that you were going into the holding pattern at 207 miles per hour.

Mr. MCERLEAN. There is no restriction as to where we enter the holding pattern. It is the speed we need to maintain to stay in the holding pattern, as I understand it, Mr. Chairman, and to get it down to about 207. It will vary a little bit, depending on conditions of the day. But right around that area.

What we have to do is get the airplane down in order to keep it in that holding pattern, and that the airplane is capable of doing.

Senator MONRONEY. You use a reverse thrust to slow the planes down?

Mr. MCERLEAN. If it is necessary.

Senator MONRONEY. It is capable of coming down very quickly in speed if the reverse thrust were used?

Mr. MCERLEAN. Sometimes they will use idle reverse and they are trained in how to use the full reverse on two engines.

Senator MONRONEY. If you use a full reverse, you have a quick deceleration?

Mr. MCERLEAN. Yes, sir.

Senator MONRONEY. And with considerable noise and some slight evidence of turbulence, which is merely the slowing down of the plane?

Mr. MCERLEAN. I don't know when it happened, but it is obvious that some turbulence would result. I might say there is one other question. The question was raised yesterday, Mr. Chairman, about the recorder being turned on and how it is turned on.

On United Airlines' aircraft there are two ways to turn it on. One is a switch in the cockpit which should be ground checked at the ramp in order to fix the trip number, and turn it on before the taxi roll starts. If for any reason it fails, it automatically goes on with wheels off. For some reason which we don't know, of course, and I presume we will never find out, the switch was not on at the takeoff roll. How-

ever, it was turned on before wheels off, and, as best they can read the recorder, it was about the time the aircraft had arrived at 100 knots.

So we don't know if it accidentally was turned on and knocked off and was discovered during the taxi roll and turned on and then operated through the collision point and for some time afterward, although the readings I think are a little difficult after the actual collision point.

Senator MONRONEY. We are tremendously interested, as you are, not only in the long-range system that we hope some day to have, but also in making the present system as fail safe as humanly possible, and to put whatever additions into the old system we can until we can achieve this.

We are impressed of course by the positive radar handoff which you are urging here as well. We hope we can find some way during the course of these hearings to effect that. We hope we can effect it without slowing down the system. But if necessary, then I think we have to concern ourselves with either accepting a slower acceptance or putting up with a condition which you describe as happening here in this case.

Mr. MCERLEAN. Mr. Chairman, I want to make it very clear, on behalf of United Airlines: If a slowing of the number of aircraft into this system is necessary for us to exercise that degree of care required, we are prepared to take it and not have anybody telling us what hour of the day we may necessarily have to operate the aircraft.

We certainly may have to take some delays. But we are interested in safety, No. 1. The only point I was trying to make is that if that is necessary, it is necessary for a lot of reasons, not solely this accident.

Senator MONRONEY. Would it be possible, do you believe, to have a third radar to serve the holding pattern to be installed for the sole purpose of monitoring this gap, to be sure that when area radar turns him loose as he approaches the fix to identify him in the holding pattern, to see that there is nothing coming off of that approach to the holding pattern that goes beyond the limits, to work this separately?

Personally I think this would be a good investment of Federal funds if it would help add to the safety in this very complicated area, to positively identify the entrance and the holding of any plane going in, worked from perhaps the control tower, and then as the control radar orders him to come out for his radar vector in, then he would be working only the time when he leaves the holding pattern, which apparently is the routine procedure of doing it today.

Mr. MCERLEAN. We would be interested in anything that would be positive thinking toward making these aircraft operate safely and to do everything humanly possible.

As we view this, United Airlines assumes certain obligations when a person purchases a ticket. They don't look to the Government for safe operations. They look to United Airlines.

One of the tools that we must use is the air traffic control system because we are only one user. There are many others. We are here today to try to show you that we would like to see any improvement we can find, because we want, to the best of our ability, to live up to that obligation, and perform a safe operation for these passengers.

Whatever that takes, we are willing to go along with any reasonable approach that will give us that safe operation.

Senator MONRONEY. Senator Thurmond, do you have any questions?

Senator THURMOND. Thank you, Mr. Chairman.

In your statement about the three accidents that appeared therein, your remarks indicated deficiencies.

I am wondering, since your appearance and your presentation and discussion with the chairman, do you still feel that there are deficiencies at this time in the system the FAA is now using?

Mr. MCERLEAN. Of course that is a very broad question, Senator Thurmond. If the system is still working, as I believe it worked from my facts of December 16, my answer is "Yes." It seems to me that at least in the New York area there has not been the positive type of thinking to make this system work as there apparently has been elsewhere.

I realize that the answer to that is because there is more traffic flowing into that area. There are segments of it, that a controller does not get all the traffic, and he goes through certain segments, depending on the direction. We do have difficulty in understanding which, when a man says he is following a trip, he has a little shrimp boat and he is following down the target and then he says he is terminating radar service, that he does not seem to have any knowledge where that airplane was at the time.

If that is continuing, then I think there is something wrong with the system.

Senator THURMOND. Do you feel there is a vacuum in the law, or is there a vacuum in the procedure used by the FAA?

Mr. MCERLEAN. I think there is no vacuum in the law. I don't know how the Congress could give any more authority to one agency to accomplish the task than has been done in this statute. I have no complaint with the statute.

Senator THURMOND. In other words, you feel that the law is adequate?

Mr. MCERLEAN. Yes, sir.

Senator THURMOND. But you feel that the manner in which the law is administered is inadequate?

Mr. MCERLEAN. Yes, sir.

Senator THURMOND. Do you have any further specific recommendations to make other than what you have already said this morning?

Mr. MCERLEAN. Not at this time; no, sir.

Senator THURMOND. Thank you very much.

Senator SCHOEPPEL. I am sorry I was not here at the beginning of your testimony.

Reading your testimony at pages 5, 6, and 7, and listening to you, is it your position and the position of United Air Lines and their pilots that they were misled by the various statements you have quoted, to the effect that the FAA tracked jet flights from takeoff to touchdown?

Mr. MCERLEAN. That is the testimony of our pilots in the hearing before the CAB, by the man in charge of a part of our flight operations, and some of the other pilots who also testified.

Senator SCHOEPPEL. Is that your position, representing United Air Lines?

Mr. McERLEAN. They know it today. I have to accept the fact as they told me. I did not—do you mean as to whether they knew about these things?

Senator SCHOEPPEL. Yes.

Mr. McERLEAN. Yes, sir; they did. I have in my file in Chicago the copy of the annual report of the FAA, initialed by six or seven of our top operating officials at the time it was issued in early 1960. They got that and they initialed it as coming through for their look at it. This is what they tell me their understanding was of the conversations and in the meetings they attended, some with the Government agencies, some with the industry, some with the industry group.

Senator SCHOEPPEL. That is all.

Senator MONRONEY. Thank you very much, Mr. McErlean.

Mr. McERLEAN. Thank you, Mr. Chairman.

(The following information was subsequently received for the record:)

Mr. Chairman, on behalf of my associates in United Air Lines and myself, I would like to express our sincere appreciation for the many courtesies extended to us by the Board and its staff during the investigation to date and this hearing.

We would like also to publicly compliment the Board's staff for the exceptional job that has been done under extreme pressure in preparing so much material for use in this hearing.

We have every confidence that the Board will continue its thorough, competent task in completing the investigation so that all of the facts will be set forth on the record for consideration by the Board in determining the probable cause of this accident, and what can be done to avoid a recurrence.

In addition, we would like to thank you, Mr. Chairman, and the members of the panel for the very fair treatment accorded us during this hearing.

Further, Mr. Chairman, if you will bear with me, we would like to state on behalf of those of us from United who have participated in this investigation some of the things that concern us. On the present state of the record, despite the best efforts of the Board, its staff and the parties, we believe it is impossible to determine the probable cause of this accident. It is, therefore, obvious that this investigation must continue. At this time, we think it can be safely said, that this accident would not have happened had air traffic control properly utilized the equipment, personnel, and facilities available. Considerable detail has been set forth in the record concerning the air traffic control system of the United States, particularly as it operates in the New York area. Frankly, we have been shocked at some of the things that we have learned since this investigation started. These facts should be of extreme interest and concern to the carriers who are parties, as well as the other parties to this investigation. In addition, we believe that these matters are, or ought to be, of extreme concern to all of the other air transport carriers of this country, other users of the system, and all those interested in aviation safety. In this, we include not only private organizations and individuals, but also agencies of the Government and the Congress of the United States.

In our opinion, no airline or other aviation interest in the country can ignore the record that has been made here, nor can the Congress. If they, or anyone else, have information that will help solve the problems brought to light in this investigation or can assist in improving the air traffic control system, they ought to come forward with all available information to assist the Board in determining the probable cause of this accident, and the Congress in taking the necessary steps to improve the air traffic control system. We must now take the necessary steps to establish and maintain a system that provides the degree of safety that will prevent any reoccurrence of the tragedy of December 16, 1960. Therefore, we would like to restate that anyone interested in the field of aviation cannot fail to take note of this investigation and come forward to assist in all necessary corrective measures. If we do otherwise, we will be living in a fool's paradise.

United Air Lines pledges all its efforts to find a remedy for the situation which has now come to light. In the meantime, United also pledges that it

will continue to be conscious of its responsibility to conduct its operations with the highest degree of care. Finally, we pledge that safety of our operations will continue to take precedence over all other considerations, and will be the primary factor in all our procedures and decisions.

Senator MONRONEY. We will have just a few minutes. We will run until about 12:30. We would like to have the FAA return.

We will start on category 4 of the accidents. We will have time for a little discussion, but not complete, of the United Air Lines-TWA collision in New York on the 16th of December. This involves personnel factors, including air traffic control. While this testimony of Mr. McErlean is fresh in our minds, I think it would be wise to start on this subject, and we would like to have whatever comments you have to make on this.

We are familiar generally with the basic information on the accident, so we will not have to repeat that. We have had it from CAB and also from United. We would like to have you take up the testimony from here.

STATEMENT OF HON. JAMES T. PYLE, ACTING ADMINISTRATOR, FEDERAL AVIATION AGENCY, WASHINGTON, D.C.; ACCOMPANIED BY DAGGETT H. HOWARD, GENERAL COUNSEL; PAUL T. PREUSS, ASSISTANT ADMINISTRATOR FOR OFFICE OF PLANS; DAVID D. THOMAS, DIRECTOR, BUREAU OF AIR TRAFFIC MANAGEMENT; DR. JAMES L. GODDARD, CIVIL AIR SURGEON; J. H. TIPPETS, DIRECTOR, BUREAU OF FACILITIES AND MATERIEL; OSCAR BAKKE, DIRECTOR, BUREAU OF FLIGHT STANDARDS; JAMES L. ANAST, DIRECTOR, BUREAU OF RESEARCH AND DEVELOPMENT; FORDYCE W. LUIKART, ASSISTANT ADMINISTRATOR FOR PERSONNEL AND TRAINING

Mr. PYLE. Mr. Chairman, I would like to turn the testimony over to Mr. Thomas, the Director of the Bureau of Air Traffic Management. Before doing so, I would like to frankly make a brief comment about the previous testimony that you have just heard.

I am concerned, naturally—I would only be human to admit it—about the allegations made by United's legal vice president. This appears to me to be a repetition of the same statement that was made at the New York hearing of the Board. In that instance we were forced to rebutt the inaccuracies, and rather than turn this hearing into another exchange of legal arguments to prove or protect future liabiliity action, I would like to submit for the record our letter to Mr. Minetti, which was submitted at the end of the previous hearing of the Board, which might correct the record insofar as this accident is concerned.

At this point I would like to submit this letter to Mr. Minetti for the record, if that is in order.

Senator MONRONEY. This will be received. The purpose of this committee, of course, is to hear all of those who have business before this committee or connections with air safety. We do not wish to foreclose any line of testimony that might be helpful. That is why we seek our information from all sources.

I will say that one of the principal reasons for giving CAB the right of the determination of probable cause in the accident investigation is to have a separate, disconnected Government agency under no control whatsoever with the operating agency in aviation under FAA, to have a free hand to call them as they find them. This is the thing I think that CAB quite properly has been doing and will continue to attempt to do in the accident investigation.

(The letter referred to follows:)

FEDERAL AVIATION AGENCY,
OFFICE OF THE ADMINISTRATOR,
Washington D.C., January 18, 1961.

Hon. G. JOSEPH MINETTI,
Civil Aeronautics Board,
Washington, D.C.

DEAR MR. MINETTI: I wish to take this opportunity to express my appreciation for the most fair and objective manner in which the board of inquiry under your chairmanship conducted its public hearing investigating the midair collision which occurred over Staten Island, N.Y., on December 16, 1960.

In the last minutes of this public hearing, you will recall that a statement was read on behalf of United Air Lines by its vice president, Mr. McErlean. In this statement, United Air Lines recognized that on the present state of the record it was not yet possible to determine the probable cause of this accident. United, nevertheless, undertook to charge "that this accident would not have happened had air traffic control properly utilized the equipment, personnel, and facilities available."

The Civil Aeronautics Board Rules of Practice plainly state that aircraft accident investigation hearings such as this are purely a factfinding procedure with no adverse parties. Your opening statement at this hearing left this clear beyond any possibility of misunderstanding by United Air Lines or any of the other parties to the investigation. I feel sure that you will agree that accusations of the nature made by United are not only premature but are totally inconsistent with the purpose of the hearing conducted by your board of inquiry and were wholly inappropriate. Such a tactic on the part of United Air Lines seems a deliberate effort to pervert the Board's investigative hearing into an adversary-type proceeding. The apparent sole purpose of such accusation was to serve the self-interest of United Air Lines, which seemingly is more concerned with financial liability arising from this tragic accident rather than assisting your board of inquiry in an impartial and objective investigation of the facts.

Unfortunately, if the Federal Aviation Agency were to remain silent in the face of these accusations it might be construed by many to mean that they are valid or justified. For this reason I believe that a reply to these accusations has been made necessary.

Let me make clear at the outset that we wholly disagree with the United Air Lines charges. To the contrary, I think it has been clearly shown from the testimony and documentary evidence presented at the hearing that the air traffic control provided United Air Lines was conducted utilizing the procedures, personnel, and equipment available, in accordance with the existing established practices which were well known to the users of the air traffic control system, including United Air Lines.

THE AIR TRAFFIC CONTROL SYSTEM IS A COOPERATIVE SYSTEM REQUIRING COMPLIANCE WITH ITS PROCEDURES BY THE USERS

The air traffic control system in use in the United States today is a cooperative system and requires compliance on the part of all users with the traffic rules and traffic clearances issued by the ground controller. Any failure to cooperate with the system naturally destroys the effectiveness of the system.

THE PILOT IN COMMAND IS RESPONSIBLE FOR NAVIGATING THE AIRCRAFT

Since the beginning of flight by man, it has been recognized that the responsibility for navigation of an aircraft rests with the pilot-in-command. Only he, or the flight crew under his direction, can manipulate the controls to make it

climb, descend, go fast or slow, or make it turn, as required by his air traffic control clearance.

THE AIR TRAFFIC CONTROL SYSTEM IS VERY MUCH LIKE THE SYSTEM FURNISHED TO THE HIGHWAY USERS

The governmental authorities furnish the stop signs, the red and green traffic lights and the rules for their use. This air traffic control system cannot physically prevent a pilot from disregarding a stop signal any more than the highway traffic control system can physically stop a vehicle whose operator disregards a red light and plunges through it. Both systems are dependent on and require responsible compliance on the part of the operator of the vehicle with the traffic rules.

The air traffic rules which have been in existence for many years and were originally established by the Civil Aeronautics Board provide plainly that "when an air traffic clearance has been obtained under either the VFR or IFR rules, the pilot in command of the aircraft shall not deviate from the provisions thereof unless an amended clearance is obtained * * *" (CAR 60.21). The New York Air Route Traffic Control Center had notified United Air Lines' Flight 826 even prior to the time it reached Allentown as follows: "United 826, clearance limit is the Preston Intersection * * *" to which the aircraft replied, "Right, we're cleared to Preston * * *." This made it unmistakably clear to the pilot-in-command of UAL 826 that it could not proceed beyond the Preston holding pattern without further clearance. The flight was subsequently given precise instructions for holding at Preston. In the last contact by the center, these holding instructions were reaffirmed. All of these subsequent communications from the Air Route Traffic Control Center were also acknowledged by the crew of 826.

Thus there is an indelible record that the flight was given an unmistakable "red light" not to proceed beyond Preston. It is equally clear that, nevertheless, Flight 826 had proceeded 11 miles beyond this point when it collided with TWA Flight 266.

UAL 826 SPEED EXCESSIVE

What may have been the reason or cause that the captain of UAL violated his traffic clearance and proceeded beyond his "red light" at Preston remains open to speculation. However, the flight recorder tape provides an equally indelible record that at the time of passing Preston his indicated air speed was over 400 miles per hour. UAL has acknowledged that their pilots are instructed to fly holding patterns at 207 miles per hour which is the correct speed establishment for holding pattern procedure.

NAVIGATION AIDS AND SERVICES AVAILABLE TO THE AIRCRAFT

The facts brought out in the investigation thus far show that United Flight 826 may have had one VOR navigational receiver inoperable. If so, their radio navigation would have required more effort on the part of the flight crew. The captain had multiple other aids available to him on the ground and in the cockpit which would have enabled him to navigate with accuracy. The aircraft had one VOR receiver remaining and two automatic direction finders for use in cross-checking his position. Over $\$1/2$ billion has been invested in the past 5 years in ground aids throughout the United States for navigational assistance to aircraft. There are as many VOR facilities in the New York area alone as there are in all France or Italy.

Extensive ground checks and flight checks have established that ground radio aids were functioning properly at the time. Each of these navigation aids are equipped with dual transmitters. Each transmitter is automatically monitored by electronic means. If degradation of the signal occurs, the operating transmitter is turned off and the standby transmitter is turned on. Should either transmitter fail, the pilot will get a red flag showing on his cockpit instrument. In addition, a visual light signal appears and an automatic alarm sounds at the FAA facility monitoring the air navigation aid. The alarm is not silenced without corrective action.

Three pilots later came forward to say they had experienced some difficulties in the VOR indication shown by their VOR cockpit instruments. These alleged discrepancies appeared to be afterthoughts affected by their knowledge of the accident. It is significant to note that none of these pilots reported the difficulty as a ground station irregularity as they are required to do under

the regulations (CAR 40.361). The Agency has a record, however, of over 4,000 jet aircraft having used the Preston Intersection in the preceding 90 days. Until the date of the accident, not one single complaint of malfunction of any of the ground facilities serving Preston had been made by any pilot.

Furthermore, at the very time UAL 826 was racing past Preston American Flight No. 46 was tuned to the Colts Neck VOR and continued to use Colts Neck until after the collision had occurred. The pilot of American Flight No. 46 stated that Colts Neck operated satisfactorily.

In addition, had the captain reported navigational difficulties to air traffic control, he would have been given special handling and would have been issued navigation directions, through the use of the air traffic control radar system to a landing at his destination. A Pan American flight experiencing receiver difficulties with his cockpit instruments was employing this procedure at Idlewild at the very moment the collision took place.

FULL KNOWLEDGE OF ALL DETAIL OF AIR TRAFFIC CONTROL SYSTEM PROVIDED TO USERS

United Air Lines also stated, "Frankly, we have been shocked at some of the things that we have learned since this investigation started," apparently referring to the functioning of the air traffic control system. If this is true, it is most incredible. Complete information on the functioning of the air traffic control system is available in publications such as the Flight Information Manual and Airman's Guide. Airline representatives, including those of United Air Lines and other users of the air traffic control system, regularly meet with FAA air traffic control personnel to discuss traffic control problems. Moreover, such meetings had been regularly held in the New York area to discuss the problems of air traffic control in that specific area. At such meetings the operation of the system and the various procedures used are discussed in detail. Recommendations are received for their improvement. The users, including representatives of United, are provided every opportunity to visit the facilities involved in order to better acquaint themselves with the functioning of the air traffic control system. Against this background it seems amazing that they would not be wholly familiar with the system within which they operate on a daily basis. It is for this reason that we asked earlier to inspect the flight recorder logs of other United jet aircraft and jet aircraft of other airlines, to see if they too revealed the same indelible record of noncompliance with air traffic control and navigation system as was made by United Flight 826.

It is interesting to note that TWA, the other airline party to the investigation, presented no testimony or statement experiencing such shock or lack of understanding of the air traffic procedures in use.

STEPS FOR IMPROVEMENT OF AIR TRAFFIC CONTROL SYSTEM

United has urged that all interested in aviation safety come forward to assist in all necessary "corrective measures." We in the Federal Aviation Agency will welcome any and all constructive suggestions. The facts which have been brought to light in the investigation of this accident already have shown a need for certain improvements which can be made at this time, and we have taken steps to go forward with them immediately. Specifically they are:

1. Require civil jet aircraft to carry distance measuring equipment

Distance measuring equipment was available at Idlewild, and had been for over 2 years. The use of this equipment in conjunction with existing VOR would provide a captain with continuous knowledge of his precise position. There are 343 other stations throughout the United States actually transmitting signals which would provide the pilot the precise continuous knowledge of his position if his aircraft is equipped with the necessary cockpit instruments.

United Air Lines has two of its aircraft in its entire fleet so equipped. The Military Establishment has 13,000 aircraft so equipped. The last multiengine aircraft delivered without this capability was delivered in 1959. No multiengine aircraft have been delivered to the Navy without this capability since January 1958.

The ground environment is available, air traffic control procedures have been available for months, and no reason is evident why civil aircraft traveling at speeds of 6 to 8 miles per minute should be without positive continuous position information which could help to prevent the aircraft from overrunning clearance limits.

The FAA has initiated action looking toward the possible adoption of a rule requiring airline operators to equip themselves in a manner capable of utilizing existing distance measuring facilities.

2. Impose a speed limit on civil jet operations within terminal area

The accident pointed out problems of operating jets in terminal areas at ground speeds of 500 miles per hour. Traffic congestion makes it necessary that pilots in terminal areas be prepared to hold, divert, or be vectored, without prior notice and they can do so only if aircraft speed permits maneuvers within the terminal area. In addition, during good weather conditions, the problems of "see and be seen" are greatly magnified by high-speed operations in terminal areas. Consequently, we will propose a speed limit for terminal area operations for jet aircraft.

3. Increased pilot education program

The testimony of the United Air Lines representatives revealing their lack of understanding of the air traffic control environment within which they operate, is indeed cause for alarm. We will emphasize the need for material on ATC procedures in pilot training courses given to pilot personnel of United Air Lines.

United Air Lines pledged all of their efforts to find a remedy for the situation and pledged that the safety of their operations will take precedence over all other considerations. On the basis of this pledge, it is presumed that United Air Lines will voluntarily take immediate steps to install DME, reduce speeds in terminal areas, properly train their flight crews in ATC procedures and take other positive steps without awaiting the results of the Government's rulemaking process.

I wish to thank you for your courtesy in permitting this reply to the United Air Lines statement before your board of inquiry. Inasmuch as the United charges were made in a public hearing and were given wide distribution to the news media, I feel it necessary in the interest of fairness to make this reply equally available to the public.

Sincerely,

E. R. QUESADA, *Administrator.*

Senator MONRONEY. We will be glad to hear from Mr. Thomas, particularly as to the point Senator Schoeppel just raised, as to whether the pilots had access to information showing that there was ar area where radar control was terminated and not resumed before the plane was given its approach out of the holding pattern.

Mr. PYLE. Mr. Chairman, I would like to complete a sentence or two.

Senator MONRONEY. Certainly.

Mr. PYLE. A point that I would like to make, Mr. Chairman: We want to be responsive to the objectives of the committee, and I concur completely with the thought that the Civil Aeronautics Board should investigate accidents, I would never under any circumstances recommend any changes in this procedure, at least under the present system in which we operate. I want somebody else to sit back and check us. This is absolutely essential, particularly in the investigation of accidents.

The point of submitting this letter is to correct the record, because I don't want to inject problems of charges and countercharges in our direct testimony. I think it is kind of significant that this testimony was made by a legal officer of the carrier, rather than some of its highly qualified operational personnel.

I know many of them, and they do an excellent job. This seems a little bit peculiar.

United is in a position to participate in the operating committees that work day in and day out in New York, and I would assume—I would hope—that if they find the kind of statement that is being made here before you, if this is their feeling, that it is reflected in the ap-

pearances and by their officers in the New York area. We need this kind of help.

Now, Dave, will you go ahead?

Mr. THOMAS. Thank you, sir.

I would like to refer to charts of the New York area. It would be helpful.

This chart is a skeleton diagram of the New York area facilities and arrangements as they existed on December 16. The flight paths of TWA and United are not the flight paths as over the ground but the flight paths as indicated by the clearance from the controller. These are not tape recorded flight paths. They are simply stylized to show the routing.

Prior to going into the accident—and I do not wish to repeat anything that the Board has said—I think it might be well to take a look at the system, the understanding of the system, and what the public was told about the system as it existed on December 16. I think the United counsel was quite correct that the pilot was operating under the instructions at that time, and so was the controller.

The radar advisory service, or radar service, is not new in the FAA. As a matter of fact, it has been in existence about 15 years. The first real use was made later than that. As a matter of fact, it was started in January 1952 in the Washington area. This is after about a year's test, at which time it was determined and the controllers were instructed, to vector aircraft around all targets unless they knew by observation or radar communication, some way, that the aircraft were in fact at different altitudes. They tried this for about 3 months and everybody threw in the sponge. It was a physical impossibility to do a good job with the traffic that existed in 1952, of vectoring around all targets. The targets were frequently above, below, the pilots did not accept the vectors, and all came to the conclusion that this could not be done, and the major purpose of the advisory service of radar was to inform the pilot of traffic under VFR conditions and assist his eyesight.

The manual was changed. It was published in the Federal Register. All parties knew this, that the advisory's services would be limited to calling the attention of the pilots to additional traffic on the assumption that if it is VFR it would held him to operate, and on the assumption if he is IFR the separation will exist. This has been contained in all manuals and publications since 1952, and is now current in our manual as additional services.

With the advent of the civil jet, the question arose as to whether or not the civil jet should operate in positive controlled airspace at all times; whether it would be given radar service; or, in fact, if it had too much effect on the other users where it would be extremely limited in its operation due to the impact on military operations.

A large number of conferences within and without Government and industry were held and in October 1958 the radar advisory services were initiated.

The services were initiated to the best of our ability by giving radar additional services as specified in the manual, which did provide for the controller to advise of additional traffic and it did make it a service subject to the workload limitations and ability of them to see and the other things which I will read in a moment.

We decided, and the main point of the discussion was particularly related to the operation of the civil jet in high altitude strata at the speeds which are characteristic of high altitudes and operating with the military jets. Therefore, we essentially set the dividing line at 24,000 feet.

The final services were in fact rendered at all altitudes where we had radar services and thereby the generalization from takeoff to touchdown in the speeches. But the additional advisory services were clearly spelled out to all. The major difference was, insofar as the civil jet was concerned, we paid a great deal more attention to them, and above 24,000 feet we vectored the aircraft instead of merely advised them.

We have some difficulties in vectory. It was requested that we not vector. We discontinued that for awhile. We had some problems of not vectoring, and we reinstituted the vectoring.

This was substantially the service that was issued. I have a folder this thick on notices to airmen [indicating] furnishing advisory material of minutes of meetings with industry, and I do not understand how there could be any confusion over the service that was offered insofar as the technical material was concerned that did go out to the industry.

Insofar as this particular accident was concerned, there are several points that have been stated that I think we might dwell with just a moment. With respect to the length of time between Allentown and the routing and the distance between Allentown and Preston, the distance as the airplane was initially cleared, Allentown-Robbinsville-Preston, was 72 miles. The distance by Victor 30 is about 63½ miles. It is a little over a minute or about a minute's difference in flying time. With regard to the controller—and a lot of speculation has been given as to the time of the accident—whether or not he saw the aircraft south of Preston at the time he said he did, I think it can be demonstrated that he did, much easier than it could be demonstrated that he did not, based on the time given to us. The only accurate times that I am aware of, in the accident, are those that were contained on the Idlewild tape recorders. We were then evaluating a new type of recorder which is accurate to within plus or minus 2 seconds. It is the only accurate time that I know of.

The tape recorder in the airplane was actuated sometime on the takeoff roll, as testified, and it starts its minutes from whatever that time was. As far as I know, there has been no absolute cross-check correlation between the accurate tape recordings, voice recordings of the tower to correlate with the airplane flight recorder.

The third time that enters into it is the tape recorders at the La Guardia tower. The only time that we have been able to correlate there is the spoken word of the recorder after he observed the accident, and the timing device was not operating. He spoke the words. The time was 1535. He was looking at a jump clock. In talking to the controller I learned he doesn't know if he is within 50 seconds. All he knows is that those times did appear. We are dealing in seconds. The aircraft was passing Preston at that time. It has been testified variously as 358 knots to 304 knots but essentially at 500 miles an hour. In doing so he was making about 8½ miles per minute, about 1¼ miles every sweep of the radar.

The radar does not give a continuous position. If I may, I would like to refer again to the radar pictures that we had yesterday. The radar information is anywhere from current to up to 10 seconds old. It is 10 seconds old. Whatever the radar operator is looking at, those plots are displaced by 1¼ miles.

In addition, he was operating on the beacon. As we testified yesterday, we observed that the beacon targets displaced an area 3 miles by 7 miles to about 2½ miles by 5 miles, and the aircraft could be any place within this beacon presentation. It is not necessarily the center, although the controller uses the center.

For separation purposes we separate around the edge of the targets. Preston is about 29 miles from the Idlewild radar, and tangential to it it would make the beacon target about 5 to 7 miles wide at this time.

So the controller, in looking at the beacon target, again could have been displaced by 3 or 4 miles added to the mile delay. The controller testified—and I talked to him quite at length—that he saw the target as Mr. McErlean stated, at the time United reported out of 6,000 feet. This is substantially right after the hour, 01 second, as testified this morning. This is unimportant.

The airplane did every 10 seconds thereafter move 1¼ miles, and he did call the La Guardia approach control about 28 seconds. He did not respond when the transmission was over 54 seconds. There is 53 or 54 seconds, or it could have happened after that. It could have happened earlier. Added to the error and delay in the radar presentation, and the delay or error in reading the radar beacon, it is not only quite conceivable but quite probable the controller was telling the truth in this case that that is precisely where he saw them. I don't know what actual time will come up. It may not be. But I am certain that this was burned in the controller's mind that this is where he saw him at the time he reported out of 6,000 feet.

Senator MONRONEY. Where in reference to the holding pattern would that be?

Mr. THOMAS. This would be a stylized picture of United's plan of the flight route as he was cleared.

Senator SCHOEPPEL. That would be on your lower diagram as your chart shows it?

Mr. THOMAS. The lower diagram from the left-hand corner, the bottom line coming from Allentown to a turn, Victor 30 marked on Victor 123 on the chart in the Preston holding pattern.

The controller did advise United when he was crossing the Victor 30, and immediately said he was approximately 16 miles from Victor 123. This is not the point when United first joined Victor 30. This apparently could have been the point when United was drifting a little north down Victor 30, because the controller at that time told him that he was crossing Victor 30, or crossing the centerline.

The point that this is the Preston holding pattern here was considered here. The controller visualizes him at about 01 or 03 seconds at about this point; with the radar lag, the beacon lag, he could, in fact, have been north of there anyway, and this is why we give more separation on beacon cards.

TWA is the northernmost line, showing Allentown, Solberg, Linden, and the approximate location. This is not exact at all. The drawing is to scale but the point of collision is not exact because we don't know.

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It is at this point, and United continued on to this point. The normal procedures that were being used with this aircraft and all others depend on complete cooperation between pilot and the controller. Without this the air traffic control system cannot exist. Even if we had radar, and we carried every pilot by the hand insofar as his planned position was concerned, his track over the ground, we are still completely dependent upon the pilot to report and fly at the altitudes to which he has been assigned, and we still have this important factor. So anyway that we do it, we still must have complete cooperation between the two, and we must have knowledge of the intention of the pilot or his inability to not comply with the clearance insofar as possible.

There are emergency situations which could arise when the controller renders all sorts of assistance. This he will do when he is aware of the necessity for it. Radar failure procedures, communications failure procedures—even the night before last, we followed one all the way into what turned out to be a successful landing in terms of fatalities, at any rate. All the radar on the east coast was alerted.

I think it might be of interest, also, to point out that in each area, including New York, we have regularly scheduled air-traffic control committee meetings. Here we meet with industry. We discuss patterns, we discuss procedures for a given area with all users of the airspace. This is the practice in the New York area. These meetings have been attended by all users, including United Air Lines, on these particular procedures.

There are certain things, without any evidence or attempting to determine the cause of the accident, that we have taken since that time which could have been or may be helpful; we hope they are. For example, the question was raised in the press as to whether or not the pilot could have been confused between Stroudsburg and Solberg, and turned in a 120° radial off of Solberg. I don't know. In any event we are changing the name of Stroudsburg to Tannersville. We are changing its identification, and we are changing the frequency of Solberg so there can be no possible chance for error. Whether or not that is why this accident occurred we don't know. There is one thing that is quite apparent, and I agree, there were no speed rules in existence at that time. We are proposing a speed rule which would limit civil jet aircraft to 250 knots within 50 miles of the terminal area.

Senator MONRONEY. Within how many miles of the terminal area?

Mr. THOMAS. Fifty, at 14,500 feet. And we would limit all military jets except certain tactical ones which cannot comply because of pitot tube and windshield icing problems, and limit them to 300 knots.

With regard to jets and other aircraft within the terminal area, they can be required to hold these speeds.

In addition, we are doing some work of our own.

United was told no delay was expected after he elected to start his descent after passing Allentown and checking the weather. In confirmation, he was told that the only delay would be in descent. I quite agree that the 5,000 feet was the limit to which he had been told, but he was not cleared to cross at any particular altitude.

The estimate that the controller was using was in error, there is no doubt about this, although he fully expected United to hold at Preston and the approach control could not take him beyond this point.

But to make certain, since United had not forwarded any estimate ahead as to when he expected to be at Preston, and since United had not told the controller when he expected to be at Preston, to make certain there is no misunderstanding between the pilot and the controller, the controller will, instead of giving "no delay expected," give the time they expect the aircraft to be there to take care of this in the event that this might have caused any difficulty.

Pending the actual adopting of the speed rule, we are instructing our personnel to instruct the aircraft to reduce speed when they are approaching terminal areas. We had in fact done this before, and met with some dissatisfaction due to the fact that pilots complained we were overflying the airports on occasion.

This seems to be important enough that we will institute it again. We quite agree that positive radar handoff is desirable but not possible within the limits of our resources. It cannot be done with what we have at the present time.

Mr. PYLE. Mr. Chairman?

Senator MONRONEY. Mr. Pyle.

Mr. PYLE. I know the time is short. I want to mention one further point, however, and that is the special civil air regulation that was passed which fits into the list of items to which Mr. Thomas referred, and under which malfunctioning of VOR, ADF, ILS and communications equipment is a requirement, pending the reporting of it; that is, to air traffic control facilities.

I would like to comment just very briefly on the speed problem. I agree with Mr. McErlean, there were no speed rules. Maybe we were derelict in this area, and we are trying to correct this.

On the other hand, I have in my career driven trucks as a profession. You don't come down a hill in high gear; you drop down to an appropriate gear ratio to control your vehicle, depending on load and other things.

It seems to me that rather than be legal and be 2 knots below the limit on his air speed indicator, a pilot has the obligation to be ahead of his airplane and control it in such a way that he can make whatever modifications to his flight as may be required by traffic control procedures, such as the entry to a holding pattern.

I agree, you can rack one of these airplanes up and stop it pretty quickly. I don't think it is a very ordinary procedure, however. I think this is the area in which this speed rule will be effective in keeping these airplanes under control of the pilot in such manner that he can at all times anticipate the requirements of the procedures in the areas into which he is flying.

Senator MONRONEY. Thank you very much.

One point or two before we leave, and it is on Senator Schoeppel's question again.

There was testimony at the CAB hearings that the pilots said they did not know they were not under continuing radar surveillance. You said it was published in the Federal Register and in your own bulletins and discussed, I think, with all operations branches of all the companies using this New York area. They had been told exactly what services were being rendered.

Do you depend on the companies, then, to transmit to the pilots this information?

Mr. THOMAS. We in fact have the companies transmit the information. But since the pilots are certified we depend on them reading the Airman's Guide, Pilots Information Manual, and other things.

I would like to quote from one of the earlier NOTAMS send out, not as internal instructions of the FAA, but in terms of NOTAMS, which describes this.

Senator MONRONEY. Does this go to all the pilots?

It is in the Airman's Guide?

Mr. THOMAS. Yes, sir, and went out on all teletype circuits. It was the best we knew on how to get out the information. This says, and we wanted to make certain that everyone knew this:

> This should not be considered as providing positive separation from all VFR traffic in every situation due to many factors such as limitations of primary and secondary radar, volume of traffic, controller workload, and frequency congestion. This service is, however, provided to assist the civil turbojet air carrier pilot in avoiding VFR traffic, and does not relieve any pilot of his responsibility to avoid other aircraft to the extent possible when operating in VFR conditions.

The internal instructions discussed with the groups were contained on the basis of our Radar Manual, and the Radar Manual since 1952, with its first editions, has contained a very specific actual section, almost a page, on additional services. Additional services point out what they are and our information sent out says that they are limited to 1.44. I would like to read this:

> It should be noted that many factors (such as limitations of the radar, volume of traffic, controller workload and communications frequency congestion) may prevent the controller from providing the additional services described above. The controller possesses complete discretion for determining whether he is able to provide or to continue to provide these additional services in a specific case. His reason against providing or continuing to provide the services in a particular case, is not subject to question and need not be communicated to the aircraft. In other words, the provision of the additional services is entirely dependent upon whether the controller believes he is in a position to provide them.

The words I just read are from the Manual which was current at the time of the accident, this being reprinted with the same words in there.

It was effective May 1, 1958, U.S. Standard Manual of Air Traffic Control Procedures, revised, first edition, and it is endorsed by the Army, Navy, Air Force, Coast Guard, and at that time CAA. It is now being reprinted.

The same words, or almost the same idea, were first printed in the Federal Register in 1952.

Senator MONRONEY. You don't think they could have been misled by the terms of reference in various announcements, in the publicity that they would have a radar system that would enable them to track all jet flights from takeoff to touchdown?

Mr. THOMAS. Sir, I heard it testified that they were. But I am somewhat surprised that a technical organization would allow speeches to govern its technical operations.

Senator MONRONEY. As a matter of fact, the pilots were all familiar with the normal procedure, were they, that existed on this day, when the area radar controller said, "Good day," and turned him over to the approach control?

Mr. THOMAS. There was some testimony that some of them were not. In the use of radar around the country, in the use of radar contact, turn right for a heading and so forth, we were under the impression that there was no doubt about the procedures.

This does bring up the point: If there is any doubt about the procedures, we will do everything we can to see that proper education in this regard is carried on.

Mr. PYLE. In that connection, Mr. Chairman, because of this situation, Mr. Bakke and Mr. Thomas are working out a program as part of the air carrier training program to insure that there is no misunderstanding in the future about this.

The testimony would indicate to our complete surprise that apparently there was a lack of knowledge even of these pilots who had flown radar for 10 or 12 years, or the number of years that it has been in use.

They did not seem to know what radar was. I would certainly urge they go into a center and find out a little bit about radar. And we are going to see that they learn about it, and we will have short courses on what radar does and does not do.

Senator MONRONEY. We have only time for one or two more questions before we must adjourn for the weekend.

Have you changed the approach to Preston to go over Robbinsville?

Mr. THOMAS. Yes, sir. That is one thing I neglected. The turn-in from Robbinsville on Victor 123 is about 8 miles to the Preston intersection.

Although there are thousands of jets that made this turn into Preston, the question was raised as to whether or not this allowed him adequate time to bracket. As a result of this we issued instructions to route all aircraft by Robbinsville. This gives them an additional 11 miles and more time to bracket Victor 123.

Senator MONRONEY. Amplifying bracket. That means to get a positive fix on 123 and also on their radio intersection to get a positive fix on Preston?

Mr. THOMAS. Yes, sir. I should have said to make the turn properly, and assume the right heading on Victor 123.

Senator MONRONEY. And also to identify Preston at the point that he goes into the holding pattern?

Mr. THOMAS. Yes, sir. Curiously we got some requests to use a shorter route since then.

Senator MONRONEY. This gives you a little wider margin of space at least to adjust to Victor 123 and to get ready to turn your other Omni, to set your Omni for the fix, is that correct?

Mr. THOMAS. It gives the pilot 1 or 2 more minutes.

Senator MONRONEY. And if you are sure you are slowed down to 250 knots, I believe you said, within that area, then he would also be traveling at less speed and consequently would have more time elapse to adjust himself to prepare to go into the holding pattern?

Mr. THOMAS. That is correct.

Senator MONRONEY. As of now, you still have not done anything, or perfected any system that would enable the area radar controller to put him in the holding pattern and be sure that he has stopped in it and not gone beyond the limits of it?

Mr. THOMAS. The answer to that one is essentially one of manpower and communications. We are now surveying what the requirements would be in terms of additional controllers and additional communications. To do a handoff it is necessary that the receiving controller be able to take the information at the instant that you

want to give it, and that the transferring controller be able to talk at this instant. This will take more manpower, and we are surveying this and we will have recommendations on that in the near future.

Senator MONRONEY. What about the question I asked of the counsel for United: Within the limits of the equipment, would a separate radar on the holding pattern serve any purpose in order to avoid the possibility of overflying? In other words, this would be a fail-safe procedure so that if the pilot missed his fix there would be somebody in the control tower who could say, "Whoa, boy, you have gone beyond; come back to your holding pattern."

Mr. THOMAS. Sir, you refer to another radar. I assume you mean another scope position, because there is coverage.

Senator MONRONEY. Yes.

Mr. THOMAS. This, with the associated controller to watch, can serve a purpose. One of the things, though, in considering this, is that we had not, up until now, assumed the routine responsibility for navigation.

But we also, if we do this, would have to watch on the turn on to Victor 30 for the other intersection. In other words, we would not only have a problem of holding patterns, we would have intersection turns at other locations.

Senator MONRONEY. I understood that you were watching, and your approach man was on the plane until he approaches the holding pattern, the theory being that you get in the holding pattern and there is a whole blurb of light and the approach man can't pick him up individually to specifically keep that plane under observation.

If you are going to put him within reach of the holding pattern with area radar, when he is told "goodbye," could there not be another scope with a man whose main duty is to see that that pip which comes in doesn't go beyond?

Mr. THOMAS. The answer is yes. It would be very helpful. I was trying to point out that we do not give radar services to all types of aircraft, and if we carry this on through then we would need to watch the entire airspace. Certainly it would be helpful to start with the holding patterns.

Senator MONRONEY. This is the most dangerous piece of airspace, I think, in the world. Whatever additional things we can bring in with our known technology, we should do so. Granted it will take more manpower. It is somebody's duty, like a watchman on a switching tower in a railroad, to just see that the plane stays where it is supposed to stay until he is vectored out on instructions to leave. He could at least guard that flow of traffic from going beyond.

Mr. THOMAS. The answer is that it would be very helpful. We will see what it will take in the way of resources.

Senator MONRONEY. I wish you would study that.

Mr. PYLE. Mr. Chairman, I would like to point out, I have heard the figure of 31 holding patterns in the New York area. Is that right?

Mr. THOMAS. That is approximately right.

Senator MONRONEY. There are not all used the same day.

Mr. PYLE. No; I think we must, in fairness to you, Mr. Chairman, point out that this is an order of magnitude increase in the numbers of personnel that are involved, in numbers of scopes. I am not saying this may not be the answer, if the Congress feels this is the right way.

We are going to have to have several millions of dollars to provide this service because it is not only New York but several terminal areas in the country.

Senator MONRONEY. It is not quite that important. If you have one airport you don't have the problems of airspace. I don't think you are up against the volume of traffic, the speed at which the system has to work. You have greater air separation in a one-airport town. It is when you get the complex of airports, the birdcage pattern that you have here, I think that makes such fine tolerances of absolute perfect control and perfect holding that may require some special degree of attention there. It may not be necessary to get your lower speed aircraft monitored by a separate radar in a holding pattern. Certainly where you are mixing jets with other piston-driven aircraft, and you have this great difference in speed, complexity, and maneuverability, I wish you would give time to study this to see what is possible.

Mr. PYLE. We will make a report to you, Mr. Chairman. I will point out, however, that the jet, from the standpoint of its capability, is a piece of flying equipment which properly operated is no different from a piston airplane in the terminal area. We go to, for instance, this question of slowing down. You can slow them down in 20 seconds, but for my money this is an acrobatic maneuver and I don't want to be in an airplane that does it. I think there are other ways of properly flying the airplane to achieve the result, and it is comparable at that point to a piston airplane.

Senator MONRONEY. One of your best suggestions made I think is to slow it down to 250 knots within 50 miles. I think you are a little high on that. Two hundred and fifty knots is how many miles? Three hundred?

Mr. PYLE. Roughly.

Senator MONRONEY. That is double the speed of a piston engine, practically, which would be in the same flight pattern.

Mr. PYLE. It is about 287.

Mr. THOMAS. We were trying to stay within what is reasonable for the airplane, and what is safe. With a speed of 250 knots one can maneuver, one can hold, one can take a diversion as necessary and be comfortably within the gear-up and flaps-up speed of all the aircraft with all the weights we know of today, with certain military exceptions.

This is the best compromise between—not compromise; it is the best judgment that we can make on aircraft handling versus traffic handling.

Senator MONRONEY. What is the procedure now? Do you have to go through a long published rulemaking, or can you put this in as a sort of temporary injunctive process and then study and hear comments later?

Mr. THOMAS. Our present plan is to go through the rulemaking process which has in fact been initiated by conferences with industry representatives. This is very well accepted if not agreed upon.

Senator MONRONEY. How long will that take?

Mr. THOMAS. That will take another 60 to 90 days through the normal Administrative Procedure Act. However, we instruct our

controllers to ask pilots to do it now, to publicize it, with their cooperation.

Senator MONRONEY. Can you communicate with the airlines directly and urge their cooperation on this?

Mr. THOMAS. Certainly.

Mr. PYLE. Mr. Chairman, I think you bring up a very good point, and this we will do, namely, to ask the operating heads of the various airlines to please cooperate while we study it.

There are some educational problems, there are some notification problems. In fairness to the air carriers, we must follow an orderly process. However, there is sufficient importance to this that the point you make, let's get it done now, we can do by voluntary cooperation.

Senator MONRONEY. In other words, in 90 days, if you have another one of these, it would be indeed a tragedy if you hadn't moved in one of the areas I think we are in. It would be wise to ask the carriers to cooperate in the interim.

Mr. THOMAS. We will do so.

Senator MONRONEY. If there are no other comments at this time the committee will stand in recess until 10:30 a.m. Monday in this room, and the FAA will come back for further discussion.

(Whereupon, at 12:45 p.m., the subcommittee was adjourned, to reconvene at 10 a.m., Monday, February 27, 1961.)

AIR SAFETY

MONDAY, FEBRUARY 27, 1961

U.S. SENATE,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
SUBCOMMITTEE ON AVIATION,
Washington, D.C.

The subcommittee met, pursuant to adjournment, at 10:30 a.m., in room 5110, New Senate Office Building, Hon. A. S. Mike Monroney (chairman of the subcommittee) presiding.

Senator MONRONEY. The Subcommittee on Aviation will resume its hearings.

At the time of adjournment Friday we had the FAA, represented by Mr. Pyle, here. I would like for him to resume his testimony. I understand there are two or three matters that he would like to clear up at the start.

STATEMENT OF HON. JAMES T. PYLE, ACTING ADMINISTRATOR, FEDERAL AVIATION AGENCY; ACCOMPANIED BY DAGGETT H. HOWARD, GENERAL COUNSEL; PAUL T. PREUSS, ASSISTANT ADMINISTRATOR FOR OFFICE OF PLANS; DAVID D. THOMAS, DIRECTOR, BUREAU OF AIR TRAFFIC MANAGEMENT; DR. JAMES L. GODDARD, CIVIL AIR SURGEON; J. H. TIPPETS, DIRECTOR, BUREAU OF FACILITIES AND MATERIEL; OSCAR BAKKE, DIRECTOR, BUREAU OF FLIGHT STANDARDS; JAMES L. ANAST, DIRECTOR, BUREAU OF RESEARCH AND DEVELOPMENT; AND FORDYCE W. LUIKART, ASSISTANT ADMINISTRATOR FOR PERSONNEL AND TRAINING

Mr. PYLE. Mr. Chairman, if it be in order, we would like to briefly correct and explain for the record a few matters without trying to prolong our testimony. I believe it might be helpful were this information inserted into the record. There will be statements from Mr. Bakke and Mr. Thomas, specifically.

There is one point further, Mr. Chairman, that I would like to clarify. Inadvertently perhaps my statement and our comments left what might be an erroneous impression. I would like to correct it.

I believe the statement referred to the use of identical charts both by the controller and the pilot. I think it would be better stated that we mean identical information on those charts used by the controller and pilot. The source from which these charts come is immaterial. I think it important that the information be approved by the FAA, to insure that both the pilot and the controller are working

from the same identical information. But the source is not the important factor here.

If it be in order then, Mr. Chairman, I would like, if Mr. Bakke could take a few minutes to kind of lay some background insofar as safety is concerned in terms of rates, accident trends, that I think might be helpful so that we can keep this in our minds as we proceed with the testimony.

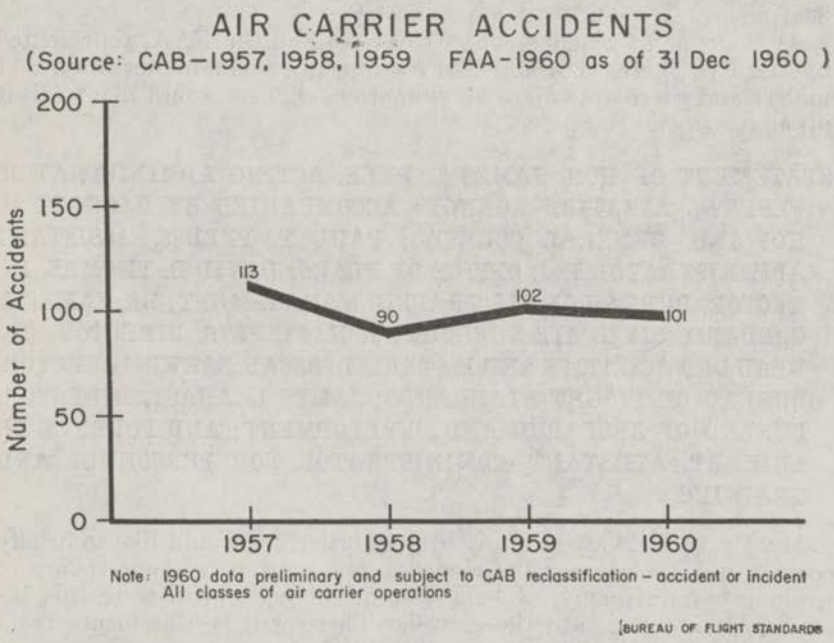
Senator MONRONEY. That will be fine.

Mr. Bakke?

Mr. BAKKE. Mr. Chairman, I believe there are at least two perspectives that it would be useful for us to obtain in order to understand fully what it is that we are faced with so far as our major safety problems of today are concerned.

One of them relates to the relationships between the causes of accidents as they confront us today, and also the relationship of accidents generally and their respective causes as they appear to develop over the years.

(The chart follows:)



Mr. BAKKE. I would like in the first chart to call your attention to the fact that the accident rate—this is the total accident rate and does not distinguish between the fatalities that may be involved in air carrier operations over the last few years—has remained relatively constant.

The reports of all of the accidents which have occurred in the year 1960 have not as yet been completed. The Board has not as yet found probable cause with respect to each one of these, and there may be, for the year 1960, an ambiguity involving perhaps a few numbers.

But I think that the 101 accidents which are shown on this first chart is approximately correct. You will notice from this chart that there appears to be no unusual, no significant change in accidents as such.

In the second chart I would like to call to your attention what has occurred.

Senator MONRONEY. Before you leave that, we were asking questions of the CAB about the distinguishing effects between accidents, so-called bumper touching and real accidents. Do we have any guidelines where this total number of accidents, including fatal and nonfatal, can be distinguished from year to year so that we will have a comparison of apples and apples and not be comparing apples and oranges?

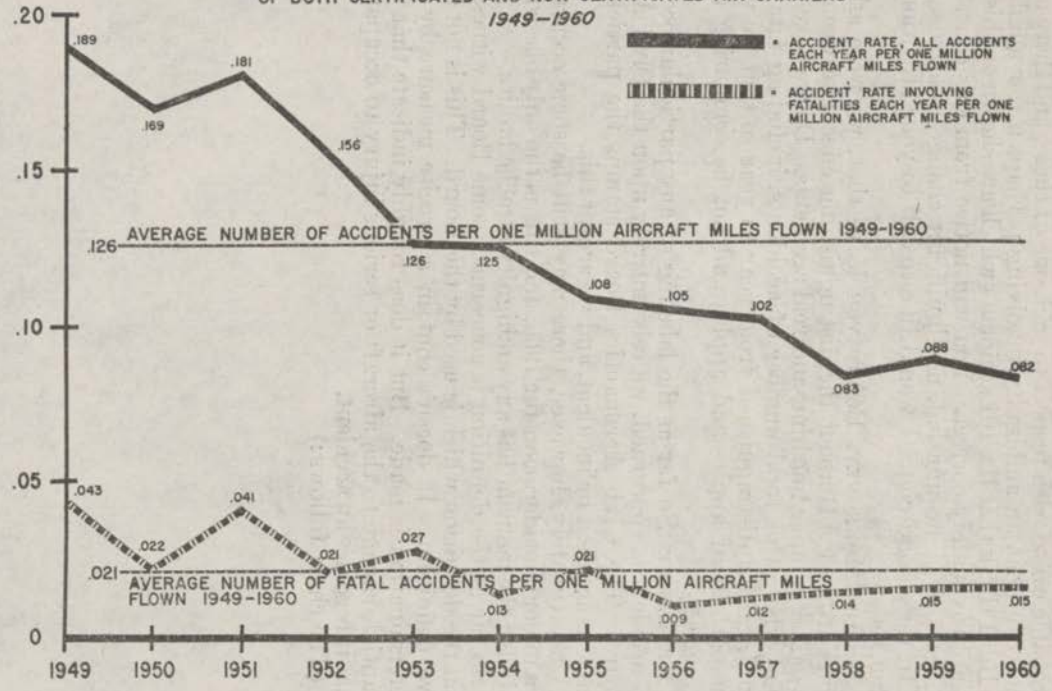
Mr. BAKKE. So far as the labeling of any particular occurrence as an accident is concerned, we rely entirely upon the Civil Aeronautics Board. The Civil Aeronautics Board stamps the particular occurrence as accident or incident, and we accept this.

Unfortunately, however, there may still be some occurrences that are under consideration for 1960, and this is the only one which in our mind at the moment has any ambiguity attached to it.

So far as the definition is concerned, some Board witnesses read to you the definition which is used by the Board. This is not a quantitative definition. It doesn't contain a precise measure by which the determination is made. But it does roughly indicate that where substantial damage to the aircraft or serious injury to occupants results, that it becomes an accident.

(The chart follows:)

AIR CARRIER ACCIDENT RATE
PER ONE MILLION AIRCRAFT MILES FLOWN
OVER-ALL REVENUE AND NON REVENUE OPERATIONS
OF BOTH CERTIFICATED AND NON CERTIFICATED AIR CARRIERS
1949–1960



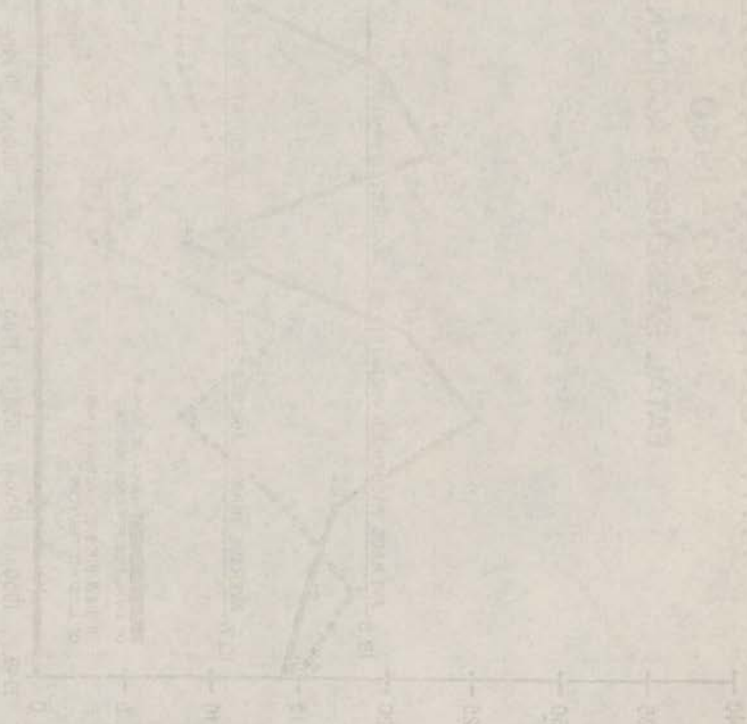
Mr. BAKKE. In the second chart I would like to refer you to one of the measures of total exposure with which we are confronted, and how this exposure rate has varied from year to year. You will notice in the last 22 years that there has been almost a continuous increase in passenger-miles flown in air carrier operations. I believe that the comparison between the year 1960 and, for instance, 1940 could rightly be called staggering. It has been a marked increase in total exposure.

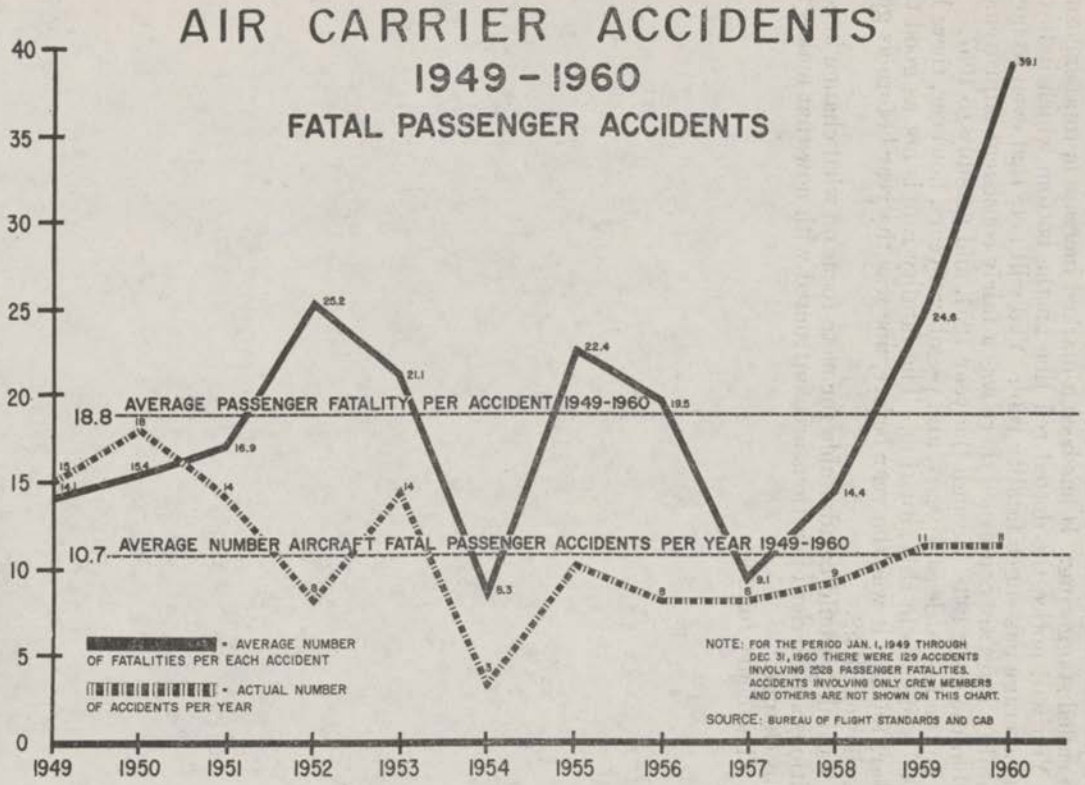
You will notice the dotted red line on the bottom which indicates the average passenger fatality rate. You will note that even so far as fatality rates are concerned there was a fairly consistent improvement from the year 1938 through the year 1954, and possibly to 1957.

In the last at least 4 years, and possibly 6 years, however, there has been a change in this situation. The fatality rate is not as good this year, 1960, as it was the year before, nor was the year before as good as the year 1958.

I think it would be advisable for us to focus on what change in conditions air carrier operations are confronted with now that makes for this change.

(The chart follows:)




AIR CARRIER ACCIDENTS
1949 - 1960
FATAL PASSENGER ACCIDENTS
AVERAGE PASSENGER FATALITY PER ACCIDENT 1949-1960
18.8
AVERAGE NUMBER AIRCRAFT FATAL PASSENGER ACCIDENTS PER YEAR 1949-1960
10.7
• AVERAGE NUMBER OF FATALITIES PER EACH ACCIDENT
• ACTUAL NUMBER OF ACCIDENTS PER YEAR
NOTE: FOR THE PERIOD JAN. 1, 1949 THROUGH DEC 31, 1960 THERE WERE 129 ACCIDENTS INVOLVING 2528 PASSENGER FATALITIES. ACCIDENTS INVOLVING ONLY CREW MEMBERS AND OTHERS ARE NOT SHOWN ON THIS CHART.
SOURCE: BUREAU OF FLIGHT STANDARDS AND CAB
0
5
10
15
20
25
30
35
40
1949
1950
1951
1952
1953
1954
1955
1956
1957
1958
1959
1960
25.2
21.1
5.3
22.4
19.5
9.1
14.4
24.6
39.1
16.9
15.4
14
8
14
8
9
8
9
11
9

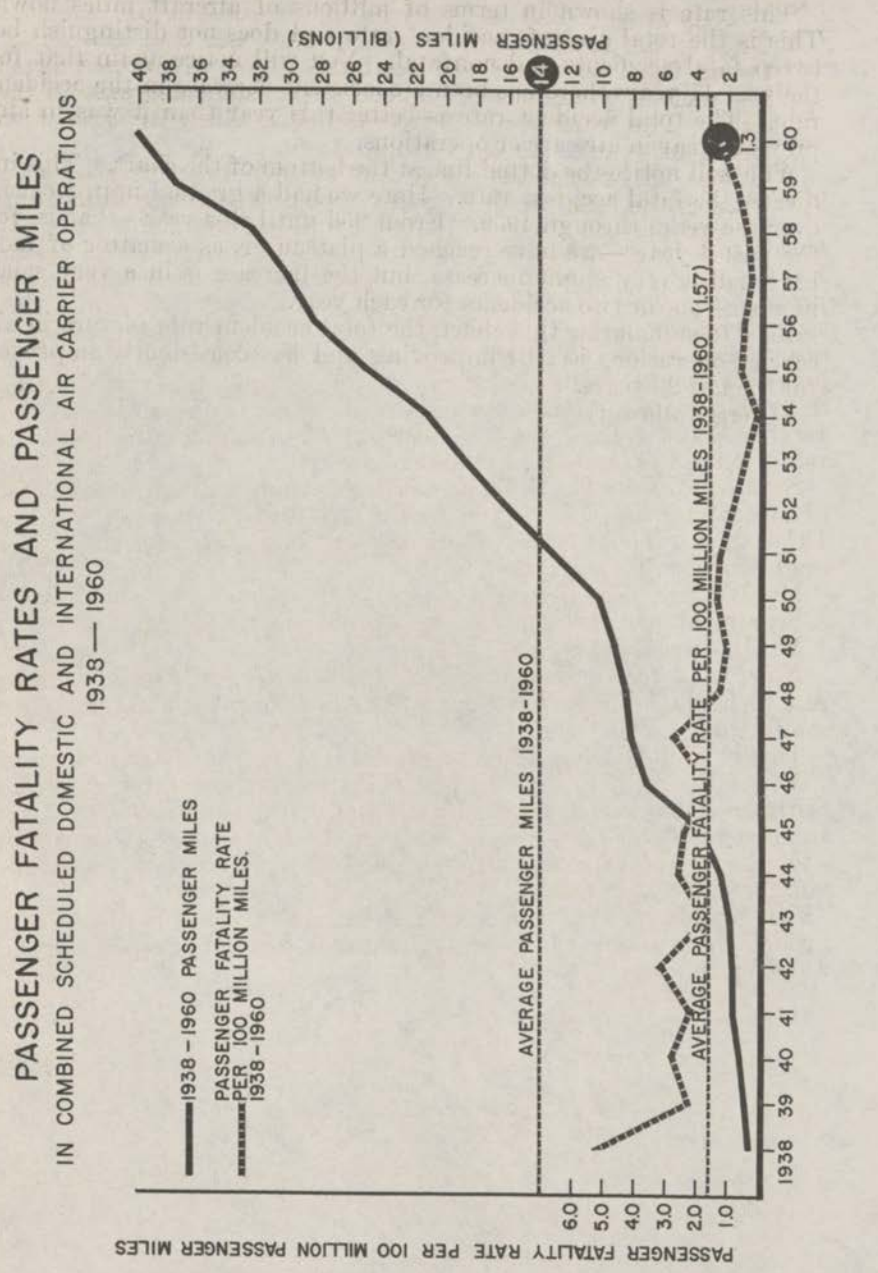
Mr. BAKKE. The next chart shows a somewhat contrasting trend in the air carrier accident rate.

This rate is shown in terms of millions of aircraft miles flown. This is the total aircraft accident rate and does not distinguish between fatal accidents and nonfatal. You will notice again that for the past 11 years there has been a consistent decrease in the accident rate. The total accident rate is better this year than it was in any previous year in air carrier operations.

You will notice the dotted line at the bottom of the chart. This indicates the fatal accident rate. Here we had a gradual improvement over the years through 1956. From 956 until this year—that is, for the past 4 years—we have reached a plateau or, as a matter of fact, have had a very slight increase, but the increase is in a very small number—one or two accidents for each year.

Just to summarize this chart, the total accident rate picture in air carrier operations is still improving and has consistently improved for the last 20 years.

(Chart follows:)



PASSENGER FATALITY RATES AND PASSENGER MILES

IN COMBINED SCHEDULED DOMESTIC AND INTERNATIONAL AIR CARRIER OPERATIONS

1938 — 1960

Mr. BAKKE. The next chart will give us an indication of what specifically is the condition that we are confronted with. If the accident rate continues to improve, why is it that our fatality situation is bad?

The top green line shows what has happened in the last several years in fatalities per accident. You will notice that the curve for the year 1960 skyrockets to approximately 40 fatalities per fatal accident.

What this obviously means is that the exposure in terms of numbers of fatalities per accident, aircraft sizes being what they are, numbers of people carried on board being what they are, results in the probability of a far larger number for each accident—each fatal accident. I think what this means is that although we have been able to improve the total accident picture over the years, that with the increased size, increased landing speeds, increased fuel quantities carried on board, that these records make it very, very clear that we can no longer tolerate the same improvement in accident rate, that in order to accommodate the far larger risk of passenger injury and passenger fatality that further attention must be given to an even more drastic reduction in the total accident rate picture.

Senator MONRONEY. In other words, if you had a total destruction of everything in a DC–3, you would have lost 21 passengers in the DC–3 days. Today if you have a total single plane accident you might run as high as 125 or 150.

Mr. BAKKE. That is right.

Senator MONRONEY. So your exposure is greater per accident?

Mr. BAKKE. That is right.

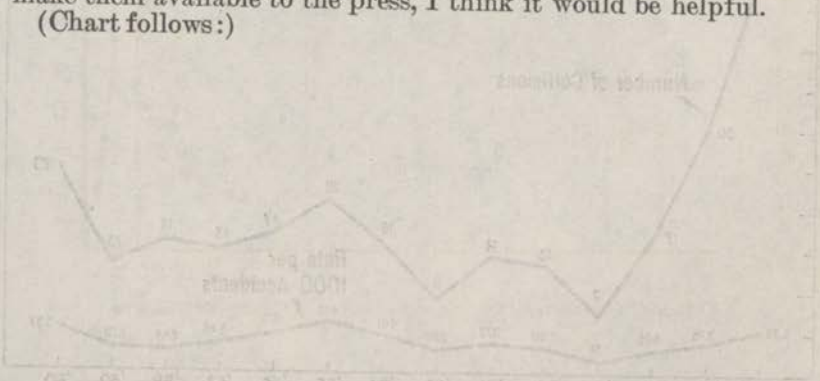
Now, as a result very largely of this factor on which we have just focused, the next chart shows the situation which is rather discomforting.

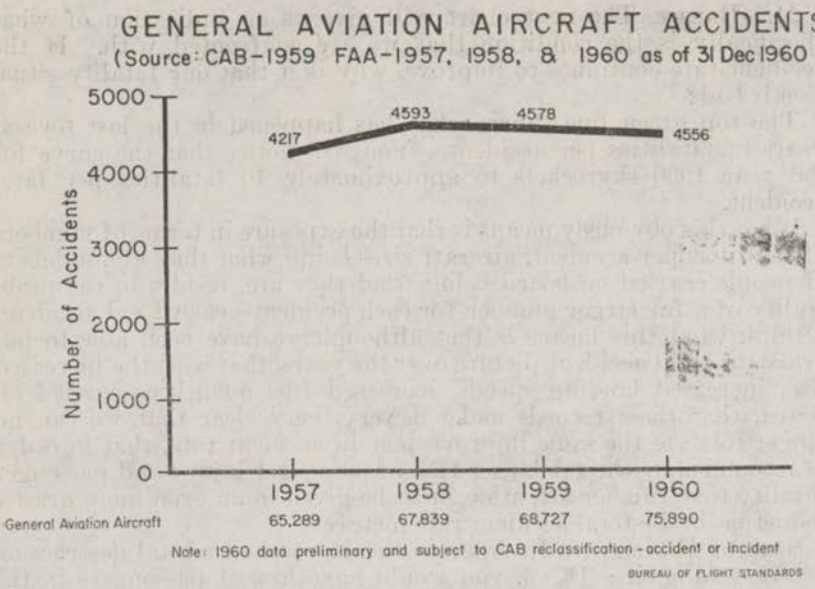
This is what has happened to the fatality rate in the last 4 years.

You will remember that the first chart which I presented showed a fairly level and perhaps even slightly improving situation in the total accident rate over the same 4-year period. Unfortunately, however, although the total accident rate remained the same, the same cannot be said for the fatality rate.

Senator MONRONEY. If you take the charts that we have seen and make them available to the press, I think it would be helpful.

(Chart follows:)

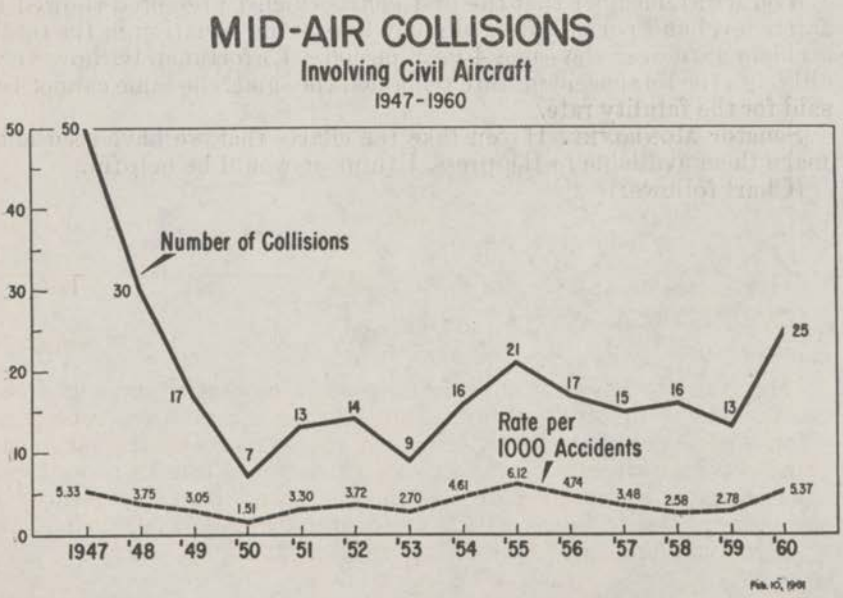




Mr. BAKKE. You will note for this chart that the fatality rate per hundred million passenger-miles was approximately twice as bad in 1958 as it was in 1957; almost twice again as bad in 1959 as 1958. And the solid red curve which depicts total numbers of fatalities in this same period correlates with the fatality rate chart.

One might focus briefly on the next chart, which also indicates the source of some of our problems.

(Chart follows:)

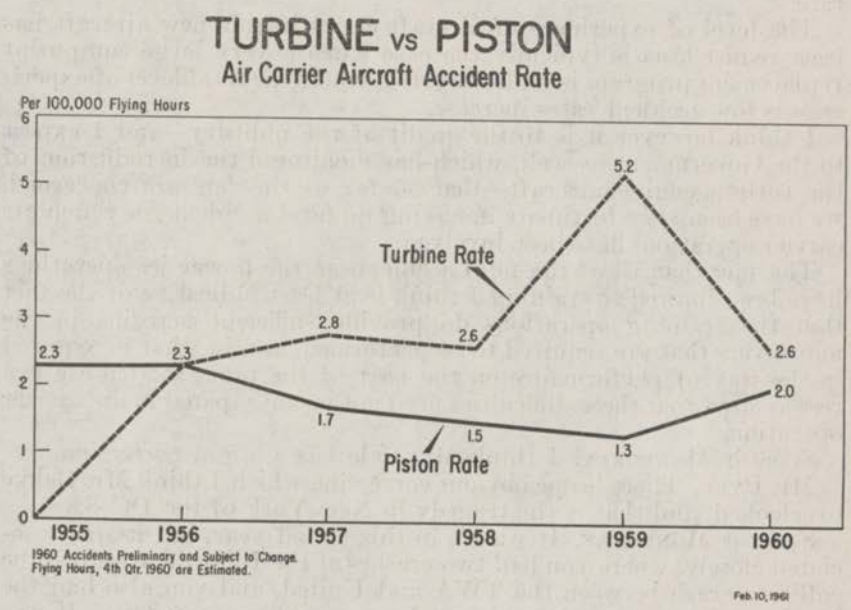


Mr. BAKKE. So far as midair collisions are concerned, you will notice that the occurrence of midair collisions in large numbers is not novel in aviation. It didn't occur in the last year or two. You will notice, for instance, the greatest number of midair collisions that we have had in our history occurred in 1947, at which time we had 50. In 1948 we had 30. We have since that time never reached this figure. And until the year 1960, roughly speaking, if we faired out this curve, we would get a slightly improving situation. Unfortunately, however, the midair collision picture has again reached a peak for the last 10- or 11-year period. Last year we had 25.

Of these 25, 20 percent or 5 of them involved air carrier aircraft. With the exception of 1 year, which was 1949, we have never had as high a percentage of air carrier aircraft involved in collisions. Fortunately, however, the air carrier collisions in 1949 did not include any fatal accidents. Accordingly, their total effect on the fatality rate picture was not marked.

In the year 1960, as you know, one of the five air carrier collisions was a fatal accident, and with the total number of fatalities—133 so far as the aircraft occupants are concerned—this caused a very substantial increase in the fatality rate.

(Chart follows:)



Mr. BAKKE. The next chart indicates a somewhat promising aspect so far as the involvement of turbine-engine aircraft are concerned. You will notice that shortly after the introduction of the large turbine-powered aircraft, the total aircraft accident rate in the air carrier industry skyrocketed to a high that hasn't been experienced in something like 15 years, of 5.2 accidents per 100,000 aircraft-hours.

Senator MONRONEY. This is fatal and nonfatal?

Mr. BAKKE. This is fatal and nonfatal. But you will notice that there has been a very marked break in the curve in the year 1959.

During the 4-year period——

Senator MONRONEY. Do these include training accidents?

Mr. BAKKE. Yes, sir, they do. These are total accidents.

You will notice that in the 4-year period, from 1955 to 1959, while there was a marked increase in the turbine-engine aircraft accident picture, the piston-engine aircraft rate was actually improving. This curve, unfortunately, broke upward in 1959 at the same time that there was a drastic reduction in the rate in turbine-engine aircraft.

I believe now that we are over the hump so far as this extreme adverse turbine-engine aircraft accident rate is concerned. This part of the picture looks promising for the future.

Senator MONRONEY. What is your guess as to why the prop-driven accidents went up and turbine-engine accidents went down?

Mr. BAKKE. This is the price we pay for learning, both engineeringwise, maintainencewise, and operationswise.

Every aircraft that we have ever experienced has had a debugging process which has involved a somewhat higher than normal accident rate. The extent to which emphasis has put on training, for instance, in transitions to new aircraft types has had its price in the accident rate.

The level of experience of aircraft crews in this new aircraft has been reduced, as is typically the case when a very large equipment replacement program is underway, and where the total level of experience is low accident rates increase.

I think however it is to the credit of the industry—and I expect to the Government as well, which has monitored the introduction of the turbine-engine aircraft—that so far as the jets are concerned, we have been very fortunate in having no fatal accidents in which air carrier operations have been involved.

The fact that all of the fatal accidents in the power jet operations have been limited to training I think is at least indicative of the fact that the training operations do provide sufficient margins in the maneuvers that are required to be performed, and in what is required in the way of performance on the part of the pilot, so that we can rest assured that these difficulties need not be anticipated in air carrier operations.

Senator MONRONEY. I think Mr. Pyle has a slight correction.

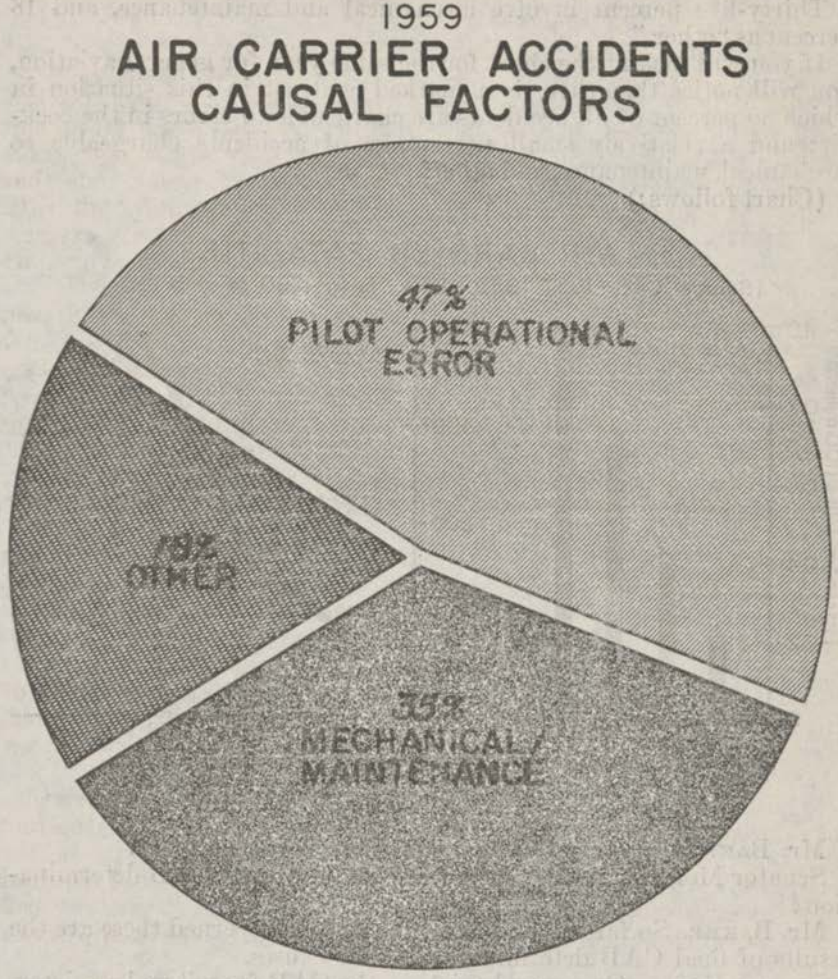
Mr. PYLE. There is one obvious correction which I think Mr. Bakke overlooked, and that is the tragedy in New York of the DC–8.

Senator MONRONEY. It wasn't in this actual year, but it was associated closely, where you had two crashes at the Idlewild area, one the collision crash between the TWA and United, and you also had the Mexican airline plane in which at least some lives were lost. It was a significant power jet accident.

Mr. BAKKE. There were no lives lost in the latter accident, sir, and none of these statistics include foreign air carrier accidents.

Senator MONRONEY. We will get to that in a minute. Those accidents are just as important for us to study, whether they carry the American flag or the flag of some other country, because they are using oftentimes the same equipment and the same procedures and are under the same traffic control system and air safety rules.

(Chart follows:)



Note: DURING 1959 THERE WERE 102 ACCIDENTS. THESE CAUSAL FACTORS ARE BASED ON PRELIMINARY FAA STUDIES. FINAL REPORTS ON PROBABLE CAUSE WILL BE RELEASED BY THE CAB AT A LATER DATE.

Mr. BAKKE. This chart we will deal with rather briefly, merely to give a rough comparison between the causal factors that are involved in air carrier and general aviation.

You will notice in the first chart, which gives a breakdown of the total numbers, causal factors of air carrier accidents, that we have a 45-percent indent of operational error which is associated with the piloting function.

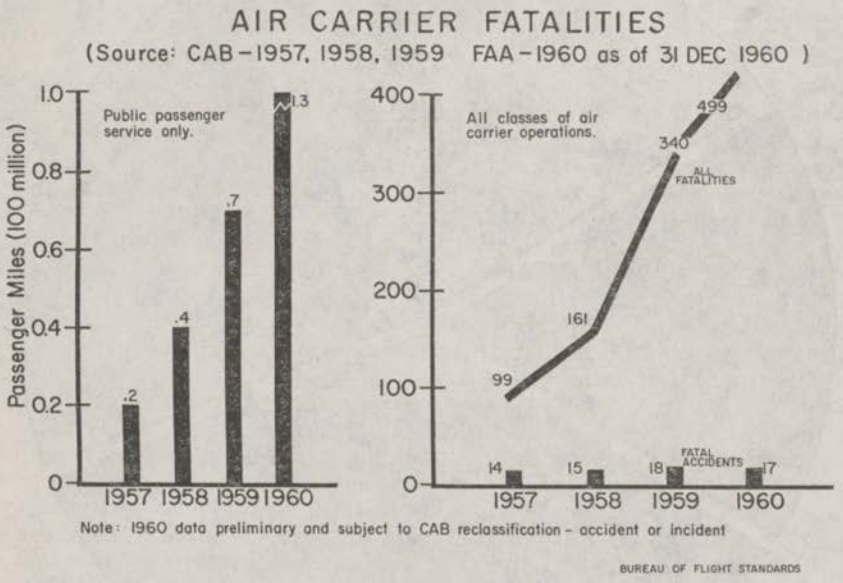
Senator MONRONEY. That 47 percent is what?

Mr. BAKKE. Operational errors which are associated with the piloting function. Errors of the cockpit, so to speak.

Thirty-five percent involve mechanical and maintenance, and 18 percent as "other."

If you will look at the chart for the same year for general aviation, you will notice that there is a marked contrast in this situation in which 80 percent of all accidents are chargeable to errors in the cockpit; and a relatively small percentage of accidents chargeable to mechanical, maintenance, and other.

(Chart follows:)



Mr. BAKKE. We believe the answer here is rather plain.

Senator MONRONEY. Are these the results of final CAB determination?

Mr. BAKKE. So far as the 1959 accidents are concerned these are the results of final CAB determination of the causes.

Senator ENGLE. On general aviation, the CAB doesn't make a determination, does it?

Mr. BAKKE. Yes, sir, the CAB makes the determination of cause on all accidents. We may investigate the accident and submit the reports to the CAB, but we do not submit probable cause. The Board does this in every instance.

Senator ENGLE. Is that true on airplanes of 12,500 pounds gross or less?

Mr. BAKKE. Yes, sir; it is true of all aircraft.

Senator MONRONEY. I still think, however, that these high figures on operating errors do not take into consideration in many cases all the circumstances involved. I continually criticize the rate, particularly on private aircraft, when weather perhaps is the major causal factor, they are still charged up as operational errors because the pilot finds himself in weather that he can't cope with. And not being an

instrument pilot or with thousands of hours behind him, it goes into the book as pilot error, whereas actually if more care were taken to determine the weather and other conditions under which the pilot was operating, they would be charged I think more to weather than they would to the pilot himself.

I think the charge of pilot error should be more or less concerned with whether under circumstances that the pilot would normally be expected to fly through with his capability, whether he erred at that point or not rather than finding himself with a set of circumstances that either the plane or he himself was not competent to get out of.

Senator ENGLE. One other thing can be said about it, too. Whenever the air carriers get involved, the airline pilots have their people sitting right there to see that the dead pilot isn't blamed falsely. We have a good many illustrations of that. We have had some classic cases in which we have had the airline pilots take the CAB and the FAA right over the hurdles for improperly and wrongly charging the airline pilot. The general pilot has no such help and as a consequence it is an easy disposition of the matter to blame it on him.

I would like to say, Mr. Chairman, that I don't trust the record at all on that particular point. I just suspect that if the general aviation pilot had the same kind of assistance that the airline pilot gets, that that figure would be a lot different.

Mr. BAKKE. Mr. Chairman, I think that even were we to take account of possibilities such as those that have been suggested, and make very large adjustments in these figures, we still come to a conclusion which I believe is basically valid; namely, that considerable emphasis on air carrier selection, on air carrier pilot selection, air carrier training, and air carrier discipline of crews, has paid off particularly well in air carrier operation in this relatively small total percentage of operational error. We believe that this at least gives you a clue to the method through which we can expect to make the greatest contribution in general aviation, and this is by contributing even more substantially to the training and qualification of the general aviation pilot.

We have a very substantial program which we hope to get underway this year which I think will have a marked impact on this deficiency. I might say that these programs have the enthusiastic support of all of the major general aviation organizations.

Senator ENGLE. I would be very interested in that.

Do you have those programs now outlined?

Senator MONRONEY. One was held last week, wasn't it, at St. Louis?

Mr. PYLE. Yes, sir. They are pilot forum meetings, Senator Engle. We would be glad to give you a briefing on this if you wish. These are to work with the pilot groups by way of education, by way of identifying additional services that are available to the pilot, and I think we have a deficiency in this area. We have not said enough about, and been sufficiently expansive in our educational programs as to those areas on which the pilot can depend for additional information. This is our objective, to work with the pilot groups and in pilot forums and meetings, magnifying, if you will, to see if we can't improve this rate. It is a serious problem.

Senator ENGLE. I would like to comment that I think the obligation that the Federal Government has in the field of air safety is

quite different when you are dealing with commercial airlines, the commercial carriers, and anybody who operates as a commercial operator, than that which you have with a fellow who is a private flyer and wants to fly for fun or just wants to go some place.

It is all right to try to help those people out. I used to hunt coyotes in an airplane; and I quit it because, when I counted up, the coyotes were getting more of us that we were of them. [Laughter.]

The question is, Should the Federal Government stop that kind of business? I don't know. I just think that what the Federal Government does in that field ought to by handled by a different standard than what you apply to the air carrier operation.

I noticed when Mr. Halaby was up here he made a very clear distinction, I thought, in the answer to one question, as to what he regarded the obligation of the Federal Government in the safety field to be, and in the business of pilot qualification regulation, as between the private flier and the business pilot, the commercial aviator, whether flying for hire—carrying cargo and carrying passengers on a nonscheduled basis, or when you move up into the air transport field. And the thing that those of us who are interested in general aviation are mortally afraid of is that they are going to regulate us completely out of the air. We don't want the kind of situation in this country that there exists at the present time in Great Britain, where they simply don't have any private flying at all. And the reason they don't have it is because the private fliers simply have been regulated out of the air. That is the thing that we are worrying about.

I hope that when these operations get underway that consideration is given to the fact that if I want to get out in my flying machine and hunt coyotes, say—whether or not the Federal Government ought to stop that where it is off airways and is not a hazard to anybody else. I think that a relatively large amount of freedom ought to be allowed in this private field, and I hope it continues because that is where the aviation that creates the kind of industry we have in America today is built up, and which eventually results in the pilots you have flying this executive fleet and flying these air carriers.

You can go back and look at the record of any of these oldtime pilots. Most of them started out flying off of grass fields some place. I want the young people of America to still have that opportunity.

We may have a little danger involved in it, but within the framework of not being silly about it, or foolish, or reckless or hazardous, and just plain flat-hatted as we used to call this, I think we cannot press this business too far with reference to what the private and business pilot want to do. That is why I say I am in hopes that I can look at this program which you gentlemen have in mind. I applaud the business of going out and sitting down with these pilots. They don't want to get killed any more than anybody else does. When it comes to writing regulations that is when we get kind of uneasy.

Thank you, Mr. Chairman.

Mr. PYLE. I would like to say that I agree wholeheartedly with what Senator Engle has said. I don't think you win this battle by regulation. I know you don't, in fact. I do think, however, that we do have an obligation to the general aviation pilot to do what we can to make known to him those services that are available and in his

best interest. This I think has been an area where we have been, perhaps, in the rush of time, negligent.

There are certain of course—as I think you yourself made the correct statement—there are areas where a hazard exists to other users of the airspace that are public, and in this area we do have to come in with some sensible type of control. But this should be to a minimum. I think we have to depend on the cooperation of the aviation community in the general aviation area to improve the situation that we have here.

I agree with you.

Mr. BAKKE. Mr. Engle, there is one other observation which I believe should be made. I think that the record which I would like to indicate to you at this time manifests quite clearly that we have not demanded of general aviation the kind of regulatory discipline that we have imposed upon air carrier operations. As a matter of fact the departure in the contrary direction is so marked that I think we have an obligation to do something in this direction. I don't believe that the answer, however, is by any means limited to enforcement. I think we have a very substantial promotional obligation under the act, an opportunity that has not been taken in recent years that I believe that we can expect much promise from. I call your attention to the fact that in the year 1957, when we had a total occupant fatality rate in terms of a hundred million air miles flown in general aviation, that this occupant rate is something in the order of 60 times that of air carrier operations. We are not talking about just a small difference. This I believe is a tremendous difference.

With the gradual improvement in this figure—it has been reduced from 22.5 down to 19.1—and with the worsening of the air carrier fatality rate during the same period, we are now down to something in the neighborhood of 20 to 1. But there still is a very marked difference.

In attempting to focus upon what contributions we might make to a further improvement of this situation, we also concluded that regulation is in my judgment not the only primary way to promote general aviation. I believe that the accident rate in general aviation is one of the, if not the primary, deterrents we are faced with today.

Insurance rates, the expenses in repair of aircraft, and the threat of personal injury and perhaps even death, represents, of itself, a very substantial deterrent. We believe that if we can make a contribution to the further improvement of this accident rate, that we will have removed one of the primary deterrents, and this is our objective.

You will note, so far as the total numbers of fatalities, that there has been somewhat of an increase from the year 1958. However, again we appear to be leveling off.

The total trend in general aviation, in terms of total numbers of accidents, appears to be level, approximately level.

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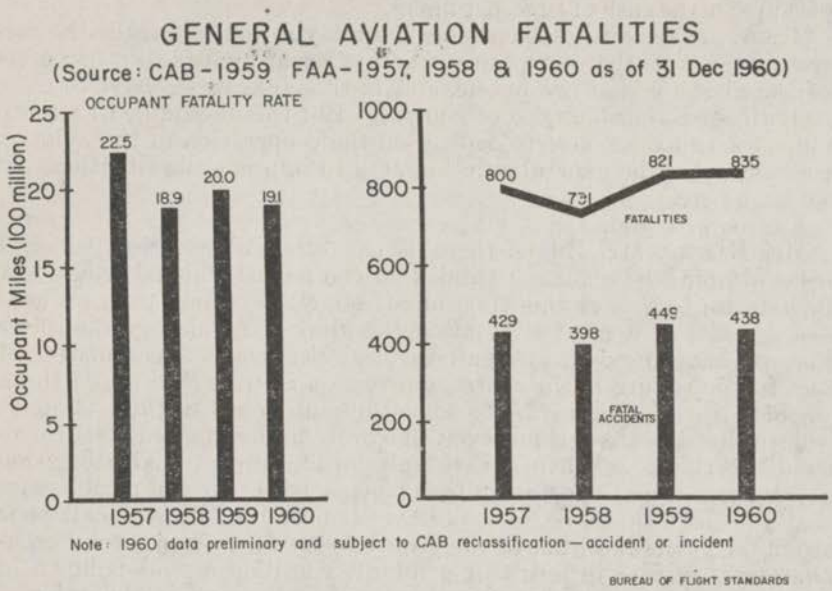

Mr. BAKKE. There has been no marked improvement in this picture, although we are gratified in seeking an improvement in the fatality rate.

Generally speaking, so far as general aviation is concerned, there is a slight improvement in the fatality rate. The situation so far as the total accidents and total fatalities are concerned, appears to remain about the same.

We find that there is much work that can usefully be done, and we are exploiting our resources in this direction as well as we can for the coming year.

This I think briefly, sir, covers the situation so far as trends are concerned.

Senator MONRONEY. I don't want to belabor this, but while you have more planes in the general aviation fleet, the planes are greatly improved on their performance, maneuverability, and stability. Yet I can't help but feel that some way we are not getting the weather hazard out of general aviation such as we have taken it out of air transport largely, because of the fine meteorologist staffs, dispatchers and all the other things that go into flight information before takeoff or en route weather information.

The question, I think, comes back primarily to helping general aviation through better weather advisories, through making it very much easier—in fact, almost a routine—if we can encourage the general aviation pilots to observe it, to get the very latest current weather before they get airborne and before they put their noses into some kind of a front that they don't know how to get through. This, I think, is one of the problems we took up last year.

We increased the Weather Bureau's facilities. We tried to increase your funds for the dissemination of this weather. We have improved

the observance of weather for the ontop pilots by filtering that into the weather network.

When this, then, can be made available and in every fixed-base operator's hands, with big neon hands saying, "Check your weather before you take off," I think you could lower this rate tremendously.

Mr. PYLE. I agree entirely. This is one of the areas in which we are concentrating heavily in trying to work out a better environment in which the general aviation pilot can operate. The weather reports are a sore subject for me personally. I find they are totally inadequate if you want to fly VFR around the country. With the cooperation of the Weather Bureau, we have instituted a vast pilot reporting program which heretofore has been practically negligible. Last Saturday we had information at almost all levels, from both air carriers as well as general aviation pilots, those that were in the air—there weren't many of them on Saturday. But the other point is that we have a facility, the flight service station, available. This is now being reoriented to perform the major part of its function for the general aviation pilot; a flight following system; briefing on weather; trained observers, trained personnel who can brief the pilot on weather. We beg them to come in and use these facilities. We think the deficiency, if there be any in our program, is that we have not been broadcasting it enough and making its use known to the general aviation groups. This we propose to do.

Senator MONRONEY. It certainly seems to me that there is some better method than we have now, even if it is to try to encourage better liaison with fixed-base operators from the points from which these planes generally are serviced, to contact most of the general aviation fleet before takeoff, where someone will be alerted if there is severe weather in the neighborhood so that a transient pilot, like I think I read in the paper Sunday, coming up from Florida, was just fine and dandy until he got into Georgia; then he got into weather that he couldn't handle or his plane couldn't take. You read these stories in the paper, and almost inevitably you find that he had good weather at takeoff, he was all right on his first landing, but perhaps the general aviation fixed-base operator didn't have an advisory on what this pilot would be running into.

I think maybe the aviation habits may have to change where fixed-base operators will feel at least it wouldn't be obnoxious to the general pilot to give him some information that he might not otherwise acquire in his haste to refuel and be on his way.

Mr. PYLE. I think we have a problem here, Mr. Chairman. We would welcome any suggestion that anybody has as to this behavior pattern. Too often the pilot takes off in good weather, and everything is fine, and there he goes.

Senator MONRONEY. As one who uses general aviation considerably, I don't believe you are using the fine cadre of fixed-base operators enough. I think in your conferences that you should not only talk to the pilots—I think that is fine—but also the fixed-base operators. This is not the way to build an industry. It is not the way to cut down your fatalities. You have to go beyond this. Not by regulation, Senator Engle, but by moral persuasion in every effort to acquaint the pilots, particularly the new ones with 40 or 50 hours behind them, those who

read all the ads about it being as easy to fly as driving your own car, who find themselves in something they can't handle.

Mr. PYLE. Your point is well taken. If it isn't already in the program I assure you it will be.

Senator MONRONEY. I urge you to work closely with the fixed-base operators. I think you will find these men very cooperative, and a little recognition on the part of the FAA on the vital service they render—they do render a vital service—that they can be in on the act and help save many lives by making a custom which should not be obnoxious to the pilot, and saying we have a bad front between here and Nashville, for example; let us check the weather for you, if you don't have time, and we will get it for you.

Mr. PYLE. That is a valid suggestion.

I might also point out, Mr. Chairman, that we have instituted—Mr. Bakke will have to give the date—a requirement that the private pilot be able to use his instruments to maintain the altitude of his airplane. In other words, to fly his airplane by use of instruments. This is not intended to make an instrument pilot of him, obviously. But it does give him that ability if he should get trapped, to be able to at least make a 180° turn and get out of the area.

This many of them cannot do now. This is a requirement that we have put in, and I think it has been generally well accepted.

Senator MONRONEY. I believe it was urged by the AOPA, even before it was adopted by the FAA, at informal meetings.

Mr. PYLE. I agree. It is a very good program.

Senator ENGLE (presiding). Will you proceed?

Mr. BAKKE. One final word on the latter question.

As Mr. Pyle indicated, we have a requirement for instrument competence in the issuance of private and commercial certificates, for approximately a year now. The total number of pilots so certificated are still sufficiently small so that we have not been able to identify precisely a trend with respect to their susceptibility to weather accidents.

However, we are following this group of newly certificated people to see if we can measure more precisely what the value of this additional training is. We are hopeful that this type of training will make the individual a good deal more responsive to the requirements of flight planning and make him far more cautious in his handling of weather than he would be without this competence.

We have every reason to believe that this is the case. I might mention briefly one project that was attempted throughout the West Virginia area, which we have called, for the sake of identification operations, Talk Down, a project in which our folks went out to the fixed-base operators, of which Senator Monroney spoke, and solicited their cooperation in attempting to determine whether it would be possible for flight service stations of the FAA to render any effective assistance to a general aviation pilot who is caught on top of an overcast, as there are every year in substantial numbers, to make a letdown through the overcast.

Is there anything that you can tell an individual that will increase the likelihood of successful penetration of an overcast and descent through it on instruments? This is the question that we have raised. We have flown with over a hundred pilots throughout the West

Virginia area and have been surprised ourselves at the considerable assistance that can be given.

The one important byproduct that I wish to call your attention to, however, was that invariably as we took these people up, simulating the kind of condition that they might expect to be confronted with when caught on top, every one of them without exception went out and bought additional instruction in order to increase his competence on instruments.

Exposure to this type of thing does not necessarily prove the old adage that a little learning is a dangerous thing. Quite the contrary; a little learning in an instrument area has, we believe, generally made a pilot more responsive to the need for instrument flght.

We expect to find this reflected in the accident record. We have not been able to do so as yet, however.

Senator ENGLE. I agree a hundred percent with that. I think that this is one of the finest programs that has been undertaken. I am sure that everyone knows that sooner or later you are going to get yourself into weather if you fly enough. You will do it in perfectly good faith. That is, you may think you are all right, but all of a sudden you look down and there are not any holes there any more, where it used to be broken. Then you check around and you cannot get back to where you came from, and you are right up there on top.

That of course creates problems for a pilot. Any time you have flown long enough, years enough, there is not any question but what they will get into it sometime. Therefore, they ought to have some instrument training.

That brings up something else that I want to mention, and that is that it is important for the pilot to believe that the man on the ground is his friend, and is not sitting down there to cite him right off the bat, just as soon as he gets off the ground. This is important, and I have said this before, and that is one thing that I objected to about the way this Agency was being operated when I said they were acting like an organization of cops.

The time was when we pilots thought that when we got in trouble we had a friend down there. Some of the performance in the last year or two has not led us to believe that. I hope the attitude is spread throughout the Agency that when a pilot gets into trouble he can expect to get some help and not figure on having his license, which is a very valuable piece of property to him, pulled just as soon as he hits the ground. Because if that is not the case, he will not contact the facilities on the ground. He will sweat it out himself. He will say "Well, I got myself on top like a big knucklehead and here I will sit, and just as soon as I call the FAA they may get me down, but I will also have lost my license."

So he will monkey around and get himself killed. Whereas if he got ahold of the FAA they would help him get out.

In the case of gross negligence, or something like that, I would not blame the FAA for citing the man, or pulling him up and giving him a going over for getting into it. But if that kind of policy is continued, those fellows won't seek the assistance of the ground helpers any more.

I wish you would think about that a little. I know how the pilots feel about it. They talk to me all the time. If a fellow pulls a bonehead play he deserves to have his competency checked. In my own experience, flying over 20 years, I know that as careful as you can be, you are going to get into difficulty with weather some time or other. I think the FAA ought to look on that with not too much severity, provided the fellow has not been grossly negligent about it.

Mr. PYLE. Senator, I agree. I think in this area our inspectors have an obligation to carry out their duties.

But I also think that the rule of commonsense, where, for instance, a reprimand will serve the purpose, with maybe a gentle tap on the back of the knuckles, perhaps can buy more compliance with the system and the regulations than a very formal enforcement proceeding. This is the direction in which we are trying to move.

I point out, however, that, as I understood you to say, that where there is gross negligence and willful violation of a regulation or several regulations, then I think we do have to move in and use enforcement proceedings as a last resort.

This is a general statement, but this is the way I believe we should go. I must point out that this, of course, is a position and a philosophy that Mr. Halaby will have the responsibility for, and I do not wish in any way to inadvertently commit him, and I am sure you appreciate that.

Senator ENGLE. I understand that. I have not even discussed it with him, though I intend to. I think in the flying field, just as in driving automobiles, some people are accident-prone. They have a tendency to get themselves into hot spots. If a fellow has had a couple of incidents where he got a reprimand and he constantly repeats those, that is the fellow to be watching thereafter because in addition to getting himself killed he will possibly kill some other people. That kind of approach would be beneficial.

What I would like to see reestablished is the confidence the pilot has in the people who are on the ground and who have the facilities for helping him. So that when he does get into trouble—and they will do it just as sure as shooting—they can't help it—you will get into a weather situation if you fly long enough and often enough, and at the same time, just being as big a coward in the front end of an airplane as I am and you will still get into it.

I suggest that at these meetings which you are holding, which I think will be a fine thing, that you try to reestablish the contact between the pilots and FAA which in my opinion has been seriously damaged or lost over these last few years.

Mr. PYLE. Mr. Chairman, I agree. In the last analysis, it seems to me this is our mission, to be of service to the pilots, the aviation community, as well as carrying out the other duties. I think that we must insure that the pilot has no hesitancy in coming to us if he is in trouble, and taking advantage of our services.

Senator ENGLE. Senator Schoeppel?

Senator SCHOEPPEL. I would like to ask you this question: Say in 1958 or 1959—you probably have records on it for 1960—how many licenses of pilots have been suspended on some of the things you have been talking about?

Do you have any record of it?

Mr. PYLE. I am not sure that we have it here.

Senator SCHOEPPEL. Can you furnish that for the record?

Mr. PYLE. I will be delighted to.

(The information requested was not furnished to the committee.)

Senator SCHOEPPEL. Has it been building up or receding?

Mr. PYLE. Mr. Howard may have some current figures on that.

Mr. HOWARD. Senator, in fiscal 1960 there were 3,682 enforcement actions, and I can read to you a list of the various ways in which these actions were disposed of: 485 were filed without action; 960 were reprimands; 923 were civil penalties; 1,063 were certificate actions; 126 were military violations; and 125 are in a general category of "other," which means that they were handled administratively in some other way.

Senator SCHOEPPEL. Of that amount, how many licenses were actually suspended for a period of time?

Mr. HOWARD. I don't think we have a breakdown on that here, but we certainly can provide it for you, Senator.

Mr. PYLE. You would like a trend, to show the trend of several years?

Mr. SCHOEPPEL. Yes.

Mr. PYLE. We will be glad to do that. We can't do it here.

Senator SCHOEPPEL. I think it ought to be in the record in view of this testimony.

Mr. PYLE. Yes, sir.

(The information requested was not supplied to the committee.)

Mr. THOMAS. Mr. Chairman, if I may I can provide a little insight on this.

Last year—and this is running about the same—we provided about 2,500 cases, known cases of assistance to pilots in some sort of distress. This was as simple as an aircraft being lost on top and calling us, and we vectored another airplane to him to lead him down, or giving him weather information, or getting car lights on some close field.

Some were sad, such as aircraft proceeding in the known—and we knew that they knew—adverse weather, depending on radar, and could not make it and crashed on landing.

But the number of cases of assistance are staying about the same, around 2,500 a year.

Senator MONRONEY (presiding). You may proceed.

Mr. BAKKE. Just a brief survey of the year 1960, so far as air carrier accidents, fatal air carrier accidents, are concerned.

I would like to suggest to the committee that although the final reports and indications of probable cause have not been established for these accidents, with the exception of the Bolivia—the National Airlines accident at Bolivia—that there nevertheless are some factors that will indicate whether significant trends exist in the air carrier fatal accidents.

I would like to point out that generally speaking there are no trends so marked as to indicate any serious deficiencies in a particular area. I would like to point out, for instance, that we have had accidents involving the loss of control during takeoff. There have been three such fatal accidents during the year. They involve three different aircraft types under three markedly different circumstances: the Delta 880 accident was a training accident at Atlanta, and involved four

crew fatalities. The precise cause of that has not as yet been determined. It was a VFR day, there were no obstructions to flight involved. There was a loss of control during takeoff.

The second was the Eastern Electra at Boston. This one the details you are familiar with. There was contact with birds. There was loss of power on at least one and possibly more engines, and a subsequent loss of control by reasons of this fact.

The third was the Arctic Pacific, which was a V–46 aircraft at takeoff well below the visibility minimums for the aircraft, and a subsequent failure or possible failure of powerplant during these extremely adverse conditions.

Without wishing to indicate probable cause with respect to each, I believe that just these brief descriptions will indicate that there was no strong correlation between these accidents.

Similarly with respect to collision with respect to terrain, we have had three such accidents, and yet one of them was immediately after takeoff, the World Airways accident at Guam.

Senator MONRONEY. Where was this? Guam?

Mr. BAKKE. Yes, sir. Another was in an en route operation, the Pacific Northern operation at Mount Gilbert, Alaska. And the third was during the final descent to landing, the Northwest accident at Missoula. Again there is no specific trend that appears to be indicated and the operating circumstances surrounding each of these were markedly different.

In case of structural component failures in flight we have several.

Senator MONRONEY. Before you leave those three, I don't recall in any years where we had three such cases that contributed to such large numbers of fatalities. The Guam accident, according to the CAB testimony, was, upon examination of the wreckage, caused by the flaps being open and therefore the motor was not developing the power that it would require to successfully make the takeoff over the terrain.

Is that in line with your preliminary study of the accident?

Mr. BAKKE. Yes, sir, that is our understanding.

Senator MONRONEY. So this was the duty of the pilot to have closed his flaps so that his motor would be developing its regular power?

Mr. BAKKE. Yes, sir, this is a checklist item.

Senator MONRONEY. And there is no way that those flaps could have accidentally come open?

Mr. BAKKE. No, sir.

Senator ENGLE. Which is that?

Senator MONRONEY. The Guam accident, involving a nonscheduled carrier accident in which the plane on takeoff with a large number of military personnel, taking off from Guam, flew into a ground obstruction. It was not developing its normal altitude, as I recall the testimony. That is listed in section F of your black book. It cost the lives of some 80 people.

Senator ENGLE. He had his cowl flaps open?

Mr. BAKKE. Yes, sir.

Senator MONRONEY. And then the crash that you mentioned at Mount Gilbert, Alaska, which the testimony developed was quite a distance off of his scheduled route, a distance off of his radio beacon. Do you have any comments to make on that one?

Mr. BAKKE. I would make but one observation, and if appropriate, Mr. Thomas can elaborate.

I am of the view from an examination of the records that had been available to us that there was no agreement between the FAA and ADC to furnish a continual flight following—a radar flight following service for civil aircraft negotiating en route; and, secondly, there were no communications attempted between the ADC radar facility and the flight in question.

Senator MONRONEY. Has anything been done? This is what I am interested in. It was brought out of course in the testimony that ADC normally, according to the CAB, will notify at least your air traffic control that a certain flight on their radar seems to be considerably off course.

Mr. BAKKE. I believe there is some error in interpretation of the agreement that is at issue here, and I believe Mr. Thomas has the details of this case.

Mr. THOMAS. Mr. Chairman, there is agreement between our region 5 in Alaska and the Alaskan Air Defense Command with regard to ADC radars helping in the air traffic control situation and assisting pilots in distress.

However, this agreement has to have as its basis that ADC knows that some aircraft either desires assistance or is in fact off course. Under the arrangements that were set up under the agreement, the Air Defense Command at the installation of Fire Island was notified of this particular flight.

The Air Defense Command installation at Middleton Island did in fact observe the target, a target, proceeding toward the terrain, but there was no duty or in fact knowledge, as far as I can find out, on Middleton Island, to advise the center on each and every target observed, because quite frequently they see targets going in the vicinity of glaciers.

The agreement did specify, and the directive did specify, that all military aircraft would be followed by ADC, and that they would warn them. But they never undertook, as a consequent duty, to observe all targets, identify them and warn them.

Senator MONRONEY. This appears to me to be another one of those gaps that can be filled. These boys are not that busy in Alaska to the point where the ADC observer could not have known that this plane was flying toward terrain that was going to conflict with his assigned altitude.

It seems that we need closer liaison to learn from these accidents where we can get together. If you are going to have ADC, if they are going to be working part time on some of these things, and it is only optional whether they notify air traffic control of the straying of a plane, that some closer liaison between air traffic control and ADC would be advisable.

Mr. THOMAS. Senator, I believe that they were not aware of the altitude of the plane, and they rendered a great deal of assistance upon request either by air traffic control or the pilot.

Senator MONRONEY. But air traffic control did not apparently know that this fellow was off the course. You don't have a radar on the plane. You are using ADC radar, at least for whatever services they can render. It would be a very easy thing if you notify ADC that this

flight is on this course and giving the assigned altitude, so that at least then he can be alerted also that it is off course and merely an intercommunication with air traffic control could have notified someone that at a check point he was far off course.

From his takeoff he was off course, and he continued to go farther and farther into known areas of high altitude mountains. Of course what we are looking for is a fail-safe system. Certainly if the pilot stayed on his radio beam, which was there and available to him in normal flight, the accident would not have occurred, apparently.

Mr. THOMAS. Sir, in this connection, we are looking for every way that we can to improve the situation. I was hoping to point out that ADC was not then obligated to watch all flights, track them, or know their altitudes.

In fact, Fire Island did know this particular one but never did see it because of the terrain. This involves quite a change in concept of the operation of Air Defense Command, and air traffic control, both, to guarantee to track all aircraft, to assure that pilot errors are detected when they occur.

Senator MONRONEY. What good is this ADC going to be if a plane is off course, heading for high terrain, if it is not going to be given any radio assistance? We know he is not going to bomb Anchorage, if he is identified as a commercial target. To have it on—and this testimony was that he observed this plane, he observed it off course, but he was not even required to tip off anybody that could reach the pilot to give him at least some warning of danger.

Traffic is not heavy up there, I am sure. We have a good deal of military traffic, but certainly your civilian traffic is not so heavy that this task of monitoring these flights, and at least notifying air traffic control of deviation from a course, would be too onerous a thing to put into your air traffic information pattern.

Mr. THOMAS. Sir, I think we have two situations: One, what actually existed. I was trying to point out that this did not then exist. The other situation would be whether or not what would be the resources necessary to man those facilities and establish the communications and procedures that would guarantee continuous surveillance of all known traffic in the area.

I think these are quite two different things, and the latter would involve, I suspect, quite a bit of additional in the way of resources to Air Defense Command, as well as to ourselves.

Senator MONRONEY. I understand that. In looking at the screen to see if there is any approaching traffic whatever, there must be some purpose in notifying ADC that this plane is approaching on this course. I am sure that the course was given to Air Defense Command. Then the monitor on the screen noticed, according to the CAB testimony, and knew this plane was far off course.

Can't he do something about it?

This is all I am trying to find out. I don't see where that would require additional personnel or anything else. It would make one extra duty that when you see somebody so far off course, your job would be to pick up the phone or if you have an intercom to communicate that to Anchorage or Cordova to give this information.

Mr. THOMAS. Sir, I think this is correct, had they known precisely what was occurring. As far as I know, Middleton Island did not know that, did not have a flight plan. They merely identified a

target, altitude and identity unknown. The purpose of Middleton Island at that time was that, and the other was to watch inbound aircraft toward Alaska, but not watch coastal traffic. They did in fact see it, but there was no coastal interchange, insofar as I know, between Middleton Island and Cordova and Anchorage. The information was given to the air defense site at Anchorage, Fire Island, for its purpose on traffic coming into Anchorage.

But as far as I know, Middleton did not have it.

Senator MONRONEY. Does air traffic control in Anchorage talk to air defense in Anchorage?

Mr. THOMAS. Yes, sir; it did. These are two separate sites, air defense sites.

Senator MONRONEY. Two separate airports?

Mr. THOMAS. Yes, sir; but Middleton Island, of course, is an air defense site out on an island.

Senator MONRONEY. That is right. It communicates with Anchorage, you say, and did?

Mr. THOMAS. I think I have not made this clear. The air traffic control center, in accordance with the agreement with Air Defense Command, sent the flight plan to an air defense site at Anchorage on this Fire Island.

It did not, and would not, normally, give this information to Middleton Island. The Fire Island site would have observed the traffic had it ever seen it. However, the mountains were intervening and it did not see it. The Middleton Island site, as I understand it, did observe a target, altitude unknown, proceed in the direction of the glaciers. As I also understand it, they frequently saw targets proceed in the vicinity of the glaciers because people went over there sightseeing. At higher altitudes the glaciers can be cleared. They can observe a target going in that direction and disappear, but it did not alarm them, not knowing anything about it, nor did they have any information on it.

Senator MONRONEY. Fire Island could not see it because of the terrain?

Mr. THOMAS. The intervening mountains, that is correct.

Senator MONRONEY. The other air defense radar did see it? I thought you said earlier that they had reported this to Fire Island, which was located adjacent to the Anchorage military facility at which, nearby, there is a civilian facility to which this plane was destined. All I am asking is, is there not some way, through intercommunications, that this report of this plane heading toward the glaciers, could not have reached the air traffic control at Anchorage and something have been done about it to give this military some warning.

Mr. PYLE. Mr. Chairman, I think we have a situation here. I understand exactly what you mean. I thing we ought to take a good hard look at it. I think what you are really saying is that there are additional facilities which conceivably might be made useful.

Senator MONRONEY. You are doing it at rapcons. You have a situation where you have tremendously rough terrain, and sometimes dangerous flight conditions, and any auxiliary services that the Air Defense Command, in watching for Soviet bombers, can render to civil aviation I think should be possible without the addition of millions of dollars or without the addition of large-scale personnel.

Mr. PYLE. Mr. Chairman, I think what we are really talking about is a situation not unlike the jet advisory service, as you speak of, for filling in. We will take a look at this and give you a report on this. It is that simple.

Senator MONRONEY. There is one other that you mention in this same category.

Mr. BAKKE. The other one was Northwest.

Senator MONRONEY. Northwest Airlines plane at Missoula, which collided with a mountain.

Mr. BAKKE. Yes, sir. Our understanding there is that the aircraft had been cleared for an approach to Missoula. It was observed at a very low altitude, pulling up to avoid terrain, too late to avoid collision. It was not at all clear at the moment whether we were confronted here with maybe a descent too low in altitude, impossible to avoid by reason of ice or some other such occurrence, or whether the descent was voluntary on the part of the pilot. We have not established what the probable cause of the accident was, so far as this occurrence is concerned.

Senator MONRONEY. Is there any evidence of icing?

Mr. BAKKE. I am not prepared to say this. Icing conditions——

Senator MONRONEY. There was snow in the area?

Mr. BAKKE. They did exist in the sense that he was flying through visible moisture, through snow. Whether the situation was one in which an aggravated icing condition would be expected, I am not certain. I believe that it was not.

Senator MONRONEY. Had he been at his normal assigned altitude he would have been clearing these obstructions?

Mr. BAKKE. Well, sir, he had been cleared for descent. Had he been at the proper altitude for this portion of the descent, there is no question that he would have cleared the terrain.

Senator MONRONEY. There was no radar or anything else to give him that, because you don't have that, you could not reach down in the valleys with it anyway?

Mr. BAKKE. That is correct.

Senator MONRONEY. You may proceed, unless there are questions.

Senator SCHOEPPEL. I have none.

Mr. PYLE. Mr. Chairman, we had intended to bring in this morning an exhibit showing some of the outputs of the R. & D. program and how they have been folded into the operating program, as well as certain other measures that have been taken over the last couple of years, in line with your question of how are we coming along.

This, frankly, was not in the form that I think will be helpful to the committee, so we will have to submit this for the record just as soon as we complete it in the next couple of days. (See hearing record of February 23, 1961.)

I would like, however, if it would be helpful, to have Mr. Anast make a brief statement with respect to the reports that you had heard about, about the lack of capacity of our data-processing central, if this would be in order.

Senator MONRONEY. Certainly.

Mr. ANAST. I would like to amplify my remarks in this regard. Your question, as I understand it, was the capacity of the computer being developed by the FAA now, compared to that being used in the field, the Univac machine.

I would like to read into the record and also furnish more complete data to you on one page in regard to these comparisons. Before I start, though, I should like to say that any comparisons that I make certainly should not be taken as disparaging to the particular Univac equipment, nor the company from which it came. It was not designed for air traffic control, whereas the one we have was.

Computers can be likened some to subnormal human beings in that they add, multiply, subtract, and they have memories. It is on these bases that we can compare these two.

For example, the Univac machine takes 1,900 microseconds—a microsecond is a millionth of a second—to do an addition. The FAA computer takes from 48 to 58 microseconds, which represents a ratio of 40 to 1 improvement in adding capacity.

In multiplication, the same sort of thing occurs; it takes the Univac 42,300 microseconds to do a multiplication, whereas the FAA computer can accomplish this in from 102 to 678 microseconds, which represents an average of 100-fold increase in capability.

In division it is the same, a ratio of 100 to 1 increase. In access to the memory—that is, the speed of access to the memory—the Univac machine is able to get into the memory and pull out information for the controller, for the human controller, in 2,500 microseconds.

The FAA computer is able to do this on an average in 6 microseconds, which represents a 400 to 1 increase.

In regard to capacity, or memory, the Univac computer has a memory of approximately 200,000 words, the standard words. The FAA computer has a memory for 500,000 words. It also possesses what is known as a high speed core memory for 8,000 words, in which you have this 6-second access to, which the Univac does not possess as a capability.

I do have a couple of reports which bear on this, one internal and one external. We have as a matter of fact policy in this program, which is nearly 3 years old at this point, separate analyses made of the development, the programing that is associated with it, and the general capacities and equality of the program.

The most current studies that we have available are pretty much in consonance, and to summarize they say this:

The FAA computer system going into Boston, to be operational in October 1962, will be loaded to only 53 percent of its capacity. Some of our people, our scientists, are concerned about this generally, I might explain, because there is some pessimism in this regard.

They would like to ascribe, they would like to have the computer do things that are classically the role of the human controller.

The second study, which is done by a contractor, perhaps one of the finest computer systems analysts in the world, pretty much corroborates the internal study and says this: that the computer system, through 1965—that is, with the increase of traffic through 1965—will be able to handle the functions for which it was designed, and will load the computer only to 50 percent capacity.

Both of these studies point out improvements, some of which have already been made, and to illustrate the kind of improvements that would further decrease the capacity—that is, the percentage utilization of computers, both studies suggest that we speed up the drum, the memory drum; double the speed.

This is a minor modification already planned in the course of the development as an in-service improvement.

I might say at this time, also, in just finishing, that comparing computers for air traffic control is not quite a good comparison.

We believe that the unit of air traffic control is a human controller. Computer systems aid human controllers, and we believe they will always aid them.

It is a continual fight inside our organization to keep the computer functions within rational bounds.

I personally believe that human controllers will do a large part of what they are doing today. I expect that computers will never do conflict resolution, for example. They will primarily do the bookkeeping, the transfer of data back and forth between controllers, and the fast and large memory that is required to dredge up data that controllers need practically instantaneously from space to space, from sector to sector, and from center to center.

Senator MONRONEY. This data processing central computer that will go into Boston, will you build more of those, or will you wait until the Boston computer proves its capacity and its ability?

Mr. ANAST. Our current plan is as follows: We do not have funding in fiscal year 1962 for data processing computers for air traffic control. We will wait for the results of the tests which are taking place now at Atlantic City and expect a significant part of it to be finished by Ocober of this year.

We also have some data resulting from the analyses and resulting from test of equipment at Atlantic City of the prototype equipment designed for Boston.

Senator MONRONEY. That is fine, and well and good, but until it gets on the line and starts to really bring the planes in, do you have any means of knowing whether you have the system that is as good as you think and your preliminary tests indicate will be? In other words, what I am wondering about, you try it out in actual functioning of handling air traffic control, then make your decision to go on and concentrate on this type of computer against the Univac or whatever one you are using at the present time.

Mr. ANAST. Yes, sir. We have a full program of testing at Atlantic City as originally designed. We have broken out a portion of this data processing central system ahead of time. That part which fundamentally was being accomplished by the business machines which are now in use, plus two more functions: one, the automatic updating of the display for the controller, and some conflict prediction.

Senator MONRONEY. Conflict prediction?

Mr. ANAST. Conflict prediction display, not conflict resolution.

In addition, we have a full program involving the air defense computer which is going along, and on which the significant tests will be finished also by October 1 of this year. This involves a computer whose development is now finished, which has a capacity and performance much higher than the one we have developed as well. So that we have two main streams of development applicable to air traffic control: one, through the reprograming of the air defense computation systems, designed for air defense, and one which is now under test at Atlantic City.

Senator MONRONEY. When you finally complete the use and approval in actual air traffic control work, in what centers do you plan to use this newly developed or revised air defense computer?

Mr. ANAST. In the case of the air defense center we are already planning some operational tests to begin in July of this year at Fort Lee, Va., in which actual air traffic controller from the Bureau of Air Traffic Management will be in place for high altitude air traffic control tests.

Senator MONRONEY. Where will the civilian computer be installed next, if it works as well as anticipated at Boston?

Mr. ANAST. Our current plan is New York.

Mr. PYLE. The next installation, if everything goes according to schedule, would be the New York area, Mr. Chairman. I think the important point that I would leave with you is this: We have the evaluation of the data processing central, that which is developed in our shop. We are also working with the air defense system, the FSQ–7 specifically, which is an integral part of the SAGE system. Until we have resolved which way we must jump in this area, we are not in a position to commit taxpayers' funds. It will be approximately October of this year before we are in that position.

At this time the decision will have to be made as to whether we fund it in fiscal 1963 for those additional improvements to the system, and installation if the various parts of our air traffic control system, or whether, if we are far enough along, we might go for a supplemental appropriation. But we are not now, Mr. Chairman, in a position to give you a finite answer because the testing and evaluation is in process.

Senator MONRONEY. Keep this in relation to our general problem. These are for area radar, for long distance flight plans filed and computing time of arrival, with the speed of the plane, wind, and all this.

Mr. ANAST. And route traffic control function.

Senator MONRONEY. They are of no value whatsoever after plane X is placed in the holding pattern; is that correct?

Mr. ANAST. That is correct. There is pictorial bright display available integral to the equipment, but it is also available without the equipment. So that in Boston, in 1962, you can expect to have bright pictorial display from which radar data can be found. We do not expect to have any three dimensional radars as pointed out last week, for another 18 months.

Senator MONRONEY. The air traffic controller will place the plane in a holding pattern and it will still be up to the manually operated approach radar and the men on the ground to vector him in under the present system?

Mr. ANAST. That is correct. That portion which will go into Boston and be operational next year will not have the terminal feature to it. It will be added the next year, in which vectoring aid will be given to the controller and a more complex and sophisticated transfer will be available.

Senator MONRONEY. Will you have a positive radar handoff at that point?

Mr. ANAST. Yes, sir.

Senator MONRONEY. You are satisfied that it will be possible?

Mr. ANAST. Yes, sir; we are convinced of it.

Senator MONRONEY. Senator Schoeppel?

Senator SCHOEPPEL. Do you have funds committed up into 1961 for what you desire to do there? I mean through 1961 or into the first half of 1962?

Mr. ANAST. We have sufficient funds within fiscal year 1961 for the entire Boston installation.

Senator MONRONEY. In the meantime, until this is thoroughly tested do you still have access to rental computers so that we will have no lag in any place where they may render aid, and turn them back to the manufacturer when you are able to equip with a more efficient one?

Mr. ANAST. Yes, sir.

Senator MONRONEY. Do you plan to manufacture these yourselves?

Mr. ANAST. Our plan is to have them improved. We actually have got production equipment now. We have gone to that stage, and I might point out that their cost is approximately $1.7 million per item.

Senator MONRONEY. How does that relate to the off-the-shelf computer?

Mr. ANAST. The off-the-shelf computer we have been leasing for approximately $800,000 a year.

Senator MONRONEY. So in 2 years you would approximately pay for the ownership of this new one?

Mr. ANAST. We are figuring on a 3-year writeoff. There will be other peripheral costs.

Senator MONRONEY. Proceed, Mr. Pyle.

Mr. PYLE. Mr. Chairman, I might point out, in answer to Senator Schoeppel's inquiry, we have the funds committed for fiscal 1961. Provision is made in the President's budget for fiscal 1962. Hearings, however, have not been held on this budget. It is in this context. We think we have made provision for it.

Mr. Chairman, I would like to take an additional minute or two to make one or two observations on Mr. McErlean's testimony of the other day. He referred specifically to the Grand Canyon accident as being—I don't want to misquote him—in essence a deficiency in our traffic control system that was the cause of this accident. I think it should be pointed out that the rules that were then existing, the procedures and the facilities, did not give our air traffic control system the responsibility nor did it have the capability of separating aircraft outside the controlled airspace.

If you will remember in our testimony before you, and before your committee, these two aircraft were outside controlled airspace. Neither of them had to go outside the controlled airspace. They had the ability to fly on routes on which positive separation could have been provided had they elected to do so.

I want to be sure it is clear for the record the environment in which these two aircraft were operating.

It might be pertinent to point out that this charge has been made by United right down through the years since the accident, but there has been no court in the land which has found the Government negligent in conection with this specific accident.

In the case of the Las Vegas accident, I think it should be clear, at least made clear on the record, that United had personnel based at Las Vegas—I am talking about the Nellis Air Force accident, colli-

sion with the Nellis-based aircraft. Their dispatchers by regulation are required to know the environment in which those aircraft are operating. It was well known to United personnel.

Senator MONRONEY. In other words, it was well known to United personnel that there was no relationship between military traffic and civilian traffic?

Mr. PYLE. There were practice penetrations taking place.

Senator MONRONEY. But no notification to the central control tower where the Government was required to furnish information that penetration was taking place at a certain time, certain hour, and certain position?

Mr. PYLE. That is correct.

Senator MONRONEY. There is one of the things we sought to correct in the Federal Aviation Agency setup to have both military and civilian air traffic control under the same planned program, and that any civilian traffic or military traffic then would be on notice as to where the cross-overs and underpasses were occurring.

Mr. PYLE. And extensive as both the result of the additional responsibilities made available to us by the act, as well as certain operational procedures which were worked out by the military, this situation of course has been changed so I want to be sure that there was an understanding of the accurate situation that prevailed at that time.

I think Mr. Thomas, Mr. Chairman, has some information that might be helpful with respect to DME procedures, which I believe if I understood Mr. McErlean right, he stated that these were only made available on February 1, 1961. This is not the case.

Senator MONRONEY. Mr. Thomas?

Mr. THOMAS. Mr. Chairman, Mr. McErlean probably was referring to a revision to the ATM manual—Air Traffic Control Procedures—and the revision was effective February 1. However, the procedures were first developed and were shown actually in movie form to an international symposium here more than 2 years ago. They were published on January 26, 1960, and amplified on April 29, 1960. So they have been in official use for nearly a year.

Senator MONRONEY. This is in the same category, you might say, as radar. Radar is not yet compulsory on your transport aircraft. It is beginning to be. But for years preceding this compulsory order, many of the foresighted, safety-minded airlines installed radar. United was one of the first. They installed it not only on their long-range but with particular reference to their short-range, their Convairs and others, so that they would have this added protection in flight. DME had been known for a long time, had been tested, and had the ground installation support, cockpit installations for any airline that desired to install it.

Mr. THOMAS. Mr. Chairman, I think this is an excellent comparison because the weather radar was extremely valuable with or without regulation. DME in the cockpit is extremely valuable with or without information or with or without any recognition within the air traffic control procedures by giving continuous positive information of position over the ground at all times. Many of us have used it for 10 years. It is almost a necessary part of the navigation scheme, regardless of its effect on traffic control.

Senator MONRONEY. There has been some resistance on the part of some airlines to be compelled to put it in, has there not?

Mr. THOMAS. Sir, I think the installation record was given the other day. There is a conference being held next month with the industry, and being called by the Agency to discuss the rulemaking aspects of it, and the feasibility.

Senator MONRONEY. The point I am making is that any airline which wished to put DME in, could have put it in a year ago, almost 2 years ago. There might have been some service problems connected with it at that time, but it has been available on an off-the-shelf basis for those who would wish to install it as an extra instrument in the cockpit to give the pilot a more positive fix on his ground environment. Is that correct?

Mr. THOMAS. Yes, sir; this is correct.

Mr. PYLE. I think, Mr. Chairman, in fairness, I would like to point out that DME, based on the TACAN concept, has not been available too long, and only from one source, which makes it a little difficult for the airlines, for the simple reason that it is basically a TACAN—it is one part of the overall total TACAN system. We have been using TACAN equipment, TACAN receivers in our aircraft in order to use the VORTAC. The commercial product that the airlines will be buying, there have not been too many units produced. I think some 200 units. However, I don't think there is any reason why this couldn't have been expedited with a little effort and push on the part of the air carriers.

The point, that you cited, that I would like to reaffirm, is this: The procedures that we are talking about are only an added bonus, let's say, that you buy from the system, but the basic information doesn't require procedure 1 to use this instrument to great advantage.

Senator MONRONEY. This would have given the pilot of the United aircraft a better fix on his Preston holding pattern.

Mr. PYLE. It would have positively identified the Preston holding pattern.

Senator MONRONEY. Would it, on the course that he is presumed to have been flying? He took a shortcut and he took a sweep into Victor 123.

Mr. THOMAS. Mr. Chairman, I think this would depend on how he had used the DME had he had it. There was DME available at Solberg, and published. There was a DME available at Idlewild, and published. There was DME on test, but not published, at Robbinsville, so he had no reason to know it was there. He would have been using either Idlewild or Solberg. I think the important thing here is that he would have known, not at Preston, but all the time, what his ground speed was, and his progress, and his estimate on coming into the Preston pattern. I think it would have helped him on Preston and on his entire navigation problem.

Mr. PYLE. Mr. Chairman, we can finish up with perhaps a brief description of what we had in mind with respect to the additional gains, safetywise, that we can get by beefing up our radar procedures in traffic control. I would like Mr. Thomas to comment briefly on this.

Mr. THOMAS. Mr. Chairman, with respect to your question on what would it take to get aircraft into the holding pattern, to see that they made entry, whether or not we identify them beyond this point, we

have surveyed our facilities to determine what in their opinion those requirements would be. The problem that we are facing now is that we are not at all certain of the procedures that we would use to give the maximum service in this regard, since we know that it has to be something less than 100 percent; that is, neither man nor machine do we know of today that will hold the identity of an aircraft in the holding pattern. Consequently, we are starting immediately a simulation project at Atlantic City to set up different situations of traffic, controllers and communications, where we will start with low-density traffic and have an occasional stray from the holding pattern to very high density traffic and with a great number of strays until we break the system down. Then we will try other arguments of controllers and communications and traffic so that we can get some concept of what we can advertise to the public as being a reasonable service that they might expect, recognizing that we want to provide some increased service which is less than 100 percent.

Our initial estimates in looking at not the 3,000 holding patterns that are in existence in the United States, but just the major 50-odd terminals at 79 airports, would take about 800 people and about $8 million a year. If we reduced this to 25 terminals—considering now La Guardia, Washington, New York, San Francisco, and this type—the 25 densest terminals, it looks like it would require about 350 additional controllers and with additional interphone lines, reporting equipment, something over $3 million a year—between $3 and $3½ million a year.

But the important thing here, and we would like to make quite certain that it is recognized, is that this is a change in traffic control concept in that we are now working with a cooperative system where the pilot is expected to do what he is told. This will go one step further, and we would like to do it as much as we can, to say that wherever a plane deviates from a flight path that we will do our best to minimize the risk of collision, whether or not the plane for whatever reason deviates.

We do feel, right at the moment, that we won't be 100 percent successful at this, nor do we want to advertise it as such. What we want to do is find out how much we can do and what is reasonable for the Government to undertake in the way of additional services and liabilities for doing this, and what we can do to increase safety within human capabilities.

I think it will be 2 or 3 weeks before we know very precisely what this will be.

Senator MONRONEY. I think what the committee's position is is not to free the pilot from his careful study of all of his present navigational instruments, and perhaps in the future to include DME, but to add as you do in all aircraft manufacture and instrumentation a fail-safe situation to where there is a basket, perhaps, to catch him if he does, through inadvertence or lack of attention or instrumentation error, failure of his instruments, to go beyond that which he has.

I don't presume, and I am sure the committee doesn't, to insist upon some additional facility to relieve the pilot of any of his present responsibility. It is for that 1 chance out of 100,000, perhaps, that he might stray, if there were some way to notify him from the ground that he had passed the point and was in very dangerous territory;

it would give you a fail-safe in addition to what we now have. In that context we are not dreaming at all, I don't believe, of being able to provide this on the entire system. I don't believe that we quite need it there, because in the first place your volume of traffic and proximity of your holding patterns exist nowhere in the world such as they do in the New York area where these airports were located without any relation to proper planning. Like Topsy, they just grew. You have to fly through a bird cage pattern of conflicting traffic to reach any of the four or five in that area. And therefore, for the purpose of our study, while we would not expect it to be limited to the New York area, we certainly think this is the No. 1 place to start it, and perhaps within the area of some 10 or 12 of your extremely high density airports, airport areas, that a start could and should be made at the earliest possible time to provide this service.

Mr. PYLE. I would like to comment briefly on this point. In the first place, I think this is exactly the direction in which we want to move. I know this is the direction in which we want to move. I think we want to be sure that we are on the right track, and it is for this purpose that we are going to put this through a simulation study at Atlantic City. This is what this facility is for, to make an intensive study of a situation of this kind. In fact, Mr. Anast was well ahead of all of us. He has the deck cleared so that we can go into this as soon as we possibly can. This program is now underway.

I think we have to be realistic in this one respect: We do have the human nature problem here. I don't think we want to let the impression get out that the pilot can rely on the traffic control system to bail him out. I am sure that the pilots don't want this, either.

Senator MONRONEY. And neither does the committee.

Mr. PYLE. The pilots are mighty responsible individuals and I am sure they wouldn't want to lean on this as a crutch. However, I want to also correct one thing perhaps more for the public than for us who are more knowledgeable in the business, and that is I hesitate to use the term "fail-safe" because we won't be 100 percent fail-safe and I don't want to have that impression go out. We have gone a step further in trying to lock the door, but it won't be entirely because in a crowded terminal where it is conceivable, until we get altitude, the controller might lose the identify of his particular aircraft.

I think it is important that we not get a false impression out. This will go further down the road than we have ever been before, but it is not all the way.

Lastly, I concur entirely with your thought that we should be selective in the application of this program and hit the high density areas, certainly top priority, and gradually expand it if it is a valid concept.

Senator MONRONEY. Why, since I presume Preston and Linden were located in the days of slower traffic movement, do you still maintain these? This is not like abandoning a highway. It is merely a circle put in the sky of radio devices. Why cannot those holding patterns be separated by far greater distances than they are today?

Mr. THOMAS. Mr. Chairman, the holding patterns in the New York area have been very carefully placed over the years and modified over the years. As a matter of fact, they were reexamined many times, but this most recent arrangement was as late as last September. Any

movement of one holding pattern affects others in the whole New York area. And this is the way principally we are looking at it.

I think one thing which may have created some wrong impressions is actually the size of the holding pattern as related to the airspace needed to actually contain the airplane. The holding patterns are actually of three sizes. The bottom size goes up to 14,000 feet, and I have a chart here if it will interest the committee, of the holding patterns.

The second size from 14,000 up to 29,000 and—they are doubled from the first to the second. And they are tripled above 29,000. With 180 knots airspeed, there is adequate space on the holding pattern to give adequate separation with other traffic. We are, however, revising the size of these holding patterns to increase the speed from 180 knots for the civil jets to 210 or 230, depending on the altitude, to make them more comfortable to fly, and therefore slightly increasing the size of them.

Senator MONRONEY. I still don't get why you have all this geography below you. You have an ocean to the side of you. I don't understand why Preston and Linden have to be so close, and why the approach to La Guardia has to swing even closer than the holding pattern indicates to Preston, and in line of flight that would cross within a very few miles if the pilot overshot or missed his fix on Preston.

Mr. THOMAS. Sir, there are around 30 holding patterns in the New York area. With many hours and months of study, as a matter of fact, in the air traffic control committees where all industry is represented, these are at the moment the best arrangements that we can visualize. We will continue to look at it and see if we can improve them or change them. There is, under all normal circumstances, adequate separation in the holding patterns.

Senator MONRONEY. There is adequate separation if everything goes right, but there is a very fine margin of error if it doesn't go right.

What I am searching for, and not being a technician, is that merely as an uninformed person, I ask why these holding patterns could not be separated even further, and to ask at this point if your approach radar can reach out accurately at a greater distance so that perhaps a holding pattern, we will say over Robbinsville, would be safer coming in from that direction than the holding pattern at present at Preston?

Mr. THOMAS. The answer is "No," sir; it cannot.

Mr. PYLE. Mr. Chairman, I readily appreciate the problem that we have here. This is a highly complex problem to be resolved.

Senator MONRONEY. And it is rather peculiar to the New York City area, because as I said before, you have so many airports with high density traffic in such a narrow airspace.

Mr. THOMAS. This is correct. The problem is more serious at New York, but it is getting just about as complex. You have 30 holding patterns from which you feed the various airports in the New York area. You have arrivals and departures that are carried on over and above the normal handling of the holding pattern traffic.

You have warning areas out to sea, which we are continuously working with the military to use to the best advantage we possibly can. But we somewhere along the line have to give the Air Force and

the Navy some area in which to do their training. They have been cooperative. They have moved it off into ocean areas.

What we are trying to do is to lay out a pattern, procedurally and operationally, that is a feasible one. We don't rely only on our own judgment. We then take this is industry and say, "Here is our problem; here is our suggested solution. You fellows take a cut at it and see whether or not we are moving in the right direction. Is this the way that we solve this problem?"

These New York patterns were worked out in this way. Let's face it, Mr. Chairman, if there is not compliance with the procedures, and if the aircraft are not operated in conformance with those procedures, and at the speeds which make these procedures practical, you have trouble.

I think until we get into a system of positive radar handoff where we can identify these aircraft and follow them through no matter what happens, we have got to expect a compliance with properly worked out procedures and compliance with these procedures is necessary. This is the environment in which we have to do our job.

If we cut down the number of holding patterns—and we can do this—we will reduce, to the extent we cut them down, the amount of traffic that can be handled, and this will come down to where we can have only one holding pattern for the New York area. Then the result is that the traffic drops back to that extent, the air carrier sells its airplane, the pilots lose their jobs. I know I am being absured, but this is the problem we have.

Senator MONRONEY. I realize that the slowing down of the system may result in fewer schedules, maybe a little less revenue for the airlines, and fewer jobs for pilots. But you still don't explain to me—and I must say that I am unfamiliar with the terms of art and all of the high technicalities—why greater distance separations which would make the holding pattern further away from the airport, thereby giving you some additional space separation in the event of error, is not possible or practical.

I am sure you might slow the system down a little bit as they come out of the holding pattern for their final approach.

Mr. ANAST. Mr. Chairman, I can respond to that. This matter has been under study for at least a decade with regard to speeding up the operation, both coming into airports and going out of airports. We are in possession of a tremendous amount of data relating to the placement of holding patterns, the control of aircraft, and so on, which affect these.

I would like to say one thing with regard to where the holding pattern is with regard to airport traffic. The farther away the holding pattern is from the airport, the smaller will be the input. The main reason for that is that it stretches out the path which is essentially common between aircraft, so that speed differences show up and spacing has to be increased.

The only way that this can be improved, and keep holding patterns farther out, or shall we say remove them entirely from the immediate vicinity, would be to have extremely rigid speed and performance control. As a matter of principle our air traffic control system today—and I might add the one under development—permits control of the aircraft by the aircraft operator, and does not control rigidly his speed. This is the essential thing.

We have developments which were done by the military which are under test now, I might add, at Atlantic City, which control speed rigidly, and you get an increase in performance, and you reduce the necessity for having holding patterns nearby.

One other thing is that when you do have stoppages of flow and you have holding patterns as you must have some place in the system, some place for people to go if the runway is closed, the farther away you are the longer it will take to recreate the flow again after the stoppage. So there is a natural tendency from the operational standpoint to put these holding patterns close in.

Mr. THOMAS. Mr. Chairman, it may be helpful to look at the holding patterns. The proposal for limitization of speed will do a great deal, I think, on the separation problem by keeping the aircraft speed down, therefore the time for decision will be increased. The actual holding pattern is this little tiny area in the center, which is based on the scale of 180 knots. The larger pattern is that airspace which is given for the protection of the aircraft and its actual separation.

This again is doubled, at 14,000 feet, and it is tripled at 29,000 feet and above, which gives us some rather large areas. The smallest airspace protection we have is 8 by 16 miles on a 1-mile pattern, and the largest goes up to 24 by 57 miles. We are changing and have developed 31 different pattern sizes for the different altitudes and speeds. They will range from a small one of 6 by 9½ to a larger one, 49 by 64 nautical miles for one aircraft to hold. This is a military jet holding high. That is a very large one.

I think the point I would like to make clear is that the edge of the holding pattern is not the track that the airplane flies, but the edge of the protected airspace. Reduced speeds, I think, will do a great deal on keeping the separation as we visualize it.

Senator MONRONEY. If I remember correctly, the so-called reduced speeds that you are putting in are greatly in excess of what the company manual of United already had in it.

Mr. THOMAS. Yes, it is. We are enlarging the pattern to accommodate it. This is for more comfortable flying.

Senator MONRONEY. As you enlarge the pattern you further encroach on airspace that is adjacent; do you not? As you enlarge the pattern at Preston you come closer to the Linden holding pattern?

Mr. THOMAS. When we put the new patterns in, I don't know whether they will be at Preston, Linden, or not. We are still studying this for the best arrangement.

Senator MONRONEY. It seems to me that any enlargement without providing for the same amount of separation, or greater, would be squeezing the airspace to a still thinner margin.

Mr. THOMAS. These new pattern sizes we have tried under all speculated wind or probable wind conditions. We find that with normal adherence it will be almost impossible to violate the pattern.

Senator MONRONEY. Your 200-knot speed is in the holding pattern, or at a point approaching the holding pattern?

Mr. THOMAS. Under our proposal for the new pattern it would be within 3 minutes of the holding pattern.

Senator MONRONEY. Within 3 minutes of the holding pattern?

Mr. THOMAS. Yes. Somewhere to within 3 minutes prior to entering.

Senator MONRONEY. In other words, he would expect, within 3 minutes of approaching Preston, to have slowed to 200 knots an hour?

Mr. THOMAS. Yes; under the new proposal. Not as it then existed.

Senator MONRONEY. Under the present rules, as I understand it, there was no rule of the FAA but a rule of the companies that certain speeds would be maintained in the holding patterns?

Mr. THOMAS. No, sir. It was in the Pilots' Information Manual for quite a number of years that the holding speeds would be 180 miles per hour. With the advent of the new aircraft the speed was raised to 180 knots, some 2 years ago, and the altitude at which the pattern doubled was lowered to take care of the additional speed. It used to be doubled at 20,000 feet, and when we raised it to 180 knots it was doubled at 14,000 feet since the true air speed increases as one goes up in altitude.

However, with specific regard to Preston—and these are the low altitude 180-knot patterns—there are several other protections here. In the first place, the holding at Linden is to the north of the pattern, and the holding at Preston is to the southwest. This is even still further protection.

Senator MONRONEY. But if you will notice, your approach to La Guardia comes right out toward Preston from Linden. This throws him directly in conflicting line of flight if something goes wrong.

Mr. THOMAS. Yes, this is correct. But I know of no arrangements of holding fixes around multiple airports in a single community—New York or otherwise—where the extension of the holding pattern would not eventually conflict. To do otherwise they would have to be absolutely parallel and our airports are not so fixed on this basis.

Senator MONRONEY. Unfortunately.

Mr. THOMAS. As the normal exit out of Preston, there is a radar buffer line here for the controllers' use where the Idlewild traffic is brought down in this fashion to the southeast, and then turned in, and La Guardia traffic is brought down in this area on La Guardia ILS to space it properly with other traffic landing at La Guardia.

Senator MONRONEY. Do both of those patterns have 5,000-foot altitude? In other words, could you have more vertical separation if the holding altitude at which they were placed were at a different altitude?

Mr. THOMAS. That is if we alternated altitude.

Senator MONRONEY. That is right, one at 7,000 and the other at 5,000. You wouldn't necessarily be in conflict as to those that were in parallel the first stack at 5,000 and 7,000.

Mr. THOMAS. Eventually you would, sir.

Let's assume we have 7,000 at Preston and 5,000 at Linden. As the man descended below 7,000 at Preston, as he eventually must do to land at Idlewild, he would go through the 5,000-foot level. As the airplanes came into Linden at higher than 5,000 feet they eventually must descend. We found very little advantage due to the constant descending, of assigning altitude levels to stacks in the same community.

Senator MONRONEY. It wouldn't be as fast, either.

Mr. THOMAS. Oh, no. It would reduce our activity quite a bit. But besides this, I don't think it would achieve the objective. In the case of Preston, below 4,000, it is used to feed La Guardia and Newark; 5,000 and up, Idlewild; and Linden was also used sometimes for Newark.

Senator MONRONEY. Was Linden used for Newark, Idlewild, and La Guardia?

Mr. THOMAS. No, sir. Linden was not used for Idlewild. The stacks at that time were Preston on the west side and Ambrose to the east. They were being fed in on both sides and intermixed with proper spacing on the ILS course. In the case of La Guardia the stacks were at Linden and Idlewild and were being vectored with proper spacing on the ILS course to La Guardia.

Senator MONRONEY. The first plane in Linden, if at 5,000, and the first plane in to Preston at 7,000, the only bad result would be to slow down the acceptance of this man having to lose 2,000 feet more altitude before he could be vectored in to land at Idlewild?

Mr. THOMAS. Yes, sir; that would be one of the results. But trying to achieve altitude separation there would be defeated because eventually they would have to descend in both stacks. Sometime they would be at the same altitude.

Senator MONRONEY. He would be in his holding pattern and not beyond it. If the United plane were given 7,000 coming into Preston, and the TWA were given 5,500, I believe, coming into Linden, had this been the practice this man would have been above the conflict with traffic out of Linden and missing his holding point, had he caught his holding point at 7,000 he would have only had to lose 2,000 feet of altitude coming out of the stack, before coming out of the stack he would have had his normal approach to Idlewild.

Mr. THOMAS. Yes, sir. In this particular case. One of the problems that we face is under any situation when an aircraft is either at the wrong altitude or the wrong geographical position, he could be in conflict with another aircraft.

Senator MONRONEY. This is why you have staggered altitudes going each way on an airway, so that even though a man is off the beam he will have some altitude separation. This is current in your area flying. I wonder why it wouldn't be good policy in your approach pattern.

Mr. THOMAS. I don't believe I have made it clear, Mr. Chairman, that the difficulty that we are having with it, as the aircraft descends from various altitudes down to the airport, they inevitably have to go through the same altitude somewhere in their descent.

Senator MONRONEY. But their descent doesn't conflict because you are bringing your man out when the approach radar has him. He is brought out on a different course and separated, and under positive radar control of the sophisticated and accurate approach radar.

Mr. THOMAS. In this case TWA was descending. He was not being held level. He was descending down to 1,500.

Senator MONRONEY. He was descending across the line of flight exactly at 5,000 feet that the United plane was taking into Preston. Going beyond that a few miles, the collision occurred.

What I am trying to say or ask—perhaps I am way off base—why, if his holding altitude was 7,000, would it substantially interfere with air traffic movement, and why would it not add just a little bit more airspace to maneuver and give a greater chance of accident avoidance?

Mr. THOMAS. If I understand correctly, we would hold all aircraft at Preston until after we maneuvered them out of the holding pattern. This would make a very steep descent into Idlewild from 7,000

down. It is about 25 miles. It could be done. But we used to, some years ago, separate stacks by altitude, just for this very reason. We found out that even if you start out with separation, as you descend into the terminal area, they are at the same altitude anyway so we discontinued the practice.

Senator MONRONEY. The point I am making is that he could go go into Preston at 7,000, make one swing around it and come out at 5,000. But as he gets his fix, to be sure where he is, this is apparently the basis of error that caused this tremendous accident.

We are searching for the possibilities of things within reach today to make these kinds of accidents less likely.

Mr. PYLE. Mr. Chairman, I think the key to this—I understand your point—you are talking about the initial point to a holding stack.

Senator MONRONEY. Yes. If he had been told initially to go to 7,000, come down to 5,000, and then been vectored, had he gone past he would have missed the conflicting traffic at least that was in the 5,000-foot stack or emerging from it at Linden.

Mr. PYLE. I understand your point. I really would offer that I think the procedure that is going to result in greater safety than would this, or that we should look at, is that I am concerned that if you assign him at 7,000 you have the chance, if he overshoots, so to speak, of having him run into departure traffic over the stack at Linden. So you have the same situation with a different type of traffic.

I think the clue is that the airplane be slowed down, and this is the imposition of the speed rule. This I think will make a far greater contribution to stop overshoots, or to provide against the possibility of an overshoot, because the airplane will be going slower and he has that much better chance to know exactly where he is. He is moving at half the speed.

Senator MONRONEY. Certainly the speed approaching the holding pattern is of vital importance, which has never been observed before. It was in the holding pattern and not approaching. If it is 3 minutes before he arrives at the holding pattern, I think you have added a considerable margin of safety there. I was exploring to see whether there are other margins that might be available.

Mr. PYLE. The point is well taken. The complexity of New York traffic—if I recall correctly there is some other traffic going out over Linden.

Senator MONRONEY. You have control of that on the ground. If you want to hold the plane on the ground, you can do it.

Mr. PYLE. Granted. But at this point we are separating traffic to the point where it won't move.

Senator MONRONEY. This comes down to the guts of the whole thing: Are we putting so great an emphasis on more and more schedules to where we don't have time to add a few seconds additional to be sure that those that do take off, or those that do come in to land, are able to walk away from the landing when they get there. This is a question that this committee has, despite the fact that the airlines and everyone else is going to scream about, that I think needs to be carefully explored.

Mr. PYLE. I certainly have no problem with that, Mr. Chairman. It is my personal opinion that at this stage of the game we are not trying to inject more than the system can hold if compliance with the procedures is followed. This is the problem.

Senator MONRONEY. And if they work every time.

Mr. PYLE. Yes.

Senator MONRONEY. The committee will have to stand in recess.

We would like to come back at 1:30, at which time we will excuse the FAA for the balance of the day, and we expect to take the Air Line Pilots Association for their testimony. They arrived with several vice presidents of the ALPA from out of town. We will take them this afternoon. We hope to be through with them by 3:30. We will go back to our normal schedule tomorrow morning.

The committee will stand in recess until 1:30.

Mr. PYLE. Could I add one point?

Senator MONRONEY. Yes.

Mr. PYLE. We have photographs of the graphs to which Mr. Bakke referred in his testimony. Would this be helpful for the record? If so, we will furnish them.

Senator MONRONEY. Those we would like to have placed in the record at the point where Mr. Bakke referred to them. Also, I would like inserted into the record the "Résumé—Lockheed Electra Accidents and Corrective Action Taken"; "Airborne Flight Data Recorders"; and "Runway Slush Accountability for Takeoff Operations of Turbine-Powered Transport Category Airplanes, Civil Air Regulations Draft Release No. 61–1."

(The material requested is as follows:)

RÉSUMÉ—LOCKHEED ELECTRA ACCIDENTS AND CORRECTIVE ACTION TAKEN

1. September 29, 1959, Buffalo, Tex.: Structural failure in flight.
2. March 17, 1960, Cannelton, Ind.: Structural failure in flight.
3. March 25, 1960, airworthiness directive: (*a*) Speed restriction; (*b*) Deactivate autopilot; (*c*) Special refueling procedures.
4. March 25, 1960: Federal Aviation Agency directs Lockheed to revaluate Electra.
5. April 15, 1960, Fleet inspection; no significant findings.
6. Early May, Definition of "whirl mode" developed and related to both accidents.
7. June 1960, Re-audit program. Found airplane generally in compliance with Civil Air Regulations; no cause for accidents.
8. June 1960, Beginning of LEAP program.
9. July 27–29, 1960, Civil Aeronautics Board hearing, Los Angeles, Calif. No significant controversy.
10. November 30, 1960, LEAP modification approval; speed still restricted.
11. December 31, 1960, LEAP approved; unrestricted operation.
12. LEAP modified Electra deliveries; one per day. Sixty-four aircraft completed to date.
13. July 1961, All Electra aircraft will be modified.

REPORT ON REEVALUATION AND MODIFICATION OF ELECTRA AIRCRAFT

This report summarizes one of the most intensive investigations ever to take place in the aviation industry. It began September 29, 1959, when a Lockheed Electra turboprop transport crashed at Buffalo, Tex., under circumstances which could not be explained. While the investigation of the Buffalo accident was taking place, a second crash occured at Cannelton, Ind. This second crash, which was due to a structural failure almost identical to that suffered by the first airplane, made it clear that immediate and positive action was required.

While the Civil Aeronautics Board was responsible for the official investiga-

tions of the accidents, it was the responsibility of the Federal Aviation Agency to direct the reevaluation of the entire structural design criteria of the airplane. The Civil Aeronautics Board, the National Aeronautics and Space Administration (NASA), other airplane manufacturers, airlines, and other groups all cooperated closely with the FAA, the Lockheed Aircraft Corp., and Allison Division of General Motors, the manufactuer of the Electra engine, in the reevaluation. It proceeded as follows:

On March 23, 1960, the FAA called a meeting with the president of each airline operating Electras and representatives of Lockheed and Allison to completely review the program. The technical assistance of the NASA and its complex of wind tunnels was requested by FAA at the start of this engineering and research investigation, and the NASA has provided the most outstanding cooperation and assistance throughout the program.

On March 25, the FAA initiated a five-point program which included:

(1) *Emergency airworthiness regulations.*—Reduction of the originally certificated normal operating speed of 373 miles per hour to 259 miles per hour. This speed restriction provided an additional airload margin of 50 percent between the maximum loads expected in normal operation and the structural capability of the airplane. The new lower speed provided an ample margin for maneuvers needed for the safe operation of the airplane. Also, the new operating speed permitted a more rapid slowdown to rough air penetration speeds required whenever turbulence is encountered. The autopilot was deactivated until it could be proven that was blameless in the accidents and to permit the incorporation of FAA required improvements to eliminate porpoising, which had been noted in the original installation. Operators were instructed to conform precisely to the aircraft manufacturer's refueling procedures in order to prevent overstressing wing components caused by overpressurization of the tanks with the pressure fueling system.

(2) *Emergency maintenance system.*—FAA inspectors made thorough structural inspections of the entire wing of all Electra aircraft. Daily checks were made of the engine reduction gears to detect any possible damage to these gears. Any aircraft which went through severe turbulence or which made a hard landing was given a thorough structural inspection before flight was again permitted. When inspection revealed evidence of inadvertent overpressurization the tank was completely drained and internally inspected prior to further flight.

(3) *Special air carrier operations inspections.*—FAA air carrier inspectors were directed to conduct accelerated inspections on Electra flights in air carrier service. Particular emphasis was placed on insuring that the flight crews were instructed on the new speed limitations and that they were familiar with flight techniques and procedures contained in Electra flight manuals.

(4) *Flight recorders.*—The FAA required that flight recorders be installed in all Electra aircraft. These devices insure a permanent record of airspeed, altitude, direction, and acceleration and are crashproof.

(5) *Engineering and research investigations.*—Most important, the Lockheed Aircraft Corp. was directed by the FAA to undertake a program of engineering and research investigations which were, in effect, a complete reevaluation of the Electra design. Although no specific causes had been announced by the CAB for the Electra accidents, a thorough technical review of all engineering aspects of the design was conducted by Lockheed and the FAA. This included a flight test program to demonstrate the soundness of the airplane with respect to loads imposed by maneuvers and air gusts. Particular emphasis was given to the ability of the wing to dampen, after it was disturbed and loaded by air gusts.

The control system was completely evaluated to determine the effect of possible types of malfunction, and a complete review of the basic engineering data on strength and stress analysis was made. Over a million engineering manhours have been spent by Lockheed, Allison, NASA, and FAA in this reevaluation. Voluminous engineering reports were prepared by Lockheed, assisted by other companies. All were studied and approved by the FAA.

An accelerated flight test program of a highly instrumented Electra aircraft was immediately started, to obtain sufficient data to demonstrate the aerodynamic and structural characteristics of wings, nacelles, and control surface assemblies. Maneuvers, natural gust penetrations, and flutter response tests were conducted over a range of weights, speeds, and fuel loads sufficient to insure that if any possible and, heretofore, unsuspected abnormal structural effects were present, they would be revealed.

The following conclusions were drawn after extensive flight testing:

(1) The original design loads used for all maneuvering conditions were correct and accurate as proven by measured flight loads and stresses.

(2) During an abrupt pullup maneuver, the airplane's stability characteristics are normal.

(3) No abnormal characteristics are present in the Electra for such evasive action maneuvers as rolling pullups. This was clearly demonstrated and recorded in time history curves obtained from the most sophisticated instrumentation during maneuvers.

The Electra was flown through areas of heavy turbulence to measure and determine what affect air gusts had on the wing and fuselage structure. The recordings of gust velocities and airplane response represented extensive rough air flight time; more than half a million data points were read and processed.

This gust flight program, one of the many segments of the overall technical reevaluation, was one of the most extensive and far-reaching investigations if its kind in the history of aviation. New knowledge was gained which will benefit the entire aviation industry in the development of methods of analyzing airplane stresses.

The Lockheed Aircraft Corp. was directed to conduct a thorough evaluation of the airplane control system including the autopilot characteristics giving consideration to the influence of possible malfunctions, failures, and induced effects to insure that sudden destructive forces are not reasonably probable. As a result, FAA approved a series of changes to the control system, including the autopilot. The changes are now reflected in an FAA approved service bulletin which is an integral part of the overall modification program.

The most important part of the analysis was obviously that related to the basic proof of structure itself. In the design of all airplanes, it it necessary to use estimated aerodynamic loads for the purpose of calculating stress in the structure. Due to the fact that the flight test program was so extensive, however, it was now possible to validate the estimates with actual measured aerodynamic loads. This process permitted a reaudit of the basic proof of strength employed in the structural substantiation of the Electra. This included:

(1) Integration of validated data obtained in the flight pragram.

(2) Review of existing statistical data on magnitude, frequency, and characteristics of atmospheric gusts as applicable to the Electra.

(3) Reinvestigation of flutter and divergency analysis, including consideration of abnormal situations arising as a result of typical likely failures, such as damaged gear box support structures, complete loss of one engine, and damaged wing structures.

(4) Wind tunnel investigations to obtain basic aerodynamic data both for normal airplane configurations (including propeller induced effects on airflows, forces, and other phenomena, and including varied propeller inflow angles) and for abnormal conditions arising as a result of typical likely structural damage or failure.

As a result of these studies and tests it was concluded that under certain conditions of engine nacelle or powerplant damage, a phenomenon, known as "whirl mode," could occur. A brief explanation of this phenomenon and the problems of flutter and damping may be in order.

As a wing is "excited" i.e., loaded intermittently as might occur when encountering air gusts, it is necessary that the wing return automatically to its previous position. Good damping requires that a motion of this sort die out rapidly. The damping forces are those which take energy away from the oscillations. A small amount of damping comes from internal energy absorption in the metal structure and energy absorbing parts such as rubber engine mounts, but the greatest damping comes from designing the structure so that the aerodynamic forces on the airplane resist the motions and thus absorb energy from the oscillations. Conversely, if a major change occurs that permits the air forces to aid the motion, the oscillation grows. This condition is know as flutter.

The Electra wing has good positive damping which inherently prevents flutter. The studies and tests conducted during the reinvestigation show that while the control system could not induce wing oscillation, the wobbing of an outboard propeller could. In a normal airplane such propeller misbehavior cannot occur. However, if certain structural failures occur in the outboard powerplant installation, the stage could be set for a wobbling propeller condition.

Since a propeller has gyroscopic characteristics, it will tend to stay in its plane of rotation even though it may be loosely mounted. It it. A list of

possible external forces would include atmospheric turbulence, abrupt aircraft maneuvers and sudden engine power surges. When such a force is applied, the propeller reacts 90° out of phase with the applied force. Assuming the propeller is displaced upward by some force, the structural resistance of the mounting system applies a nose-down pitching moment. The propeller disc, when viewed from the rear, will then turn to the left due to precession. The yaw stiffness then causes a nose-down pitching, which is in turn resisted structurally, resulting in the propeller disc yawing to the right. The yaw stiffness on that side then causes a nose-up pitch, to complete the cycle. This effect has been termed the "whirl mode," and its direction of rotation is opposite to that of the propeller.

In a normal healthy airplane, the "whirl mode" could operate only within the limits of flexibility of the engine mounts, and it was damped out very quickly. However, if some structural element of the power plant, the power plant mounting system, or the nacelle was in a damaged or weakened condition, so that the stiffness of the propeller supporting system was reduced below normal, then the "whirl mode" would not damp out rapidly at high airplane speed. Power plant installation damage did not significantly change the conditions under which the "whirl mode" might have been initiated, but it made that phenomenon which is not hazardous in itself, become threatening in three ways. First, the greater flexibility of a weakened installation could allow the "whirl mode" more freedom and it could become more violent. In an undamaged installation, stiffness increases rapidly as deflections approach the mount limits, but in a damaged installation this characteristic might be altered. Second, in a weakened installation the strength level was reduced, and this, in combination with the increased force and violence of the "whirl mode," could lead to further damage, progressively, and thus further reductions in stiffness. Third, and most important, this changing "spring constant" situation was a condition wherein the frequency of the "whirl mode" in a damaged and overly flexible structure could have reduced from its natural value, (which is safely above the fundamental natural vibration frequencies of the wing) to lower values which approached the wing's natural frequencies. As the "whirl mode" progressed in a damaged installation, the frequency of the mode could have approached the natural frequency of the wing which would in turn tend to perpetuate the "whirl mode." The oscillations would then be coupled at the same frequency. This is a form of induced flutter, forced by a powerful harmonic oscillation to occur at a lower airspeed than that at which flutter in the classical sense can develop. This condition could produce a catastrophic failure through severe oscillatory divergence. A situation could develop where damping diminishes and each oscillation of the wing becomes greater until the wing structure failed.

Identification of the whirl mode phenomenon, therefore, has become the key to the mystery which had baffled the aviation industry for months. The correction of the various wing, powerplant and nacelle deficiencies was, in retrospect, relatively simple once the problem was identified. The Lockheed modification program designed to correct these deficiencies was submitted to the FAA and has now been approved.

Briefly, the modifications are as follows:

(1) Additional mounts have been added to stabilize the propeller should any mount fail, or should breakage occur between the gearbox and the power section.

(2) The nacelle structure has been strengthened considerably by the addition of reinforcements and diagonal braces.

(3) The wing strength has been increased by:

(*a*) Increasing the thickness of three lower surface "planks" and one upper surface "plank".

(*b*) Reinforcing the front spar and the wing lower surface.

(*c*) Strengthening 18 ribs in each wing by additional diagonal braces and reinforcements.

Dramatic flight tests were completed during the latter part of December on an Electra modified in accordance with the program.

The FAA required that the test be accomplished to show the results of one of the severest structural failures that could be conceived; specifically the failure of the torque shaft and the torque shaft housing. The shaft and shaft housing were, in fact, removed prior to flight. The airplane was dived at speeds up to 418 miles per hour in this weakened condition. Severe flight loads were imposed by the pilot to record strains on the critical parts of the structure. Instruments revealed complete absence of the whirl phenomenon

or any other adverse condition. The flight tests, which included endurance flying and a rigorous 100 hour program of run-ups, take-offs and landing, coupled with high speed dives, to prove out the effect of the new mounts on engine wear were completed on schedule.

In order to provide for operation of LEAP modified airplanes, Lockheed requested that the LEAP configuration be approved at the restricted speeds as soon as possible. This was accomplished at VNO equals 225 knots by approving Lockheed Service Bulletin 500 on November 30, 1960.

The evaluation of the LEAP configuration was completed and the airworthiness directive was revised to permit LEAP modified aircraft to operate at unrestricted speeds on December 31, 1960.

The Lockheed Co. is presently modifying Electra aircraft at a rate which will permit all of the Electras to be modified by July of 1961. All work is taking place at Lockheed's Burbank, Calif., headquarters under the most careful control by Lockheed and FAA. As each airplane is completed, its speed restrictions are automatically removed. It is expected that airlines will return to the high speed schedules as soon as they have a substantial part of their fleet modified.

In summary, the FAA believes this extensive reevaluation, proven by an intensive and thorough flight test program, fully justifies the removal of speed restrictions on modified Electras. The strength of the modified Electras, when operated at higher speeds, is well above the requirements of the FAA for structural integrity.

The Agency has employed every means available to it, including the expert technical assistance of the National Aeronautics and Space Administration, generally recognized as the world's leading authority in the aeronautical sciences. In addition, the services of leading aeronautical experts from our aviation industry at large have been employed. Every available scientific and technical resource has been brought to bear to assure the traveling public of the airworthiness of the Electra, before permitting it to return to its originally designed operating speed.

Airborne Flight Data Recorders

For many years the aviation industry has recognized the need for a chronological record of certain parameters of flight. Such information would be useful not only for the investigation of accidents and incidents, but also would provide data to more precisely define the normal and abnormal operation of the aircraft in flight.

We now know that steps must be taken immediately to improve flight recorders and to increase the amount of information they can record so that the sequence of events which occurred during the flight can be determined with minimum delay and if the operation of the airframe, engine, or components has been affected, proper action can be taken.

The FAA wholeheartedly subscribes to an accelerated development program and will do all we can to assist the aviation industry to make rapid advances in this field.

The FAA position is that a flight data recording system capable of documenting all phases of flight, airframe and engine component operation is mandatory, and the operator must also be provided with a quick readout method in addition to computer-type storage.

Attached is an abridged rendition of a presentation made by the FAA soliciting the cooperation of the aviation industry in accelerating the development of the airborne flight data recorder.

(The following presentation was given by the Chief, Engineering and Manufacturing Division of the Bureau of Flight Standards at the Flight Safety Foundation International Air Safety Seminar at Chandler, Ariz. November 14–18, 1960. The presentation outlines the development, growth potential and use of the flight recorder in the investigation of incidents. It is submitted as an exhibit, showing the FAA stand on the need for an airborne flight recorder that will document all phases of flight.)

For many years the aviation industry has recognized the need for a chronological record of certain parameters of flight. Such information would be useful not only for the investigation of accidents and incidents, but also would pro-

vide data to more precisely define the normal and abnormal operation of the aircraft in flight.

The first Civil Air Regulation on flight recorders, amendment 100, was effective April 1951. It required the installation of a device to record altitude and radio transmitter operation (on and off). The compliance date was subsequently revised three times and finally in June 1944, the Civil Aeronautics Board rescinded the requirement. The CAB action was brought about by maintenance difficulties and lack of replacement parts for the recorders due to the war effort.

Another Civil Air Regulation was adopted in September 1947 and required a flight recorder in aircraft of 10,000 pounds or more to record altitude and vertical accelerations. Again, on July 1, 1948, the CAB rescinded this requirement as there were no instruments readily available of proven reliability and fully adequate for the purpose intended. No flight recorders were installed as a result of this regulation.

During the ensuing 9 years, the CAA and CAB studied the requirements, met with industry, and proposed various amendments defining the flight recorder program. Finally, in August 1957 the CAB adopted regulations to be effective in September 1957. This required flight recorders to be installed after July 1958 in all aircraft over 12,500 pounds that would be operated in air carrier service about 25,000 feet altitude. The functions to be recorded were: Airspeed, altitude, direction, vertical accelerations (gusts), and time. In September 1959 these regulations were revised to establish a retention period of 60 days for records and to clarify the time period that the flight recorder shall be in operation, that is, continuously during flight, from takeoff roll until landing roll is completed.

As more experience was gained in the operation of turbine-powered airplanes below 25,000 feet, numerous incidents occurred. This indicated the need for additioanl information to determine the sequence of events and factors leading to the incident. It became increasingly evident that the information provided by flight recorders would be invaluable in determining the cause of each incident.

Commensurate with the foregoing, the FAA published a draft release in March 1960. This proposed the installation of a flight recorder which records at least time, airspeed, altitude, vertical acceleration (in-flight gusts), and heading on all turbine-powered aircraft of more than 12,500 pounds takeoff weight and all other aircraft of more than 12,500 pounds that operate above 25,000 feet. It further stipulated that the recorder be installed and operated continuously during flight and that the recorder be retained by the air carrier for at least 60 days. The effective date of this amendment was to be in September 1960.

Due to comments received from interested parties, it was concluded that this effective date could only be met by removing some airplanes from service, an action which would impose undue burdens of additional expenses and interruptions of scheduled operations. Also, it was determined that flight recorders capable of recording additional parameters of flight would soon be available. These would provide information that could be used by the air carriers for developing more efficient maintenance and operations procedures. Certain manufacturers of flight recorders said that September 1, 1960, would not provide them with time to manufacture and deliver flight recorders to the air carriers affected by this new requirement. The manufacturers also said that some air carriers had preferred to install newer flight data recorder systems capable of recording additional parameters.

Accordingly, the proposed effective date was changed from September 1, 1960, to November 1, 1960. Furthermore, if an air carrier indicated prior to September 1 that it would be unable to comply with the November 1 date due to procurement or installation problems, an extension of time beyond November 1 would be granted if the air carrier presented substantiating data to the FAA outlining the installation program. A total of 19 air carriers requested and have been granted extensions of the compliance date to the period between December 1960 and April 1961. In any event, the extension would not be granted beyond May 1, 1961. Relaxation of the original proposal provided the air carriers with further opportunities to investigate the various types of recorders available. It also allows them to proceed with an orderly procurement and installation program.

On June 12, 1958, the CAA published Technical Standard Order No. TSO–C51, Aircraft Flight Recorder, effective on August 1, 1958. This standard covered three basic types of aircraft flight recorders which record time, airspeed, altitude, vertical accelerations, and heading. There is no FAA plan to revise the minimum standards set forth in TSO–C51 as the state of the art has not advanced beyond TSO–C51 to the point where reliable airborne performance flight recorders with increased recording capabilities are available for installation.

The FAA is convinced that flight performance of the aircraft, engines, and associated component operation must be recorded by a means other than by the flight crew to provide the operator and the airplane designer with precise data records.

Several manufacturers are striving to produce flight recorders. It appears that recorders capable of an almost infinite number of parameters are possible. Some of the more important factors affecting flight operations and maintenance, and which appear to be within the capabilities of recent development research, are as follows: Flight number and date; power, temperature, and pressure indications for each engine; engine r.p.m.; fuel flow; engine vibration; ambient air temperature; altimeter pressure setting; flap and gear position; autopilot operation; propeller feathering; fire warning; anti-icing and deicing; radar operations; cabin altitude, pressure, and oxygen operation; brake operation; radios in operation and frequencies selected; radio communication and intercom messages; landing gear impact accelerations; and special investigations for short or long intervals.

The FAA initiated a feasibility study for recording spoken words of the flight crew. One of the greatest obstacles was high noise level in the cockpit. This problem has reached the point of resolution, and recording of crew conversation now appears feasible. This was finalized in an FAA report published December 1960, entitled "Transport Aircraft Voice Recorders."

The introduction of turbine-powered aircraft into airline operations has caused a tremendous change in the previous concepts relating to the economics of operation. The aircraft are more expensive, more complicated, and their ability to produce profit is increasingly sensitive to the many variations affecting the operational life of the aircraft. The importance of "Down for maintenance" time, resulting in missed schedules, poor utilization, and high material costs, all greatly affect the margin of profit. Achievement of the highest possible standards in these areas therefore is a major objective. To this end, the rapid accumulation of accurate and reliable data in flight is essential. The most important gains that can be realized are associated with—

(1) Maintaining a life history of critical parts so that the maximum service period can be achieved and still maintain an acceptable margin of safety.

(2) Providing a rapid checkout system for trouble-shooting malfunctions.

(3) Reduction of ground time.

(4) Providing a continuous check on aircraft and engine performance to establish maintenance criteria.

(5) Providing a means for a rapid study of the actual operating conditions encountered during flight.

The reduction, correlation, and storing of these data in a reliable, rapid, and efficient manner are as important as the recording process. There are currently available methods of readout and reduction using either manual, semiautomatic, or automatic systems. Manual systems offer a "quick look" using a simple projector similar to the film editor. Semiautomatic methods can digitize the recorded information directly and punch paper tape or IBM cards. Automatic methods automatically reduce the data and feed it into computers for later use.

The FAA has contracted with the Battelle Memorial Institute to investigate methods of data collection, to optimize the number of parameters that can be recorded, and to study the flight recorder program with a view toward general improvement and greater utility of the system. The study report will be available July 1961.

To date four manufacturers are producing FAA approved flight recorder systems. These have been installed in the turbojet air carrier fleet. The installations vary somewhat due principally to the type of accelerometer utilized. Three of the recorders use accelerometer sensors which can be remotely located at or near the center of gravity of the aircraft. The third recorder incorporates an integral accelerometer. If this recorder is installed at any station other than at or near the center of gravity, correction factors must be applied to the recorded data. The pitot and static pressure sources also vary. If independent

sources are required, they must provide intelligence equivalent to those furnished the flight instruments. However, if the copilots systems are utilized, means for isolating the recorder during flight is mandatory and is used in the event of system malfunction.

Recorders have been very useful in providing information on a number of incidents. Several incidents involved heavy to severe turbulence en route and during letdown. By analyzing the flight recorder tape it was possible to determine before, during and immediately after the period of turbulence, the flight speeds, heading deviation, gain and/or loss of altitude and most important of all vertical accelerations imposed on the aircraft.

An incident involving the loss of a foreflap in a four engine turbojet during approach configuration was analyzed. There was some suspicion that the loss was attributed to excessive speed either at the time of lowering the flaps or immediately thereafter. A check of the flight recorder tape proved conclusively that the speed was well below flapsdown speed during the entire segment of flight. The investigation and study of this matter resulted in a redesign of a portion of the flaps.

On a flight to Chicago at 29,000 feet, the radar was in use and the seat belt sign was on when the flight encountered heavy turbulence. Several minor injuries resulted. A readout of the recorder tape revealed that the aircraft altitude increased 1,200 feet, the heading varied one degree, the airspeed increased 15 knots, and the vertical accelerations were plus 1.05 and minus 1.5. This information was highly useful in determining the severity of turbulence and acted as a guide for the turbulence inspection check.

The readout of the tape from a flight that suffered a runaway stabilizer provided useful information in determining the vertical accelerations that were imposed on an aircraft during such a condition.

A near miss report from a military aircraft indicated that an air carrier was operating 2,000 feet lower than the assigned altitude. A check of the flight recorder tape showed that the airliner was at the proper altitude.

By mid-1961, the FAA turbine-powered fleet will number six modern multiturbojet and turboprop transport category aircraft. All will be equipped with flight recorder systems. The recorders installed in the high altitude flight inspection aircraft will undergo evaluation to include system posture, system analysis, system reliability, and comparison of pilot readings with tape readings. The Engineering, Operations, and Aircraft Management Divisions of FAA are collaborating in this evaluation.

The story goes on and on. The flight recorder has become an integral part of the operation and maintenance troubleshooting procedures, even within the limits of the present systems designed to comply with TSO–C51.

Let's look toward the not too distant horizon and envision the supersonic transport. It is evident that the ultimate in flight data recording systems will be necessary to keep this supersonic machine in the air with the minimum ground time and operating within the prescribed flight envelope.

The ultimate aircraft performance data system installed in the supersonic transport should be capable of transmitting innumerable parameters to a ground station for continuous monitoring by a fully automatic computer. It should be capable of alerting a ground monitoring system and/or the pilot of improper performance indications. This information would be extremely useful in maintaining peak efficiency during flight and provide invaluable information in the event of an accident or incident.

We now know that steps must be taken immediately to improve flight recorders and to increase the amount of information they can record so that the sequence of events which occurred during the flight can be determined with minimum delay and if the operation of the airframe, engine, or components has been affected, proper action can be taken.

The FAA wholeheartedly subscribes to an accelerated development program and will do all we can to assist the aviation industry to make rapid advances in this field.

In summary, the FAA position is that a flight data recording system capable of documenting all phases of flight, airframe and engine component operation is mandatory, and the operator must also be provided with a quick readout method in addition to computer type storage.

RUNWAY SLUSH ACCOUNTABILITY FOR TAKEOFF OPERATIONS OF TURBINE-POWERED TRANSPORT CATEGORY AIRPLANES, CIVIL AIR REGULATIONS DRAFT RELEASE NO. 61–1

The Bureau of Flight Standards has under consideration a proposed Special Civil Air Regulation covering the takeoff operations of turbine-powered transport category airplanes when wet snow, slush, and standing water are present on the runway.

Current regulations do not specifically provide for the adverse effects of precipitation on the runway on airplane performance. Experience with the new turbine-powered airplanes indicates, however, that some provisions in this respect are necessary to insure safe operation of these airplanes during takeoff. For this reason, a policy was adopted in December 1959, revised March 1960, to restrict takeoff operations of turbojet airplanes in wet snow, slush, or standing water.

The subject was discussed at the FAA's Airworthiness Conference held in March 1960, and again at supplementary meetings held in July and October 1960. During these meetings it was determined that sufficient information on which to propose new regulations covering all aspects of takeoff operations in detail, was neither available nor capable of being obtained at that time. For example, very little was known of the effect of slush on the braking capacity of wheels and therefore on the accelerate-stop distance. There now appears to be sufficient data available (e.g., NASA Technical Note D–552) upon which to base an interim regulation for the takeoff acceleration case.

The rules proposed would supersede the policy presently in effect and would apply to turbopropeller as well as turbojet airplanes. Under the proposed rule, the maximum takeoff weights for all operators would have to be adjusted to reflect the adverse effects of wet snow, slush, or standing water on the takeoff distance and takeoff run performance, in addition to the factors currently prescribed in the certification and the operating rules; i.e., altitude, temperature, wind, and runway gradient.

Civil Air Regulations draft release No. 61–1 is attached for reference.

FEDERAL AVIATION AGENCY,
BUREAU OF FLIGHT STANDARDS,
Washington, D.C., January 16, 1961.

CIVIL AIR REGULATIONS DRAFT RELEASE NO. 61–1

Subject: Runway slush accountability for take-off operations of turbine-powered transport category airplanes.

The Bureau of Flight Standards of the Federal Aviation Agency has under consideration a proposed special civil air regulation covering the takeoff operations of turbine-powered transport category airplanes when wet snow, slush, and standing water are present on the runway. The reasons therefor are set forth in the explanatory statement of the attached proposal which is being published in the Federal Register as a notice of proposed rulemaking.

The Bureau of Flight Standards desires that all persons who will be affected by the requirements of this proposal be fully informed as to its effect upon them and is therefore circulating copies in order to afford interested persons ample opportunity to submit comments as they may desire.

Because of the large number of comments which we anticipate receiving in response to this draft release, we will be unable to acknowledge receipt of each reply. However, you may be assured that all comment will be given careful consideration.

It should be noted that comments must be submitted in duplicate to the Docket Section of the Federal Aviation Agency, and in order to insure consideration must be received by February 27, 1961.

GEORGE C. PRILL,
Acting Director,
Bureau of Flight Standards.

FEDERAL AVIATION AGENCY

BUREAU OF FLIGHT STANDARDS

[14 CFR Parts 4b, 10, 40, 41, 42, 43, SR–422, SR–422A, SR–422B]

[Regulatory Docket No. 628; Draft Release 61–1]

NOTICE OF PROPOSED RULE MAKING

SPECIAL CIVIL AIR REGULATION. RUNWAY SLUSH ACCOUNTABILITY FOR TAKEOFF OPERATIONS OF TURBINE-POWERED TRANSPORT CATEGORY AIRPLANES

Pursuant to the authority delegated to me by the Administrator (§ 405.27, 14 CFR Part 405), notice is hereby given that the Federal Aviation Agency has under consideration a proposed Special Civil Air Regulation covering the takeoff operations of turbine-powered transport category airplanes when wet snow, slush, and standing water are present on the runway.

Interested persons may participate in the making of the proposed rules by submitting such written data, views, or arguments as they may desire. Communications should be submitted in duplicate to the Docket Section of the Federal Aviation Agency, Room B–316, 1711 New York Avenue NW., Washington 25, D.C. All communications received on or before February 27, 1961, will be considered by the Administrator before taking action upon the proposed rules. The proposals contained in this notice may be changed in the light of comments received. All comments submitted will be available, in the Docket Section, for examination by interested persons when the prescribed date for return of comments has expired.

Current regulations do not specifically provide for the adverse effects of precipitation on the runway on airplane performance. Experience with the new turbine-powered airplanes indicates, however, that some provisions in this respect are necessary to insure safe operation of these airplanes during takeoff. For this reason, a policy was adopted in December 1959, revised March 1960, to restrict takeoff operations of turbojet airplanes in wet snow, slush, or standing water.

The subject was discussed at the FAA's Airworthiness Conference held in March 1960, and again at supplementary meetings held in July and October 1960. During these meetings it was determined that sufficient information on which to propose new regulations covering all aspects of takeoff operations is neither available nor capable of being obtained at this time. For example, very little is known of the effect of slush on the braking capacity of wheels and therefore on the accelerate-stop distance. However, there does appear to be sufficient data available (e.g., NASA Technical Note D–552) upon which to base an interim regulation for the takeoff acceleration case. During the October meeting, the ATA presented a proposal for consideration.

The ATA proposal excluded consideration of the one-engine-inoperative takeoff condition on the basis that the probability of an engine failure with slush on the runway is too remote to warrant consideration, and that such consideration would unnecessarily curtail aircraft operations because of the large adverse effect of slush on one-engine-inoperative takeoff performance. It also excluded consideration of turbopropeller airplanes on the basis that they are not appreciably affected by precipitation on the runway surface. Finally, it provided that the first one-quarter inch of precipitation be allowed without penalty on the basis that the anticipated effect of this amount of slush, etc., will be absorbed by the all-engine takeoff-distance margin of 15 percent prescribed in Special Civil Air Regulations Nos. SR–422A and SR–422B.

The view that the probability of an engine failure in combination with slush on the runway is too remote to consider was not substantiated by statistical or other data. On the other hand, the fact that slush has a much larger adverse effect in the one-engine-inoperative case makes a catastrophic accident more probable when this combination does occur without having been taken into account.

The view regarding the relatively small susceptibility of turbopropeller airplanes to the adverse effects of slush, etc., was also unsubstantiated. While it is known that current turbopropeller airplanes operate at lower takeoff speeds than do current tubrojet airplanes, which tends to lessen the retardation effects of slush, etc., on such airplanes, the precise extent to which slush, etc., has an adverse effect upon turbopropeller airplanes is not known. However, if, as is

alleged, these effects are virtually eliminated by the airplane's takeoff-speed characteristics, the proposed accountability corrections and operational penalties would be correspondingly small.

The suggestion to ignore the first one-quarter inch of precipitation is related to the proposal to exclude the one-engine-inoperative case. The magnitude of the performance correction for runway precipitation increases rapidly as the thrust to weight ratio of the airplane decreases. Thus, the correction for one-quarter inch may be within the existing performance margins for the all-engine-takeoff case, but is much more serious in the one-engine-inoperative case, particularly for twin-engine airplanes. The proposed regulation therefore does not specify a depth which may be ignored.

The rules proposed herein would supersede the policy presently in effect and would apply to turbopropeller as well as turbojet airplanes. Under the proposed rule, the maximum takeoff weights for all operators would have to be adjusted to reflect the adverse effects of wet snow, slush, or standing water on the takeoff distance and takeoff run performance, in addition to the factors currently prescribed in the certification and the operating rules; i.e., altitude, temperature, wind, and runway gradient.

The proposal contains a provision designed to prevent the use of special procedures which would adversely affect the airplane's takeoff performance beyond that resulting from the retardation effects of wet snow, slush, or standing water. Therefore, use of the approved takeoff speeds would be required for operations in slush, etc., unless the applicant intends to recertificate the airplane under the applicable airworthiness requirements to differentiate the conditions.

The proposal contemplates that the takeoff performance of each type airplane, and variations thereof, would be corrected so as to produce consistent weight adjustments under comparable operating conditions.

The proposal would also require that measurements of depths and densities be accomplished by an approved method. This will necessitate the submittal of industry recommendation to the FAA for review and approval. Such approval will be granted on the basis of simplicity consistent with the necessity of obtaining uniform and accurate measurements. Alternate methods must be compatible for the same reason.

In recognition that each type airplane, and variations thereof, will be affected to a different degree on a given runway, the proposal avoids prescribing specific locations on the runway for precipitation measurements.

No arbitrary limit on depth of precipitation, other than the range of reliable correction data, is considered necessary for performance purposes. However, the proposal recognizes that maximum depth limits may be necessary for those types of airplanes where spray can cause critical engine ingestion or damage to the airframe.

In consideration of the foregoing, it is proposed to promulgate the following Special Civil Air Regulation:

Contrary provisions of the Civil Air Regulations notwithstanding, no U.S. registered turbine-powered transport category airplane shall be taken off from any runway having precipitation consisting of wet snow, slush, or standing water on its surface, at a takeoff weight which exceeds the takeoff weight established for such airplane under the provisions of this regulation.

1. The takeoff distance and/or takeoff run data for the airplane established for dry runway conditions shall be revised in an approved manner to account for the retardation effects of the precipitation on the runway. The retarding effect shall be determined by the method set forth in NASA Technical Note D–552,[1] or an approved equivalent method.

NOTE: NASA Technical Note D–552 is not applicable to precipitation depths in excess of those tested and reported therein.

2. The precipitation depth and density shall be measured by approved methods. The measurements shall be made at such points on the length and width of the runway as are necessary to obtain the maximum retardation effect of such precipitation on the particular type of airplane and variation thereof. Density measurements of wet snow or slush are not required if a density of 1.65 slugs/ft^3 or higher is assumed.

3. Using the precipitation measurements and the revised takeoff data, the takeoff weight shall be determined in the same manner as that specified in the

[1] Copies of NASA Technical Note D–552 may be obtained without charge from National Aeronautics and Space Administration, Code ETD, Washington 25, D.C.

applicable operating rules for the determination of the takeoff weight for dry runway conditions.

4. Each operator shall establish for each type of airplane operated by him, the maximum precipitation depth limits at which the spraying of precipitation during takeoff will cause critical engine ingestion or airframe damage. No airplane shall be taken off when the depth of precipitation exceeds the maximum depth limit for such precipitation established by the operator.

5. Airplane operating procedures for takeoff with precipitation on the runway which differ from the procedures approved for dry runway conditions shall comply with the applicable airworthiness requirements.

These rules are proposed under the authority of sections 313(a), 601, 604 of the Federal Aviation Act of 1958 (72 Stat. 752, 775, 778; 49 U.S.C. 1354, 1421, 1424).

GEORGE C. PRILL,
Acting Director, Bureau of Flight Standards.

Issued in Washington, D.C., on January 16, 1961.

(Thereupon, at 12:50 p.m., the subcommittee was recessed to reconvene at 1:30 p.m. the same day.)

AFTERNOON SESSION

Senator MONRONEY. The Subcommittee on Aviation will resume its hearings.

We are happy to have back before us our friends of the Air Line Pilots Association who contributed so greatly to aviation safety through their testimony at these hearings and in other ways.

I believe Mr. Sayen, president of the Air Line Pilots, has with him the vice presidents of his organization.

Would you care to introduce them for the record and then you may proceed in your own way, Mr. Sayen.

STATEMENT OF CLARENCE N. SAYEN, PRESIDENT, AIR LINE PILOTS ASSOCIATION; ACCOMPANIED BY JOHN C. CARROLL, J. D. SMITH, HAROLD R. MILLER, EDWARD R. WATSON, HOWARD C. KELLY, AND MEL LOGAN

Mr. SAYEN. Thank you, Mr. Chairman. We are delighted to be back here. We are delighted that the committee has given us this opportunity to review some of the records of the past year and to bring the records up to date. I would like to introduce the people who are here with me today; who are essentially, outside of my first vice president on the right, the regional air safety chairmen for each of the regions in which the association divides its safety efforts.

Just a word or two about these individuals to help the committee to have more background on any comments or questions which we may be making or answering.

On my far left, Captain Logan, who flies for Capital Airlines, and who run his own airport, flying school, and has been a flight instructor and been flying for about 30 years and for American Airlines for the past 19 years. For many years he has been our regional air safety chairman covering the Western States of the United States.

He serves on the Los Angeles Air Space Committee; Sound Abatement Committee; San Diego Committee, and a number of functions in that area as our representative.

Next is Captain Kelly, who has been flying since 1935, an instructor, charter pilot, executive pilot, presently pilot in command for Piedmont Airlines.

Captain Kelly is regional safety chairman for this particular region; for the Washington area.

Next is Captain Watson, captain with Eastern Airlines, an Air Force pilot, flying for the last 20 years. He has been with Eastern for the last 16 years. Like the other man, he has 15,000 or more hours of flying and is qualified on all aircraft, including the Electra aircraft, and is chairman of the ALPA Training Plans Committee, safety chairman of region II, and received the Alpa Air Safety Award in 1960 for contributions in the field of training, some of which are now Federal regulations. He was a member of the pressure groups which helped improve pilot training.

To my immediate left, Captain Smith, regional air safety chairman of region I, New York area and the Northeastern States. He has been flying with Capital Airlines for the past 16 years, and has about 17,000 hours of flying, and attended St. John's University in engineering.

On my right, Captain Miller, American Airlines, flying for the past 23 years, with American for the past 19 years, over 15,000 hours of flying, and is our regional air safety chairman in Fort Worth for the southwestern district of the United States.

On my immediate right, John Carroll, first vice president of the Air Line Pilots Association, University of Missouri graduate, with TWA for the past 19 years, presently flying Convair 880's for TWA, with over 16,000 hours of flying. He has been active in both safety work and other work for the association for many years.

Mr. Chairman, we would like to confine our statement today in the context to what we think the committee described in establishing these hearings, that you didn't want to review the testimony that had been put in here in previous appearances over the last year, but rather to bring up to date some of the previous testimony and to review some of the problems that have come up since that time. So our statement will be short.

It may be a little difficult to follow because we will be referring back to the testimony we gave a year ago January and a year ago June, when you were going into an overall review of air safety problems.

Otherwise it will be brief. But we will be happy to elaborate or answer any questions that the committee may have in the area.

We are here today representing the Air Line Pilots Association, International. We previously appeared before this committee on this subject on January 18 and June 6, 1960. During these appearances, we discussed various aspects of air safety generally and are pleased to have this opportunity to bring our statements up to date and comment further on the current problems with which the committee is concerned in the aviation industry.

No one has a keener interest in safety matters than do the individuals who operate our air transport aircraft. Further, we recognize the fact that the aviation industry is unique in that it is almost completely dependent upon the Federal and municipal governments to provide facilities for the operation of these aircraft. Consequently, we feel that substantial contributions to aviation safety can result from congressional interest and we, of course, feel that we have a definite responsibility to bring such matters to the attention of the Government in order that we may perform our job with the degree of safety expected of us.

I would like to interject at this point, Mr. Chairman, that I was very impressed with the statement of the new Administrator, Mr. Halaby, in the confirmation hearings which have been reported, in which he stated his philosophy of the responsibility for air safety, with which I personally and my organization heartily concur. The statement in response to a question, where he stated that he felt that the primary responsibility for safety rested on the individual actually doing the job, the mechanic, pilot, dispatcher, meteorologist, or whoever, that you had to inculcate a keen sense of responsibility in the individual.

Secondly, it rested upon the owner who might or might not be the operator.

And thirdly, it rested on the Government, the Government having the overall responsibility, of course, to step in. But I think this is a sound philosophy for safety, a sound approach. I am glad to see it.

To give the committee members some idea of the background from which our opinions emanate, we have attached to this statement a brief description of my qualifications and of the Air Line Pilots Association's organization for safety.

During our previous appearance before this committee, we have dealt at length with the air safety record then current and pointed out problems related to air traffic control, training requirements, rulemaking, and enforcement procedures under the present Federal Aviation Act, the inadequacy of navigational aids, and the dire need for improvement of our terminal area facilities and airports. Since those previous appearances, we have continued to give serious study to the problem areas outlined and can find nothing in the record to indicate a change in opinions previously outlined. Consequently rather than repeat ourselves, we urge that this committee again review our position as given on January 18 and June 6, 1960. We are attaching a copy of our statement of June 6, 1960, to which we will refer later in this discussion.

Basically our problem is to move aircraft safely and efficiently from the ramp of a departure airport to the ramp of the destination airport. Most of the facilities necessary to such movement are the responsibility of the Federal Government, either directly or by regulation. We have previously stressed air traffic control and navigational problems to you. There is not much logic, however, in building an efficient air traffic system between two airports and leaving a bottleneck at both ends. Consequently, along with the urgent airways problem, we will emphasize today the great need for assistance in providing adequate airport and terminal area facilities.

We will next turn our comments to the safety record during 1960, in accordance with the committee's request.

The committee has available to it from other sources the statistical record on air safety during 1960. We will summarize our views of it very briefly. As in 1959, the record for 1960 is still not good. For assistance to the committee, we are attaching as appendixes A and B a list of condensed information with respect to our findings and accident record.

The association's records show 17 fatal accidents occurred during the calendar year 1960 in which 429 passengers, 57 crew members, and 13 others were killed. These fatal accidents may be categorized as

follows: Four during takeoff and climbout (bird ingestion, mechanical, weather); seven en route (cabin explosion, structural failure, weather, mechanical, enroute terrain); six during approach to airport (midair collision, mechanical, undetermined).

We have included in our table a brief summary of our opinion of the problems involved in each accident. These opinions do not indicate in all cases the direct or most probable cause of the accident, but do cite factors which we believe established the accident potential and, where relevant, indicate safety measures which we believe could have provided the additional margin of safety that might have prevented the accident or reduced its severity.

In appendix A we list 28 accidents which occurred in the terminal area—we consider all accidents occurring while under departure or approach control to be in the terminal area—and in appendix B seven which occurred while en route. Since we are primarily concerned at this point with terminal area problems, where 80 percent of our accidents occur, we will first direct our remarks to this phase of the air safety problem.

In analyzing these terminal area accidents, it appears that they fall generally into certain categories, based on the common cause which applies to each type, as follows:

During 1959 we had no accidents involving air carrier aircraft from collisions.

During 1960, five midair collisions occurred during approach to airfields, illustrating the hazard present in this phase of aircraft operations.

They are listed in appendix A, dated April 20, 1960, October 1 and 4, 1960, November 17, 1960, and December 16, 1960. One, the DC–8 Constellation collision over New York, occurred under instrument conditions. The other four occurred between air carriers and light aircraft in landing patterns under conditions of good visibility. Three resulted in the loss of all occupants of the light aircraft and could have resulted in fatalities to those aboard the airliner. Twenty percent of terminal area accidents fall in this category.

The increasing performance of present-day aircraft combined with the increased amount of traffic and saturation of airspace demand improved means of positive traffic separation under all conditions, especially in terminal areas. We must find means to supplement the criteria of "see and be seen" during visual flight and bring the state of traffic control during visual and instrument flight up to the state of aircraft development.

Overrun and underrun areas, runway length: As in past years, another major factor in the accident record during 1960 was the lack of suitable overrun and underrun areas. This condition resulted in four accidents involving major damage to aircraft, and in one case fatalities were averted by a narrow margin. In other years, we have not been so fortunate in limiting accidents in this category to aircraft and ground damage. Appendix A lists four accidents in this category dated February 4, 1960, February 6, 1960, February 25, 1960, and September 14, 1960. Fifteen percent of the terminal area accidents were in this category.

By the way, there was another one Sunday night in Houston as you probably heard. The touchdown was 17 feet short of the runway and

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resulted in large damage to the aircraft. The wheels came off, some pods came off, and there was major damage to the aircraft. Fortunately the people got off. It was another case of touching down short of the runway and resulted in a serious accident.

The association has advocated overrun and underrun areas one-tenth the length of the runway as a safety factor to prevent accidents from such occurrences. The operational history of all aircraft has, for years, demonstrated that overrun-underrun areas are vitally needed to cope with weather conditions, mechanical failure of the aircraft during takeoff or landing, and other factors not included in computations for runway lengths for normal operation of aircraft.

Runway width: The accident survey illustrates that runway widths are marginal under adverse operating conditions at our airports. This has been reflected in the 1960 safety record by two accidents listed in appendix A and dated March 24, 1960, and June 14, 1960.

Compacting one-third of the width on either side of the runway offers the necessary safety precaution that is needed. In the June 14, 1960, accident a DC–8, due to unsymmetrical reverse thrust, veered off the runway and received nosewheel damage. The instrument runway was closed for 17 hours during instrument weather conditions. Hundreds of passengers were inconvenienced, the air carriers lost money, and a $6 million airplane was damaged and laid up for repairs for several weeks. This costly and hazardous minor accident was caused by soft soil and mud adjacent to the runway.

Senator MONRONEY. You say compacting one-third of the width on either side. This would merely be a compact surface and a light surfacing to maintain a plane which accidentally veered off. It would not be usable under normal conditions; is that correct?

Mr. SAYEN. We are talking, Mr. Chairman, basically about what we learned on the highways years and years ago, that people do run off the road once in a while and when they do it shouldn't cause a major accident; that for years now we have compacted the sides of highways to prevent accidents. We have learned this on highways years ago, but we have not on our airports yet. This is a simple thing we are talking about.

Senator MONRONEY. In other words it is a hard shoulder versus a soft shoulder?

Mr. SAYEN. Yes, sir.

On February 7, 1961, a similar incident occurred at Dallas, Tex. This time, the airport was closed for 52 hours to jet operations since only one runway is suitable for use by large jet airplanes. These accidents will continue to occur unless the sides of our runways are compacted similar to the shoulders of our highways. We have recognized this danger in our highway system and should recognize it on our airports.

Snow removal: Runway surface condition can, as in highway surfaces, be very hazardous if not properly treated. Snow and slush have accounted for a substantial percentage of our major and minor damage accidents. Fortunately, there have not been a large number of fatalities connected with these accidents; however, they are potentially hazardous. Five accidents in 1960, of which we have record,

involved snow removal and are listed in appendix A and are dated: February 20, 1960, February 25, 1960, February 28, 1960, March 8, 1960, and March 24, 1960.

I think an examination of appendix A will indicate a very serious problem here with a rather obvious solution.

Bird-collision problem: There have been numerous incidents of birds colliding with aircraft over the years. The seriousness of this condition has been emphasized by a fatal accident in 1960 which may have been caused by birds. The accidents we have recorded in appendix A involving bird incidents are dated as follows: October 4, 1960, and November 18, 1960.

Evidence has shown that birds ingested into an engine may cause it to fail. Some means must be found to keep birds away from the takeoff area at airports, but a more foolproof solution is research and development to increase the tolerances of engines and airframes to bird strikes and ingestion.

In addition to the bird strikes involving engine damage, there have been incidents involving birds crashing through windshields and, in some cases, incapacitating the pilots. On October 17, 1960, a North Central Airline DC–3 hit a flock of geese near Muskegon, Mich., with resultant severe damage to the nose of the aircraft. Other similar bird strike incidents have resulted in serious damage to the eyes and faces of the crew members to the point of incapacitation. It is possible that in the future an aircraft will be lost if stronger windshield protection is not provided. Presently, DC–3's and C–46's are flying without birdproof windshields. Available birdproof windshield glass would minimize this hazard, but some air carriers have not chosen to provide this protection for the passengers and crew.

In discussing this matter last night among our air safety people who had gathered here, it was pointed out that in some new runway construction at one of our airports in the West there is a very fine duck pond right off the end of the runway. It is about a 75-foot drop into the pond right off the end of the runway, and also make a beautiful nesting place for ducks and geese. We are trying to get something done about it.

Senator MONRONEY. While you are on the windshield matter, do your jets have birdproof windshields?

Mr. SAYEN. Yes. They are supposed to have it.

Senator MONRONEY. This is especially necessary in a highly pressurized place because a loss of pressurization could be almost catastrophic at higher altitudes.

Mr. SAYEN. Yes. Of course the major bird accidents occur on takeoff and landing. If you ever see the tremendous damage that a large or a small bird can do to an airframe, let alone the windshield, the tremendous damage in the DC–3 of North Central Airlines, there was a hole put in the front of the airplane below the windshield where it leads into all the instrumentation from the aircraft, a hole that size [indicating] right through the airplane, where blood and guts came through the front of the aircraft itself.

Senator MONRONEY. It could badly damage the prop, too, a bird as large as a duck.

Mr. SAYEN. Yes, sir.

Lack of landing aids: We continue to have accidents due to lack of proper approach and landing facilities. Landings short of the runway would have probably been prevented by more adequate approach lighting. At least in one case this year an approach to the runway would have been closer to the runway threshold and an accident prevented if an ILS glide path had been available. The accidents in Appendix A dated February 22, 1960, and May 9, 1960 show the need for these facilities to improve safety.

In our opinion, no single category of preventable accidents has caused so much loss of life, injury, delay, and substandard air service, destroyed and damaged aircraft, and adversely affected the growth of the aviation industry than the continued lack of known and obtainable landing aids and airport safety standards.

Senator MONRONEY. I see you have that underscored. This refers to the hardware that has been obtainable for years, and that can be used and put on at perhaps lesser cost than almost any other safety factor, and year after year we go on with only a minimum of approach to filling these needs; is that correct?

Mr. SAYEN. That is entirely correct. We covered this in detail in the statements last year, particularly the January statement.

Senator MONRONEY. And the year before that and the year before that.

Mr. SAYEN. Yes, sir, and we will summarize in this statement the record insofar as appropriations and expenditures is concerned in this area. We think the record is very tragic. This is not an area that requires any particular research. It merely requires the cooperative effort between the Federal Government and the local airport people.

Senator MONRONEY. A simple two-syllable word—"action."

Mr. SAYEN. Right.

We bring to your attention the fact that at 569 airports into which airline service has been certificated for the fiscal year 1961, only 249 instrument landing systems and 174 approach light systems have been authorized. Future planning indicates that by 1963 we can expect only 265 instrument landing systems. This represents less than one-half of our domestic airports served by air carriers. Most airports having ILS and approach lights will only have them in one direction on one runway. We have documented these facilities in a good deal of detail in our statements before, and we will document them some more in this statement, particularly in a study which we are now making of airports throughout the United States.

Senator MONRONEY. You mention the 569 airports to which airline service has been certificated. Well over half of those, I presume, are serving only feeder service and flying under CFR conditions only.

Mr. SAYEN. I don't think this is true today. Feeder lines are getting to be pretty big airlines today and are moving into larger, heavier, faster aircraft with high performance requirements. Of course, they are trying to give air service with some reliability. This can't be done unless the airport is kept up with the development of the traffic.

Senator MONRONEY. As to the matter of priorities I would certainly like to see ILS on all of them. But on a first things first basis I think what you mentioned in the latter part of your statement, that most airports which have ILS and approach lights will have them only in one direction on one runway, this is only a half loaf for airports such

as Washington National, which has them on only one runway. I think Idlewild has them on only two runways, and nothing on the other end. Unfortunately, the wind has a habit of blowing in the opposite direction and negates entirely the aids when it is out of 180° direction away from the landing aids that are placed on there.

It seems to me to be completely unrealistic to say we have them in one direction. It will not do you any good to have the approach lights on the south end of Washington National when the wind is out of the south, because you are going to be using the dark side of your instrument runway for your approach then.

Mr. SAYEN. We pointed out in one of our previous statements that London airport is an example, which has about one-fourth of the traffic of our busy airports in New York, Chicago, and Washington, and has four ILS systems, in four directions, of course, and four complete approach lighting systems—the Kelvin system—as contrasted to our facilities here.

We will cover this in more detail a little bit later in the statement.

(7) Unrealistic training: Each year accidents occur during pilot training for emergency procedures. This is particularly true when new models of aircraft are being introduced into service. The association has been very active in efforts to assure adequate pilot training programs and substantial improvements have been made. This training should be reevaluated since it is strongly indicated that the benefits of training for these emergency conditions can be obtained when conducted at higher, safe altitudes or in a flight simulator.

In 1960, we had several "close calls" and one accident which occurred on May 23, 1960, attributable, we think, to this practice. Of course recently there has been another one.

(8) Mechanical and structural failure: There were four accidents that involved mechanical failures of various parts of the aircraft last year.

Accidents in this category are listed in appendix A on the following dates: July 22, 1960, October 7, 1960, October 15, 1960, and October 25, 1960.

In addition to fail-safe design, accidents of this type are minimized by maintenance of a well-organized inspection department. Most carriers do maintain excellent inspeciton and maintenance departments; however, a review of the mechanical failures that are all very potentially hazardous that occur in flight or are detected on the ground illustrate that this is an area which should receive attention. We believe the inspection function should be entirely separate from the maintenance department and urge that the Federal Aviation Agency establish this procedure.

Airport and terminal requirements: We think that the committee will recognize the fact that while those accidents which result in fatalities are more spectacular, we must consider the nonfatal accidents in order to eliminate the possibility of future fatalities and destruction of property. Consequently, the foregoing summary lists nonfatal accidents as an indication of the corrective action which must be taken. As application of this principle to the airport problem, let us consider the phase of accidents related only to the runway lengths.

As in past years, inadequate runway lengths and unsuitable overrun and underrun areas resulted in four accidents involving major dam-

age to aircraft with an extremely hazardous exposure to the occupants of the aircraft. These accidents were reviewed in the foregoing 1960 accident survey. A solution to this problem resides in providing adequate runway lengths together with compacted surfaces on each end of the runway to compensate for the adverse runway conditions frequently encountered.

The problem is illustrated by the recent jet aircraft accident at Idlewild on January 19. This accident to the jet aircraft of a foreign airline resulted in the loss of four lives and the complete destruction of an expensive aircraft, together with attendant criticism and publicity adverse to the industry. The aircraft came to rest only 630 feet beyond the end of the runway. An adequate overrun area would have allowed this accident to remain a harmless incident.

In a like manner, there were two accidents of serious potential as a result of insufficient compacted surface at the side of our runways. The solution to this type problem can be stated quite simply—we need more money in order to provide adequate landing surfaces. While we are not unmindful of the fact that Federal participation in this area is on a matching funds basis, we do view the Federal effort to this date as completely inadequate to catch up or keep pace with the rapid growth of our commercial aviation.

Senator MONRONEY. Would you assist the committee on those two accidents? I am not familiar from our previous analysis of accidents as to just what they are.

Mr. SAYEN. The March 24 accident——

Senator MONRONEY. These are all listed in appendix A chronologically?

Mr. SAYEN. Yes. On page 2 of appendix A, the terminal area accidents, fatal and nonfatal during 1960:

> On March 24, American Airlines DC-6, Syracuse, N.Y. During landing rollout the aircraft started drifting to the left and would not respond to correct action and departed runway. Runway covered with snow and there was an existing strong crosswind. Improved weather and runway condition reporting, runway marking and compact surfaces adjacent to runway would have prevented this accident. Substantial damage.

The other one is on June 14, page 3, United, Chicago, DC–8:

> After touchdown and upon the application of reverse thrust, the airplane veered to the left. Aircraft came to rest with the nose collapsed and main gear in the mud. Compact surface adjacent to runway could have prevented this accident. Substantial damage.

Senator MONRONEY. This also would have helped, would it not, by keeping the runway clean to avoid pulling through the suction of a jet motor foreign objects which might damage the turbine blades.

Mr. SAYEN. That is right. Fortunately this hasn't turned out to be quite as serious a problem as the industry anticipated, but still a major problem.

Senator MONRONEY. The three accidents you mentioned in the preceding paragraph, could you identify those?

Mr. SAYEN. The overrun accidents?

Senator MONRONEY. Overrun and underrun.

Mr. SAYEN. February 4, February 6, February 25, September 14, appendix A.

Senator MONRONEY. February 4 was the first one, in St. Louis?

Mr. SAYEN. Yes. TWA, a 707. The next is February 6, Delta, C–46, Chicago.

Senator MONRONEY. For a summary, let's get the summary so we will have it in the record at this place.

February 4, TWA, 707.

Mr. SAYEN (reading):

Aircraft ran off end of runway due to surface condition of runway. Insufficient runway length and overrun for adequate safety margin in wet conditions. Substantial damage.

February 25, Delta, Convair 440, Chicago:

Aircraft landed hard after striking 18–24-inch ride of ice prior to touchdown. Inadequate snow removal. Substantial damage.

September 14, page 4, American Airlines Electra, LaGuardia, New York:

Aircraft struck a 12–13 foot dike, 161 feet short of the runway threshold and came to rest inverted with the nose pointed in the opposite direction. Improved approach clearance and runway length would have prevented this accident. Aircraft destroyed.

Senator MONRONEY. This is the one in which the crew managed to evacuate the passengers with no loss of life, but the pilots had to be liberated through emergency doors, as I understand it. They were locked in.

Mr. SAYEN. That is right.

Senator MONRONEY. I think the testimony at that time was an 8-foot 2-inch dike. Let's get this dike straight for once. That is measured from surface above the water? And the 8-foot, 2-inch is measured from the surface of the runway, is that correct?

Mr. SAYEN. Captain Smith?

Mr. SMITH. Mr. Chairman, I haven't seen the official source for this information. However, the difference would be in relation to the glide path obstruction to the end of the runway, which would be measured above the end of the runway itself, and the other one could possibly be the top of the dike as measured from that area to where the incline starts.

Senator MONRONEY. The difference of 4 feet is of interest because obviously the runway would have to be above the waterline, or should be; I don't know whether it always is or not?

Mr. SAYEN. It is not; no, sir. That is the purpose of the dike being there. In fact, the airport has been constantly sinking ever since its inception.

Senator MONRONEY. We have had the testimony on this. I have a very long telegram to the effect that we dealt unfairly with LaGuardia Airport in our hearings earlier last week, that this is not anything unusual, that this field is approved under FAA regulations for aircraft of this type, leaving the impression that everybody is just happy as a lark about it. It is not the impression I received from discussing it with pilots, and I don't think they consider it among the best airports of the world at least.

Mr. SMITH. Might I say that I happened to stop in last week while you were discussing that subject and I agree wholeheartedly with your statement.

Senator MONRONEY. Thank you.

Mr. SMITH. I am sure that the majority of airline pilots operating into that territory would share my feeling.

Senator MONRONEY. While we are on this, whether it is an 8-foot dike or a 13-foot dike, this is not a very good obstruction to build into any runway of perhaps only 4,900 feet on which you have to put down a very heavy aircraft, is it?

Mr. SMITH. If you leave the dike out there, and keep operating over it, sooner or later somebody will stub his toe. This has been averaging out about every year and a half or so since we started operations there.

Senator MONRONEY. The cost of the aircraft, not to mention the exposure of millions of passengers coming in, could lead to some corrective action, I would think, to move that dike back a ways. It needs be back only the width, or a little more than the width of the runway, to give you 20, 30, or 100 feet more clearance, and still preserve the integrity of the dike.

Mr. SMITH. Mr. Chairman, we have been very interested in the configuration of LaGuardia for a number of years. Three or four years ago we made specific recommendations to extend that runway to the southeast to take care of not only that problem but also provide the ability to improve the capacity of the airport. We are greatly disappointed that $56 million is currently going into LaGuardia Airport and there is not an inch of additional runway length to go with it.

Senator MONRONEY. It would not cost great sums of money, would it, to extend at least the touchdown position on that by a little additional fill and a little movement of the dike farther away?

Mr. SMITH. There are some engineering problems that are certainly not insurmountable. The amount of investment, I am sure, would more than pay off for the expenditure. We need this additional runway length if we are ever going to gain the advantage of putting up new buildings on the airport.

Senator MONRONEY. This is certified for landings of Constellations, DC–6's, DC–7's, and Electras?

Mr. SMITH. Yes, sir.

Senator MONRONEY. All of which are considered rather high-performance aircraft. And a 5,000-foot runway is certainly not more than adequate at least to take care of planes of this weight and size?

Mr. SMITH. Not only that, Mr. Chairman, referring back to the earlier position taken by the airport operator as to the regulations or procedures, these same regulations or procedures also authorize a downwind component for landing in a heavy Constellation-type aircraft. While the regulation may permit this, we do not consider this consistent with safety. It is merely one of the minimum standards that we don't think really does the job it is supposed to do.

Senator MONRONEY. Have you ever talked with the FAA about increasing the standards for that particular area?

Mr. SMITH. Yes, sir. We have discussed the matter of LaGuardia Airport on numerous occasions over the years. I recall Senator Schoeppel asked this question last week. We have discussed it from an air traffic control standpoint. We have discussed it on occasions with FAA and the port authority during the recent construction

when one of the runways was closed down. In all fairness to the airport operator, our discussions at that time were very warmly received.

The port authority implemented all the corrective action that we requested, except the problem of making available full runway length, which at the time of this particular accident was shortened due to their construction program.

Senator MONRONEY. This also has been affected and is to be corrected, by the addition of approach lighting of at least the stub type on the end of runway 22, and also to put in this new British system on the end of the other runway?

Mr. SMITH. There is a stub lighting program being implemented, I believe, within the next 30 days. As far as the visual glide slope system for runway 31 is concerned, we hear about it. When it will actually be implemented I don't know. It has taken almost 10 years to get the stub approach lights to runway 22. I just hope we don't have to wait that long for the visual glide slope indicator. Possibly FAA or the airport operator has been unable to determine whose responsibility this is. We certainly need it at the earliest possible date.

Senator MONRONEY. As I understand it, the glide slope is a light which gives you visual green or red if you are on the glide slope coming in.

While you now have centerline approach lighting or a stub thereof, on three sides, you still do not have centerline approach lighting on the east-west runway.

Mr. SMITH. This would be correct, Senator. Because of that the weather minimums for landing on runway 13–31 would of necessity be higher.

I would like to point out, if I may, that at ICAO at a recent visual aids panel meeting, on an international worldwide level, this visual glide path information was given the highest possible priority for the earliest possible implementation.

This urgent requirement was agreed to wholeheartedly by all the countries participating in this discussion. There is no doubt but what we need this equipment very badly.

Senator MONRONEY. Even though you get the glide slope which goes on the end of the runway, as I understand it, it still would not be a completely adequate solution for all approaches to be covered by this. You also need your high intensity approach lighting to even make these more safe, do you not?

Mr. SMITH. The visual glide path indicator that we are referring to is certainly not a substitute in any part whatsoever, for the configuration approach light system, sequence flasher, together with an instrument landing system, runway marking, runway lighting. This is merely an aid to assist us in the higher performance aircraft to maintain the proper angle of approach into a runway in fairly good weather.

Senator MONRONEY. If you merely put the glide slope on the east-west runway—what number is that?

Mr. SMITH. It is northwest-southeast runway, runway 13–31.

Senator MONRONEY. 31 would be the east-west?

Mr. SMITH. Yes, sir. The ends of runway 31 would be that area that this Electra had the premature touchdown.

Senator MONRONEY. My understanding is that they will put a visual glide slope indicator there and they are not contemplating going out with the center line high intensity approach lights?

Mr. SMITH. To my knowledge there are no plans to put the approach lights out there.

Senator MONRONEY. Other than the fact that it is over water, is there any impingement upon doing that; physical impingement? Is there a blockade of another navigational channel or something?

Mr. SMITH. No, sir. It is my understanding that now that the lagoon on the other side of the airport has been filled in with sand that there is no channel problem there similar to what we have off the southwest runway.

Senator MONRONEY. So far as you know, then, it is just a matter of funds on the part of the runway, the Commission, and/or the FAA to do this?

Mr. SMITH. Yes, sir.

Senator MONRONEY. Do you think it will increase the safety factor on runway 31?

Mr. SMITH. Any time we can obtain a visual flight path indicator approach we are improving the safety factor.

Mr. SAYEN. Mr. Chairman, I would like to point out that not only from our studies here in the United States and studies of other groups, but our studies through the International Federation of Airline Pilots Associations, now 36 countries I believe, covering most of the world aviation, we consider this entire subject of underrun overrun accidents as one of the most serious problems facing aviation today. It is one thing to say that according to some calculation you are supposed to get the airplane on this runway and keep it there, and that you are supposed to land in the same place all the time, and that theoretically this runway or this certain set of conditions is safe.

Nevertheless, the statistics keep showing us, year after year after year, that the underrun and overrun accident is one of our most serious problems worldwide. A touchdown a foot or 2 feet short of the runway results in major damage or maybe a major accident. An overrun of the airport by a couple of hundred feet, because of ice on the runway or water on the runway, or brake failure or some other problem, or gusty conditions maybe, results in major accidents. This is one of the most serious areas that we have. We have been concerned about it for a good many years. It has particularly become more serious in recent years with high wing loadings, high-performance aircraft, and many problems that you run into. It is a serious problem on jets because of the particular problems connected with sink rates and so forth on the jet aircraft.

The solution was recommended many years ago by the Doolittle Commission, but there has been very, very little done about it.

Senator MONRONEY. Since we keep getting these answers back that these runways of 5,000 feet or less that take a very heavy Electra or DC–7—that is certificated for 5,000-foot runway as well, is it not?

Mr. SAYEN. Yes, sir.

Senator MONRONEY (continuing). Or DC–6 or Constellation. Can any of you give me the margin of safety that you can have under a crosswind or slightly crosswind condition in gusts up to 40 miles an hour that would indicate that this 5,000-foot runway would not re-

quire almost precision piloting to be able to touch down and have your satisfactory rollout on that 5,000-foot runway? That is a very involved question.

Mr. SAYEN. I am not sure whether anyone here can arrive at a precise mathematical answer to this problem. You would have to take the precise conditions involved. The point is that our aircraft are certificated to take off and land on dry runways, usual level dry runways with good surface, by highly experienced test pilots, and the derivation of the calculations for operation—as you know, the airport is not certificated, the operation of the airplane is certificated into the airport—and that the operation when you are involved with gusts and crosswinds and ice and snow and slush, which you have in combination many times, there is no allowance made for this in the calculations, very little allowance made in the calculations, or for normal average pilot technique. So the situation can become very marginal with a combination of circumstances. A little underrun on the front end and a little overrun on the back end would prevent a lot of these accidents.

What we try to point out is that if you look over the statistics over many years time all over the world you will find accident after accident happening where the airplane touched down 100 feet short, 50 feet short, 10 feet short, 6 inches short where the runway projects above the ground, sometimes, and knocks the gear off.

I think the accident which happened Sunday night at Houston was 17 feet short of the runway at touchdown, for some reason, with a high sink rate, and this took the gear off the airplane. It was enough of a rise to take the right main gear off the plane.

Senator MONRONEY. How long is the runway at Houston?

Mr. MILLER. 7,600 feet.

Senator MONRONEY. What plane is involved?

Mr. MILLER. Braniff's Boeing 720.

Senator MONRONEY. It would require about that minimum amount of runway?

Mr. MILLER. Yes, sir.

Senator MONRONEY. In other words, if your runway is longer, if your overrun and underrun is longer, the pilot has a great deal more latitude as to where he places the wheels down, and therefore has an opportunity under adverse conditions to make the landing much more safely than if he has to hit on just the very cutoff line as to the runway for his touchdown?

Mr. MILLER. Sir, this is true. This runway at Houston, as I said, was 7,600 feet. However, at the operating weight they operate, Dallas-Houston, it is way down around 170,000 pounds, and they consider this an adequate length. But you are correct, this is getting marginal for turbine aircraft.

Senator MONRONEY. In other words, the more runway length that you have, the safer is the margin there. You don't have to land on the line; you can land 100 feet on the safe side of the line if you have enough runway out in front of you for an overrun, or if you have an underrun that is surfaced to at least some degree so it won't wash out the landing gear of the aircraft. Is that correct?

Mr. CARROLL. Yes; that is correct. There are a couple of points that I would like to make in regard to this subject that you have just

brought up. There are quite a few experienced pilots in the room, and a lot of other people who are very knowledgeable in aviation, and I am sure that there are others who must wonder why do these pilots cut it so close, why do they always try to get it in on the short end of the runway?

This, of course, is involved in the question that you just asked: Are these runways long enough?

I would like to draw an analogy here that I think everybody will be able to understand. There is an economic rule that somebody has propounded, that spending rises to meet income. This is what happens to us in these airplanes. As they lengthen the runway they keep crowding an airplane into it which just barely gives us the minimum which is necessary.

As far as the La Guardia Airport is concerned, we have been operating with one runway there for a considerable period of time during construction.

We have had some very, very unpleasant experiences. Many times you will be operating with a supposed 90° crosswind. If it is fairly strong or gusty it can swing around. One of the closest calls anybody has had has been a situation where it swung around to a tailwind as the airplane made its takeoff roll. I haven't gotten over it yet, to be honest with you.

Senator ENGLE. Were you flying it?

Mr. CARROLL. Yes, sir. The closest I ever had.

Senator MONRONEY. To amplify this and get it down to what can be done about it, the FAA has it within its power, as it approves funds for construction and for taxiways and for ramp space and various other things, including even terminal buildings, it has it in its power to require as a condition precedent to these allocations that hard shoulders can be provided on a matching basis, or else it can withhold the whole grant, can it not, or that overruns and underruns can and must be provided as a contingency to allowing the grant, or that the runway itself must be lengthened before any further funds go in; is that correct?

Mr. SAYEN. Yes; that is correct, sir.

I think we come right back to the whole philosophy of the problem, which gets back to the Doolittle Commission's recommendations in 1952, where all of these problems, about which we have been complaining so loudly for years, going into conferences all over the world with various groups, making calculations and recommendations as to what needs to be done in these areas, it gets right back to some of these recommendations which simply are not being implemented at many of our airports throughout the country. Underruns, overruns, zoning, and all of the other ones which we will get to a little further along here, and which we have brought to the attention of this committee a year ago January.

Senator MONRONEY. But you still go back to the very basis—and the fundamental cause—in which you show, I believe, a very high percentage of the accidents this year as in every previous year—being, I think, 80 percent, or in that neighborhood—resulting from generally inadequate landing areas; is that correct?

Mr. SAYEN. Overrun and underrun we gave as 15 percent of the terminal accidents for 1960.

Senator MONRONEY. I am talking about the whole percentage. This is only one. Runway width is involved. You give that as a pretty high percentage. And snow removal and bird troubles.

I am trying to get the general amount to focus on the importance of this very simple and unelectronic approach to air safety.

Mr. SAYEN. I think if you take the whole subject of terminal area accidents, the accidents on or in the vicinity of the airports, this is a major area of accidents by far. This is an area to attack. This is a major area. Whether theoretically or not, these accidents should be prevented. They are taking place in the terminal area, every year.

Senator MONRONEY. You say on page 3:

> In appendix A we list 28 accidents which occurred in the terminal area, and, in appendix B, 7 which occurred while en route. Since we are primarily concerned at this point with the terminal area problems, where 80 percent of our accidents occur, we will first direct our remarks at this phase of the air safety problem.

This is still the primary area of accidents and one where you have so ably in time past focussed it but where we seem to have so few improvements.

You may proceed.

Mr. SAYEN. The foregoing illustrates the terminal facilities problem which we have indicated in our view is one of the most critical problems in aviation today. Coupled with this are, of course, the means of navigation, communication, traffic separation, visual aids, turnoff areas, taxiways, and other facilities by which the pilot takes his aircraft from the en route system, makes an approach to the airport, lands, and guides his aircraft safely to the ramp.

We discussed these matters in more detail during our appearance on January 18, 1960, and suggest that the committee review our testimony at that time rather than to burden you with repetition now.

I might say, in bringing up to date some of our testimony, in our testimony at that time we discussed at quite some length the situation concerning crash firefighting facilities at airports. We pointed out at that time that insofar as the Federal Government was concerned, that there did not even exist a piece of paper to which an airport operator could secure to see what kind of firefighting equipment he should buy for his airport, and that there were no standards, and that a pilot flying en route, who knew he had to make a crash landing with the possibility of fire, would, one, not have any information as to the type of firefighting equipment required for his particular airplane, and, two, not have any information where that kind of equipment might be located, even if he knew what kind of equipment he needed.

In other words, there simply had been no criteria established, as far as the Federal Government is concerned, for this subject. There had been some work done by the National Fire Protection Association and by our association and others on the subject. At most of our airports we have completely inadequate firefighting equipment.

Since that time there has been some progress made. I understand FAA has now produced a paper which makes recommendations at least to airport operators as to what should be done about this problem. But this still remains a very, very serious problem with the number of passengers being carried in our transport aircraft today.

The seriousness from an aborted takeoff or landing, where you might wipe out the gear, or any landing where there is a potential of fire, where you have from 115 up to 150 passengers on board, it is imperative that you have adequate firefighting equipment on the ground, and we just do not have that at the present time.

Senator MONRONEY. Is there any national firefighting school where airport firemen could receive instructions of the various ways of opening up the various types of aircraft, or fighting particular types of fires resulting from aircraft crashes?

Mr. SAYEN. Captain Smith tells me that the military have some established training procedures. I don't know of any civilian school that has.

Senator MONRONEY. Do civilian firefighters on airports attend this military school?

Mr. SMITH. Yes, sir. I had an opportunity to talk with the people from Cleveland about this arrangement a couple of months ago. They have a system whereby they send selected personnel from their facilities to the military installation where they get into some of this work. As to whether the work deals with specific types of equipment that we operate in the airport, I am not too familiar with, except that some of the airports do have procedures whereby they familiarize their staff people on emergency exits and firefighting procedures and things of that nature.

There are also some airports where, through a cooperative effort of airline personnel who normally work within the airport itself ,whereby they have an exchange of information on various types of aircraft, and these people are available for rescue type work.

Mr. SAYEN. In our view, the solution of these problems has been available for some time and consists chiefly of application of present criteria and hardware as rapidly as possible. We have previously called to your attention the fact that this problem was adequately reviewed as far back as 1952 by a commission created by the President of the United States, known as the President's Airport Commission, and the report made at that time contained recommendations for improvement of existing airports and criteria for future construction of airports which would have ameliorated our present difficulties had the Congress and responsible Federal and municipal agencies taken action on them.

While we have previously discussed some of the Commission's suggestions with this committee, their recommendations are as applicable today as they were in 1952 and, in our opinion, warrant review by the committee. Our specific recommendations are contained in pages 11 through 13 of the testimony we delivered on January 18, 1960, before this committee.

We strongly urge that this Congress take immediate action to see that these important recommendations are followed:

(1) Support required airport development: New airports will be needed and present airports must be improved today in a rapidly growing industry in which 75 percent of the total air transportation of the world is moved by U.S. air carriers. State, county, and municipal governments should be prepared to assume their proper share of this expense.

(2) Expand Federal-aid airport program: Authorization of matching funds for Federal aid to airports should be implemented by adequate appropriations. Highest priority in the application of Federal aid should be given to runways and their protective extensions incorporated into the airport, to bring major municipal airports up to standards recommended in this report.

(3) Integrate municipal and airport planning: Airports should be made a part of community master plans completely integrated with transportation requirements for passenger, express, freight, and postal services. Particular attention should be paid to limited access highways and other transportation facilities to reduce time to the airport from sources of air transport business.

(4) Incorporate cleared runway extension areas into airports: The dominant runways of new airport projects should be protected by cleared extensions at each end at least one-half mile in length and 1,000 feet wide. This area should be completely free from housing or any other form of obstruction. Such extensions should be considered an integral part of the airport.

(5) Establish effective zoning laws, one of the most imperative problems we have in aviation today: A fan-shaped zone, beyond the half-mile cleared extension described in recommendation 4, at least 2 miles long and 6,000 feet wide at its outer limits should be established at new airports by zoning law, air easement, or land purchase at each end of dominant runways. That is one of our most urgent problems in connection with noise today. We are threatened with all sorts of restrictions on the operation of aircraft, and a substantial lessening of the ability to utilize our national airport system.

We build new airports and within a year or two after they are built they are completely surrounded by housing and duck ponds.

In this area, the height of buildings and also the use of the land should be controlled to eliminate the erection of places of public assembly, churches, hospitals, schools, etc., and to restrict residences to the more distant locations within the zone.

(6) Improve existing airports: Existing airports must continue to serve their communities. However, cities should go as far as is practical toward developing the cleared areas and zoned runway approaches recommended for new airports. No further building should be permitted on runway extensions and, wherever possible, objectionable structures should be removed. Operating procedures should be modified in line with Commission recommendations for minimizing hazard and nuisance to persons living in the vicinity of such airports.

(7) Clarify laws and regulations governing use of airspace: One of the big reasons we haven't been able to do something about zoning in airports is the conflicting laws governing the use of airspace. Authority of the Federal, State, or municipal governments with respect to the regulation of the use of airspace should be clarified to avoid conflicting regulation and laws.

(8) Extend Civil Aeronautics Act to certificate airports: The Civil Aeronautics Act should be amended to require certification of airports necessary for interstate commerce and to specify the terms and conditions under which airports so certified shall be operated. Certificates should be revoked if minimum standards for safety are not

maintained. Closing or abandonment of an airport should be ordered or allowed only if clearly in the public interest.

(9) Maintain positive air traffic control: Certain air traffic control zones in areas of high air traffic density should be made the subject of special regulations to insure that all aircraft within the zone are under positive air traffic control at all times regardless of weather.

(10) Accelerate installation of aids to air navigation: Research and development programs and installation projects designed to improve aids to navigation and traffic control in the vicinity of airports, especially in congested areas, should be accelerated. Installation and adequate manning of radar traffic control systems should be given high priority.

(11) Meet standard requirements for runway length: For each category of airport a standard runway length has been established consistent with its future planned use. Airports should bring their runways up to the standard. For intercontinental or transcontinental airports, the length of the dominant runways should be 8,400 feet with the possibility of expansion to 10,000 feet if later required and with clear approaches as per recommendations 4 and 5. Longer runways are required today at many airports.

(12) Accelerate ground noise reduction programs: Engine runup schedules and runup locations should be adjusted to minimize noise near airports. Adequate acoustical treatment in runup areas and at test stands should be provided.

(13) Arrange flight patterns to reduce ground noise: Some of these things are being done. Airways and flight patterns near airports should be arranged to avoid unnecessary flight over thickly settled areas to minimize noise, but only within the limits of safe flight practice.

(14) Minimize training flights at congested airports: Flight crew training should be conducted, as far as practicable, away from thickly settled areas and with the minimum number of flights into and out of busy airports.

(15) Separate military and civil flying at congested airports: Military aircraft should not be based on congested civil airports except when it is not economically or otherwise feasible to provide separate facilities for them nor should commercial aircraft operate regularly from busy military airports. Some of this is being done.

The next subject is difficult to do something about. We have been trying in our own way to do something about these airport problems.

Air Line Pilots Association's airport survey: We realize that to outline a problem does not necessarily provide an appropriate answer. Consequently, in an effort to establish our requirements in concrete terms, the Air Line Pilots Association inaugurated a program in 1959 to survey the 569 airports in the United States into which airline service had been certificated by the Civil Aeronautics Board. It was felt that proper determination of the areas of greatest deficiency would allow us to make recommendations in terms of dollars which might aid the committee in their deliberations. The objectives of the survey were to—

(1) Determine where airport inadequacies exist;
(2) Determine what can be done to correct the deficiency;
(3) Assist the local airport management to incorporate desirable features into the airport improvement schedule.

Generally speaking, our data was collected by our ALPA safety representatives in the field with the cooperation of the airport manager involved. Our initial surveys have been followed by efforts to maintain liaison with the proper officials and expedite installation of improved airport facilities. We have thus been able to establish communication to the point where we receive constant requests for information from various airport managers for the association's views on terminal facility requirements. In practically all instances, we have received the utmost cooperation. Our conclusion, however, has been that financial requirements are the major stumbling block to improvement.

Although our airport survey is not yet complete, the information currently available provides an important yardstick on the degree of deficiency of airport development on a nationwide basis and the extent of remedial action required to improve our terminal facilities to the desired standard.

We have attached for the committee's information, as appendix C, a copy of the statistics currently available. This study has not yet been completed. It is about half completed. We will give you the information we have to date.

These statistics are based on reports from 257 airport survey forms, tabulated and analyzed as of January 1, 1961. It is interesting to note that our findings are somewhat congruent with a report recently issued by the Airport Managers Council, the American Association of Airport Executives, and the National Association of State Aviation Officials. That report indicated that almost one-half of our publicly owned airports in the United States needed immediate improvement and expansion. Their cost estimate was $1 billion, $100 million over the next 4 years. Under our matching funds formula, it would be necessary that one-half this amount be appropriated by the Federal Government.

The Air Line Pilots Association's study, which did not include needed new airport development, indicates that an amount of money approximating $100 million must be appropriated by the Federal Government each year for the next 5-year period in order to provide adequate airport facilities for our present aircraft.

I might say in connection with this study that we don't claim that this is a model of perfection in objectivity. Our pilot representatives, with the TSO's and various standards available to them, went out to the airports and surveyed the airports' personnel, filled in forms, and so forth, which were then analyzed. This information is set forth in appendix C.

Just a few points at random will indicate the startling deficiencies at some of these airports. In appendix C we show the survey of 257 airports as of January 1961. Just taking a few points at random, approach lighting installed, configuration, 30 percent only. Runway lights installed, high intensity runway lights, only 38 percent of

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the airports had it. Medium intensity, 44 percent; low intensity, 18 percent. Runway marking—this is a matter of painting to standards—good, only 20 percent of the airports; 42 percent of the airports surveyed had no runway markings. Runway length available: adequate, 21 percent, was the judgment of our people in the survey. Marginal, 75 percent. Taxiway lighting and marking: good, 13 percent; marginal, 36 percent; deficient, 51 percent.

Skipping a bit, available fire and rescue facilities: Good protection, 8 percent; some protection, 35 percent; no protection, 57 percent.

Senator ENGLE. Is that on fire?

Mr. SAYEN. Fire and rescue facilities, yes, on the airports. This is practically nonexistent in most places. If you are real lucky you might get the local municipal fire department to come out with the equipment they use for house fires.

Senator ENGLE. They can get there in time to save the wreck.

Mr. SAYEN. That is right. This is a self-explanatory analysis and I don't want to take the committee's time but I did want to point out a few of the areas.

Let us contrast this requirement with the situation which now exists. The Federal aviation budget for 1962 proposes $40 million for all U.S. airports. The budget is already exceeded by the Port of New York Authority budget for $68 million. Chicago has a 3-year program for airport improvement averaging over $40 million a year. It is obvious that the current budget is not adequate to meet even the currently planned improvements which are admittedly insufficient. A review of Federal aid to airport appropriations and expenditures for the last 10 years shows the following:

Federal-aid-to-airports appropriations and expenditures (for grants)

Fiscal year	Appropriations	Expenditures	Fiscal year	Appropriations	Expenditures
1950 [1]	$36,500,000	$33,182,519	1956 [2]	$63,000,000	$16,515,871
1951 [1]	21,200,000	30,388,415	1957 [2]	63,000,000	20,649,031
1952 [1]	15,850,000	32,808,068	1958 [2]	63,000,000	42,870,387
1953 [1]	9,710,029	26,990,836	1959 [2]	63,000,000	56,577,624
1954 [1]		17,481,945			
1955 [1]	20,750,000	8,353,021	Total	356,010,029	285,817,717

[1] Cash appropriations.
[2] Contract authority.

Source: Airports Division.

While we sometimes have an appropriation in a 1-year period which looks like we are doing something about it, I think periodically we have to look back and see what we have been doing during the last 10 years or so.

It is noted that the average Federal aid to airports over the past 10 years has been at the rate of $28,500,000 per year. This is approximately 10 percent of the total projected cost to build Dulles Airport. Contrast this with $3.223 billions spent last year in the Federal aid to highways program and the firm assurance given for billions of dollars—$26.6 billion spread over the fiscal years 1957–69—to build Federal highways in the future.

We can complete 3,589 miles of four-lane highway and 184 miles of six lanes or more—U.S. Department of Commerce, Highway Progress,

1959—the equivalent of 71,336 miles of single-lane construction—per year but it requires practically a national emergency to secure another 1,000 feet of concrete for a runway on an airport. When we can have a $4 billion road-building program, 90 percent federally financed, a $100 million airport aid bill does not appear unreasonable. We feel that if the record of Federal aid to airports for the past 10 years is repeated in the next 10, we will fall farther and farther behind.

We must realize that we have in this country a large number of airports, 568 airline airports alone and 3,500 other airports. But on the other hand we do 75 percent of the total flying done in the world. If we are going to keep this industry growing and healthy, we are going to have to build a system. We can't subscribe to the philosophy that the airports are solely the responsibility of the community. If we are, then we are going to have to say that highways are solely the responsibility of the States and municipalities also. The airport system as we view it is an integral part of the airways. We just cannot have an airways system without having an adequate airport system. One has to go with the other. You have to move the airplane from the ramp at departure and to the ramp at destination. It is all part of one system.

In addition to the foregoing specific financial requirements with respect to improving the airport itself, we have the additional matter of providing navigation, communication, and terminal area landing aids, the need for which was so graphically described by the 1960 accident record.

Some people have a tendency to be complacent about this very serious problem because appropriations in recent years for this purpose have been substantially in excess of those for past years. We believe that this is a very dangerous view. While appropriations in recent years have been of substantial improvement, we ask that you examine the record for the past 10 years and it will not be difficult to understand why we have fallen so far behind. The following shows the appropriations and expenditures for the establishment of air navigation facilities for the years 1950 through 1959:

EANF (establishment of air-navigation facilities) appropriations and expenditures

Fiscal year	Amount [1]	Appropriation for new work	Expenditure
1950	$8,000,000	$10,650,000	$18,337,390
1951	22,000,000	5,500,000	17,850,387
1952	12,000,000	10,500,000	18,670,845
1953	3,641,499	9,950,000	16,935,754
1954		7,000,000	12,044,982
1955		5,000,000	8,679,768
1956	7,000,000	16,000,000	9,702,951
1957		75,000,000	23,587,755
1958 [2]		124,603,525	50,575,419
1959 [3]		158,500,000	98,081,367
Total	52,641,499	422,703,525	274,466,618

[1] Liquidation of prior year contractual authority.
[2] Excludes $21,500,000 transferred from the Air Force to the FAA for VORTAC facilities.
[3] Excludes $16,500,000 transferred from the Air Force to the FAA for VORTAC facilities. Of the Air Force funds transferred, $1,046,695 was expended in 1958 and $4,107,251 in 1959 (not included in above totals).

Source: FAA Budget Office.

These figures were furnished us about a year ago from the FAA budget office. This is the money for the establishment of air navigation, new facilities for the airways system, and for terminal area aids.

You will note that the average expenditure for the establishment of air navigation facilities over the past 10 years has been $27 million per year. In our view, this demonstrates shocking neglect when you consider that the Federal Government has assumed the entire responsibility in this area and that 75 percent—from March 1959 Le Monde Economique—of the total revenue passenger-miles flown in the entire world are flown by U.S. air carriers. They have only done it to the tune of $28,500,000 a year average for the past 10 years. In some years you can see from an examination of the table it got down to as low as $5,500,000. This will hardly buy a couple of computers that were discussed this morning.

It is obvious that this committee and the present session of Congress must immediately assume a reasonable financial burden if the responsibility which the Federal Government has assumed to provide adequate and safe aviation facilities is to be carried out.

Mr. Quesada, before he left office, made a statement with which I strongly agree. He said he felt it would take a sustained appropriation of at least $150 million a year to establish air navigation facilities for a long period into the future in order to catch up with the backlog.

I would now like to refer to a subject which we discussed at length in our January and June statements of last year, on near-miss and incident reporting.

On pages 21 through 23 of our June 6, 1960, testimony before this committee, and on pages 24 through 26 of our January 18, 1960, statement, we urged the restoration of an effective system of near-miss and incident reporting to facilitate the discovery and analysis of areas of potential hazards. We pointed out that we felt that the enforcement philosophy and general behavior of the former Administrator had broken down important lines of communication. We refer you once again to this testimony and urge FAA and CAB to take the earliest possible steps to remedy this situation.

Senator MONRONEY. You have a scheduled briefing and consultation with the FAA in the near future?

Mr. SAYEN. Yes, we are going to have a meeting tomorrow, as a matter of fact. We, of course, have meetings of various committees and working groups from time to time.

Senator MONRONEY. Don't you think this would be the proper place to take this up? There must be some middle ground. I can see FAA figuring if automatic immunity is given to the first man filing a report on a near-miss and being absolved, that it will be quite difficult to have an effective system. But the way it worked before, I think jointly they were trying to collect statistics and not trying to punish, and they were able to identify a great many near-collisions in this way, which haven't been coming into the reporting system since that was abandoned. Is that correct?

Mr. SAYEN. The near-miss reporting program is only a little tiny bit of the entire subject that we are urging here. Actually in the near-

miss reporting program, it is an organized program between Government and industry to try to get as close a fix as we could as to how bad this near-miss was. It never was the purpose of the program to grant anyone immunity from any infraction of the rules. The only immunity that was granted was that the individual would not be prosecuted as a result of his own report. This I think is very common in all sorts of things.

Senator ENGLE. Will you yield for a question? It is very simple, Mr. Chairman.

The FAA has complicated this all out of proportion. All that anybody would insist on is that the man not be required to testify against himself, or that his words be used to convict him.

That is the principle that is so common to Anglo-Saxon justice and law that it hardly requires any explanation.

All they have to say in the regulations is this: that his own words shall not be used against him. He may report a near-miss, and the near-miss may come to their attention by other means, or, even as a result of his own words they look into it. But they should not be permitted to take his own words out of his mouth and put him in the dock for those words. That is all that we have to say. It is just as simple as that.

If a fellow reports a near-miss, he doesn't want to have his words read back to him at some other time. I think the application of just that simple principle, that no man should be required to testify against himself, should apply. And if he reports a near-miss, and the only basis on which he can be found at fault is his own words, then he is immune. But if on other circumstances and exclusive of his own statements he is nevertheless in the soup, then he has had it, whether he reported it or not. That is a very simple matter.

And of course it is important to report these near-misses because they indicate the areas of hazards in the traffic situation. It is important for the FAA to know where those are, as well as for the pilots, once identified, corrective action can be taken.

To give an illustration, Mr. Chairman, I found out one time that they were conducting high-speed high-attitude climbouts at Moffett Field right through an airway, and I stopped it. I wrote to the FAA and said how about this? Somebody will bore a hole right through the bottom of an air transport one of these days. And they stopped it.

But some pilot had written me about it. He was a private flyer from California. And he had a hairy near-miss. He just wrote in and asked about it. I wrote to the FAA and the FAA stopped that.

But that is the kind of thing that will develop if we give these pilots a chance to talk without being convicted out of their own mouths.

Senator MONRONEY. This is what I suggested and called to the attention of the pilots and to the FAA, that they try to work out a system which both will agree is fair, and then we can resume having the value of this reporting system.

Certainly I think that two reasonable men or groups sitting down together, with the new administration of FAA, will be able to come up with something which is satisfactory to both the enforcement agency as well as the pilots themselves on whom we must rely for the information and reporting.

Mr. SAYEN. I thing Senator Engle has expressed the exact situation much better than I could. I was trying to say in the record that in the near-miss reporting record no one was ever guaranteed that they would not be fully prosecuted for any infraction of the regulations, only that they would not be prosecuted as a result of their own report, their own words, as you have said. He said it exactly right. This was the only guarantee anyone ever had in this program.

But the second point I want to emphasize, and it is very important, is that the whole basis for your inspection system, your safety system, is the flow of information not only from pilots but from all of the people involved. If a mechanic find something wrong, he should be encouraged to report it. If he does something wrong himself, that is going to create a hazard, he should be encouraged to report it. The same for air traffic controllers who turn up dozens and dozens of incidents where hazards have been created.

I don't know, and no one knows, whether or not the situation that existed in New York at the time of the crash of the DC–8 and the Constellation might not have come about or existed dozens of times before in terms of near-misses, but never been reported. Maybe somebody was apprehensive.

If we build a system of fear, and information will stop flowing, not only to the Government but to our organizations, all of the organizations which depend on this flow of information for our safety programs. We get reports from pilots who say we are sending this to you but we wouldn't even consider sending it to somebody else. It needs a good healthy program where there is confidence between all the people, and we intend to discuss this with the FAA.

Amendments to the Federal Aviation Act: We would like to note the fact that this committee and the Congress have made significant contributions toward the ultimate solutions to the problems with which we are dealing.

For example, it is our view that the Federal Aviation Act of 1958, in whose development we participated and supported, is basically a good law and removes many of the former impediments in the way of solutions to our important safety problems. We do, however, feel quite strongly, as we did at the time of its adoption, that certain basic errors were made in the statute which should be corrected in the light of experiences in order to provide the most effective law available.

Under the urgency with which we were confronted at the time the Federal Aviation Act was adopted, the Congress, in effect, delegated the legislative authority of Congress in aviation matters to one man. As we have testified previously and as most of this committee is aware, under the present statute the Administrator is required only to give notice under the Administrative Procedure Act and is then free to adopt practically any rule he desires, no matter how arbitrary.

Congress has truly created a one-man czar over the entire aviation industry and its personnel. If the particular Administrator happens to be arbitrary, naive, or capricious, the people affected have no appeal except to the Congress or the Federal courts.

We were apprehensive of these facts during consideration of the Federal Aviation Act of 1958 and attempted to persuade the Congress to provide for an effective appeal from arbitrary rulemaking. We were unsuccessful and our fears have since been realized.

During our appearance here on June 6, 1960, we presented a detailed description of this problem and we refer the committee to pages 27 through 41 of that statement, which is attached, for a review of those examples which we feel merit consideration of an amendment to the law which will assure our constitutional rights of appeal from arbitrary action, as well as assist toward sounder decisions in our required rulemaking.

We note that bills have been introduced in this session, numbered S. 446 and S. 447, which would accomplish our purposes and we firmly support the objectives of that proposed legislation.

Senator MONRONEY. I believe to keep the record clear we should print at this point in the record pages 27 through 41 of your testimony on June 6, 1960, in our survey of the work of the Federal Aviation Act.

(The material referred to follows:)

PERSONAL BACKGROUND OF CLARENCE N. SAYEN

By way of personal background, I hold bachelor of arts and master of arts degrees in geography and economics and an honorary doctor of science. I have been a teacher and an airline pilot. Some current activities have included membership on the Committee on Aircraft Operating Problems of the National Aeronautics and Space Administration; executive committee of the National Air Transport Coordinating Committee; War Air Service Pattern Committee of the Defense Air Transportation Administration; executive committee of the Radio Technical Commission for Aeronautics; the Chicago Aero Commission; Industry Advisory Committee of the Inter-Departmental Aviation Manpower Committee; and national defense executive reserve.

DESCRIPTION OF AIR LINE PILOTS' ASSOCIATION, INTERNATIONAL

The Air Line Pilots' Association, International, is an association of the professional airline pilots of the scheduled U.S. air carriers. At present it has a membership of over 18,000 active and inactive members, employed by 49 certificated airlines. The association represents airline pilots in all aspects of their professional life. It is their bargaining agent under the Railway Labor Act, maintains an extensive air safety organization in 149 councils scattered throughout the United States and a number of foreign countries, and is spokesman for the airline pilot in his relationship with municipal, State, Federal, and international organizations.

ALPA'S ORGANIZATION FOR SAFETY

ALPA's organization for safety is composed of representatives of 149 councils located throughout the United States, its territories, and a number of foreign countries. Each council has an air safety committee composed of active airline pilots who are selected for their competence and interest in the air safety problems being encountered by their pilots. The chairmen of all of the council air safety committees are organized into a central air safety committee which coordi-

nates the safety activities of all of the pilots of the particular airline, subject to the authority of the master executive council which is their highest governing body, and which is subject only to the board of directors which makes national policy for all pilot groups within the association. In addition, regional safety chairmen are appointed within five main geographic regions and with subregions. These pilots coordinate the safety activities which are primarily regional in character. Each pilot group designates accident investigation representatives who, along with regional accident representatives, participate in the investigation of all major air carrier accidents and report their findings to the president of the association. The activities of all of these safety representatives are coordinated by the international officers of the association and by a professional staff.

When specific problems require sustained study and representation, committees are created of pilots specializing in the particular subject and assisted by professional staff. For example, such committees in recent years have reported on such problems as new aircraft evaluation, training standards, collision avoidance, dangerous cargo, air traffic control, physical standards, and others.

APPENDIXES

APPENDIX A

Accidents (1960), fatal and nonfatal—Terminal area accidents [1]

Date	Carrier	Equipment	Location	Number of fatalities				Summary
				Crew	Passenger	Other	Total	
Feb. 4	TWA	707	St. Louis, Mo					Aircraft ran off end of runway due to surface condition of runway. Insufficient runway length and overrun for adequate safety margin in wet conditions. Substantial damage.
Feb. 6	DAL	C-46R	Chicago, Ill					Aircraft unable to stop on runway length due to poor braking action. Insufficient runway length and overrun for adequate safety margin. Substantial damage.
Feb. 20	AAL	Electra	St. Louis, Mo					Hit snowbank on takeoff from Chicago. Inadequate snow removal. Substantial damage.
Feb. 22	ALA	DC-6	Elmendorf Air Force Base					During a precision ground-controlled radar approach under minimum conditions aircraft struck the ground 1,200 feet short of the runway. Inadequate approach lighting. Substantial damage.
Feb. 25	DAL	CV-440	Chicago, Ill					Aircraft landed hard after striking 18-24-inch ridge of ice prior to touchdown. Inadequate snow removal. Substantial damage.
Feb. 26	AAA	202	Erie, Pa					Left runway on takeoff at night with poor visibility due to blowing snow. Nose gear collapsed. Improved runway marking and compact surfaces adjacent to the runway could have prevented this accident. Substantial damage.
Feb. 28	TWA	404	Olathe, Kans					During takeoff from Chicago the 2 left wheels parted from the aircraft. Aircraft was diverted to NAS Olathe, Kans., where a gear-up landing was accomplished. The gear could have been weakened by rough taxiways and snowdrifts. Substantial damage.
Mar. 8	EAL	Electra	St. Louis, Mo					Aircraft struck snowbank on rollout. Runway lights were obstructed by snowbanks so that they were not visible to the pilot after touchdown. Improved runway marking (center line lights), snow removal would have prevented this accident. Substantial damage.
Marl 24	AAL	DC-6	Syracuse, N.Y					During landing rollout, aircraft started drifting to the left and would not respond to correct action and departed runway. Runway covered with snow and there was an existing strong crosswind. Improved weather and runway condition reporting, runway marking, and compact surfaces adjacent to runway would have prevented this accident. Substantial damage.
Apr. 20	PAI	F-27 Cessna	Hickory, N.C			4	4	Midair collision with Cessna on final approach for landing. Inadequate traffic control facilities. Substantial damage.

APPENDIX A

Accidents (1960), fatal and nonfatal—Terminal area accidents [1]—Continued

Date	Carrier	Equipment	Location	Number of fatalities				Summary
				Crew	Passenger	Other	Total	
May 9	TWA	707	Idlewild					Aircraft settled on runway with gear retracted on an attempted go-around from an instrument approach. ILS glide slope inoperative, inadequate approach aids. Substantial damage.
May 23	DAL	CV-880	Atlanta, Ga.	4			4	Aircraft took off on a scheduled training flight. Immediately after lift-off the aircraft was observed to assume an exceedingly nose-high attitude, made left bank, veered to the left side of runway, then banked right approximately 90° and struck the ground. Aircraft was totally destroyed by impact and fire. No survivors. A cockpit sound recorder could have provided valuable information.
June 14	UAL	DC-8	Chicago, Ill.					After touchdown and upon the application of reverse thrust, the airplane veered to the left. Aircraft came to rest with the nose collapsed and main gear in the mud. Compact surface adjacent to runway could have prevented this accident. Substantial damage.
June 20	TWA	707	Idlewild					Aircraft struck ½-inch cable on approach to airport. These cables were strung across the approach path from tower 70 feet in height approximately ½ mile from the runway. Flight diverted and landed with minor damage.
July 22	TTA	DC-3	Houston, Tex.	1			1	Ground collision on ramp with another aircraft. Brake failure. Mechanical. Substantial damage.
July 28	AAA	Convair	Wilkes-Barre					On an attempted go-around, after power was applied and gear retracted, aircraft settled to the runway on the fuselage. Training accident. Substantial damage.
Sept. 14	AAL	Electra	La Guardia, New York, N.Y.					Aircraft struck a 12- to 13-foot dike, 161 feet short of the runway threshold and came to rest inverted with the nose pointed in the opposite direction. Improved approach clearance and runway length would have prevented this accident. Aircraft destroyed.
Sept. 18	World Airways.	DC-6	Guam	7	73		80	Aircraft crashed on takeoff.
Oct. 1	EAL	M-404 and Beechcraft.	Orlando, Fla.			1	1	Midair collision with Beechcraft just prior to turning base leg for landing approach. Normal landing completed. Beechcraft crashed. The control tower did not have the Beechcraft in visual contact. Surveillance radar could have aided in the prevention of this accident. Substantial damage to air carrier. Beechcraft destroyed.

Oct. 4	CPT	C-46-Cessna	Sacramento, Calif			2	2	Midair collision while on final approach for landing. The C-46 completed a normal landing. Surveillance radar could have aided in the prevention of this accident. Minor damage to air carrier. Cessna destroyed.
Oct. 4	EAL	Electra	Boston, Mass	3	59		62	Takeoff and climb to approximately 200 feet and commenced a left turn. The aircraft then nosed down and struck the water. Bird remains were found in all engines and a great number of dead birds were found on the runway after takeoff. Development of a method to eliminate concentration of birds on airports. Aircraft destroyed.
Oct. 7	AAA	DC-6	Newark, N.J					Nose gear failed during landing rollout. Substantial damage.
Oct. 15	CPT	C-46	Near Ogden, Utah	2			2	Aircraft failed structurally while making a GCA approach under turbulent VFR conditions. Cockpit sound recorder may have provided valuable information. Aircraft destroyed.
Oct. 25	AAL	707	Carswell Air Force Base					Unable to extend nose gear. Landed with nose gear retracted. Minor damage.
Oct. 29	Arctic Pacific	C-46	Toledo, Ohio	2	20		22	Crashed on takeoff. Aircraft destroyed.
Nov. 17	UAL	DC-6 Beechcraft	Denver, Colo					Midair collision with Beechcraft while on final approach for landing. Both aircraft landed safely. Surveillance radar for traffic control would have aided in preventing this accident. Minor damage.
Nov. 18	EAL	DC-8	Boston, Mass					Collision with birds during takeoff. Aircraft braked to a stop on runway. Bird damage to engines and leading edge. This could have been very serious. Development of a method to eliminate the concentration of birds at airports and further "birdproofing" of aircraft and engines are needed.
Dec. 16	UAL TWA	DC-8 Constellation	New York	12	116	6	134	Midair collision during instrument weather. Improved air traffic control procedures are necessary. Aircraft destroyed.
Total				31	268	13	312	

[1] Aircraft operating under departure or approach control are considered to be in the terminal area.

APPENDIX B

En route accidents (1960), fatal and nonfatal

Date	Carrier	Equipment	Location	Number of fatalities				Summary
				Crew	Passenger	Other	Total	
Jan. 6	NAL	DC-6B	Bolivia, N.C.	5	29	------	34	Dynamite explosion occurred within the passenger cabin causing inflight structural failure with resultant inflight disintegration.
Jan. 18	CAP	Viscount	Holdcroft, Va.	4	46	------	50	Aircraft crashed en route at night. Witnesses in vicinity of crash site heard aircraft circle low 2 or 3 times just prior to crash. Rain and fog were present at the time of the crash. Cockpit sound recorder may have provided valuable information.
Mar. 17	NWA	Electra	Tell City, Ind. (Cannelton, Ind.).	6	57	------	63	Aircraft broke up in flight at 18,000 feet (structural failure). Cockpit sound recorder may have provided valuable information.
June 14	PNA	L-749	Between Cordova and Anchorage, Alaska.	5	9	------	14	Aircraft struck mountain, elevation 9,600 feet 26 N.M. to the right of course approximately 23 minutes after takeoff. Although flight was radar tracked by an Air Force radar site no attempt was made to contact the aircraft. Possibly inadequate instrument power failure warning. Cockpit sound recorder might have provided valuable information.
July 14	NMA	DC-7	Jomalig Island (near Manila).	------	1	------	1	Propeller departed the aircraft making two holes in the fuselage and an uncontrollable magnesium fire developed. Ditching was accomplished approximately 10 minutes later. 57 survivors and 1 fatality were picked up approximately 3 hours and 30 minutes after ditching. Mechanical.
July 27	CHA	S-58	Chicago, Ill.	2	11	------	13	Aircraft broke up in the air. Structural failure.
Oct. 28	NWA	DC-4	22 miles northwest of Missoula, Mont.	4	8	------	12	Aircraft crashed in mountainous terrain. Preliminary indications are that the aircraft structure was intact at the time of ground contact and that the engines were capable of developing power. No further details. Cockpit sound recorder may have provided valuable information.
Total	------	------	------	26	161	------	187	

APPENDIX C

ALPA's airport survey results, 257 airports as of January 1961

	Percent
Runway condition:	
Good	56
Fair	33
Deficient	11
Taxiway condition:	
Good	53
Marginal	35
Deficient	12
Loading ramp condition:	
Good	64
Fair	30
Deficient	6
Approach lighting installed:	
Configuration "A" and others	30
Strobe beacons	11
Runway identifier lights installed	2
Runway lights installed:	
High intensity	38
Medium intensity	44
Low intensity	18
Runway marking installed:	
Good	20
Marginal	38
None	42
Runway length available:	
Adequate	21
Marginal	75
Deficient	4
Taxiway lighting and marking:	
Good	13
Marginal	36
Deficient	51
Ramp lighting and marking available:	
Good	20
Marginal	57
Deficient	23
Obstruction lighting and marking available:	
Good	24
Fair	66
Deficient	10
Runway overrun available:	
Good	16
Fair	24
None	60
Available fire and rescue facilities:	
Good protection	8
Some protection	35
No protection	57
Snow removal available:	
Good [1]	10
Marginal	35
Deficient	15
Vehicular procedures in use:	
Good	20
Fair	69
Deficient	11

[1] Not applicable.

	Percent
Instrument landing facilities available:	
ILS	33
VOR	53
Beacons only	33
Tower facilities available, commissioned	42
Communications procedures available:	
Good	42
Fair	42
Deficient	16
Weather facilities available:	
Good	34
Marginal	51
Deficient	15
Surveillance radar available:	
Now	14
Planned	3
None	86
High-speed turnoffs available:	
Now	3
Planned	6
None	97
Runway distance markers available:	
Now	13
Planned	1
None	87
Runway visual range available:	
Now	4
Planned	8
None	96
Navigation facilities installed at terminal areas:	
H beacons only	33
VOR facilities	53
ILS facilities	33
Surveillance radar	14
Terminal facilities lacking:	
No towers	58
No weather facilities	15
Marginal snow removal procedures	50
Marginal fire and rescue facilities	92
Marginal vehicular procedures	80
No runway visual range procedures	96
Insufficient obstruction lighting and marking	76
Marginal communication procedures	58
Airports having taxiways which:	
Are too narrow or need repair	47
Are not properly lighted or marked	51

ALPA's airport survey results, 257 airports as of January 1961—Continued

	Percent
Airports having runways which:	
Should be lengthened	79
Are deficient, need repair, etc.	11
Have very inadequate overrun areas	60
Do not have high intensity lighting	62
Do not have marking	42
Do not have approach lighting	70
Do not have runway identifier lights	98
Do not have runway distance marking	87
Do not have high speed turnoffs	97
Airports having loading ramps which:	
Are too small or need repair	36
Are inadequately lighted or marked	23

RULEMAKING

To this point in our comment we have covered the subject and pointed up problem areas which could be dealt with successfully by agencies of the Government without any change in the Federal Aviation Act. We now address ourselves to another and most disturbing problem; one which demands congressional action to amend the act. We will also make recommendations for such amendments.

We have reference to the unbridled authority of the Administrator under the act to make rules. This authority is reposed in the Administrator without the usual requirement of public and evidentiary hearings, and with no right of effective review, judicial or otherwise. The result has been no less than might have been expected.

In its understandable zeal to improve the air traffic system and improve the functioning of the Federal aviation agencies for this purpose, the Congress in adopting the Federal Aviation Act of 1958 made the Administrator practically a one-man dictator in all civil aviation matters.

In effect, it delegated the legislative authority of Congress in aviation matters to one man. As indicated in our previous statement, the Administrator is required only to give notice under the Administrative Procedures Act and is then free to adopt practically any rule he desires, no matter how arbitrary.

If he should decide, as he often does, that his new rule is only an interpretation of an existing regulation, even the requirement of notice is not provided. Congress has truly created a one-man czar over the entire aviation industry and its personnel. He is empowered to legislate at will in the multitude of areas coming under the jurisdiction of the agency. If the particular Administrator happens to be arbitrary, naive, or capricious, the people affected have no appeal except to the Congress or the Federal courts.

In addition, such arbitrary rulemaking authority, as we will demonstrate, makes it possible for the Administrator to effectively negate even the limited appeal preserved in some areas.

We were apprehensive of these facts during consideration of the Federal Aviation Act of 1958 and attempted to persuade the Congres to provide for an effective appeal from arbitrary rulemaking. We were unsuccessful and our fears have been realized. The Administrator has promulgated regulations and, in doing so, he has totally disregarded the clamor for a prior evidentiary hearing upon the subject by those whose very livelihood is affected.

We refer, for example, to the recently issued civil air regulations which will require pilots to retire from their employment as commercial airline pilots upon reaching their 60th birthday. In this action, the Administrator, without any evidence as far as we have been able to ascertain, rushed into a rulemaking area where the Congress or no Government agency has ever ventured.

It may be profitable here for us to review the procedure employed by the Administrator in the promulgation of this new rule. On June 27, 1959, the Administrator issued civil air regulation draft releases 59–4/5/6, in which he proposed to amend CAR, parts 40, 41, and 42, to include therein a requirement that no individual who reaches his 60th birthday should be utilized or serve on any aircraft while engaged in air carrier operations, and no person over age 55 could be qualified to operate jet aircraft.

This is not the first time that this subject has been under review. Pilots 60 years of age or over have been flying transport aircraft for many years and, specifically, have been flying airline aircraft for probably the last 10 years.

The question as to how long a pilot should be permitted to fly has, of course, been the subject of discussion among various groups in aviation for many years. The Civil Aeronautics Board, which had the authority for the promulgation of physical standards and safety rulemaking prior to the Federal Aviation Act of 1958, undoubtedly reviewed this problem on many occasions but never reached a position of initiating rulemaking since, we believe, they concluded that there was no reason for such action.

In 1956, the Flight Safety Foundation was commissioned by the Civil Aeronautics Administration to do a complete review of the physical standards of airmen and other aviation employees to determine whether there were areas which required new or different standards. A contract in the amount, we understand, of $200,000 was allocated for this purpose. The Flight Safety Foundation sought the advice of most experts in the various fields and, at the conclusion of their studies, submitted their recommendations to the Civil Aeronautics Administrator. Although they made a number of observations and recommendations in this area, not one of their recommendations included a compusory retirement age for airline pilots. To the best of our knowledge, this was the most exhaustive study on this subject that was ever made.

The Federal Aviation Agency came into being on November 1, 1958, and the present Administrator was appointed.

During 1958, there was a dispute with one of the major airlines over the company's attempt to arbitrarily discharge three pilots because they had attained age 60. The dispute proceeded under the Railway Labor Act to arbitration. The arbitrator, after lengthy evidentiary hearings, concluded that the company had wrongfully discharged the pilots in question and ordered them reinstated.

After a prolonged dispute, in January 1959, the company finally complied with the arbitrator's decision but only after informing the association's representatives that "it is our intention to go to the Federal Aviation Agency and secure a rule on this subject."

On May 26, 1959, there was a meeting between officials of the association and of the Federal Aviation Agency to discuss a number of air safety problems. Representing FAA at this meeting were the following officials: James Pyle, Deputy Administrator; William Davis, Director, Bureau of Flight Standards; Gordon Bennett, Special Assistant to the Administrator; Lee Warren, Bureau of Air Traffic Management; George Moore, Bureau of Flight Operations; Ward Masden, Bureau of Flight Operations and Deputy Administrator for region I; Ned Zartman and Gerald White, General Counsel's Office; Burleigh Putnam, Bureau of Flight Operations; Daggett Howard, General Counsel; Mr. Vansahn, Bureau of Research and Development; George Borsaris, Bureau of Airports; Henry Weeks, Bureau of Flight Operations, and Dr. Smith, Acting Civil Air Surgeon.

Representing ALPA were the following: C. N. Sayen, president; S. W. Hopkins, first vice president; Robert Tuxbury, secretary; Clark E. Luther, vice president, region III; E. P. Rordam, vice president, Region II; J. D. Smith, chairman, air traffic control committee; Harry W. Orlady, chairman, physical standards committee; E. R. Watson, chairman, training plans committee; Theo G. Linnert, head, engineering and air safety department; T. A. Basnight, engineering and air safety department.

During the meeting we inquired of the FAA officials present as to the origin of certain newspaper reports on the pilot aging question and as to whether there was any research or action contemplated on this subject. We were informed that no action was contemplated and, for that matter, any such action would have to be preceeded by 2 or 3 years of study.

On June 27, 1959, the Administrator issued his draft releases on the subject. The releases requested comment by August 28, 1959.

On July 14, 1959, the association directed a letter to the Administrator, requesting an opportunity to review the evidence on which the Administrator relied in making his proposal. In addition, the association requested that an evidentiary hearing be established in order that a full opportunity to explore any evidence having a bearing on this subject would be available.

The reply of the Administrator dated August 5, 1959, is attached for your information. You will note that the reply includes largely a collection of outdated and general textbooks. The association made a diligent search of these texts but was unable to locate any information that would have a direct bearing on the Administrator's proposal or would reveal any information that has not

been continuously available for more than 10 or 20 years. The request for an evidentiary hearing was evaded.

On August 12, 1959, in response to a request from the air transport association, the deadline for comment was extended for 30 days. ATA stated that they needed more time to study the problem. The ATA comment which was submitted consists of 1½ pages of general comment in which the arbitrariness of the rule is conceded. No evidence was submitted. Several airlines commented directly to the Board in opposition to the rule.

The association's comment submitted on September 25, 1959, was comprehensive and consisted of some 105 pages of evidence and argument. A copy is attached for your information. The request for a public and evidentiary hearing on the subject was repeated. As time passed, the association sensed the reluctance of the Administrator to risk a public evidentiary hearing as had been requested, and on November 2, 1959, the association filed with the Administrator its supplementary comment in opposition to the proposed regulations. Once again, the Administrator was urged to hold public hearings before finalizing and including the proposed rule within the civil air regulations.

Many other segments of the industry commented. Many such comments were in opposition based upon sound reasoning. There was ample justification for an evidentiary proceeding in which the contentions of the various parties could be examined, but the Administrator continued to refuse to even discuss the matter.

On December 5, 1959, the Administrator finalized the age 60 regulation, to become effective March 15, 1960. Since the act makes no provision whereby these actions of the Administrator may be reviewed, the affected parties have found it necessary to appeal to the Federal courts for relief.

The rule in question reads:

"No individual who has reached his 60th birthday shall be utilized or serve as a pilot on any aircraft while engaged in air carrier operations."

As indicated previously, on May 26 the association had inquired of FAA officials as to any contemplated action on this question and was told that no action was contemplated and that any such action would require 2 or 3 years of study. Nevertheless, the draft release was issued shortly thereafter. All of our attempts to try to determine the basis on which the release was issued or the evidence in the possession of the Administrator on the subject, were without avail.

It was only after our court action was initiated that it was revealed to us in an affidavit filed by the Administrator in the Federal district court that on June 3, 1959, 8 days after our meeting of May 26 when we were informed no action was contemplated and studies would take 2 or 3 years, the Administrator had a private meeting with eight people whom he had evidently invited to confer with him on this subject.

In the affidavit, the Administrator indicates that at the end of several hours discussion, there was concurrence that such a rule should be adopted. The nature of the discussions, the evidence produced, the contentions of the participants, has never been revealed. For that matter, the existence of the meeting was never revealed until after our court action was in process.

To the best of our knowledge, none of the individuals who participated in this meeting commented publicly on the draft release issued 24 days after the meeting under the Administrative Procedure Act and inviting public comment.

This regulation has been characterized as unthinking, arbitrary, and capricious. We find it difficult to disagree with this description for the following reasons:

First, there is admittedly no evidence, or even the suspicion of evidence, that age alone is responsible for the diminution of a pilot's efficiency or effectiveness. If anything there is justification for a contrary conclusion. The pilots whose professional careers will be ended by this arbitrary regulation are among the most experienced pilots to be found anywhere in the world and have been certificated by representatives of the Administrator and the air carriers as meeting all physical and competency requirements to do their job.

Second, although this rule effectively amends the pilot's certificate by placing a limitation upon it which prohibits his employment after age 60 by any commercial air line, the rule neatly circumvents the requirement of the Federal Aviation Act (sec. 609) by which the Congress sought to guarantee that a pilot's certificate would not be amended, modified, suspended or revoked without a hearing and the subsequent right of judicial review of any ensuing order.

This circumvention is accomplished by directing the rule at the air carriers, merely prohibiting them from utilizing the services of the 60-year-old pilot, yet leaving the pilot with all his licenses apparently unaffected.

As may be seen, the regulation is a cunning device which defies the mandate of our Congress and does by indirection that which the Administrator might find most difficult, if not impossible, to accomplish directly.

Third, it will be noted that the regulation does not prohibit the pilot who is 60 years of age and over from exercising the privileges of his licenses in general aviation. He may still fly any type of aircraft carrying cargo or passengers so long as he does not do so for a commercial carrier operating under parts 40, 41, or 42 of the Civil Air Regulations. The regulation is therefore discriminatory.

Fourth, in order for a commercial airline pilot to remain in his profession and at his post, he must, by regulation, demonstrate his proficiency and his physical fitness every 6 months. This is true of a pilot whether he be 26 or 60 years of age. It is evident that there is already in effect a much more proficient retirement rule for pilots than the one which the Administrator proposes. The present retirement rules require a pilot to retire no matter what his age, as soon as he is unable to meet the health or proficiency standards required to maintain his license.

Fifth, there is no precedent in Government for this arbitrary action and yet this important step has been arbitrarily taken with no showing of evidence whatsoever.

Lastly, this retirement rule cannot be justified upon any sound evidentiary consideration of safety. We do not make this statement idly. The truth is, that there has never been an accident, or incident, in commercial aviation since its very beginning which can be said to be the result of the "aging pilot."

We attach to this statement for the information of the committee, copies of the briefs which we filed with the Administrator on this subject. We particularly direct your attention to pages 42, 43, and 44 which summarize our contentions on this subject.

In the light of all these facts, and we challenge anyone, everyone, and particularly the Administrator, to demonstrate their inaccuracy, it is clear that the rule accomplishes nothing in the pubic interest, and contributes nothing to safety in flight.

The only thing that the rule does accomplish is the useless termination of the careers of experienced, highly trained, and efficient pilots, whose condition of health is unquestioned, and who otherwise meet every standard required of any airline pilot. In the face of these facts, it is no wonder that this rule has been characterized as "unthinking, arbitrary, and capricious."

Upon the adoption of this unfortunate rule by the Administrator, the association informed him of our intention to ask the courts to set it aside and requested that its effective date be postponed until this matter could be finally decided. He refused.

We requested the Federal district court in New York City to stay the effective date of the rule until it could be reviewed. The court refused stating in its opinion, in effect, that it should not interfere with the "expert opinion" of the Administrator.

A request to the U.S. Court of Appeals for a stay met with a similar reply. The exact language of the court is as follows:

"It is not the business of courts to substitute their untutored judgment for the expert knowledge of those who are given authority to implement the general directives of Congress. The Administrator is an expert in his field; this is the very reason he was given the responsibility for the issuance of air safety regulations."

While an action for an overall review of the rule is still pending in the U.S. district court, no date for the beginning of hearings has been established. In the meantime, the individuals affected by the rule are trying to determine its meaning and their status of pilot is fully licensed.

However, the company is prohibited from utilizing him for certain purposes. The use the company can make of him has never, to the best of our knowledge, been specified. Everyone remains confused. The Administrator will probably issue an arbitrary "interpretation" soon clarifying or confusing further his rule.

Evidently, the Administrator is so expert and has such arbitrary authority under the act that as long as he follows the minimum requirements of the law as to notice, he may take any action he desires—no matter how arbitrary or capricious it may be.

The retirement rule is a flagrant example to point up the necessity for amendment of the Federal Aviation Act so that review of the Administrator's rule-making will be assured. However, there are other examples equally potent.

There are cases on record of pilots whose certificates have been suspended or revoked for reasons which were at the time subject to review by the Civil Aeronautics Board under section 609 of the Federal Aviation Act. While such cases were pending before the Civil Aeronautics Board the Administrator has summarily amended the civil air regulations so as to require a decision by the Civil Aeronautics Board adverse to the pilot.

One such incident occurred in the case of a pilot whose first-class medical certificate was revoked by the Administrator for certain medical reasons. The pilot claimed that the condition of his health did not preclude his right to a first-class medical certificate and he appealed the Administrator's order to the Civil Aeronautics Board. This right is assured him by Congress under section 609 of the Federal Aviation Act. While his case was pending and before the evidentiary hearing could be concluded, the Administrator summarily and effectively amended part 29 of the civil air regulations by issuing his official interpretation of such part.

This amendment wholly disqualified the pilot and made it mandatory that the Civil Aeronautics Board so find, notwithstanding substantial evidence which the pilot might have produced in his behalf to the contrary.

This device of summarily changing the operation of an existing regulation by official interpretation has been resorted to by the Administrator on more than one occasion. In addition to the foregoing example, we previously indicated to the committee the interpretation which has been placed upon the existing Civil Air Regulation No. 40.354, "Flight Crew Members at Controls." The amended intepretation of this CAR by the Administrator reads:

"All required flight crew members when on flight deck duty shall remain at their respective stations * * * except when the absence of one such flight crew member is necessary in the performance of his duties in connection with the operation of the airplane. * * *"

This interpretation was issued without any prior consultation, notice of rulemaking, or procedure. The "interpretation" still remains unexplained or defined. Rules obviously in conflict with it remain undisturbed.

Pilots are unable to comprehend what the rule means and simply cannot live within the letter of this regulation, but the Administrator is insistent, and there have been actions initiated in instances where the pilot left his position only for the purpose of physical relief.

We previously pointed out to the subcommittee that under the present regulations of the Administrator a pilot may be scheduled to fly for 12 continuous hours during an onduty period of indefinite duration.

The scheduled-to-fly trip may actually mean 14 or 15 actual continuous flying hours during an onduty period of 20 or more hours. A flight schedule has just been announced under which a flight crew will be assigned to fly 19 hours and 40 minutes during one continuous assignment.

The onduty hours, of course, will far exceed this time. When the pilots of one airline recently announced their intention to refuse flights scheduled for such extended flight periods, the company after failing in one court shopped around until they found a judge who issued an injuction forbidding the pilots from refusing such assignments partly on the basis that they were not contrary to the regulations.

The Administrator is evidently unconcerned with all of this for he has taken no affirmative action.

These results point up with equal clarity the necessity of providing review of the rulemaking activities of the Administrator, without which the rights of affected parties are always subject to summary adjudication and safety may be jeopardized.

In June of 1958, the association's president appeared before the subcommittee of the Committee on Interstate and Foreign Commerce of the House of Representatives at which time hearings were being conducted on legislation which ultimately resulted in the passage of the Federal Aviation Act of 1958.

At that time, we foresaw the mischief which could ensue if no review was provided of the rulemaking authority of the Administrator. The following statement appears in the testimony to the committee:

"We believe that such changes to provide for review of decisions of the Administrator in the promulgation of safety rules are vital for at least the following reasons:

"(1) The provision for review of decisions of the Administrator in this field is consistent with the remainder of the act. In every other case, provision is made for review of the decisions of the Administrator (such as sus-

pension of certificates, physical standards, etc.). This is consistent with a system of checks and balances so as to protect against arbitrary use of authority without inhibiting efficient functioning.

"(2) The Board is the logical agency to review such decisions, and such review is consistent with their function in other proposed sections of the act. It is a quasi-judicial agency which is equipped and staffed to perform this important function and will be performing related functions.

"The Board has been doing this job for many years. It has been working in many fields which don't generally come to the attention of the public or the Congress. As I indicated, there are some 60 areas of regulation."

We believe that statement is no less appropriate at this time. Experience under the act demonstrates the dangers and possible arbitrary and capricious action under the present law. The situation permitted by this portion of the law is foreign to our concept of government and is not duplicated in other similar agencies of government.

The experience also demonstrates that it is impossible to maintain an effective right of review under certain portions of the law while delegating arbitrary rule-making authority in others as is attempted in the present law. If the Administrator does not desire to have his action reviewed, he promulgates the rule in such a manner that review is impossible. If he does not approve of a review action currently in process or anticipated, he may merely change the rule under which the review is being conducted.

We propose to amend section 601 of the Federal Aviation Act of 1958 by the addition of the following section:

"(d) The Civil Aeronautics Board, by its own act or upon the application of any affected person, may review any rule, regulation, standard or order issued or made by the Administrator under this title VI. The Board, insofar as practicable, shall give such review priority over other proceedings under this Act. Upon such review the Board shall have authority in the public interest to revoke or modify any such rule, regulation, standard, or order. Pending such review and determination thereon, the Board, by its own act, or upon the application of any interested person for good cause shown, may suspend the effect or operation of any such rule, regulation, standard, or order. Nothing in this subsection shall be construed as amending, modifying, or repealing any portion of the Administrative Procedure Act."

By this amendment, we would assure that all parties affected would have the right of review of any rule or regulation promulgated by the Administrator. What we are asking is nothing more than an extension of the American tradition of checks and balances to power; we earnestly feel that this amendment to the act is imperative.

We next propose an amendment to section 313(a) of the Federal Aviation Act of 1958, by adding the following sentence thereto:

"Nothing in this Act shall be construed to authorize the Administrator to promulgate or make any rule, regulation, standard, or order which shall have the effect of amending, modifying, suspending, limiting, or revoking airmen's certificates or an airman's certificate, or of depriving or limiting any airman in the use of such certificate or of disqualifying any airman from operation pursuant to such certificate, except after a hearing and compliance with the procedures provided under section 609 of this Act."

By this amendment we propose to assure that the Administrator shall take cognizance of, and adhere to the mandates which Congress has already placed upon him, and which he has found the means of circumventing. It is our belief that this amendment is also imperative to protect and preserve the rights of affected individuals and assure to them the remedies which the Congress has sought to give them.

In summary of our foregoing comment, and in addition to the recommendations made to this committee on January 18, 1960, we wish to emphasize our position on the following basic problems upon which we have touched, and in which we need continued and increased attention by the FAA and other interested groups, as well as financial support from Congress:

(1) A safe and efficient air traffic system capable of handling the present and future needs of our rapidly expanding air commerce should be a goal toward which we should never cease to strive.

(2) Airports sufficiently equipped to insure safety of operation at maximum capacity is a requirement no less important; and this is true for those airports off the presently controlled airways as well as others.

(3) Enlightened ATC procedures for turbojet aircraft are a necessity and the utter uselessness of the see-and-be-seen concept in this phase of aviation should be recognized and a substitute devised.

(4) Devices and procedures must be developed to insure positive separation, and this program should be accelerated in view of the increasing number of high performance aircraft which will soon be operating at all levels of flight.

(5) Meteorological requirements on the industry should be met and the Congress should insure that no budgetary insufficiency can be claimed as a reason for satisfactory solution of this problem.

(6) We propose to amend section 601 of the Federal Aviation Act of 1958, by adding the following section:

"(d) The Civil Aeronautics Board, by its own act or upon the application of any affected person, may review any rule, regulation, standard, or order issued or made by the Administrator under this title VI. The Board, insofar as practicable, shall give such review priority over other proceedings under this Act. Upon such review the Board shall have authority in the public interest to revoke or modify any such rule, regulation, standard, or order. Pending such review and determination thereon, the Board, by its own act, or upon the application of any interested person for good cause shown, may suspend the effect or operation of any such rule, regulation, standard, or order. Nothing in this subsection shall be construed, as amending, modifying or repealing any portion of the Administrative Procedure Act."

(7) We next propose an amendment to section 313(a) of the Federal Aviation Act of 1958, by adding the following sentence thereto:

"Nothing in this Act shall be construed to authorize the Administrator to promulgate or make any rule, regulation, standard, or order which shall have the effect of amending, modifying, suspending, limiting, or revoking airmen's certificates or an airmen's certificate, or of depriving or limiting any airman in the use of such certificate or of disqualifying any airman from operation pursuant to such certificate, except after a hearing and compliance with the procedures provided under section 609 of this Act."

It has been a pleasure and privilege to appear before you and we wish to thank you for the opportunity.

Mr. SAYEN. To bring the testimony completely up to date, a word or two about the now rather famous "60-year controversy." At the time we testified previously we had the matter on appeal to the Federal courts. There had been statements made that this matter was being considered by the courts on its merits and that in each case the courts agreed with the Administrator on the merits. This is not true. The rulings of the court had been on procedural matters, and the question of the Administrator's authority under the law.

We indicated that we felt the action taken by the Administrator was not within the intent of the act, and that when it took action against an individual's license that this should be appealable. To get around this clear requirement of the law, what the Administrator did was to pass a rule on the air carriers which in effect modified each individual's license. On these legal problems, we asked for a restraining order and this was denied. We appealed and the appeal was denied. The Government asked for summary judgment and the summary judgment decision had been upheld in the circuit court. There has been no hearing to my knowledge, and to my knowledge no one has agreed with the Administrator on the merits, so far as the courts are concerned, and most certainly not us. This brings the matter up to date.

Senator ENGLE. Is that the reference to the 60-year-old provision?

Mr. SAYEN. Yes, sir; that is where it stands at the present time.

Senator ENGLE. I agree 100 percent, and that ought to be corrected. What happens is that the Administrator makes a rule, and the appeal on the rule is to him.

They say that you can go to court. But you don't go to court on the rule. You go to court on the question of whether or not the Administrator was within his jurisdiction in making the rule, and court said the Administrator was within the latitude given him by Congress in making the rule.

I pointed out here one time that the Administrator could pass a rule that all pilots who wear glasses should be grounded. I didn't think Mr. Quesada would do it because he wears glasses. He might also provide in a rule that any pilot 20 pounds overweight would be grounded until he lost the 20 pounds on the ground that people overweight have a tendency to have heart attacks. He might pass a rule saying that all pilots are grounded until they are trained in the skill of recovering from inverted flight, because occasionally we get turned over. And all the court would pass on is whether or not the Administrator was within the delegation of power given him by the Congress, not whether the rule was reasonable; not whether or not it had any reasonable relationship to safety whatsoever. They wouldn't pass on that. That is the complaint that the pilots make, and make legitimately, and that is why I have introduced legislation that says that whenever the Administrator puts in a rule, that the pilots or the interested aviation people affected will have a right to take it to the CAB for a review before a public body. I think it makes good sense and it is fair, and it is good law, too.

Mr. SAYEN. Thank you, Senator. As you know, we very strongly agree with you, and you are exactly right. The court said in every case that we are not competent to second-guess the expertise of the Administrator. We can only judge whether or not he acted within his authority under the law. What we are saying is that the authority granted under the law is too broad. We certainly agree with you in your view of this situation.

We want to clarify the record because there has been an opinion in the press and before this committee, that the action of the Administrator is proper. There has been no such agreement to my knowledge by anyone in an official capacity, and the only study that has been made of this problem—there has been only one exhaustive study made of this problem—was by Government contract with the Flight Safety Foundation, as reported in our testimony, and that made no recommendation that any rule be adopted by the Government on this subject. To my knowledge, to this date, there has never been a study made of this subject. It is my understanding that the Federal Aviation Agency is now beginning to make a study on the subject.

SUMMARY

This appearance before the committee is the third time within the period of 14 months that we have been provided the opportunity to comment on matters which affect the safety of airline operation. We are most appreciative of these opportunities and have made every effort to summarize our viewpoint on such matters. With the thought that it may be helpful to this committee, and to summarize the highlights of our total testimony, we offer the following specific recommendations, most of which are repetitions of conclusions previously reported to you.

I. We believe that a major effort must be made to improve the airport and terminal area facilities of this country without further delay. This is a project of emergency proportions and must be approached vigorously or the safety and efficiency of our air transportation system will be severely handicapped. We have indicated in our testimony today the amount of Federal funds which we deem necessary in order to approach the problem.

I would like to interject at this point, because there is a great deal of discussion in Governmental circles today and by all sorts of groups throughout this Nation, that in the middle of this recession we should do some of the public interest projects which could be done immediately and which would stimulate our economy. I contend that this is an emergency project.

Certainly if we can expedite highway construction in order to stimulate the economy, and depressed areas and so forth, this in effect is a depressed area. If we are going to keep our total national picture in the aviation industry up to date, we need fast action, and this would be one way to expedite some of the expenditures which we are going to have to make anyhow.

In our opinion, the following projects are immediately necessary to move this program forward:

(*a*) Immediate decisions on standards for approach lighting and runway lighting.

These are still being held in abeyance. They should be made immediately. Some of the airports are being installed without any guarantee that this is to Government standards.

(*b*) Immediate research and decision on standards for airport firefighting and rescue equipment.

(*c*) Immediate decision on standards for airport zoning and clearways along the lines recommended by the President's Airport Commission.

There have been some recommendations issued recently on that. I am very glad to see them.

(*d*) Immediate steps to certificate airports in line with the report of the President's Airport Commission.

(*e*) Immediate installation of known aids to navigation, such as—

(1) The establishment of control zones at all airports which are provided with instrument approach procedures.

(2) The establishment of control towers at all airline airports.

(3) The installation of standard approach lighting on all major instrument runways.

(4) The installation of instrument landing systems on all major instrument runways.

(5) Early installation of visual glide path equipment wherever necessary.

II. Expedite the implementation of the standard short-range navigational aids to replace older and less reliable aids with efficient equipment as soon as possible. At the same time, we must recognize the need for continued research and development of new and more revolutionary aids in order to keep abreast of the technological improvements taking place in our aircraft.

Here I would like to interject something which we feel quite strongly about. Our entire planning and research program, as we see it, improvement of the airways system at the present time is pro-

ceeding along the line of rather fixed concepts for our navigational and communications systems. The testimony that has been given indicates that really our airways system is going to be developed by a greater and greater reliance on radar. When all else fails we will buy more radar.

Point 1: We are not certain—we don't pretend to have the final technical answers—but we are not certain that we are going to be able to build a satisfactory airways system in this country based on present navigational systems. We have advocated very strongly through the International Federation of Pilots for many years—because this is really a worldwide problem; you have to have a standard system of navigation worldwide—that research be done on an area-type navigational device with a pictorial representation in the cockpit.

These devices have been available for years in various forms. They are being flown in other parts of the world. There was one developed over 10 years ago by TDC, which provides the pilot in the aircraft with a picture of where he actually is and how to get from here to there.

I flew one 10 years ago in which I used it to taxi on the runway at the airport, to takeoff from a strange airport in a strange airplane, to fly to another strange airport, make an approach down to 50 feet on a runway that I had never seen before, and then fly back home. This was all done by tracing on a little map.

If you had this sort of system you would have great flexibility in your traffic control system, so you could fly multiple routes.

We have advocated this very strongly. In the last year FAA has announced that they are in the process of developing a pictorial presentation in the cockpit off of the VOR system. We hope this works.

There is a lot of testimony by technicians that VOR doesn't give you enough accuracy, this sort of thing. We hope it does, or that it could be built up. But we are convinced, pretty well convinced, that trying to jam more and more traffic into a system which is dependent on fixes and dependent on point source navigation, on radials, is going to be tremendously expensive and not necessarily going to do the job for us as we move into heavier traffic in airplanes going 2,000 or more miles per hour.

I think that we must do basic research on other approaches to this problem, because we might have to start with an entirely new approach to the problem somewhere down the line.

On the question of radar, we said to this committee in our previous testimony, and we say again here, and we discussed it last night at length again: Our people who specialize in the air traffic end of it, and so forth—Captain Smith, for example—were not convinced that radar is a satisfactory device for control of air traffic, and we are convinced under no condition is it a satisfactory navigational device. But in our present theory of moving traffic we are using it for both.

It has never worked in any other system of transportation when we have tried to roll it from the ground. We have to devise some system which is self-sustained so far as maintaining clearance from other obstacles and other moving objects. We would like to see a tremendous concentration on an anticollision device so that an aircraft could be self-sufficient to a larger extent for air traffic control purposes. We don't think that our research projects should be so channeled that we

can only go down the road of concepts which we have fixed some years ago. We must be more versatile than that.

We don't see much relief for the pilot in the air traffic control system by merely automating the work of the ground controller and leaving him basically with the same system, which is inadequate at the present time but now is automated, but should be supervised by the human being, and the human being is the fail-safe part of the system.

We think this requires a great deal of research and original thinking.

III. Expedite a program of direct communication between the pilot and air traffic controller and take all possible steps to reduce the cockpit communications workload.

We documented this kind of workload to you in previous testimony. We pointed out that the workload is such today that we have practically lost the use of one crew member, who is now for all practical purposes a radar operator.

IV. Initiate immediate rulemaking that will provide the traveling public with a fail-safe crew, providing the same protection in the flight crew that is afforded in the other components of the aircraft. This problem was dealt with in detail during our testimony of January 18, 1960, which is in the committee record.

V. Expedite research in every way for an airborne anticollision device that will restore the "see and be seen" capabilities to the cockpit.

VI. Amend the Federal Aviation Act of 1958 so as to provide adequate review of the rulemaking authority currently in the hands of the Administrator.

VII. Establish a comprehensive incident-reporting program which will expose potentially hazardous situations.

It is interesting to note, and we cannot urge this position too strongly, that in practically all areas the means of resolving the problems are available and have been available for some time. It is our sincere hope that this Congress, in the light of the known facts and past experience, will pursue solutions to these problems aggressively.

We also wish to assure you of our continued interest in the subject and our earnest desire to be of assistance wherever possible in providing the committee with more detailed information which might be helpful in their deliberations on the specific legislation required.

Thank you for your consideration and the opportunity you have made available to us to express our viewpoint on a subject which affects us so greatly.

Senator MONRONEY. Thank you very much, Mr. Sayen.

Senator Engle, do you have any questions?

Senator ENGLE. I think not.

Senator MONRONEY. I note in your breakdown you point out that there were 28 accidents in the terminal area last year with air carriers, and only 7 percent occurred while en route. Of course, there are many things which can bring about en route safety, and safety systems will be required as the space gets more crowded. We would like to have your view or the view of your experts as to what we have learned from the Idlewild crash between United and TWA that you would recommend for the earliest possible study and consideration.

I am talking now not about the things that we hope will come out of research and development, but the things that can come off the

shelf and can be done to take care of the millions of people who will be flying between now and the time that the scientists may come up with some degree of automation or pilot anticollision devices and things of that kind.

Mr. SAYEN. Captain Smith who is in charge of our investigating teams which investigated the entire accident, including both aircraft involved, and also sat in on the entire investigation as the association's representative along with our other representatives, is here. I would ask him to comment on your question. I would only say this to you, in introduction: I discussed this problem with all of our air safety people who are here with me, last evening, and I asked them this question. I said to them, in studying this entire accident, if I had been the pilot of the United aircraft—either one of the aircraft—I would have flown this flight just the way this pilot flew it. Does my view coincide with yours? And all of the people here said: With the same information, with the same setup, they would have flown this flight the way this pilot flew it. So something is wrong with the system.

Senator MONRONEY. Do you mean that all of these well and thoroughly experienced captains approve of 445 knots speed going into a holding pattern?

Mr. SMITH. Mr. Chairman, is this an inference that this was the speed of the DC–8?

Senator MONRONEY. It is rather well admitted by United; it is rather well documented by the tape recorder that as near as they can tell the speed was never reduced much below that until the time of the impact. I am merely reciting what I heard at the hearings, at which I believe you were present and heard.

I don't wish to argue the point. I'm merely stating what was indicated. I don't mean to establish that as the final, absolute finding. But assuming that that were the speed, would that have been the speed at which you would have flown the approach to Preston on that particular day with half your navigational equipment out?

Mr. SMITH. I wonder, Mr. Chairman, if it would be possible to defer answering that specific question just for the moment, and provide a little background material beforehand?

Senator MONRONEY. Certainly.

Mr. SMITH. I think it would bring it probably into a little better focus, if I may.

At the outset I would like to mention that we participate with the Civil Aeronautics Board in accident investigations as an interested party. In this particular case I was very ably assisted by approximately 14 to 15 flight and staff personnel of the association. There have been various statements related to this accident in the form of cause or corrective activity that may be undertaken. But we have learned from years of experience that if you use an accident as the basis for coming up with corrective action, you must satisfy the answers to three basic questions, and this is necessary in order to assure that your corrective action is realistic, intelligent, and predicated on actual facts.

The three questions are very simply: What happened? How? Why?

A great personal concern of mine has been the fact that various information presented as related to this accident has not effectively or factually answered some of these basic three points; that is, as to how, what, and why.

There has been a very casual attempt to view the United aircraft as a single airplane in a complex air traffic control system. In reality, upon analysis, we find very definitely that there is more than just a single aircraft involved, even beyond the TWA aircraft itself.

There has been a position taken that this aircraft had a clearance limit of Preston. By issuing a clearance limit at Preston, this, therefore, divorced any responsibility of the controlling agent to further monitor or render any assistance to the aircraft involved.

Upon reflection of the traffic situation at the time prior to this impact, the facts do not reflect the ability to view this traffic complexity with such casualness.

I would like to go into the holding pattern problem as such and then possibly with your permission go into a few basic details of facts related to this investigation.

I might point out that normally we refrain from publicly discussing the information in an accident investigation prior to the release by the CAB of a probable cause. However, in this case I don't believe we have any other alternative than to take the furnished course of action.

Senator MONRONEY. We are not trying to press you for the probable cause. We are only searching for anything that can be brought about in rule changes or improvements pending the perhaps 12 months span of time that will still be required before that paper comes down from the CAB.

Mr. SMITH. Yes, sir. I appreciate the position of this committee on that point.

As to holding patterns, there is no doubt but what the current procedure stipulates that the holding pattern airspeed at the lower altitudes is limited to 180 knots. This procedure was originally designed in 1951, and at that time it was put in, as Mr. Thomas testified earlier this morning, for 180 miles per hour maximum holding speed.

The holding pattern airspace, allocated to the holding pattern procedure, was established in 1951.

Subsequently, with the implementation of jet aircraft, the holding pattern speed was increased from 156 knots to 180 knots. This, in miles per hour, means that we now have a procedure of raising the holding pattern speed from 180 miles an hour in 1951 to a speed of 207 miles per hour today. When the speed within the holding pattern was raised, the size of the holding pattern airspace was not. We are still today in a complex, high-density terminal area using holding pattern airspace for a system that was put in in 1951. The fact that a procedure appears on a piece of paper outlining the activity that an aircraft should follow when holding is to some extent a statement of position and can casually be accepted by saying that this is what the procedure calls for. Unfortunately, the procedure is no good. The procedure is unrealistic. We need go no further than the Washington area to find out how unrealistic the holding pattern philosophy is, and I would point out that in the holding patterns that have caused some trouble here in Washington in recent months, which fortunately

have been modified, there has not been a jet aircraft involved. These are the so-called old-fashioned type DC–6, DC–7, and in some quarters Viscounts, supplemented with the Electra type aircraft.

Therefore, FAA recognized the holding pattern problem at a considerable time prior to this accident.

Around last August we supplied comments to their proposals, which were mentioned this morning, which we believe had considerable merit and could very well have been the basis for preventing this collision in the first place, had the procedures been implemented.

We urged and pointed out the high priority we placed on the implementation of this new concept, recognizing the serious problems we had in the terminal areas. This was greatly magnified by the presence of turbo jet commercial aircraft.

I would point out for your information that jet aircraft under the ATC system is not a new thing. Jet aircraft have been in the ATC system for well over 10 years. The military, fortunately, have received some pretty good consideration in being provided with jet climb corridors, jet penetration approaches, and procedures that we feel should be applied to the commercial turbojet aircraft.

The complexity of today's system is such that regardless of the weather, it is practically and completely impossible for the crews flying our jet aircraft to look outside, see and avoid other airplanes. Adherence to the system requires constant attention to the inside of the cockpit itself, and we are quite concerned that we are flying through some of these high density areas without being able to take advantage of the eyesight.

Therefore, it is perfectly obvious that the holding pattern concept that we use today, particularly in the high density zone, must be modified at the earliest possible time. We must have holding patterns that are realistic with the performance requirements of the aircraft. One of the basic deficiencies that I feel FAA has had in their approach to the air traffic control solution is the point that they have designed the system and then tried to fit the airplane into it. I feel that the airplane has an operational requirement that must be met, and the ATC system must satisfy this.

To give you an example, recently we had a proposal to slow down airplanes on departures. This applies particularly to jet aircraft. The original proposal was less than a minimum speed that will permit these aircraft to operate in turbulence. This is a very basic conclusion. If the aircraft is required to be flown at 250 knots, minimum speed through turbulence, this must satisfy this requirement. This is not a pilot position nor a personal individual whim. This is a requirement of the aircraft and it must be solved.

Therefore, the holding pattern problem, and the fact that an aircraft is cleared through an intersection, does not necessarily in my opinion relieve the system responsibility to insure, particularly when it is possible to visually observe the flight of the aircraft, that it is able or unable to adhere to the clearance limit.

In this particular accident, there is no doubt whatsoever that the jet aircraft exceeded the Preston intersection.

Then we come up with asking the questions: How, why, and what happened? We don't have these answers yet.

There has been a detailed study of all available aircraft components, particularly in the navigation equipment on the aircraft. No information has become available to date in spite of a very thorough investigation which would explain from the cockpit side what caused the aircraft to pass Preston, particularly the distance that it did.

We know, however, that prior to this flight aircraft were passing Preston. We know, also, that in holding patterns in the New York area aircraft were passing intersections. So much so that in one holding pattern in the New York area it is current practice now to radar-monitor the holding pattern, and it was prior to the accident; and if it becomes apparent that the aircraft are unable to adhere to the holding pattern dimensions through radar observations, the holding patterns are relocated to another site.

We hear that there is a considerable problem of radar-monitoring aircraft in holding patterns, and yet the New York center today is effecting radar handoffs with the Washington center with aircraft not equipped with radar transponders on an airway that is probably the most heavily traveled in the world.

Ironically, the situation in New York does not reflect a superabundance of aircraft in the New York area. In fact, traffic to all intents and purposes was extremely light. The most traffic that was involved in any scope or area of jurisdiction was three. This number represents the total targets in an area of jurisdiction, all of which were radar-dentified.

Getting down to——

Senator MONRONEY. Could I say that Senator Engle and I both have to leave in a very few minutes. Before you start on another subject, we would like to find a place to land. We could stay another 5 minutes or so and then resume with part of your panel if you care to tomorrow. We can excuse those who have to return to their duties, and take this up again at 10 o'clock tomorrow morning. Would that be satisfactory?

Mr. SAYEN. We are going to be here tomorrow. But we have a meeting, starting about noon. We could be here in the morning. I think everyone can be here in the morning.

Senator MONRONEY. Suppose then, since we do both have appointments at 4 o'clock, if this is a good stopping place, we recess the hearings for today and resume tomorrow morning at 10 o'clock.

Mr. SMITH. May I, Senator, cut this discussion off with the recommendation.

Senator MONRONEY. Yes. You can summarize this particular phase and resume tomorrow.

Mr. SMITH. That will take care of the holding pattern problem.

Senator MONRONEY. You are all through, then, with the holding pattern?

Mr. SMITH. On that particular subject; yes, sir.

Senator MONRONEY. The committee will stand in recess until 10 o'clock tomorrow morning, when we will continue hearing the Air Line Pilots Association pilots.

(Thereupon, at 3:50 p.m., the subcommittee was adjourned, to reconvene at 10 a.m., Tuesday, February 28, 1961, in Washington, D.C.)

AIR SAFETY

TUESDAY, FEBRUARY 28, 1961

U.S. SENATE,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
SUBCOMMITTEE ON AVIATION,
Washington, D.C.

The subcommittee met, pursuant to adjournment, at 10:23 a.m., in room 5110, New Senate Office Building, Hon. A. S. Mike Monroney (chairman of the subcommittee) presiding.

Senator MONRONEY. The Subcommittee on Aviation will resume its hearing.

At the time of our recess yesterday Mr. Sayen, president of the Air Line Pilots Association, and his vice presidents, were testifying I believe on the holding patterns over the New York City area.

FURTHER STATEMENT OF CLARENCE N. SAYEN, PRESIDENT, AIR LINE PILOTS ASSOCIATION; ACCOMPANIED BY JOHN C. CARROLL, J. D. SMITH, HAROLD R. MILLER, EDWARD R. WATSON, HOWARD C. KELLY, AND MEL LOGAN

Mr. SAYEN. Before we go on, Mr. Chairman, I would like to clarify, if I may, one statement that I made yesterday. I want to make it very clear.

I stated that if I had been flying United or TWA airplanes and received the same information under the same circumstances as this pilot received, we would have conducted the flight in the same way; and that this was the consensus of our views. I want to clarify, if I may, exactly what I meant, because I think there might be some confusion.

The sequence of clearances that were given to this pilot in terms of what they customarily mean to pilots operating in this kind of an environment, will convey this kind of information to this pilot. And as he came in at cruising altitude, the clearance said to him, in effect—he asked them, "If I am going to have to hold, I want to hold up here." And he was told in effect, in return, "No, you are not going to have to hold, we are going to bring you in. In effect, we are going to expedite bringing you in by this series of clearances."

He asked whether he could get down and he was told he could, and he then proceeded to follow his clearances down.

As far as the information he had all during the descent and approach it was pretty obvious that there was no intention to hold him, and that the flight was going to come directly in.

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And so, as he was coming up on Preston, as far as we can tell, as far as the pilot in the cockpit was concerned, he felt that he had never reached Preston. But coming up on Preston he was in a position to where when he switched to tower control he felt that he would be cleared directly in. Or alternatively, if he was not cleared directly in, not having yet reached Preston, he was in a position then, and he was in the process of reducing speed, which was shown by the charts, he was in a position to go into the holding pattern at a reduced speed.

This is the situation we feel, as pilots, this is the information the pilot had, this is the reasoning process that he would have been following, and to us this is a reasonable process. This is what I meant by my statement.

Senator MONRONEY. Would you have been concerned as pilot over the loss of half your navigation equipment?

Mr. SAYEN. No, but I would like, if you want to get into that further, Captain Smith was the chief of our investigating team in that entire matter. In our view he had adequate navigation equipment.

Senator MONRONEY. We are not trying to fix blame for this accident or any accident. We are trying to examine the known facts to see what regulations may be put in to prevent the next one. This is our concern, and my question yesterday was if you would have flown the course in the holding pattern in excess of 400 miles—I think 445 is the generally accepted figure off the tape recorder, with the loss of half of your navigation equipment.

In other words, it resolves itself, I think, into the question of why did not we have positive radar surveillance.

Senator ENGLE. Will the chairman yield before you go on?

Senator MONRONEY. Yes.

Senator ENGLE. Will you clarify the point that has been made several times, and I want to be sure the record is straight: Did he lose half of his navigation equipment? I can't believe that.

I hope we are not, by repeating a statement, getting something in the record here that is not correct. He lost one omni. That isn't half his navigation equipment by any means. If I read the reports correctly.

I think that ought to be clarified immediately. The reason I interrupt, Mr. Chairman, is because that statement has been made several times. If I lost one omni I wouldn't think I lost half of my navigation equipment where I had another omni, ADF, and Lord knows what else.

Mr. SMITH. If I may speak to that point, Mr. Chairman, actually there was a report made from the aircraft which would infer that the service of one VOR receiver was inoperative. This would leave in the aircraft another VOR receiver, two ADF receivers, a marker beacon receiver, and, of course, his communications system.

Through speculation you could assume that one VOR receiver was inoperative on the copilot's side.

Senator MONRONEY. But one is enough?

Mr. SMITH. The regulations in effect today authorize participating in the ATC system with a single VOR receiver. There are many aircraft flying the system with a single VOR receiver today.

Senator MONRONEY. But is there any manual of any company that would permit a takeoff with one known omni out?

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Mr. SMITH. Referring specifically to the jet aircraft, if this particular component that was reported as inoperative were actually the problem of the system, the aircraft could not have been dispatched with this part inoperative.

Senator MONRONEY. This is what I was trying to get at, that this was an important part. It may not have been half, but it was an important part on these highly sophisticated aircraft for finding your fix and making it more definite and certain that you would have a fix when you came over a certain point, particularly where there was a narrow separation when changing your ranges.

The question arises, in searching for ways of doing this, the testimony of the FAA indicates that they are going to attempt voluntarily, on the part of the airline pilots and on the part of the companies, in situations occurring hereafter, that they will ask that this deficiency, whatever degree it amounts to, be reported to the control towers so that they would be able to extend some extra help as a matter of course.

Mr. SMITH. Mr. Chairman, if I may, I would like to point out that the procedures that the system had in effect on this day in my opinion were more than adequate to flight-follow this aircraft and observe any deviation whether the pilot reported the incident to the ATC system or not. I think this gets into the area of classification that I referred to yesterday that possibly we can point out as we go along with our testimony this morning.

Senator MONRONEY. That will be fine.

Mr. SMITH. As you will recall, we finished up yesterday with a recommendation of implementing a realistic holding pattern airspace before holding procedures. We would like to also mention that one of the problems we have experienced with holding patterns, particularly in the high-speed aircraft, are the routings into them. Usually the problem centers around the first couple of turns at the fix, and after things slow down you are in fairly good shape and you can remain in the airspace set up for it.

Referring back to this particular flight, and picking it on up east of Allentown, this aircraft was picked up on radar and as you know given a clearance to go Victor 30, and 123 on up toward Preston. In addition to this aircraft there were also other airplanes being directed toward Preston.

There was an American 707, and an American DC–6. The 707 was destined for Idlewild, and the DC–6 was destined for La Guardia.

Considerable discussion and comments have been rendered toward the radar service that the commercial turbojet aircraft are afforded by the ATC system. I don't believe there is any difference of opinion as to what this system provides at altitudes of flight level 24 and above. There seems to be discussion as to what takes place below flight level 24.

It has been our feeling, in a review of the NOTAM's that have been distributed to the pilot group, testimony that the FAA has given before Congress and reported to the President and publicly, that the ATC system was providing a radar flight-following service to the commercial turbojet aircraft at all altitudes. The term "at all altitudes" is contained in the NOTAM's that were distributed as the jet route program was expanded.

This is in the form of a radar flight-following service to the extent that information will be given consistent with the controller workload as determined by the controller.

Ironically this particular phase of the system does not have any direct relation to this flight.

The radar application of the system is even more direct when you analyze the aircraft involved.

Because of the fact that radar was being used to feed the Preston holding pattern between United aircraft and the American flights, there is a specific requirement of the system to maintain identification of these aircraft receiving radar separation services until such time as the aircraft return to the ANC, which as you know is the time-distance separation concept of the system. This, therefore, obviously means that the aircraft should have been observed in some form to maintain positive identification.

An analysis of the flight recorder clearly indicates that when this aircraft passed the Preston holding pattern—as we would know it, it was still above 8,000 feet—radar separation for the United aircraft would continue until such time as the aircraft reported leaving 6,000 feet.

This, therefore, meant that the system should have been observing and maintaining identification with the United aircraft until a report at 6,000 feet was provided.

The flight recorder clearly indicates that the aircraft left 6,000 feet northeast of Preston, and shortly thereafter, within 45 to 50 seconds, we had the midair collision.

A few very important points that are factual in this regard are:

1. When the pilot called Idlewild approach control—in this case I am speaking of the United pilot—he advised that he was approaching Preston. This is a rather irrefutable indication that in his mind he had not yet reached the intersection. Approximately 20-some-odd seconds thereafter, and during the time that Idlewild approach control was acknowledging this position report, the midair collision occurred.

It is also perfectly obvious that the aircraft was well northeast of Preston when it left 6,000 feet.

Obviously one of the—actually there were two key questions that we are searching answers for. 1. Why did the pilot indicate a position other than what was actually existing in space when he called the Idlewild approach control?

2. In view of the fact that radar procedures required identification of this aircraft to be maintained, why was it not observed to be proceeding as far northeast as it did?

Quite frankly, as far as the aircraft side of it is concerned, we do not have the answer in spite of some very thorough and detailed investigations by the CAB, the manufacturer of the navigating equipment, and many other interested parties.

Neither do we have the answer from the other side of the coin.

We know that the ATC system today is a cooperative system. I might point out that if it weren't for the cooperation of the pilots and the controllers with some tremendous workloads, we would have many more problems than we do today.

But the procedures as such that were in existence at the time of this accident in effect did provide a fail-safe system if the system had been properly exercised. These are facts. The record is not as clear as it should be because we don't have the transcript of some of the conversations with the American jet airplane in the record as yet.

After laying these points, these factual points before you, I think we could proceed in answering the basis question that you asked yesterday as concerns some of the recommendations.

Senator MONRONEY. Before we leave that, I think the record should be clear. As I understand it, there are three duties in this order of priority, and check me if I am wrong:

1. It was the duty of the pilot, using his navigation equipment, to find the Preston fix. That is the prime responsibility; that is the way the airline pilots want it. They do not wish to be left solely to the judgment of the ground controllers, and they have that instrumentation even though some of it may be out. But it was their duty, first, and will remain their duty, to get their fix from the navigation equipment on the ground installation. That is the first priority?

Mr. SMITH. Yes, sir; there is no doubt about it.

Senator MONRONEY. The second priority, on which there has been some issue raised, is for this equipment on the ground to be absolutely reliable and absolutely fixed so that there can be no question regarding its accuracy as to the various locations. There is some testimony in the record at public hearings that some pilots found difficulty with a straying beam.

Mr. SMITH. Yes, sir.

Senator MONRONEY. So this was the second order of priority, and perhaps almost as good as a team with the first one.

The third one was the radar service which I believe you say or indicate was mandatory and which the FAA says is advisory.

Mr. SMITH. I had better clear that one up, Senator. Obviously I did not make myself clear.

There are two types of radar service that could be involved with this flight. One would be the particular radar service that is provided the commercial turbojet operations. This is the one that, as indicated, a form of radar assistance would be provided at all altitudes. This particular form of radar service, when a review is made of the traffic in the area, was not involved with this flight.

There is another type of radar service which is mandatory from a procedural standpoint, and in effect radar separation is being used to maintain minimum distances between aircraft under IFR that dictate maintaining identification of both aircraft involved until such time as the flights revert to the standard time-distance ANC separation.

Senator MONRONEY. That is correct. But is it not a fact that under the system and the crowding of the system that we now have, and the element of time, that the standard procedure is to maintain this radar control to the time that the area controller checks the man in, you might say, to a lock and tells him to go into locker Preston, and then, because of the confusion, perhaps, in the operational phases of it, there may be many planes in the Preston holding pattern, to then check him out of the locker and say, "Come out, we have radar on you." Isn't that the customary way, in spite of the testimony that we heard up there, that the airline pilots know when they are told to go into a

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holding pattern that they are not surveyed as they stay in the holding pattern but are under radar control when they are told to come out?

Mr. SMITH. I think, Mr. Chairman——

Senator MONRONEY. In other words, there is a gap there. This gap is what concerns this committee very seriously, so much so that we even suggested at one point in the record that maybe we need some extra radar on the holding pattern to avoid strays.

Mr. SMITH. I am familiar with the reference to this gap, Mr. Chairman, and the point that bothers me, and that I ask myself, Why is there the gap? I then find out where the problem is. There is no reason for the gap as such.

In this particular case I would not refer to this operation as a normal routine traffic flow into the Idlewild Airport for a couple of reasons: (1) This aircraft was indicated to the Idlewild approach control radar as proceeding from Colts Neck up toward Preston. Under such an arrangement an informal agreement between the center and the tower was to the effect that the Idlewild approach control would not assume responsibility for the aircraft until it was at Preston. This particular routing was not covered by the normal letter of agreement on an interagency-FAA procedure.

Normally flights coming on from the West would go over Robbinsville to Preston. The procedure, the interagency procedure of the FAA, did stipulate that the transfer of control responsibility would take place northeast of Robbinsville prior to reaching the Preston intersection.

This is a sound procedure that provides the backup.

Idlewild approach control did not receive information as to the difference of routing or actually the fact that the airplane would arrive approximately 5 minutes ahead of the previous estimate.

The Victor 30 and the Victor 123 routing was not covered in the letter of agreement, the interagency FAA letter of agreement, in as specific a way as it should have been because of allowing flexibility for routing aircraft into the Preston holding pattern.

Prior to the accident of October 26 the industry, from the standpoint of the airlines and some pilot people that were in attendance at the meeting expressed concern with routings into the Preston holding pattern.

We were told that some changes would be made to the extent that if the aircraft were actually to hold at Preston, they would be brought in over Solberg and proceed direct from Solberg to Preston. This was to facilitate the entry into the holding pattern, or this would be if there were no holding at Preston. This would line you up right on a vector for Idlewild.

If there was going to be holding at Preston, the aircraft would be brought down over Robbinsville and on up to Preston to permit time to slow the airplane up. Unfortunately the agency did not pass this on to the controllers as was testified to at the hearing.

The controller, in an attempt to help the flight out, was using this particular routing, and I take no issue with the controller because nobody had ever passed on to him the problem that we have in the airplane with this type of routing.

This is why I say that when you talk about a normal operation into the area, this is one thing. The reason that you had the gap in this

case was the requirement that the center regain ANC separation and eliminate confliction with other aircraft prior to transferring the responsibility for this flight to Idlewild. In the process of doing this, the aircraft will exceed the Preston pattern, and while under radar surveillance, was above 8,000 feet when he went past Preston, and obviously reported leaving 6,000 when well past Preston.

Senator MONRONEY. Will the separation of these holding patterns add any degree of safety to this operation in the future?

Mr. SMITH. As I understood the testimony yesterday, by enlarging the holding pattern this will automatically increase the distance between them.

I would like to point out in this case, however, that the physical location of the two holding patterns in my opinion is not necessarily the basic problem. The basic problem is the fact that in radar vectoring of aircraft, distance from La Guardia away from the Linden holding pattern, and then having the Preston holding pattern directed right into this radar vectoring area of La Guardia, this is where your exposure is.

FAA recognized this and set up a 3-mile no man's land which is referred to as a buffer zone between the radar vectoring area for La Guardia and Idlewild. Unfortunately, this particular fail-safe backup procedure was not available for use due to the fact that the airplane did not get over to the Idlewild approach control in time.

Senator MONRONEY. The speed had something to do with that undoubtedly?

Mr. SMITH. Absolutely. There is no doubt that speed played a part in this.

Senator MONRONEY. Do you approve of the suggestion made yesterday by the FAA that 3 minutes away from the entrance to the holding pattern that speeds will be reduced to 200 knots?

Mr. SMITH. Mr. Chairman, the Air Line Pilots Association wholeheartedly supported this proposal last August. We took one exception to it, and that was that if there is to be no holding, we saw no reason to slow the airplane up. If there were actual holding contemplated, we recognize the merit of this proposal.

I might point out that this is the first time that we have had a procedure proposed covering the speeds and the entries into the holding patterns. There are no procedures as to speeds of entering holding patterns today.

Senator MONRONEY. It was only the speed inside the holding pattern before, in company manuals. Speed was also recognized apparently but it was not recognized as a prior requirement to entering and finding the holding pattern. This was the testimony here. At least I am convinced that there is such split second accuracy required because of the varying speeds that in the course of conversation of turning the plane over from area radar control to the tower that this buffer zone, whatever else was in there, had vanished because there was no way for the tower at that time to get a fix on the plane by the time he had given the pilot that which he was required to give, and that is the weather and the traffic in the area and the various things that a tower gives when a pilot comes in for his final approach.

Mr. SMITH. That is true, Senator. I would again like to point out that according to the informal agreement between the center and

tower facility, the tower would not anticipate accepting the actual control of this United flight until it reported at Preston, because he was under the impression that this aircraft was proceeding from Colts Neck to Preston. Unfortunately this was not the case.

Senator MONRONEY. The directions had been changed by the area radar, and not communicated to the approach control; is that correct?

Mr. SMITH. I don't know whether I could state the term "area radar" as such. I could say that the information was not relayed.

Senator MONRONEY. Not relayed to the control tower or that the ETA had been moved up 5 minutes?

Mr. SMITH. Yes, sir.

Senator MONRONEY. Would the pilot still say if there was no holding, no holding indicated at Preston at that point, that it would be unwise to slow the speed down whether there was holding or no holding?

In other words, your space is just as close, and your margins are just as thin, on finding the Preston fix and to getting on to approach radar at that point as there would be had there been a holding required at Preston. In other words, you are coming into a danger zone, whether there is known traffic in the area or not, because there is other traffic going a different way, or conflicting traffic in the Linden pattern being vectored in at the same time and not to the knowledge of the individual approach tower man at Idlewild.

Mr. SMITH. I think if we were to take a quick review of the American 46, which was a 707, 4 minutes behind this DC–8, we find out from the transcript that when this aircraft called Idlewild approach control and said he was approaching Preston he was given clearance to leave Preston on a heading of 120, but it was subsequently rescinded.

This I feel quite certain was the type of treatment that the Idlewild flight would be expecting because he knew that when he reached his 5,000 feet he would be going on over to the Idlewild approach, and this is a normal routine arrangement, that when there is no traffic involved at Idlewild, approach would give you a clearance away from the intersection and radio identify you as you checked over Preston.

Senator MONRONEY. In transmission, there is necessary information—and the tape shows this—of the approach radar giving this pilot his weather, his ceiling and other necessary information. Although there was no traffic in the area, he would he well beyond, or could be well beyond, the holding fix.

The point I make is why can't these planes be slowed down before they get into the holding pattern? What is wrong with that?

Mr. SMITH. There are a couple of things involved, Mr. Chairman. One, to go back to the basic point I brought up yesterday, I will agree that this aircraft could have been slower when it passed Preston. A jet aircraft is a pretty flexible piece of machinery under certain circumstances.

We ran some test flights after this accident, entered the Preston holding pattern at 320 knots indicated, and were able to remain within the holding pattern.

Senator MOROEY. OK. You used reverse thrust, did you not?

Mr. SMITH. This is correct.

Senator MONRONEY. Is there a DC–8 pilot among you?

Mr. SMITH. No, sir, I don't believe so.

Senator MONRONEY. That is unfortunate because I would like to ask the question: How often is reverse thrust used in the normal flight.

Mr. SMITH. I can answer that.

Mr. SAYEN. That is just common practice. I was on a DC–8 flight in the last couple of days and we used reverse thrust on descent in all cases.

Senator MONRONEY. At idle or power?

Mr. SAYEN. Just inboard reverse.

Mr. SMITH. If I may point out, Mr. Chairman, DC–8's are certified to accept reverse thrust at any speed up to VNO, and it was testified at the hearing that use of the reverse thrust is—this is not applicable to other aircraft but specifically to the DC–8—reverse thrust is an available tool for slowing down. In fact, it is one of the most effective ones.

Senator MONRONEY. It is a little noisy and it does result in some shaking of the aircraft as though you were in turbulence, does it not?

Mr. SMITH. Yes, sir. In fact, I would be quite impressed with the operation the first time it occurred if I had not been made aware of it beforehand.

Senator MONRONEY. Isn't there some tendency to scare a hundred passengers with this, and for the comfort of the passengers, and tranquillity inside the cabin, the pilots do not use it as often as the silent spoiler which can drop your altitude and slow your speed without other mechanical means?

Mr. SMITH. Some of these spoilers are different equipment. There are various restrictions. The best information I can obtain, in discussing this reverse use with various airline operators, is that this is not an unusual operation.

Senator MONRONEY. Let's get back to the primary question.

What is wrong with slowing down to a snail's pace of 200 knots an hour, as you are 2 or 3 minutes away from the holding pattern?

Is time so precious on arrival, or must we crowd the system so greatly that we cannot just yield to a little more margin of safety of approaching this as you do on a highway? If you are coming to a red light or a stop sign, you get a notice far enough back where a careful driver can begin to decelerate. This, after all, is an aerial stop sign, when you come to your holding pattern.

Mr. SMITH. Mr. Chairman, I believe Captain Carroll has some comments on this subject.

Mr. CARROLL. I think maybe we can clear up something that may have led us into a misunderstanding. I think the point that you are making here is very well taken. I think this practice is overdue. The method of trying to determine when you are 3 minutes from a point, slowing down and entering into a somewhat slower speed, this is something that is overdue as far as I personally am concerned.

But the point that I want to make and the one that is apparently being overlooked here a little bit is the undue emphasis—what I consider undue emphasis—on the speed with which this aircraft was being flown.

The one thing that we have to consider as basic is that the pilot of this DC–8, Captain Sawyer, did not have indication in his cockpit that he had reached Preston. So whether he was going 100 or 200

knots, this simply is the only thing that will determine what time he reached this point over Miller Field, where the collision took place.

The fact that he was going 400 or 200 knots is somewhat irrelevant to the fact that he would have arrived at the same place.

We can say that this particular morning had he been going slower he would not have hit the TWA Constellation and might have hit the next plane in the La Guardia pattern. But the speed at which he was flying is a point that is not completely relevant to the fact that he had proceeded past the geographic point on the ground at Preston.

Senator MONRONEY. It is his prime duty to find that geographical point. If he was having a little more than normal navigational problems, and given a shortcut under those conditions, which he was given, to come in, which further narrowed the airspace separation, then speed apparently, without his knowledge, did shorten the time element considerably in which other things could have happened.

Had radar handed him off a minute or two earlier and told him to contact the tower, had ceased that aerial surveillance and turned him over to the tower a minute or two earlier where the control tower then could have had a response from this man, he would probably have had the area radar on him at that point, would he not?

These are all "iffy" questions and I am still not trying to get down to this particular accident but to use whatever known information from this accident there is to try to see what kind of a fail-safe addition we can put into the system.

Mr. CARROLL. Let me see if I can discuss this a little more since it is on the table. The word "shortcut" was used consistently in the discussion of this particular accident. As far as an airline pilot is concerned, there is no such thing as a shortcut. We have a particular route that we are cleared to fly, especially when we are under instrument conditions, and we do not regard this as a shortcut. The shortcut is a straight line from wherever you are to the point that you are going to go. This is the shortcut.

The impression was given that there was a corner cut here, in this terminology used. I think it has led to some erroneous impressions that maybe there was dereliction shown on somebody's part because of the route that was followed.

Senator MONRONEY. This was the assigned route. It was not the pilot's fault. He was originally to come in over Robbinsville, which would have lengthened the distance some 8 or 10 miles.

The control-tower man apparently expected him to come in over Colts Neck, which would have lengthened it several miles. The route he took was a shorter route. Whether it was a shortcut or not, I am not prepared to say. But it lessened the time in which the pilot had to adjust himself to the turnoff of Victor 30 onto 123, and in a matter of a minute he was over Preston.

So the normal time to adjust to a changeover from control A area to control C on approach was not there.

Therefore, the speed shortened this time and the route given was shortened also. You therefore condensed your airspace that you had to fly in and it took much faster action and much more careful action if the pilot was to identify Preston fix as he went over. Is that not correct?

Mr. CARROLL. That certainly is partially true. There is no such thing as a normal route there; you must realize that. We have only a cleared route. A route down over Robbinsville is not necessarily the normal route. As a matter of fact, Victor 30 onto Preston had been considered the normal route wherever it was possible, and air traffic control was accustomed to clearing the airplanes that way. And of course, as Captain Smith had pointed out, on October 26 there was a semiannual meeting sponsored by the New York Airways Traffic Control Center to gather information from the chief pilots of the companies and the pilots who fly into that area. And this particular procedure was pointed out as one that the pilots thought should be sharply reviewed.

It of course has since been changed. This is the one change that I am aware of that has been made in this particular area. They have not changed the Preston pattern but they have advised the center that they are no longer to route aircraft into it via Victor 30, that they must come from the southeast as far south as Robbinsville.

You made another point that needs clearing up and that is the matter of partial navigation aids, as if there was something that should have been perhaps taken into account. And of course now a regulation has been promulgated which says that an airline pilot is obliged to report to the FAA whenever he has some part of his navigational equipment that is not operating. And then he is supposed to indicate what effect if any this will have on his ability to use the airways system.

It was also pointed out this morning that there are aircraft using the system, as a matter of fact probably a majority of them, which have only one receiver to begin with. So the answer is that if it requires two, then there are not enough on the other airplanes. If one is enough, then it does not impair the ability of an airline pilot to use the system with one.

Senator MONRONEY. A good pilot flying, I guess a jet, could do it. But do many jet 707's, 720's, 880's, DC–8's, have less than two?

Mr. CARROLL. They all have two installed. And of course hopefully they are always working. Occasionally we do have problems with them. There is no question about it. It is handier if there are two available. But it is certainly not a mandatory item to have the two.

Senator MONRONEY. Let's face it. I want the Airline Pilots Association to tell this committee whether they consider the second omni merely a spare tire, to be used when the other one goes out, or whether they consider it a very important part of their navigation equipment on high-performance aircraft.

It is not any good to say the business aircraft use one omni. I don't think there are over two or three jets in the business fleet. I would also bet a hat with Bill Lawton here that those have two omnis. After all, it is a tax-deductible item.

This business of saying there are other planes in the pattern, sure. They are piston-driven aircraft. Some of them may be hotrod bombers but they are still flying at top speed, almost, to what the speed has been suggested for coming into a holding pattern as the slow speed for jets.

Mr. CARROLL. I am currently flying jets into this area, a Convair 880, regularly. As far as I am concerned, I can use this system very handily and very conveniently with one omni working. I find it handy to have two. But as far as I am concerned, it is not at all necessary to have two to operate in this system.

Senator MONRONEY. You would not want to be flying into New York every day with just one, would you?

Mr. CARROLL. If I have two available, I would certainly like to have both of them. But believe me, sir, I do not consider it necessary that I have both of them.

Senator MONRONEY. If you lose one, the other is sure worth its weight in gold. But perhaps two are worth their weight in silver, in helping you to be a little more definite. I am sure you will admit that you are a little more definite, a little more easy in the cockpit if you have two, so if you change from Victor 30 to Victor 123, you are coming off of Victor 30, and prior to approaching 123, you will set it for Victor 123, will you not? Then immediately you will turn the other one on to whatever the range fix would be on Preston, so you would not have to move back and forth at great speed in that short period of time to be able to have one on your forward heading, Victor 123, and another to where you intersect Victor 123 with another range to give you Preston.

Mr. CARROLL. I do not pretend that it is not more convenient to have two, nor that it would not call for a little more attention on the timing of the tuning and so forth, a little more anticipation. But this is the kind of thing that we are completely accustomed to doing. We have a very great variety of situations that face us as we operate this navigational system into these areas.

I must say again that I do not consider it impractical or impossible or truly very inconvenient to use only one omni. I have done it on a number of occasions in airline aircraft, for one reason or another.

Of course it seems to be overlooked but there is not anything that prevents airline pilots from exercising their certificates as private pilots. Due to circumstances I have had a good many occasions in recent months to fly into the New York area in light aircraft under instrument conditions, with only one omni, and with this same omni being used for two-way communications, to add an additional burden on the thing. It is quite busy.

Senator MONRONEY. There is quite a difference in your speed between that and the 880, though?

Mr. CARROLL. As far as I am concerned, I say again it is a question of timing, and I must anticipate a little more.

If I had only flown the light aircraft and then were thrown into the 880, I would find the cockpit tempo probably beyond my immediate capabilities.

We have three pilots on this jet, we have a number of other things which we use to provide us with the ability to handle this increased tempo. In the light plane that I was speaking of, of course, I did not have an autopilot, did not have a copilot, and the additional time is most useful. But there is not an airline pilot who is not aware of the fact that if there is an accident, or if he for some reason or other, whatever it may be, fails to maintain his position in the airspace in a

crowded area, that he is very likely to be the first one at the scene of the accident.

These things almost always hit nose first. This is something that the men are acutely aware of.

I think this is the thing that plagued the airline pilots—as you continue to read in the press—that perhaps we are not interested in safety. It is something which upsets us grievously. We have an opinion, and this is the type of conversation which takes place in sessions between pilots and in other professions such as doctors.

Doctors have a very grave responsibility. But if there is a serious mistake made with a patient, they have lost another patient. If a lawyer makes a serious mistake in defending a client, he has lost another client. If an airline pilot has made a mistake, he probably, in many cases, has lost his life. This is something, and we continue to read this as if we are not interested in safety. It hurts a little bit.

Senator MONRONEY. This is not the feeling of the committee or anyone associated with aviation. We know the great contributions pilots have made. And we know that whatever our exposure is as frequent riders of airlines, yours is 10 times or a hundred times as great because you are in those planes a great many times each week.

The thing that worries me a little bit is the statement that the pilots had opposed the slower speed going in when there was no holding necessary, going into a holding pattern. And, secondly—if I am wrong I hope you will correct me—that the new suggestion for voluntary reporting of an outage of navigational equipment would not be welcome by the pilot.

Mr. CARROLL. Sir, this is not voluntary. It is mandatory. I have tried to make the point without delving into it too deeply, that we consider it totally unnecessary. It will require a utilization of an already crowded communications facility for no purpose whatsoever. There is scarcely a trip that goes by that we don't have some kind of main or major problem with our two-way navigational equipment.

This is one of the severe limitations on the use of radar as a navigational and as a traffic separating device. A good percentage of the time as we switch frequencies at the direction of air traffic control from one to the other, we are unable to raise the new position the first time we contact them.

The first thing we do is recycle our equipment. We have two different knobs to turn to get the thing in position. And we recycle it to be sure that the crystals have switched into the proper position. And we make another call.

Then if we do not have any luck with that one we switch to our other two-way and switch to that frequency and make a call on that.

Of course now standard practice for our third pilot is to maintain a continuous record so that we can remember the last frequency that we have used, because we have 40, 50, or 60 frequencies that are in effect, and sometimes you are on one for only 20 or 30 seconds or 2 minutes, and you change back and forth.

So this is going to call for a reporting procedure, a use of the communications facilities between the pilots and the FAA centers that I personally am convinced is completely unnecessary. It will not contribute one iota to safety because it will still require the pilot to declare what impairment he has in the use of his system, and if he

does not declare any, then the matter is completely extraneous except in the event there is an accident to come back and say he made a mistake in judgment here, where he said it did not impair his ability to use the system, and he obviously had this impairment that he did not anticipate.

Do I make my point clear?

Senator MONRONEY. You make it very clear, and I am going to be a little more nervous each time I fly, because I would like to feel that there was a radar eye a little bit brighter on the plane that I was riding in if the pilot had notified the approach control, the area control, that part of his navigational equipment was malfunctioning.

Mr. CARROLL. That is the next point that we proceed to here. Regardless of whether the pilot is obligated to report what part of his equipment is or is not operating, it is still incumbent upon him prior to this regulation to take such action as he deems necessary to protect himself, the aircraft, and the pilots. This he is obligated to do in any event, whether he must in addition report what specific item of his equipment is out. This is the part. Believe me, you need feel no more uneasiness prior or after this particular reporting procedure because it still is completely incumbent upon the pilot to determine to what extent he needs additional help beyond the regular amount.

So this is all I am trying to say, that I do not see that this adds anything except a record to be used for some purpose which is not altogether clear.

Senator MONRONEY. The United pilot in this case did feel it incumbent upon himself to report it to United on the company radio. United could not do too much about it. That does not help me out to have Pat Patterson know that half of the panel was gone. I would much prefer to have the approach control and the area radar know that, rather than going into the company headquarters. For any good reason or any bad reason, there might be somebody looking just a little bit sharper.

Of course, we assume that they look just as sharp as they can.

Mr. SAYEN. There is no evidence whatsoever from the track being flown in this case that this pilot was having any difficulty navigating. Preston, yes, he did not know that he had gone past Preston. That is perfectly obvious. But otherwise the track that he flew was an excellent track.

Senator MONRONEY. That is fine. He had one omni and lots of time to shift it around and know where he was, and the radar and flight recorder showed he was exactly on the course until he got close to Preston. When he got close to Preston, something happened. We don't know what. And the stop line was there, and was not seen.

Mr. SAYEN. That is right.

Senator MONRONEY. He got into one-way traffic going the wrong way beyond Preston. I cannot see where reporting some malfunction would have been detrimental or would have so cluttered the already heavily burdened communications system that it would have been detrimental to safety.

Mr. SAYEN. You get down to a question of judgment, Senator, the question of whether the pilot has some malfunction which is a perfectly routine malfunction and for which alternatives have been provided.

We are now going to notify somebody on the ground who may or may not know the significance of this, or be able to evaluate it in relationship to the overall flight situation in which the pilot finds himself. It is still the pilot's responsibility to navigate the aircraft, to accept or reject clearances for the movement of his aircraft, and so forth.

If he wants additional assistance from the ground, or if the ground assistance is supposed to be provided, this should be handled in any event.

Just reporting to somebody on the ground we cannot see makes any particular contribution except to further congest the already congested communications system.

Senator MONRONEY. Do you have any questions on that, Senator?

Senator THURMOND. I have another question.

Yesterday I believe you testified, Mr. Sayen, that the records show that 17 fatal accidents occurred during the calendar year 1960, in which 429 passengers and 36 crew members and 13 others were killed. That is page 2 of your testimony.

You categorize these in three categories, I believe?

Mr. SAYEN. Yes, sir.

Senator THURMOND. In the first category, which is during takeoff and climbout, you listed as a cause of the accidents there bird ingestion, mechanical, weather. Those were the causes of the accidents that actually occurred, is that right?

Mr. SAYEN. Yes, sir. This is a general category.

Senator THURMOND. There are four listed here.

Mr. SAYEN. The accidents are broken down in the appendix more specifically by what we consider the factors that set up the potential situation for the accident, or caused the accident. This is just a general categorization on page 2.

Senator THURMOND. There are four accidents listed as resulting or occurring, rather, during takeoff and climbout. And they resulted from one of these causes.

The question I want to ask you is this: Are there other causes that did not cause any of these accidents that you did not list and that you visualize could have caused an accident during takeoff and climbout.

Mr. SAYEN. I am not certain——

Senator THURMOND. The three points you mentioned caused the four accidents that you list: bird ingestion, mechanical, and weather?

Mr. SAYEN. I think in the further categorization of accidents and accident potential that we have described, that there are areas of potential hazards that we tried to point out.

Senator THURMOND. I wonder if you could give us what would be the cause of other accidents during takeoff and climbout than those you have listed here as causing those four accidents?

Mr. SAYEN. One of the things that we have pointed to very strongly here is the question of underrun and overrun accidents. On takeoff of course overrun potential, in case you have to abandon the takeoff, such as happened in the Aeronaves accident at Idlewild, is a very real potential where you do not have adequate overrun on the airport. That is, where you have minimum length runways for the weight and performance of that particular aircraft and the computations

are made largely on the basis of dry runways, and almost ideal performance of the aircraft. And you might have complications of snow, ice, slush, rough runways, gusty winds, and so forth, or some failure of the aircraft, that the ability to stop within the airport is marginal.

In this case if you do not have some overrun area off the end of the airport, or if you have a blast fence, as they had in this case, to hit, the potential for accident is very large and the potential for damage to the passengers, or death of the passengers.

In this particular accident it was fortunate that the passengers got out. The crew were killed, with one exception. We think that this is a subject, for example, of comparative importance at all airports, to have an adequate overrun area. It should be combined again with adequate firefighting facilities. If you are going to puncture this airplane in some way so that you get fuel, and so forth, a combination which produces fire, you need adequate facilities to get the passengers out of there in a hurry with safety.

You can increase the survivability of these accidents very much. This is an area we pointed out that we think is an extremely important area. There are too many airports with cliffs on the end of the runway, and we pointed out yesterday one with a duck pond on the end with a 75-foot drop, with blast fences immediately across the end of the runway, some of them running out into busy streets, with strong fences, and so forth.

We think, and we pointed out, that the Doolittle Commission recommendations in 1952 called for overrun and underrun areas. We pointed out the extremely large number of accidents that are happening immediately in the airport vicinity from landing and takeoff.

Senator THURMOND. From your experience and the statistics that you have compiled, is there any particular cause or several causes that are preponderant in producing these accidents during takeoff and climbout?

Mr. SAYEN. I don't know of any single category that would have a preponderance over others.

I think the one that I have just described is the one that worries us as much as any. But I do not know, statistically, whether I can give you an accurate answer to that question.

Senator THURMOND. I would like to ask you the same question as to your second category, which is en route: cabin explosions, structural failure, weather, mechanical, and terrain.

What additional causes would produce accidents en route?

The ones I just mentioned are the ones you listed as causing the seven accidents.

Mr. SAYEN. Of course another possibility en route always is midair collision. We have had five collisions during 1960. They were all in the terminal area, in the vicinity of the airport. But an en route midair collision, as we have learned at Grand Canyon and two or three other cases, is always a possibility.

Senator THURMOND. Is there any particular cause, or are there several causes there that are preponderant in producing that type of accident?

Mr. SAYEN. I think one of the things that we have pointed out over the years, in which some progress has been made, is that for en route traffic we still rely at many areas for altitudes on the see-and-be-seen concept, for maintaining clearance between aircraft.

With high-speed aircraft this is an obsolete concept which is impossible of performance. We are still seeing IFR and VFR traffic in come area, and we would like to see positive separation as much as possible. And of course what we would dearly love to have for Christmas would be a self-contained anticollision device by which we could maintain our own clearance from other aircraft by something which is within the airplane and not on the ground.

Ground assistance is fine, but we would like to have that sort of device. Unfortunately such a device does not exist today.

Senator THURMOND. I did not get to hear all of the testimony during this investigation.

Did you bring out any type of instrument that would divert a plane and prevent a collision in the air?

Mr. SAYEN. No. We don't know of such device that is developed and reliable.

Senator THURMOND. I was told that one is being worked on.

Mr. SAYEN. I think a great deal of research is going on in some organizations. I think some of the testimony said that 64 different devices have been at least looked at or suggested in recent years.

Of course, we go out and take a look at every one we hear of. But to our knowledge there is no device that is presently existing that is for sale, that will be reliable, and that does this job for civil airports.

Senator THURMOND. I think I read an article about such a device being available on the highways to prevent highway accidents. I understood that may be possible in the air, too.

Mr. SAYEN. We hope it is, and we hope that there will be tremendous research efforts devoted to this particular device because we think this comes closer to the answer for many of our problems than some of the other proposals.

Senator THURMOND. Who is doing research on that now?

Mr. SAYEN. I don't think I could list the companies, but I am sure that FAA can give you a complete list of the companies.

Senator MONRONEY. Is that under the direction of the FAA or some Government agency, or is that entirely by the private companies?

Mr. SAYEN. FAA has a working group, I know, that are evaluating operational criteria and analyzing all the different suggestions that come in from the manufacturers.

I am certain that that working group could furnish the committee with a list of companies currently doing research on various methods being explored.

Senator THURMOND. But they are doing that research on their own?

Mr. SAYEN. Yes.

Senator THURMOND. A third category you listed here, at the top of page 3, was the approach to the airport. There you listed three causes of the six accidents that occurred: midair collison, mechanical, and undetermined.

Are there other causes that have produced accidents to any extent on an approach to the airport?

Mr. SAYEN. We dwelt at quite some length in our statement and testimony yesterday on what we call the underrun accidents, the accidents where the pilot touches down for some reason just prior to

beginning of the runway, all the way from six inches to several miles, and pointed out that statistically this seems to be an increasing area of accidents.

There has been a great deal of study done on it. This is an area which we pointed out is an area of hazard and we would like to see underrun areas as one feature of an airport, which has been recommended for many, many years, which would prevent these becoming serious accidents.

Senator THURMOND. Do you recommend longer runways for the jets?

Mr. SAYEN. Yes.

Senator THURMOND. What did you recommend on the side; impacted areas similar to shoulders on the highways?

Mr. SAYEN. Yes, to do the same thing with our runways as we do with shoulders on the highway, to have them compacted so that running off the runway would not result in serious accidents.

We have had a number of seriously damaged aircraft and potentially hazardous situations from running off the runways.

Senator THURMOND. Did you recommend it for any particular distance, 12 feet or any particular width?

Mr. SAYEN. We suggest one-third the width of the runway on either side.

If you had a 150-foot-wide runway you would have 50 feet wide on either side compacted at least strong enough so that you do not bog down in the mud when you run off the runway.

Senator THURMOND. Thank you very much.

Senator MONRONEY. Senator Engle?

Senator ENGLE. I have no further questions at this time.

Senator MONRONEY. Is there anything else on this New York case that you would like to bring up?

Mr. SMITH. Yes, sir. I believe there are two points that I could briefly clear up.

In our answer to the proposal for changing the holding patterns, the reason for taking the position we did on that, slowing down if there is no traffic, is obviously—it is our understanding that there are no other aircraft around there and therefore we don't have the potential traffic confliction. If there is traffic, then we are more than willing—we felt if there was merit in the procedure to slow down.

As concerns the changeover of the United flight to Idlewild sooner, this could have been helpful. Unfortunately, the procedure that the controller had to adhere to prohibited him from doing this until such time as the aircraft reported leaving 6,000 feet. The controller was in a bind. There wasn't a thing he could do as far as transferring that plane over, the way the book was written.

We have a few guesstimates here that have been highlighted as a result of reviewing this accident to date. Even now we don't have all the information we would like to have. Obviously there would be an advantage to having 3–D radar although we will need more accuracy in the equipment than is obtainable so far. Unfortunately, we must accept the fact that we don't have 3–D radar and we won't have for a couple of years anyway. In the interim, as we have often been faced with, and from the industry standpoint, we have to figure out how to get better use of what is available.

The top priority item right now would be radar handoffs for inbound aircraft. I will concede there are occasions when this is a rather difficult task to accomplish due to the numerous unidentified targets on the scope. However, I also feel quite strongly that there are many occasions when this can be done. I see no reason to withhold implementing radar handoffs consistent with the capability until such time as you have a completely utopian solution. There are techniques that could be used in this particular case, and many others, if traffic volume was not a problem from a numerical standpoint. The traffic in the New York area was extremely light.

Radar departures or radar handoffs for departing aircraft are accomplished without too much difficulty. We have radar transponders that will improve the situation. I think the rather novel use of the radar codes together with the tower people in splitting them up will provide some relief. Ironically, we have airline aircraft today equipped with transponders which can't even use them. We think some use should be made of these.

The traffic flow patterns——

Senator MONRONEY. Before you leave that, by that do you mean to add another code where they could indicate altitude as well as identification of the plane?

Mr. SMITH. Well, sir, my own feeling, I think that you have to tie this into weather conditions. We know that in good weather obviously more aircraft are flying. When you take a peek at what is flying when the weather is bad, there is a substantial drop. The appearance of numerous radar targets in many cases disappears. Therefore, if we were to take a situation, for example, that existed on this day, where the tops of the clouds were in the neighborhood of 10,000 to 11,000 feet, somewhere around there, and the controller was aware of this and had a procedure which would give him this information, we then know that below X altitude the pilot must rely on his cockpit instruments. This is the only thing we have to use when we are in instrument conditions to determine our position.

Fortunately, the volume of unidentified traffic disappears. I feel that the bottom couple of aircraft, using Preston as an example, if they were to use a separate code on approaching patterns, say at Preston, say at 5,000 or 6,000 feet, which could be picked up by Idlewild approach control, that this radar handoff could be effected very simply.

The center people in that area have radar decoders for the transponder. I feel that we don't need the radar transponder signal as such, only for the use of identifying an aircraft. There is a primary and a secondary radar gear on the ground. Some of it does not decode transponders but will present a reinforced, better target merely by the transponder being sent from the aircraft. I think we can gain some relief in this area.

Ironically, I think that the use of transponders in the immediate vicinity of the airport may degrade safety because the signal on the controller's scope is such that already we have had some rather undesirable situations because this big blip has blocked out the traffic when the controller could not observe it.

Senator MONRONEY. In other words, it would cover what may be equal to maybe 3 square miles in area by the magnification of the

blip, and there could be some traffic within that 3 miles that would not be observed on the reflection of the radar.

Mr. SMITH. We have had this happen. This happened in quite a few areas.

I feel quite strongly that a review of this equipment and its application could provide us with some early relief. It certainly will present us with an improvement over what we have today. One of the problems referred to in discussing holding patterns was the difficulty of the routings into the holding patterns. In the particular case in New York, they were not simulated prior to implementation. We feel that the routings along with the holding patterns should be checked either by flight check or simulation at the speed that the aircraft will be operating, particularly on entry into the holding pattern. This would save us some problems in other areas where we are having and have had difficulty remaining in the holding pattern areas.

I think a better exchange of information with the working level controller in the pilot group as to each other's problems would benefit both sides.

I think from the standpoint of aircraft performance it would be very helpful if the controllers were aware of some of the restrictions that we have in the operating of our aircraft. This refers not only to speed but rates of descent.

As mentioned yesterday, we have minimum turbulent speeds of upward of 250 knots. We just cannot fly the airplane safely slower than that speed. This is what the book calls for. And there should be a better education on both sides in some of these areas.

One of the ironic problems with this accident in New York is that the potential collision, and more than likely the actual collision, was observed on radar. Unfortunately, while this observation was taking place there was nothing that the controllers could do because they lacked communication with one of the aircraft.

We have felt for a long time, in the high density area, that a single control agency for providing traffic flow into a multiple-airport complex is mandatory. This has worked at some locations very successfully. One of the big advantages it would have provided was the ability to effect some early communication on the ground and pinpoint this thing in time to have averted it.

Segregating the approach control facilities without maintaining any direct communication has many deficiencies. Work has been done on this by FAA that I am aware of. I think all I can say here is that we would urge the further study of it and an early implementation.

Senator MONRONEY. Right there, would it be possible for a master controller of the entire New York area, for example, to be in communication on one radio with all traffic in that area? In other words, it was impossible, as you say, for the LaGuardia tower controller who saw the approach of the airplane, not knowing its altitude or its collision course, to have then called on this master frequency for all traffic in the area, to have warned the plane or inquired as to his altitude. Of course, it would have probably been too late at the speed and at the time it was first observed. I think it was 3 miles off, and then it was only 1 mile off at the second call.

Mr. SMITH. This would be one of the advantages of placing the approach control facility in a single unit. The Preston holding pattern is utilized by three airports: Newark, Idewild and LaGuardia, none of which have normal direct communications with each other as such. There is a hot line among the facilities. However, this is primarily to pass information back and forth and does not relate to the direct handling of aircraft other than those under their jurisdiction. This is why procedures are set up in letters of agreement designating routes and altitude that various facilities will use.

Were these free facilities to be physically located at a single spot, it would them be possible to improve tremendously the communication and coordination processes within the agency that would improve, not only the arrivals, but very definitely would improve the departures and eliminate, in my opinion, a great amount of complexity that we have in the current system.

Senator MONRONEY. Do you have any further suggestions?

Mr. SMITH. There are a couple of changes that have been made which we wholeheartedly support. As you know, one routing was eliminated, and they have also eliminated the routing from Colts Neck direct to Preston. We would support this position.

Senator MONRONEY. Is that the entry at Robbinsville?

Mr. SMITH. Yes, sir, and previously aircraft coming up from the south would be diverted somewhere south of Colts Neck. Instead of sending them to the eastside holding pattern over to Lido, there would be times when they would direct them over Colts Neck and into Preston. We have subsequently had difficulties with this routing, and this has almost been eliminated now.

Senator MONRONEY. Any further suggestions?

Mr. SMITH. Yes, sir. I believe on the matter of terminology, issuing information, this could be cleaned up a little bit. We feel in our own mind—and I think the manual of procedures covers this fairly clearly—that holding aircraft in the terminal area should be done for a reason, not for a convenience. If there is traffic, or there is a problem on the airport, or if there is some valid reason for it, then obviously there is no problem in holding. The procedures are designed now to issue short-range clearances, not necessarily dependent on traffic, as incidentally was the case in this accident, but more to take care of saving letters of agreement that are set up within the agency itself.

This tends to create some problems. It causes us to some extent to try and stay ahead of the airplane and guess what is going on. I think it had something to do with this particular accident to some extent.

One other one that would not necessarily be tied into this, but I think refers to some earlier testimony, is relative to blast fences at the end of runways. In the Aeronaves case when this aircraft went into the blast fence, he went into a situation that to a great extent had intentionally been set up at NASA in Cleveland a year ago for the purpose of preventing aircraft fires. This blast fence and others around the country are held with rather heavy steel beams, angle irons in some cases, and in others concrete has been reported. The height of this metal supporting equipment is such that it rips open the underside of the wings, spills the fuel out, creates the fire. This is exactly what

they did at Cleveland. They had some information on firefighting procedures.

I could say very simply: These fences have to go.

Senator MONRONEY. Or could they be built of easily destructible support? Could you use light aluminum or wooden supports with aluminum blast veins instead of the heavy steel and the girders and other equipment that is used?

Mr. SMITH. Some of these blast fences have been passed off as frangible, but we find out they are not. If they were constructed within the meaning of the word frangible, then we would not have any difficulty if the blast fence is really needed.

Senator MONRONEY. Theoretically, and I am not defending blast fences—I don't want to be placed in this position—your present procedures for takeoff of the jet are to get at the positive end of the usable runway and fire up all four motors to flight speed stance and then with your wheels locked, and then release your brakes for the takeoff. Unless you have some way of making these blast fences retract into the ground, I don't see how the procedures for jet takeoffs could be accomplished without having the blast fence at the very end of the runway that the man is using for takeoff in the opposite direction from the blast fence.

Mr. SAYEN. This is only true where you don't have underrun and overrun areas, and we have a noise problem right around the place because you don't have underrun and overrun areas. You put blast fences where you have runways right up against the fence and houses across the street. We don't object to this. As a matter of fact, we have advocated this in previous testimony before the committee. Where you have an overrun area and then you put a blast fence up, this gets kind of peculiar.

Senator MONRONEY. This is a problem. The problem is really the length of the runway and the overrun and underrun. If you have enough distance from the road or from other conflicting ground traffic, you don't actually need the blast fence, do you?

Mr. SAYEN. If you have enough space around the overrun and underrun and the noise problem, the noise problem wouldn't be that severe. As I understand the situation at Idlewild in this particular case, there is no overrun area. The fence is at the end of the runway.

Mr. SMITH. I would like to clarify this runway at Idlewild, if I may. This may bring forth another telegram, so I will try to be crystal clear.

At one time the usable length of runway 7 at Idlewild was listed as 8,200 feet. This was the result of erecting the blast fence that we are referring to. This was an arbitrary decision on the part of the airport operator as to changing the available effective runway length. Prior to the Aeronaves accident, by quite a few months, the full runway length was then made available, which extended it on up to 10,000 feet. This is the full length of the concrete. The 10,000 feet factor was important because this satisfied the required runway length for jet departures from a gross weight standpoint.

So that from the runway to the blast fence—on this particular configuration—you go from the runway right to the blast fence, then there is some distance after that. But the concrete, as such, is not considered an overrun area today. It is the full available effective runway length.

Mr. SAYEN. This situation was argued internationally and nationally on establishing performance standards for aircraft, whether you include the overrun as part of the runway for calculation of takeoff requirements.

If you put in an overrun and then include it in the calculation, then it has really become in effect a part of the runway.

Mr. CARROLL. There is a point which has come up from time to time here in which the Senator and myself at least have a very close opinion, although we haven't been able to achieve unanimity among some of the other people involved, and that has to do with the flow of traffic into some of these high density areas.

We have just a little bit different approach to it, perhaps, than you have indicated in your previous discussions, but certainly headed in the same direction.

There has been considerable pressure, and not from the pilots, to set up these traffic patterns with dual feeder fixes so that they can be placed in the ideal position in relation to the final approach course so as to get the absolute maximum of traffic into the airport.

When you have a situation such as you do in New York, with three thoroughly used airports in a very close area, it is possible that some compromises have been reached in order to try to provide maximum traffic into that area.

As far as ALPA is concerned, there is no pressure from us to set up these things for maximum traffic. It should be the other way with great care taken before changes are made in this pattern, flight test patterns flown for the new proposals with the type of aircraft that are going to be used, to show that there is more than this minimum buffer zone. And if this does in fact then restrict the flow somewhat in there, we will at least have a safer operation. But the only way that you can determine how much traffic flow that an area can have, and determine it practically, is to set up patterns which can be flown safely and then whatever those patterns will handle, this is the maximum that can be taken into that airport.

I would like to make that very clear, because we have been very close to the same point here and we haven't been able to convince everybody concerned. I think that eventually we will. I don't believe you are going to give up, and I am sure that we are not.

Senator MONRONEY. I am glad we are that close to agreement. Would you also agree that there are many problems that we face today in the New York area that could be helped materially as to safety by a brandnew airport properly located with respect to the other existing airports, and where the traffic could approach and depart without a high degree of conflict with the traffic going to the other airports?

Mr. CARROLL. Senator, I don't believe you have any constituents in New Jersey, do you?

Senator MONRONEY. No; but New Jersey people also fly. Whether it be New Jersey, Connecticut, or New York or elsewhere, the final added safety factor is going to have to come from a brandnew airport that is properly located with relationship to a traffic plan for its location, rather than let it just grow like Topsy, as this complex of airports has grown.

Would you agree that another airport, properly located, would add a great safety factor to the New York area?

Mr. SMITH. Might I speak to that point, Senator?

Senator MONRONEY. Yes.

Mr. SMITH. We have been pretty close to this activity in the New York area. I think the best way that I can answer that is to point out that the surveys that have been made indicate that by approximately 1966 or 1967, in and around there, if we anticipate the normal growth anticipated, and certainly by 1970, for sure, that the current airport complex will possibly only be able to handle the airline traffic, and no other airplanes. And, therefore, when you consider overall aviation, I think it is crystal clear that obviously we need greater capacity in the New York area, and in order to permit expansion of the industry that another airport will be necessary.

Senator MONRONEY. Let me ask you another question which will probably get me 1,000 letters from the private pilots. Would there be a margin of safety added both for private pilots and for the airline users if certain high density metropolitan airports were limited to use only for scheduled airline traffic?

Mr. SAYEN. We will get some of those thousand letters, too. There have been two things suggested: One, that there has to be, with the increasing diversity of aircraft from 100 miles an hour to 2,000 and over in the near future, that there is going to have to be some segregation of traffic. There has been one suggestion, that you can, sometimes within the same airport, even, segregate traffic, by setting up separate runways well removed from each other.

Here I am not talking about instrument traffic necessarily, because you accommodate it. But if we are all realistic there must be some segregation of traffic as the years go by. It is a serious problem now and isn't going to get any less serious.

Senator MONRONEY. This would have to be met by separate private air parks for the exclusive use then of the private pilots or of the executive aircraft; is that correct?

Mr. SAYEN. Yes. I think there is no doubt whatsoever that in an area such as Chicago, that Meigs Field does a lot to unload Midway and O'Hare from private traffic. It is a lot handier for the private pilot, and the corporate people coming in downtown and so forth. There is no question. There is still a lot of private traffic at the other airport but it does help unload the airport.

Senator MONRONEY. If you could build other airports for the needs of private aircraft, the feeling then is that you would have perhaps an equal facilities rule at least for aircraft of certain types?

Mr. SAYEN. Yes. I think you made a very good point in that if you are going to expand airports—and there is no question but what we are going to have to build more airports—and, of course, one of the provisions inserted in the Federal Aviation Act of 1958, recognizing this, gave the Administrator some control over this. There must be long-term planning. I think there is no doubt whatsoever, and I made this statement a number of times and I know it irritates some people, that Chicago should now be building a third airport. No question here but that the airport facilities will be saturated before we get O'Hare built, almost.

Chicago should be planning a third airport. If they are going to plan it they should be planning it now, and it must be taken into consideration in relation to the overall airways system, and the traffic flow system for the city.

Senator MONRONEY. Or it should not be built. If it can't be built into a logical air traffic pattern then there should not be Federal funds allowed to go into it; is that correct?

Mr. SAYEN. Yes. And the provision I think was written into the Federal Aviation Act which gave the Administrator some control over location and building it. There must be extremely long-term planning on these things. When we do long-term planning we then get back to the things we talked about yesterday: airport zoning, underruns, overruns, and the other things that go in to make it a competent airport.

We are building new airports now, and practically before we get the airport completed the airport is solid with houses right up to the fence. Your ability to do something then is seriously compromised.

Senator MONRONEY. The average real estate man always has a standard answer to that, that this runway will be closed in 30 days.

Do you have any other suggestions, or any of your vice presidents?

Mr. SAYEN. One additional comment that I wanted to make in connection with some previous testimony on a serious problem, and that has to do with what we see as the continually growing overload of the Civil Aeronautics Board into work which is assigned to it by statute. This business of accident investigation isn't getting any simpler. When we smash up an airplane today, this is a very complicated thing to investigate. The aircraft is extremely complex, the whole system is extremely complex, and it takes a group of real experts to conduct an adequate investigation. It is true we have a good deal of cooperation between the industry and Government in doing the field work. But there is a fantastic amount of side research and analysis which must be done. It has been our view for a long time that the CAB is inadequately financed for this work. They have made a great contribution, not only in the actual investigation in the determination of the cause, but in their statutory responsibility to make recommendations for prevention of future accidents, recommendations that will prevent accidents.

It is obvious that this can't be done within the present budget and the present organization setup. We would like to urge very strongly that their requirements be supported.

Senator MONRONEY. We would be very happy to do that. However, I think we must still keep it crystal clear that we do not wish to duplicate research and development and other duties that are inherent in the Federal Aviation Agency. We can't afford to have a large staff of scientists and other technicians working on the identical problem that the FAA is now working on in its research and development.

As I see it, what the CAB needs is to have additional staffing so that a better analysis and generation of the value of information obtained from accident investigations will be available not only to themselves but in a presentable way to the FAA whose duty then in rulemaking is to carry forward in this field.

Mr. SAYEN. I don't think, as I understand the situation, that CAB is interested particularly in getting into the research field, except as it relates to accident investigation and accident prevention, which is their primary responsibility. They can delegate or contract for research functions from FAA, NASA, and the many other Government and public agencies. Also, we don't feel it should be necessary for the CAB to delegate its statutory responsibilities to another agency simply because of budgetary insufficiencies. It shouldn't be that one agency gets money and the other can't when the statutory responsibility lies with the first agency.

Senator MONRONEY. Are there any further comments?

Senator THURMOND. Mr. Sayen, I had some private pilots of small planes express concern that maybe since there had been so many plane accidents and people are becoming now safety conscious, so to speak, that possibly there may be an attempt to enact regulations or adopt restrictions that will practically forbid them from using their planes unless they have very expensive equipment. I am just wondering if you would care to make an expression along that line.

Mr. SAYEN. Of course among the airline pilots there are all kinds of pilots. Many of the airline pilots are private pilots currently or have been private pilots, and so on. Many of them have been military pilots. We feel that we don't merely represent the airline pilots' viewpoint because we have all been other kinds of pilots and still are. We feel that pilots generally should have access to the airspace and be able to operate their aircraft. I think realistically we must recognize that we have to accept some limitations, the limitations imposed, of course, by our own ability as pilots, and by the equipment we have to work with.

And, of course, we have to share the same airspace. So there must be some limitations. But we think they must be reasonable. You can't deny people access to the airspace who want to operate their aircraft, who should be given access, but under some reasonable conditions.

Senator THURMOND. In other words, you feel it would not be necessary to pass a strict regulation that would practically prohibit the little fellow from flying?

Mr. SAYEN. I think it would be a tragedy if we in any way inhibit the growth of private agencies in this country. It would be a tragedy if we legislated these people or regulated these people out of business. This is where our flyers come from, and this is a tremendous industry and it has tremendous advantages to our economy. It would be tragic if we regulated them or legislated them out of business, so to speak.

Senator THURMOND. And you think the matter can be handled with safety to all concerned, and yet allow them to continue to fly with reasonable precaution and safety measures?

Mr. SAYEN. Yes, sir.

Senator THURMOND. Thank you very much.

Senator MONRONEY. Thank you, Mr. Sayen, for your very helpful testimony. We appreciate it.

Mr. SAYEN. We greatly appreciate the opportunity to testify and the patience of the committee.

Senator THURMOND. I want to congratulate you, too. I did yesterday off the record. I want to congratulate you on the record for your fine statement.

Mr. SAYEN. Thank you very much.

Senator MONRONEY. Our next witness, and the last for the morning, will be Mr. Francis A. O'Connell and Mr. Fred Summers, representing the Transport Workers Union of America.

You may proceed, Mr. Summers.

STATEMENT OF FRED SUMMERS, PRESIDENT, AIRLINE NAVIGATORS COUNSEL, AIR TRANSPORT DIVISION, TRANSPORT WORKERS UNION, AFL–CIO; ACCOMPANIED BY FRANCIS A. O'CONNELL, MARVIN CHRISMAN, AND JAMES WOLLER, TRANSPORT WORKERS UNION, AFL–CIO

Mr. SUMMERS. Mr. Chairman, on my left is Marvin Chrisman, a navigator of many years experience over the North Atlantic. On my near left is Mr. Francis O'Connell, Transport Workers Union. I am Fred Summers, chairman of the Navigators Council of the Air Transport Division, Transport Workers Union, and navigator of some 18 years experience on the North Atlantic. On my right is Mr. James Woller, a navigator of some 18 years experience on the Pacific Ocean.

Senator MONRONEY. You may proceed.

Mr. SUMMERS. Mr. Chairman and members of this committee, the Civil Air Regulations require a flight navigator over certain routes or route segments and issues to him upon proper demonstration a flight navigator certificate to act as an airman in that capacity.

Section 610(2) of the Federal Aviation Act of 1958, as amended—reflected in U.S. Code, section 1430(a)—reads as follows:

> It shall be unlawful for any person to serve in any capacity as an airman in connection with any civil aircraft, aircraft engine, propeller or appliance used or intended for use in air commerce without an airman certificate authorizing him to serve in such capacity or in violation of any term, condition or limitation thereof, or in violation of any order, rule or regulation issued under this subchapter.

Carried further, subparagraph (3) of section 610 makes it unlawful for any person to employ for service in connection with any civil aircraft used in air commerce an airman who does not have an airman certificate authorizing him to serve in the capacity for which he is employed.

CAR, Part 41.65–1, paragraph (b) states:

> When a flight crew member is required to perform one of such functions—radio telegraphy, celestial or other specialized means of navigation—on the flight deck of the aircraft over a route or route segment, this shall be specified in the air-carrier's operating certificate on Form ACA–514a by indicating the function required. This will be accomplished by the air carrier inserting the letter Y on a line with the particular route or route segment under the required function; namely, radio telegraphy—specialized means of navigation.

At times, Mr. Chairman, I might insert into the prepared statement certain side comments which have been introduced in prior testimony. I would like at this time to read into the record 41.80–1, Crew Complement:

FLIGHT NAVIGATOR

The rules hereafter set forth have been issued pursuant to section 41.80 and should be followed in determining when celestial navigation or other specialized means of navigation are necessary.

A. Determination of need. Where desired precision and reliability in air navigation, i.e., accurate line of position of fixes available, cannot normally be achieved from the pilot's station by visual or nonvisual ground aids for a period of:

1. More than 1 hour, celestial or other specialized means of navigation shall be required.

2. One hour or less, a determination shall be made by the Administrator as to the need for celestial or other specialized means of navigation, taking into consideration such factors having a bearing on safety, as weather, air traffic control, traffic congestion, size of land or destination, and fuel requirements, whether or not sufficient fuel is carried for return to point of departure, or whether flight is predicated upon operation beyond point of no return.

In addition to the U.S. air armed services—Air Force, Navy, and Marines—the Coast Guard and MATS and the FAA, some of the American carriers who use flight navigators at a separate station in their international operations are Pan American, Trans World, Seaboard and Western, Flying Tigers, United, Trans Carribean, Northwest Orient, and Overseas National airlines.

Some of the foreign carriers who have navigators with a separate station are Air France, Air India, Argentine, British Overseas, Canadian and Pacific, Deutsche, Lufthansa, El Al Israel, Intercontinental Japan, Loftleider Icelandic, Panair Do Brasil, Qantas Empire which is Australia, Sabena which is Belgium, Scandinavian Airlines System, South African Airways, Swiss Air, Trans-Canada, and Transportes Aeros Portugueses airlines.

The recognition of need for navigators as a separate airman has been brought about by the requirement for a specialized means of navigation. Over land masses, a network of airways defined by short-range, ground-based radio aids has guided the pilot, monitored by radar control from the ground, from point A to point B. It is apparent that over long stretches of water, such as the North Atlantic and Pacific Oceans, that no such airway structure or radar monitoring is feasible.

Consequently, a navigator is used to navigate the aircraft to areas where radar surveillance and airway structure can be employed.

In addition to a safe and economical operation by precise navigation, a navigator's presence in terms of defense of this country in event of war is made in the form of the civil reserve air fleet requirements. This Nation's commercial air fleet committed to the CRAF program must be prepared within 48 hours to assume any role that national defense dictates and consequently the navigator and his station must be fully manned to effect the striking force necessary in long-range operations.

We must recognize that the jets today have brought with them a new concept of air traffic control, a new environment in the cockpit that is increasingly more complex, more intense, and far more demanding on each and every airman that composes the flight group today. We must, besides exploring technical matters, appraise the relative function of airmen in order to more clearly evaluate the workload of each such airman.

There have been many statements from flight safety foundations, from ICAO, jet operations panels, as well as from operating crew organizations that have recognized the increasingly complex operation

of the jet. We have heard from pilots in various publications, testimonies and TV programs, that the jet airplane is one airplane that is strictly run by the gages. There has been considerable testimony as to the necessity for pilots to remain at their stations monitoring this aircraft by the gages, as well as to keep an ever watchful eye on traffic and weather conditions, which are best described in the Civil Air Regulations, part 60.12, paragraph C. This merely indicates that vigilance is necessary outside of the aircraft. We can realistically say that the jet is making a tremendous demand upon the human mind to regulate the flight in a safe and efficient manner.

The navigator, on routes where controlled airways are not feasible, is entrusted with the responsibility of the function of navigation and is in effect assuming the airway guidance that is given to the aircraft on controlled airways.

Since the navigator is required by law to perform the function of navigation, we must examine his station to see whether he can effectively perform that function he is charged with, by his certificate, in order that the navigator may accomplish the same precise guidance that the aircraft would expect to have on controlled airways. We will relate a few incidents that have happened over the water in an attempt to show a need for investigation into requirements of the navigator's station.

We have a tremendous respect for the engineering progress that is taking place, but must point out that machines have inherent problems and failures and are only as effective as the intellect that guides it. If the human mind had failures, however, the FAA would be obliged to remove that mind from the aircraft operating crew. Yet, for some strange reason, there seems to be a philosophy existing that machines after repeated failures or discrepancies can, after being oiled a little bit, continue to replace the human mind.

For instance, in a flight over the North Atlantic an ADF bearing upon a weather ship indicated a position that was in contradiction to the position established by the navigator by some other means. Had the navigator accepted this machine's "intellect" the flight would have been over 400 miles from where it should have been.

Another experience we have had is in the area of malfunctioning of electronic compasses. A navigator in trying to determine the error on the compasses experienced a freezing of the periscopic sextant in its mount. After considerable effort to dislodge it, and a replacement made, the aircraft was located 150 miles south of its course.

Another demonstration which ties in with this departure off course is the occasion where we have been in the midst of literally a fleet of jets flying at various altitudes and separated by a few miles. This is a thrilling sight if taken in its proper perspective, but a chilling one if the imagination were to extend itself to the thought of what could happen if only one of these jets happened to be where it was not supposed to be.

For instance, recently a foreign carrier proceeding from Amsterdam to Goose Bay suddenly through the communications channels on VHF alerted the area around him which would be in the radius of 80 nautical miles that he was flying at 35,000 feet, approximating his position to be between 100 and 150 nautical miles north of a weather ship, that he was lost, had lost his loran reception, was unable to perform celestial and requested the weather ship to try and locate him on its

radar, which the weather ship could not do. Consequently, the aircraft continued to alert the air around him of his predicament, but continued to proceed westbound until coastal defense intercepted him on its long-range radar and brought him in.

The chilling aspect of this incident was not only that this airplane was lost, but that another aircraft was flying at 35,000 feet and was in the vicinity of the weather ship, approximately the same distance as the lost aircraft. Since the lost aircraft voice communications were heard on VHF, it can be assumed that the two aircraft were reasonably close and yet could not see one another. This particular incident very candidly points out that sooner or later we are going to have a midair collision over the North Atlantic because some aircraft are not equipped to establish position or control direction under all operating conditions.

As part of air safety planning we feel it imperative that appraisals be made of the navigator's station on all U.S. carriers operating under all respective parts of the Civil Air Regulations. We have heard testimony not only in this hearing but in other hearings that the CAB does not have this or that authority, that the FAA does not require this or that.

Consequently, although the FAA has on record told a carrier it does not have adequate navigation, the carrier still refuses to equip the navigators' station with the "tools" that would provide this adequate navigation so necessary and vital for the safety of the traveling public.

I might add, Mr. Chairman, that on March 14, 1960, the FAA held a meeting with a navigator group in New York, in the regional office, at which Mr. Arnold, who is, I believe, with the Oklahoma Training Center, chaired the meeting, and all the sectors were present.

Mr. Arnold had been evaluating the North Atlantic needs and came up with the recommendation that loran must be placed on board this particular carrier, and that the ADF tuning controls must be handled by the navigator in addition to other pertinent comments. He advised the group that he was strictly on an advisory capacity and that his duty, so to speak, was to proceed to Washington to advise the FAA on his findings.

Present Civil Air Regulations, part 41, outline the conditions whereunder a specialized navigator will be required. However, these same regulations do not outline the equipment necessary to accomplish this function. The proposed revision of part 41 now under active consideration by the FAA indicates that equipment shall be placed aboard the aircraft to perform this function, but the selection of this equipment is left to the discretion of the air carrier.

It has been our experience—and, I might add, the FAA's as well—that when this determination is left to the individual air carrier the basis of need is usually tempered by economics.

I might add that this specific carrier we were talking about had removed loran from the navigator's station in 1957, before they ever had any experience on the jet over the North Atlantic.

At this time, Mr. Chairman, I would like to have Mr. Woller show you and the committee various navigator station pictures that we have taken, indicating the wide discrepancy of the American carriers' equipment and the very thorough equipment that has been placed upon the foreign carriers.

For the record, I repeat the photograph depicting BOAC's navigator station indicates loran installation, which is a long-range navigational aid, ground-based, which is on every carrier operating in international waters except one, which is a U.S. carrier.

You will notice that in addition to the loran installation, BOAC had ADF tuning controls, has the very basic air speed indicators and altitude indicators, a clock, and has in addition to it the teleprinter that the FAA were talking about.

Here the navigator station is not only equipped with the latest devices, but also with a very advanced printed communications device.

It also has at the navigator's station doppler, which is an aid to determining drift and groundspeed, which——

Senator MONRONEY. It is a DME, isn't it; a type of DME?

Mr. SUMMERS. A doppler?

Senator MONRONEY. Yes.

Mr. SUMMERS. No. A doppler is what we call an electronic drift meter. It measures by doppler shift the effect of drift on the airplane and its groundspeed. It is simply a dead-reckoning function.

After viewing these fixtures, it is our recommendation, therefore, that the minimum equipment required to safely perform the function of navigation on international routes should be determined by the FAA and made a part of the regulations.

We might add that we have previously recommended to the FAA basic determination of the amount of tools and instruments that we need on the navigator station.

Very basically, we ask for static or ram temperatures, ADF tuning controls, two airspeed indicators, two electronic compasses, VOR indicator, ADF indicator, loran, periscopic sextant, and doppler.

In this day and age of jets, with its complexities and unforgiving demands, we can say that insofar as navigation over the ocean and areas where navigators are required, the tools with which he has to work on some carriers are even less than those he had 16 years ago. We ask the same question that has been asked many times in this hearing. After repeated demonstrations of lack of safety and lack of planning, can a specific carrier be made to amend its operating certificate in such a manner that these incidents would be erased.

At this time, Mr. Chairman, I would like to read into the record a letter written on May 6, 1960, written by the Federal Aviation Agency, to Mr. Floyd Hall, vice president, general transport manager, Trans World Airlines, dated May 6, 1960:

DEAR Mr. HALL: This is in regard to our telephone conversation of May 5, 1960, concerning the inadequate navigation experience by certain of your North Atlantic schedules that operate westbound, primarily during daylight hours. We are fully aware that you are cognizant of the problem and are taking steps to correct it. However, until this has been accomplished it will be necessary to dispatch these flights over a route where the combination of ground aids and celestial shots will provide adequate navigational fixes or reschedule these flights to where acceptable celestial navigation is possible over the entire route.

It is requested that you amend immediately your operations specifications en route through your Federal Aviation Agency certificate holding office to reflect the necessary rerouting or rescheduling of these flights. Of course, these restrictions can be removed when adequate position-fixing equipment is available on your aircraft.

Your cooperation will be appreciated.

Sincerely,

WARD B. MASDEN,
Bureau of Flight Standards.

I might add that the date is significant, May 6, 1960. To date this specific carrier has not installed loran, the position fixing equipment referred to, at the navigator station.

Senator MONRONEY. Does it have it on the plane in the cockpit for pilots?

Mr. SUMMERS. No, sir.

Senator MONRONEY. No loran?

Mr. SUMMERS. No loran.

I want to say that in our experience of roughly 20 years of international operations there has never been a midair collision over routes where navigators are required. It is our desire, as I am sure it is yours, gentlemen, and every other individual connected with the aviation industry, that we shall never experience such a catastrophe. We attribute this to proper separation, IFR flight planning and a program of planned responsibility and performance of duties of various airmen under the command of competent pilots. However, the airspace is shrinking, and the job of precise and reliable navigation more complex and exhausting in a given sustained time.

At this point I would probably want to make a few comments on Mr. Sayen's or the ALPA comments.

Mr. Sayen testified that the copilot today has become nothing more than a radar operator. We fully agree and concur with that statement.

Senator MONRONEY. To make it clear, it was the third pilot who has become nothing more than a radar operator.

Mr. SUMMERS. In any respect, a pilot has assumed the radar operator's duties, so to speak, and he is no longer a pilot, is the effect that I received from the testimony.

I think we are going to have to examine, Mr. Chairman, the various functions of airmen to see that we don't overload the cockpit.

We must in flight safety planning retain the same airman function with more technical assistance in the form of automation of routine manual computations. Navigation on the jets that are not flying over airways have reached the same state where autopilots had to be introduced into flying the aircraft more safely. We have said before that jet aircraft controlled by airways by transiting the short-range ground base aids and monitored 100 percent by ground radar can sustain the pilot's normal duties. Specialized means of navigation which requires proper workspace, the use of charts, plotters, dividers, projection, and constant monitoring of compass headings in a well-lighted area cannot be assumed by a pilot at the controls without sacrificing a loss of alertness to traffic, without a loss of the sequence of the gages, without a loss of instantaneous recovery of the yoke. However distasteful it may be to many people, we must face the real fact that despite 100 percent radar control and with the present means for determining position visually on the cockpit panel, the pilot on the United DC–8—this is with reference to the midair collision over New York with Trans World Airlines—had a failure of a portion of his electronic components that probably contributed to this crash. This would indicate that with all the finest inflight control and ground radar the flight path of that aircraft was not knowingly controlled. It becomes apparent that if this can happen under 100 percent surveillance on airways, what can happen over the mid-Pacific, the mid-Atlantic, when navigators

who are charged with the responsibility for navigation by specialized means do not have the facilities for establishing their position under all conditions and, consequently, direct the aircraft safely and precisely.

I might digress here to make a comment. We have been—by "we" I mean the testimony here at this hearing has made tremendous emphasis on the amount of equipment that is coming into the cockpit. You have this or that. But it fails to take into account where are they going to put it all. The pilot today, as has been testified, has an awful lot to do. We are wondering. The Air Force today, in flying the B–58's and in flying over domestic airways, have a man specifically charged with the responsibility of navigation. This is in holding areas to track the aircraft. If he finds that something doesn't exactly jell, he will so advise the pilot.

With regard to the accident, if on the jet there had been a crew member assisting the pilot in the navigation of that plane, we don't believe the plane would have progressed beyond Preston. The radio aids are more than adequate, and the Jersey coastline too easily discernible by radar.

A great emphasis is placed on the regulations, on the operational philosophies of some carriers that the black box is the answer to safety. We must never forget, gentlemen, the black box cannot think; that it does not have commonsense. Neither can we overlook the human factor, the overloading of work in the cockpit, or the lack of instrumentation to allow human judgement. We must have the human analysis first before we can determine that we are lost or not lost.

The FAA has requested $180 million in the 1962 fiscal year budget for navigational aids and research and development in this country. We wish it could have been a billion dollars, to insure that the flying public has the maximum safety and confidence in the aircraft, in the aircrews, and in air traffic control procedures. Can we deny the same flying public the same confidence over the oceans and lands where there are no airways or can be no airways?

I might add that we believe there are close to over a million people going back and forth over the North Atlantic in a given year.

Senator MONRONEY. I read in the Sunday New York Times where last year, for the first time, you doubled the number of passengers carried over the North Atlantic by air versus sea. They exceeded it several years ago, and now it is double the numbers that are traveling by sea.

Mr. SUMMERS. It is absolutely correct.

Another good illustration is a fact that a jet can outcarry the Queen Mary in a given time.

The world today is shrinking by air travel. We are enticing the peoples of foreign countries to visit with us. They in turn are enticing us. We are here, gentlemen, to ask you to insure the air travelers safety, and we ask you to standardize the navigator's station with specific, basic navigational tools to insure that all carriers have the same basic design and implementation.

Our organization, the Transport Workers Union, is prepared to furnish upon your request not only suggestions, but technical assistance as well from both the U.S. navigators and the foreign navigator

groups, all members of the International Airline Navigators Council, an ICAO qualified observer.

Senator MONRONEY. Thank you very much for your statement.

May I ask, Mr. Summers, loran is the No. 1 instrument you say you need in the navigator's station, is that correct?

Mr. SUMMERS. I believe the absence of loran on one carrier is of priority. That is on Trans World Airlines.

Senator MONRONEY. You mentioned two or three other deficiencies. You ad libbed that into your testimony, it wasn't in your prepared statement. Will you go over that list again?

Mr. SUMMERS. Yes. In addition to the one carrier who does not have loran, which we feel should be installed immediately—I might add there that they are prepared to install that—for your record I might read into the record a letter from Mr. R. C. Rourke, dated September 20, 1960, to Mr. Pierson, chairman of the board, Trans World Airlines:

> The detailed provisions for loran at the navigator station were removed as a result of a management policy meeting held in Los Angeles on May 1, 1957. This meeting was attended by Mr. Frank Busch, then vice president of operations, Orm Gobe, R. W. Rummel, Fred Austin, Jack LeClaire, Bill Hoebeller, and Richard White.
>
> The meeting decided loran was not needed for TWA scheduled operations at that time. The provisions removed at that time could easily have been reinstalled within the 48-hour period allocated for craft operational preparations.
>
> This meeting also decided to retain the loran antenna transmission line from the tail fin to the electronic equipment area. This transmission line was later removed in order to obtain a monetary credit from Boeing, recognizing that if loran were needed later the spare transmission line could be used at least temporarily.

In addition to the loran, which is no problem because all carriers have it, except TWA, we feel it is necessary that an electronic drift meter adaptable to all conditions to aid dead reckoning, which is doppler. United Airlines, by the way, has doppler installed as well as many foreign carriers.

Senator MONRONEY. Do any carriers flying over the ocean have doppler other than United?

Mr. SUMMERS. Yes.

Senator MONRONEY. I mean American flag carriers.

Mr. SUMMERS. Pan American is in the process of evaluating it at the navigator station. Northwest is contemplating having it. But you must realize a lot of the U.S. carriers are behind TWA and Pan American and United on international operations in putting in their fleet.

For instance, Seaboard and Western has the new swing-tail jet cargo carrier, and they contemplate putting in doppler also.

We are requesting the ADF tuning controls at the navigator station. We have the indicator, but we have no means of tuning the ADF.

Senator MONRONEY. Who tunes it? The pilot?

Mr. SUMMERS. The pilot does. The pilots are on record with TWA, so far as TWA is concerned, of saying this was very undesirable.

Senator MONRONEY. They would rather not have the duties?

Mr. SUMMERS. They would rather not have that duty. Many things come into it. You tune it at a different audio level than the navigator has, and frequently the pilots are involved in other duties such as

listening to a clearance or listening to some HF communications and we have to bother him to tune the station, which is not practical.

Senator MONRONEY. Does that come in code?

Mr. SUMMERS. No, sir; it is all voice communications.

We have also asked for radar altimeter, which gives you the absolute height, which most carriers have, plus as standard equipment, air speed indicator and temperature indicator.

Senator MONRONEY. These being necessary for proper celestial fix on your position?

Mr. SUMMERS. May I interject here. The navigator is at all times projecting the aircraft forward. This is done by a process known as dead reckoning. That is, he dead-reckons the position ahead by computations of drift and ground speed and true heading of the aircraft. He then takes his fixes to establish dead-reckoning processes. That is, to determine the accuracy of dead reckoning.

Senator MONRONEY. How does he take those fixes?

Mr. SUMMERS. He takes those fixes by whatever means are available to him. In most cases celestial fixing when it is available. If that is not available, we take loran fixing. If that is not available, we have a mixture of both, ADF bearings, and so on. We mix it all up in order to establish our fix.

Senator MONRONEY. You still take celestial?

Mr. SUMMERS. In certain operations we cannot. That is, a daylight operation, because the aircraft is proceeding with the same speed as the sun and, consequently, the sun is not high enough or blocks out all of the planets in daylight operations and we cannot use the celestial means.

Senator MONRONEY. You have outrun the celestial navigation?

Mr. SUMMERS. That is right, absolutely.

I might add that we should have adequate lighting and a table space.

Senator MONRONEY. Is your table space and other physical quarters large enough to do your work?

Mr. SUMMERS. Yes; it is adequate.

Senator MONRONEY. It is just the equipment?

Mr. SUMMERS. That is right.

Senator MONRONEY. I don't believe there is any other question. We will be glad to discuss this question with the FAA, which will be this afternoon.

Thank you very much, Mr. Summers, Mr. O'Connell, and the others for your appearance here. The committee will stand in recess until 2 o'clock.

(Thereupon, at 12:47 p.m., the subcommittee adjourned until 2 p.m. the same day.)

AFTERNOON SESSION

Senator MONRONEY. The subcommittee will resume its hearings.

We invited the FAA to return to resume their discussion where we left off yesterday noon.

We are glad to have you back, Mr. Pyle, with your staff. I believe we were talking about the New York area, air traffic control, when we recessed yesterday.

FURTHER STATEMENT OF HON. JAMES T. PYLE, ACCOMPANIED BY DAGGETT H. HOWARD, GENERAL COUNSEL; DAVID D. THOMAS, DIRECTOR, BUREAU OF AIR TRAFFIC MANAGEMENT; PAUL T. PREUSS, ASSISTANT ADMINISTRATOR FOR OFFICE OF PLANS; DR. JAMES L. GODDARD, CIVIL AIR SURGEON; J. H. TIPPETS, DIRECTOR, BUREAU OF FACILITIES AND MATERIEL; OSCAR BAKKE, DIRECTOR, BUREAU OF FLIGHT STANDARDS; JAMES L. ANAST, DIRECTOR, BUREAU OF RESEARCH AND DEVELOPMENT; AND FORDYCE W. LUIKART, ASSISTANT ADMINISTRATOR FOR PERSONNEL AND TRAINING

Mr. PYLE. Yes, Mr. Chairman, I wonder if it would be possible to take about two seconds to insert a couple of items into the record in response to questions brought up by Senators Schoeppel and Engle. Would this be in order?

Senator MONRONEY. Yes, sir.

Mr. PYLE. First, we would like to submit for the record, Mr. Chairman, the data on enforcement actions which have been classified and fairly detailed as to the various actions, for the calendar year 1960.

I won't take the time to read them, but I believe they are self-explanatory. Unless there be any questions on them, I would like to submit them for the record.

Senator MONRONEY. Do you have a short summary?

I believe table II gives a quick light on it, in which you indicate that out of 3,934 cases, 667 had no action filed; in 1,207 there were reprimands; 906 were civil penalties; certificate actions amounted to 1,035; military referrals, 117; foreign referrals, 2.

This means that out of the 3,934 there were certificate actions in only about one-fourth of the cases, is that correct?

Mr. PYLE. That is correct. There was no action taken in approximately one-sixth of them, and reprimands in about less than 30 percent. So that the total of no-action and reprimands amounts to about just short of 50 percent of the total number.

Senator MONRONEY. On civil penalties there is a limit above which you cannot go, at least as far as the airman's certificate is concerned. These are all airman's certificates?

Mr. PYLE. That is correct. Perhaps our general counsel, Mr. Howard, should explain that.

Mr. HOWARD. Mr. Chairman, there is a limit on any annual civil penalties of $1,000. This would apply to an airman or an air carrier.

Senator MONRONEY. Is there a table showing what the airman's civil penalties averaged?

Mr. HOWARD. I believe that we do have material on that, but it is not included in this particular material that we have given you.

Senator MONRONEY. What you supplied is very thorough.

I just wondered whether these would represent in civil penalties, the 906, a maximum penalty, minimum penalty, or what?

Mr. HOWARD. I can get it for you.

Senator MONRONEY. Put it in the record.

Mr. PYLE. I would like to submit, in response to the discussion we had with Senator Engle, what I consider a clearcut statement of agency policy with respect to enforcement programs. This I think

perhaps we had not covered as fully as perhaps would be helpful to the committee. If it be in order, I would like to submit this for the record.

I won't take the time to read it.

(The document follows:)

STATEMENT ON THE FEDERAL AVIATION AGENCY'S ENFORCEMENT PROGRAM FOR DISTRIBUTION BY THE GENERAL AVIATION COUNCIL

(Transmitted on June 3, 1960, by Mr. E. R. Quesada, Administrator of the Federal Aviation Agency, to Mr. H. B. Wetherell, Chairman, General Aviation Counsel)

Certain misconceptions regarding the Federal Aviation Agency's enforcement program have developed during the past year. Magazine editorials have appeared; letters have been written to Members of Congress by individuals; and statements have been made by representatives of certain aviation organizations—all of which indicate that there is a misunderstanding regarding this matter. Moreover, there has been a studied effort on the part of a few aviation interests to encourage and promote this misunderstanding.

In essence, the charge appears to be that the FAA is carrying on a program of "harassment" instead of enforcement. Although the FAA has asked for specific examples of unjust enforcement, and offered to take immediate corrective measures, rumors and false impressions continue to exist. I therefore wish to insure that the pilots, who after all have the greatest stake in enforcement, are fully aware of FAA's actual enforcement policies and procedures.

I think it might be well at the outset to bring sharply into focus just what we mean by enforcement. We believe that enforcement is the tool or means by which we command respect for and adherence to the necessary safety standards and rules. The basic objective of enforcement is to achieve compliance. But this tool must be used fairly and wisely. Therefore, equal justice under the law has a prominent place in the FAA enforcement program.

We recognize that only a very small minority of pilots do not comply with the safety regulations. That the vast majority do comply is evidenced by the fact that, during its first year of operation, the FAA processed only 3,000 violation reports, a very small number when compared with the number of active pilots (estimated to be 395,000) and the number of hours flown (estimated at 20,250,000). We must recognize, however, that a policy of weak enforcement, with favoritism to the irresponsible few, would quickly undermine compliance by the responsible majority. On the other hand, firm and fair enforcement against all violators strengthens the normal inclination of the great majority to cooperate voluntarily and adhere to the regulations.

Enforcement for enforcement's sake, however, is meaningless and does constitute "harassment." We repeat that the purpose of FAA's enforcement policy is to achieve compliance. In achieving compliance, we feel that we are furthering the policy set forth by Congress in the Federal Aviation Act that the promotion, encouragement and development of civil aeronautics is in the public interest.

In its desire to insure the effectiveness of enforcement policy, Congress gave the Administrator of the Federal Aviation Agency certain new authority. Under the Federal Aviation Act of 1958, the Administrator may amend, modify, suspend or revoke any certificate. Prior to doing so, however, the law requires that the Administrator advise the certificate holder as to the charges or reasons relied upon by the Administrator for his proposed action. The holder of the certificate is then given an opportunity to answer any charges and to be heard as to why his certificate should not be amended, modified, suspended or revoked. The Administrator also has the authority to compromise civil penalities for violations of the act, or violations of any rule, regulation or order issued thereunder. In addition, the Administrator can prevent further violations by obtaining an injunction from the District Court of the United States against individuals or others who are refusing to comply.

The Federal Aviation Act contains many stopgaps against possible abuse of authority. For example: If the Administrator has ordered the amendment, modification, suspension or revocation of a certificate, the holder of the certificate may appeal to the Civil Aeronautics Board, where he is entitled to notice

and hearing before a Civil Aeronautics Board examiner on the charges brought against him. If the examiner's decision is adverse to the certificate holder, he can then appeal to the five-man Civil Aeronautics Board for a review of the examiner's decision. If that decision is still adverse, the certificate holder can appeal to the U.S. Court of Appeals for a review of the CAB's decision. Furthermore, except in cases of emergency, the effectiveness of the Administrator's order is stayed during these appeals until a final decision is reached, which means that the alleged violator may continue to exercise the privileges of his certificate while his case is under consideration. These avenues of appeal and protection of the individual's rights are far more elaborate and comprehensive under the Federal Aviation Act than those in other comparable areas, such as the suspension or revocation of certificates and permits in the maritime field.

In regard to civil penalties, the alleged violator is entitled to a trial in the U.S. district court before a civil penalty can actually be imposed upon him. In addition, he may exercise normal rights of appeal in the Federal courts from such a decision.

As everyone knows, the FAA is composed of many people, including inspectors, controllers and attorneys, who have a part in the enforcement program. They are all human beings. It is inevitable that occasional mistakes will be made, in the nature of filing a violation report of initiating enforcement action, when in fact the alleged violator either has not committed the violation or has a legitimate excuse for his actions. As I have indicated, the individual is fully protected under the law. However, we wish to make it abundantly clear that, if any individual feels he has been wronged either by our failure to follow established procedures or by the decision rendered in his case, we stand ready at any time to reexamine the matter with utmost care and correct our mistake. You will understand, however, that we may not always conclude that a mistake has been made.

We, in the FAA, abhor Gestapolike tactics and categorically deny that they have any place in our enforcement policies. I can assure one and all that, if any instance of such tactics is reported to us, it will be promptly investigated and corrective action taken against any FAA employee using such tactics. Nevertheless, we must all recognize that it is the duty of FAA employees to report infractions of the rules and that a failure to do so can result in charges against the employee for neglect of duty.

It is also the duty of the FAA inspector to promote aviation by counseling and advising pilots and aircraft owners, as well as others engaged in aviation. As I have previously indicated, enforcement of the rules, in a somewhat different way, can and does promote aviation. We must constantly remember that the purpose of enforcement is to obtain compliance and that without compliance we cannot have safety. To state it another way, enforcement and compliance promote safety, which in turn is the keystone of aviation progress.

Senator MONRONEY. We were on the New York City area.

I do not know how near we were to completion when we had to cut Mr. Thomas off. You may resume or summarize.

Mr. PYLE. I don't think we have anything more at the moment, unless there be additional questions that you might wish to put to us. I am referring specifically to the New York accident.

Senator MONRONEY. I do not believe we thoroughly covered whether the FAA has the power, in the estimation of counsel and others, to institute or to bring about, if you should find the overcrowding of airspace or airways in highly congested areas, a reduction in the number of flights scheduled into these areas.

Mr. HOWARD. Mr. Chairman, I do not believe there is any question of the authority of the Agency to limit the number of flights into an area for purely safety reasons. I think that as we mentioned before, this does have rather important economic consequences, and from that standpoint I am sure the Agency has no authority to act on the matter.

Senator MONRONEY. From the standpoint of the Board?

Mr. HOWARD. The economic effects. In other words, the possibility that you may be faced with the necessity of allocating frequencies of use of an airport among competitive interests; for example, if you cut down the overall number substantially below the number that ordinarily goes in within certain time limits.

Senator MONRONEY. Do I understand that you would not have the right to prorate?

In other words, if you were seeking, we will say for example, a 20-percent reduction—maybe it is 5 percent—if you determined that the system needed to have that much give in it for safety reasons, could you then issue an order that traffic will be reduced 5 percent, and all airlines serving this should undergo a uniform 5-percent reduction?

Mr. HOWARD. I would seriously question whether we have such authority, Mr. Chairman, if only because we have a similar problem in another area, which is your air defense identification zone, national security provisions of the act, in which specific authority was given to the Agency to do the very thing that you are talking about.

Where a sector is overloaded, in essence, we can decide to allocate frequency through it. This was specifically provided by law. This raises a question in anyone's mind as to whether, in the other area of airport use, in the absence of such provision, if we would have such authority.

Senator MONRONEY. You are very doubtful that other than declaring that traffic should be cut down 20 percent, this is all you could do?

You could not allocate the arrivals and departures at that particular point on a percentage basis, being fair to all on a uniform reduction?

Mr. HOWARD. I would very much doubt that. I would say in the absence of further legislation the probable effect would be a reduction in the number, and then a first-come, first-served situation as to allocation.

This would create the very economic problems that I mentioned.

Senator MONRONEY. You have that today when the system is overloaded, when there is more and more holding and more and more delays, and people may be holding back as far as Cincinnati?

Mr. HOWARD. That is correct.

Senator MONRONEY. That is irregular. What we are talking about is to regularize, if possible, if necessary, the acceptance of the system.

Mr. HOWARD. I do have very serious doubts as to the availability of the authority to do it in that way.

Senator MONRONEY. Could any of you familiar with this situation in the high-density area—taking New York as an example only—tell us what percentage increase the present New York system can accept? A hundred percent more? Seventy-five percent more? Or what?

Mr. THOMAS. Mr. Chairman, I think the best we might do is tell you what it is doing.

Yesterday was a very good day in New York insofar as weather was concerned, as we had here. The three airports—Newark, La-Guardia, and Idlewild—between 8 and 9 handled 130 operations; between 9 and 10 handled 126; between 10 and 11 handled 124. So

we are running somewhere around 125 to 130 operations as a normal busy time there.

Senator MONRONEY. We are running not 130 operations in the area, but you are running 375?

Mr. THOMAS. For all the airports.

Senator MONRONEY. It is all in the same airspace.

This is why New York becomes quite important, I think, because of the close proximity of Idlewild, LaGuardia, and Newark, which is different from Denver, Colo., or Phoenix, Ariz., or some of these other areas.

Mr. PYLE. Mr. Chairman, those were total figures for the three New York airports.

Senator MONRONEY. I thought they were three different airports.

Mr. THOMAS. This is the total for 1 hour for three airports. The typical busy hour last year, and by our definition 10 percent of the hours were busier, at Idlewild, a typical busy hour was 89; LaGuardia, a typical busy hour was 95, and a typical busy hour for Newark was 75. This includes VFR as well as IFR.

Senator MONRONEY. This includes landings and takeoffs?

Mr. THOMAS. Landings and takeoffs, operations per hour, at their busy hour. We think that those busy hours approximate their present capacity. In fact, it is at their present capacity.

Senator MONRONEY. In other words, the busy hour, which figures out to 259 for the three airports—within 60 minutes—is about their present capacity?

Mr. THOMAS. For the three airports.

Senator MONRONEY. And in figuring the maximum load you would be compelled to figure the busy hour as the measure of what the system can accept?

Mr. THOMAS. Yes, sir.

Senator MONRONEY. Can we say, without trying to put words in your mouth, that someone in Government should be concerned as to the additional scheduling of more and more traffic into these three busy airports?

Mr. THOMAS. Sir, the only answer that I think I can give is that the limitations are there on the capacity, and the capacity is not exceeded. If there are more attempts to come in than the airport can handle, they are delayed or do not come in.

Senator MONRONEY. Or takeoffs are delayed?

Mr. THOMAS. Or takeoffs are delayed, or both.

Senator MONRONEY. Can you give us any figures on the numbers of delays at the busy hours in these three airports?

Mr. THOMAS. No, sir; I don't have this immediately available.

Senator MONRONEY. In other words, incoming traffic has generally the first right of acceptance, and ground traffic waiting for takeoff must usually be delayed until there is opportunity to dispatch them; is that correct?

Mr. THOMAS. This is correct.

Senator MONRONEY. We get to the point then that I am trying to arrive at: Has the Federal Government any way, in an orderly procedure, to not have more schedules due to takeoff or due to arrive than the system can handle?

You have practically told us that 259 in a 60-minute period at the peak hour is just about all that the system can stand. Where do we wind up with—who says that we shall do something orderly about it?

Mr. PYLE. Mr. Chairman, I would like to try to be responsive to this.

Senator MONRONEY. I am not asking you to take a position as to what the Agency would recommend. I am only searching to get an answer to a very primary question.

Your comment on it would be appreciated and would not reflect necessarily your urging or advocating any legislation.

Mr. PYLE. I think, Mr. Chairman, to try to be helpful in this area, I think we have to get just a little bit of background into this.

In the first place, from a strictly practical standpoint, we have the device of flow control. I am sure you are familiar with this. Whereby we will allocate, for instance, from the New York center so many aircraft can arrive in an hour's time from Washington center, from the Boston center, from Pittsburgh, and so forth.

In this way we can impose a slowdown on traffic coming into the area to meet a peak requirement, or we have a navigational aid going out, or where the ILS went out in one or more airports.

The other day at Indianapolis the whole center went out due to power failure, with ice. The whole center was out. This comes into play where we have a peak period which creates an emergency.

The other problem which gets involved in this picture—let us assume for the moment that there is a route, and FAA, CAB, or both of us together impose a requirement for their air carriers to drop back 20 percent of the schedules into and out of the New York area, for example.

This may well result in a decrease in the number of air carrier schedules, assuming now again that we have this right.

However, there is no way that we can prevent the same number of operations coming in from general aviation or an increased number because they have more airspace available, so to speak.

As a result, unless we can come up with some device that makes it possible to do it across the board to all users of the airspace—and, incidentally, the military would have to be included in this, although this perhaps could be handled more readily than could general aviation—we really do not hit at the core of the problem.

I think that there is one area that I have already talked to the Chairman of the Board about, and this is a problem involving scheduling at specific airports, where we have bunches of schedules at certain hours, as many as seven and eight at one time.

I think this is an area that I would like to see something done about. Whether it will require action on our part and the Board's jointly, or whether it will require a cooperative approach with the air carriers, I don't know. This is a problem I suppose, and Mr. Halaby feels it is a sound or fertile area to explore, that we have to do something about. This will perhaps do something to regularize the flow of traffic into the area by spreading the load, making it come in with a more even flow than is the case at present. I see no reason why we cannot schedule air carrier departures, for instance, every 5 minutes. These we can handle. We cannot get seven airplanes off all at the same time. This I think is readily recognized.

Senator MONRONEY. At the same time the air is filled with incoming aircraft?

Mr. PYLE. This is correct.

Senator MONRONEY. You can dispatch for takeoff and landing, but you cannot take both coming in at peak hours, which is generally what occurs at Washington National and New York, to be specific, or Chicago, I am sure, at other times.

This basing of schedules might be a way of avoiding what the average traveler gets pretty sore about. I am sure you are not going to put him in the air unless you feel that it is safe to put him in the air. But the passenger who waits at the gate for a 30-minute delay, and waits at the end of the runway for another 30 minutes, is rather impatient about the glories of air travel in not getting off.

Had he been advised that he had an hour later departure he might have been much happier about it.

Mr. PYLE. Certain of the air carriers are becoming quite concerned about this themselves. It is to their credit that they are studying this problem.

Several have pointed out to me that actually this can save them some money. I think that where the Board and ourselves, if we sit down, study this out, and come up with a pattern and work it out with the carriers, maybe we can get to first base on this one.

We may have to get some help, though, if this does not work.

Senator MONRONEY. I note that Pan American is announcing daily flight service in and out from Friendship to Europe. Will this result in any decrease in the number of planes coming into Idlewild, or will this be in addition to them?

Mr. PYLE. I am not familiar with this particular trip, Mr. Chairman; whether this one goes up to Idlewild and fills the rest of the plane up or not. I do not know.

Senator MONRONEY. We could more properly ask that of the ATA.

Mr. PYLE. This kind of thing would help, also. No question about it. Maybe Philadelphia could well be considered as another international terminal for trips to and from Europe.

Senator MONRONEY. We finally wind up with who has the authority to do this. Obviously, they all would rather come into the No. 1 center, rather than No. 2 or No. 3 center.

Mr. PYLE. I think there is one other point that I would like to make in this connection, and I think the Chairman of the Board made it very effectively in his testimony, and that is this: I think the Government's approach to this problem should be to continuously strive to make the system able to meet the demands of the users; in this case the carriers, general aviation, and the military. And by new techniques, new devices, research, and development, build into the system——

Senator MONRONEY. And new airports?

Mr. PYLE. I was going to come to this one.

And build into the system the capability to handle it, and a very important part of this area is to provide, for instance, for the needs of general aviation and relieve the pressure on the big airports; let general aviation have adequate facilities for its own needs.

I feel that we must recognize that general aviation of course serves as a part of the transportation system, for instance, in bringing pas-

sengers in and out of Idlewild by air taxi, and certain of the private planes are connecting with the oversea trips and transcontinental trips.

By the same token, if adequate facilities were available to the great metropolitan areas, a great number of planes would perfer to use that rather than get in the landing pattern behind big jets. This is obvious. We must work in this direction.

I think perhaps Mr. Anast has another point to make.

Mr. ANAST. In regard to the capacity of airports as compared to air traffic control, I think it is quite clear that we have not yet achieved capacity normally in our airports that we have for air traffic control system. I think in principle the air traffic control system itself is a higher capacity system than our national airport system today. Further, you have the so-called peaking factor that the user people, the passengers, everyone, would like to come in, say, to La Guardia or Idlewild, peaking at the same time each day. It is a twice a day peaking effect.

If you were to spread out this traffic throughout the 24 hours you could handle the traffic quite easily with our airport system. But who wants to go to New York at 4 o'clock in the morning? Not too many people. So that the system is designed to, and is catering to, the user needs in this regard.

One of the main items that we are working on in research and development is to develop a higher capacity airport system. The quickest route to that is the dual runway. The dual runway we are working on experimentally in the Chicago area at O'Hare, in which we are trying to achieve independent IFR operation with runways separated by 6,500 feet.

We are also working on separate runways, separate runways for private aviation, which would be in effect an independent operation and permit general aviation operators with their slower aircraft to operate and stay out of the mainstream of the higher speed, higher performance aircraft.

We believe that also contained in our research and development work on terminal area equipment, that a certain modicum of increase in performance will be obtained in the final approach landing.

Finally, the IFR capability under full zero zero conditions is a crippling factor in air traffic control today. It is the one remaining condition that cannot be fully met by our entire system. When it is zero zero, no aircraft operates. And we have under development and expect within 2 years to have experimentally by United and Pan American all-weather landing capability. This will provide a much higher increase in the airport utilization and the air traffic control system as well.

Senator MONRONEY. Has there been any study made as to the possible better scheduling into an area complex such as New York, where one airport will accept traffic, we will say, from east and north, and another from the south and west, to avoid conflicting approaches in the flight control patterns coming into these fields?

Mr. ANAST. Yes, sir. I must be frank with you, there wasn't much attention given to such studies because we were of the opinion and still are that this would be pretty contrary to the real needs of the user operation.

Senator MONRONEY. Do you mean, in other words, the interchange between lines and the necessity for switching from one terminal to another?

Mr. ANAST. Yes, sir.

Senator MONRONEY. Here again, as we find in so many places, the economics may sometimes influence the safety factor. My question is, what I was driving at in my question, is would there be an added margin of safety if you had a directional flow from areas into these several airports?

Mr. ANAST. I think such a configuration would tend to simplify the problem, and perhaps reduce the exposure, yes.

Senator MONRONEY. Then you would have the problem of hauling them either by surface or helicopter or some other way between airports?

Mr. ANAST. Yes. This would tend to create a whole host of other problems.

Mr. BAKKE. Mr. Chairman, I might make one observation with respect to the present facilities. You understand, of course, that in the existing arrangement the runways and other facilities at Newark and La Guardia would not presently be adequate to take care of, for instance, the traffic which typically is scheduled into Idlewild. We have a 5,500-foot runway situation at La Guardia, which would appear to be a very difficult one to overcome. Although the runway situation is better at Newark, it certainly isn't as good as the Idlewild situation. These factors would also have to be taken into consideration.

Senator MONRONEY. You may proceed.

Mr. PYLE. So many aircraft, Mr. Chairman, go through the New York area, particularly in a north-south direction or northeast-southwest, going from Boston to Washington.

Senator MONRONEY. You mean nonstop, overflying?

Mr. PYLE. No, sir; transiting through New York. This, of course, is a problem that we can't get around.

Senator MONRONEY. Your normal transient operation, overflying New York nonstop Washington-Boston, do they stay out of the New York traffic pattern pretty well?

Mr. PYLE. Mr. Thomas can speak to this. We have been trying for several years—I personally, as a matter of fact—to try to get a bypass airway. I think it is in now, is it not?

Mr. THOMAS. Not completely. They do go slightly to the east of New York. We are trying to get them still further to the east, if we possibly can, or further to the west.

Senator MONRONEY. In other words, it is the objective of air traffic control to divert the through overflying traffic away from the New York pattern, is that correct?

Mr. THOMAS. Yes, sir. Our major problem has been the water run and the facilities and warning areas to the east of New York. We are trying to get them still further over the ocean than now.

Senator MONRONEY. Do you have any trouble with conflicting patterns with the military in doing this?

Mr. THOMAS. Yes, sir. There have been some with regard to the warning area out to sea. I think this is being cleared up now.

Senator MONRONEY. Is all high performance jet testing now removed from Long Island?

Mr. THOMAS. No, sir.

Senator MONRONEY. It is still there?

Mr. THOMAS. Yes, sir.

Senator MONRONEY. Has it been reduced or is it handled in such a way—I have heard complaints at various times about still getting a mixture of military high performance jets flying adjacent to or even across the Federal airways without flight plans filed or notice given as to these operations.

Mr. THOMAS. The requirement at the present time, Mr. Chairman, is that if they are operating on a VFR or VFR-on-topflight plan, as they may, that they will operate their transponder on certain settings when they pass the specified jet routes on which the civil jets operate. Thereby we are giving advisory service to the degree that we can see the beacon codes.

We are considering, in connection with the special requirements as to test aircraft, some sort of special traffic handling, positive control of them, to provide a much better service. We are doing so in connection with the activities out of the Columbus area and the Wright-Patterson area in a positive control area. It is working very well indeed.

We find that we are able to handle the test activities so long as we know what they are attempting to do, and can provide facilities and personnel for it. I think this is the area that we must move into so far as the flight test is concerned.

Senator MONRONEY. Going to another subject, unless you have something further to add to the air traffic control system: We had rather strong testimony yesterday, again from the Airline Pilots Association, in which they point out the still existing inadequacies of the ground facilities. They raised, I thought, a rather important point recommended by the Doolittle Committee as early as 1952 that might have some valid considerations, distinguished by the Senator from New Hampshire's bill on aid to airports, in certificating the airports as well as certificated aircraft and certificated airmen.

This brought into view at least the possibility of having some means by which local airport commissions or authorities could be forced to raise or meet the standards for certain safety features in approaches and in removing obstacles and things of that kind in order to retain what was suggested as a certification for certain types of aircraft to fly off these fields.

Do you have any comment on that?

Mr. PYLE. Mr. Chairman, I would like to comment, and perhaps Mr. Bakke might want to supplement my words. We have a form of certification now insofar as air carrier operations are concerned, in that there are factors of obstructions, length of runways, lighting and so forth, which are all taken into consideration in the establishment of the minimums under which the air carriers are permitted to operate into and out of a particular runway and airport. However, I think that there is considerable merit to this. I would like very much to take a good, hard look at this one because I think it has real merit, (a) from the standpoint of the very thought you bring out; (b) there is the question of general aviation type airports, too.

We don't have the same measure of control insofar as insuring that their requirements are met that we do have in the case of air carriers for obvious reasons. Our responsibility to the airline passengers, of course, is more direct. Perhaps Mr. Bakke would like to add to this.

Mr. BAKKE. Mr. Chairman, we have been confronted in the past, in considering this question, with problems that are as much political as they are technical, in the case of what Mr. Pyle has just said, namely the existence of a fairly substantial body of regulation which limits the use of facilities by air carriers, and has the practical effect of a certification. We have been asked what can we expect to gain from the certification process which we have not already gained through certification of an air carrier.

Confronting this question we were mindful of the fact that of the total of somewhat less than 600 airports which are served by scheduled air carrier service today, by far the gerat bulk of these are not self-supporting. The airports exist by reason of the support that was given to them by counties or municipalities throughout the country.

The very existence of the airport in many cases requires the vigorous support of many elements of the industry. If a certification program on the part of the Federal Government were to have the practical effect of increasing substantially the budgets required for the support of these airport, we could expect some difficulty in the continuation or at least the successful continuation of many airport projects.

It was for reasons of problems like this that in the past our approach has been a twofold one. The most effective element of control that we have had with respect to matters not specifically covered by the regulation has been through the administration of the Federal Airport Act. In other words, the Federal supports of projects which are required.

And the second item I have already touched upon; namely, the specific regulation of those characteristics of an airport which we are not content shall be governed voluntarily by the air carriers or the local authorities.

Our performance limitations, for instance, clearly spell out what runway lengths are required. Your airport minimums spell out such things as what lighting systems are required to be related to specific airport minimums, and so on.

For this reason, up until now, we have not used an airport licensing or certification process in the FAA or in its preceding agencies.

Senator MONRONEY. However, there is a body of testimony which I know impressed Senator Thurmond, who was here yesterday, regarding the still greater exposure, major exposure to accidents which occur as a result of inadequate ground landing facilities, on an airport which is completed, as far as the runways, which may have certain hazards that we all know about, and if they don't come to FAA and ask for more money then it seems to be none of the Federal Government's business. About all that you can do is withdraw the air carriers from coming in there, which will create a major revolution for the city and will inconvenience people trying to reach the city.

It seems to me that there might be some means of causing these people to come in before the withdrawal of service, which you say

is about the only means that you have of effecting certain reforms of inadequacy, to bring them around. If they don't get any more money from the FAA, you can't appropriate it through the Federal Airport Act.

Mr. BAKKE. What I am saying is that in the last analysis this is the tool that we would apply in any event. In other words, the practical effect of certification would only be manifested in the withdrawal of airplane service, whether it be air carrier operations or private operations. Many a local municipality would shrug their shoulders and ask what difference it makes whether they are certificated by the Federal Government. If we were to propose certificate action against an airport, it might very well be that the communities would say fine, take our ticket.

It must then be translated into practical effect, or subsequent effect, and that the subsequent effect would be the withdrawal of air carrier service. So what we are saying is, if we control this at the first instance, then perhaps we really control or exercise control of the most important aspect. I am not suggesting that there aren't other benefits that may be derived, but at least up until today we think we have seen through the air carrier certification the control of the most important aspect of airport facilities.

Senator MONRONEY. It seems to me that you have a question of whether you should take two bites of the cherry or one. In other words, you have one recourse if certain things are not done that you consider to be somewhat unsafe, or certainly not to the benefit of safety. You can say we are going to cut out the rights of all certificated and scheduled airlines to use your airport.

But, in the suggestion that was made by the pilots yesterday for certification of airports, I think you would have a first stage in which the Government and the people, through the press, were notified that the airport was about to lose its class A classification, which would mean if it were fully enforced by the FAA to withdraw commercial service therein you could begin to get some action on the part of the local bodies to move against known deficiencies in the airport itself.

Mr. PYLE. Mr. Chairman, I think the point that Mr. Bakke made is a very valid one and, certainly in days gone by, the airport problem, the community's problem, the municipality's, and county's problem with airports was a very real one, because it was always hard to dig up money for these facilities. But now it has become such an integral part of that community that maybe it would be a very valid thing to take a look at this situation in the light of the environment in which we are operating today and will be operating tomorrow.

I think there is considerable merit, and I certainly propose we take a good, hard look at it in any event.

Senator MONRONEY. I know, for example, in another case if a State is threatened by the American Medical Association of losing its class A rating on its medical school, things start to happen in a hurry. Certainly I think there is a comparable situation here where the airport could be evaluated and judged and deficiences shown in a report for examination for continuance of their certificate, at which time it is indicated that the FAA is awake to this.

Now if they ask for more money and you withhold it, or items that must have priority and that you recommend be done, or complete

withdrawal of certificated service, that is a major shock treatment.

Mr. BAKKE. One observation with respect to the second point, namely, to withdraw the certificate completely. As a practical matter it doesn't quite work this way. This is important to us from the point of view of our relationships with the air carriers and the local communities.

Again it is not an exclusive process by any means. It can be worked other ways. But you should understand how these relationships have practically worked in the past. What we do is go to the air carrier. We tell them that the runway deterioration is such that we are very doubtful that we can permit them to use the last 3,000 feet of a given runway. Accordingly, effective such and such a date, they will be required to limit the weight of the aircraft to whatever weight the remainder of the runway will permit.

The fact that we put the squeeze on the air carrier results in the air carrier immediately making overtures to the local community for the repaving of that runway, or the taking of whatever action is necessary to remove these restrictions. This is the daily and practical device we use to insure that we don't have to deal with it only on the basis of a meat ax; that is, the ultimate withdrawal of a certificate.

Senator MONRONEY. But I am quite aware that this can be used very effectively in a town that has one feeder-airline flight in and one out a day. If you don't get the holes patched in the runway we will not let X feeder line come in. But I don't believe you will get by at Idlewild, Midway, Logan, Los Angeles International, or a few of those. This would have such a tremendous impact on your whole airline network that they will be looking for some pretrial method by which the city, the community, and the airlines themselves could be on notice that unless something were done, that then the ultimate of withdrawal of service from that community—it might be a hub airport—would be of such force that maybe some of the bottlenecks—political, monetary, or otherwise—would be withdrawn.

Mr. PYLE. This brings up the point that we would, under this concept, be working directly with the airport management where now, as Mr. Bakke points out, really the device that we have is to work through the airlines to the airport management.

Senator MONRONEY. It is a question of whether you should use an ambassador or whether you yourself should go out and say, "This approach, or this obstruction, is pretty bad. Something ought to be done about it not later than a month from now."

Mr. PYLE. We will take a good, hard look at this one. It has considerable appeal to me.

Senator MONRONEY. I would like to yield to the author of the Airport Act of, we hope, 1961, which will soon be before this committee.

Senator COTTON. Thank you, Mr. Chairman. I didn't realize I had sprung into such prominence as an author.

I am a little confused by the constant repetition, both in the questions and the answers here, on the emphasis of the words "withdrawal of service." I was under the impression that either your Agency or some agency, as a condition precedent to allowing newer and larger types of planes to land on certain airports, insisted on certain improvements such as lengthening of runways and so forth before they could land.

In other words, in my own little airport at home, it was my understanding when we were seeking to have four-engine planes land that Northeast Airlines would not permit us four-engine planes until we extended the runway to a certain specific length. Is that so?

Mr. PYLE. That is quite correct.

Senator COTTON. Then you are certificating in advance. In other words, you weren't talking about withdrawing service. You said DC–3's have been landing at this little airport but you aren't going to have DC–6B's land here until you have done so and so, such as extending your runway, or whatever else is necessary. Has that been a policy throughout the country?

Mr. BAKKE. Yes, sir. This is precisely the point we were making.

Senator COTTON. Then I can't quite follow the difference. You already are certificating airports and laying down provisions and restrictions before service starts of a certain type?

Mr. BAKKE. Yes, sir; but we do not term it a certification process as such. There is no formal delivery of a certificate, for instance. And there aren't any of the processes which normally are associated with the certification process. Our point is that we do restrict the use of airports by regulation in the manner in which you have described.

Senator COTTON. Then it isn't always a case of saying to the carrier, "You shall not render service to this airport," or "You shall cease rendering service to this airport until something is done"; it is rather a case of saying to the carrier, "You shall not send in a certain type of plane; you shall not get jets in, or you shall not have a larger type of plane which requires better type facilities until something is done." Is that correct?

Mr. BAKKE. This is in part correct. However, there are some requirements, and I might illustrate one. Provisions for public protection: In other words, fences, another means of insuring that the public doesn't stray onto parking ramps and be hurt.

Provisions for the protection of the public must be adequate in order to permit any airplane to service a particular airport. And if inadequate public protection provisions are found, then we may, in that case, restrict the use of that airport by an air carrier for any aircraft type. It may be done either way.

Senator COTTON. The next question I have in mind is this: The difficulties that you find, which you referred to as political problems in that when you cripple the functions of a big airport somewhere by more or less arbitrary action on your part, which I can understand causes great repercussions and perhaps, in many cases, does bring about what appears to be a hardship, those problems would be in a measure, at least, disposed of if the policy of formalizing this certification—if you call it that—in advance were practiced.

In other words, it is much easier to say, "You can't have jet service until you do so and so," than to say to them after jet service is started, "Unless you do so and so we are going to refuse to let you have it any more." Is that correct?

Mr. BAKKE. Well, sir, I think the answer is "Yes," it would be simplified in many important respects. But I wouldn't wish to leave the impression that there isn't any advance planning, so to speak, or

advance inspection of facilities to achieve substantially the same purpose in the regulation of the air carrier industry.

Senator COTTON. What you are now saying, as I understand it, and what you have said before, is that to all intents and purposes, except for the use of the term and the formalizing of it, you do have advance certification of airports as being properly equipped to receive certain types of service.

Mr. BAKKE. Yes, sir. I want to be sure you understand this is only with respect to air carrier operations.

Senator COTTON. Not private?

Mr. BAKKE. Not private. The certification process might well extend also to the protection of private operations, in which we do not now engage.

Senator COTTON. If your Agency went the full length, as suggested by the chairman, in considering the conditions in airports and certifying them only when they conform to certain minimum requirements which you insist upon for the operations of certain types of planes, that would, in a sense, at least, insofar as the experts connected with your Agency are concerned, simplify this problem which we constantly have year after year before this committee in trying to determine—at least we shouldn't determine—having this constant conflict on one side of people who feel that there is almost no such thing as pilot error and that all these accidents are caused by conditions of the airport, and on the other hand people who claim that the airport is all right but it is all caused by pilot error. Won't it go a long way to establish ground rules to simplify that problem which is considered in so many accidents?

Mr. BAKKE. Yes, sir; I think it would simplify it. I don't think it would come close to eliminating this problem, however. I think that this is a problem that we will have to live with.

Senator COTTON. It will always be so.

Mr. BAKKE. Yes, sir.

Senator COTTON. It was so even in the beginning, when we had automobile accidents, when somebody said it was the automobile's fault and somebody else said it was a bad curve.

Senator MONRONEY. There is a high percentage of accidents which occur in the terminal area year after year. This is a matter of great concern to this committee. We can understand that we lack certain technical knowledge and electronic devices that can help immediately to make the air above the airport safe. These other things are fundamental, yet year after year after year we still have the same number of accidents that are occasioned by what we could call terminal area accidents. And year after year the same hazards remain, some of the same deficiencies exist. Yesterday the Air Line Pilots, I think in a very fine survey of 257 airports as of January 1961, pointed out that only 30 percent of the airports of these 257 surveyed had configuration A and other approach lighting systems installed. Thirty percent. Strobe beacons, only 11 percent. Runway identifiers, lights installed, only 2 percent.

Runway lights installed, high intensity, 38 percent. Medium intensity, 44 percent. Runway marking installed—as I understand it this is generally a very simple painting of the runway to help guide the pilot down the center of the runway, if I am correct—there were

only 20 percent listed as good, 28 percent marginal, and 42 percent none at all.

On runway length available—and this I thought was the most important part of their testimony—the pilots found at these 257 airports, as of January 1961, only 21 percent of these airports considered have adequate runway lengths available; 75 marginal, and 4 percent deficient.

Coming down to obstruction lighting and marking available, only 24 percent were considered good, 66 percent fair, and 10 percent deficient.

Runway overrun available, only 16 percent good, 24 percent fair, and 60 percent none at all.

High-speed turnoffs available, only 3 percent.

Now, 6 percent planned and 97 percent none at all.

Runway distance markers available, one of the cheapest things that could be stuck in the ground, only 13 percent now available, only 1 percent planned, and 87 percent none at all.

Runway visual lights available—this is a new means but a very good one, I think that would help—now only 4 percent; planned, only 8 percent; and nonplanned, 96 percent.

I don't think this is a very good record myself. Unless there is a question of the pilot's accuracy in reporting on them, and I don't believe it was anything other than an effort to assist the committee in an understanding of these airports, that we should rest and think we are doing a very good job in this area.

Mr. PYLE. Mr. Chairman, I wouldn't quarrel with you because I think there are definitely needs in this area. However, I think some of these figures, just from not even having seen them, certainly don't sound accurate to me. I would like the opportunity to go over them and find out.

Let's take the RBR program, visual ranges. It is one which I think is one of the most important programs we can come up with. This is panned for every ILS, I think.

Mr. Tippets may have the figures right here at hand on our status of this program.

Senator MONRONEY. Is that the RBR?

Mr. PYLE. Yes, sir.

Senator MONRONEY. I said this was quite new. We hope it can be expedited.

Mr. PYLE. We hope it is in high gear. We have to depend on funds from the Weather Bureau for the implementation of this program. But they have been working just as hard as we in getting this program into being.

Mr. TIPPETS. Mr. Pyle's figures are correct. Ultimately it is planned to put in RBR procedures at all instrument runways where instrument landing systems are provided. This is a cooperative program between the FAA and the Weather Bureau. There are 18 new installed, 30 more will have it by the end of this fiscal year. The Weather Bureau now has promised to purchase approximately 100 computers which will be added to other installations and in the next 12 months we should have 130 to 140 of these in operation. It is a fairly new facility and a very fine addition to the measure of runway visability.

Senator MONRONEY. I recognize that this is new, and that it is going to take a joint operation. I mentioned that. On overrun runway available, this seems to be one of the main things that was stressed by the pilots for additional margins of safety to prevent such accidents as the DC–8 Mexican aircrash. These overruns and underruns were given a very strong recommendation by the Airline Pilots as being one of the things that would help the most in preventing additional exposure in accidents, both in landing and takeoff.

Is there anything in the program where you could require, at the end of the runways which you certificate—in other words, you have 5,000 feet at LaGuardia—how much overrun you will have, and how much underrun? A good airport, I would think, would find the margin of safety in a little space at both ends not scheduled into the actual minimum requirements for an airplane to take off.

Mr. BAKKE. Sir, in commenting on this I would like to first state that there isn't a man who has ever flown who doesn't agree that margins beyond those specified by regulation are highly desirable and should be sought whenever practicable. The problem that we are faced with, however, if we are going to be effective in our job of regulation, we have to draw the line somewhere. Naturally, there is not always agreement as to where we draw the line. But in our operating regulations there are regulations which apply specifically to the performance of aircraft which have the effect of doing what you propose. We don't call them overruns, but they are margins of either runway or obstruction-free airspace which serves the same purpose as an overrun.

We could, for instance, have scheduled in the airplane flight manual engine takeoff distances which are not predicated on the possible loss of an engine, and then we could have said, "In addition to the takeoff distance which is required by such a process, we are going to schedule 2,000 feet of overrun beyond the end of that distance, whatever it might be."

We would have come out through such a process with 2,000 feet of what we would have called overrun. As a matter of fact, we end up in exactly the same situation but we don't call it overrun. We schedule a takeoff distance which is based on the assumption that an engine will fail at the critical engine-failure point and thereafter require that he have sufficient distance remaining within the limits of the airport, within the paved portion of the runway, to come to a complete stop; or, in the case of the takeoff distances, we require that the distance to stop be demonstrated by crossing at a certain airspeed 30 percent above the stall speed of the aircraft in landing configuration, 50 percent above the approach end of the runway.

We have some charts, for instance, that illustrate the actual situation at LaGuardia, over the dike, for instance, of which you spoke some days ago.

We find that the typical crossing altitude over the edge of the runway is something in the neighborhood of 23 feet. This means that the air carriers in actual operations are using 30 feet of margin provided in the certified landing distance which is margin which is translated into runway length.

In addition to that, he must come to a full stop, and then beyond the point at which he comes to a full stop add another 40 percent. That

is, that distance to stop shall not exceed 60 percent of the total runway available. We could have labeled that additional 40 percent as overrun. But we don't do it as a matter of regulatory technique. It is part of the runway required.

The fact is, however, that the airplane has been demonstrated as capable of coming to a stop within 60 percent of the runway which is available to the pilot if he crosses the approach end of the runway at 50 feet. This is the device through which we have regulated runway length.

If there is something deficient in these margins, if instead of additional 40 percent, for instance, we need 50 or 60 percent, then it appears to me that within the framework of our present method of regulating the industry, this would be the thing on which we should concentrate.

What I am saying in brief, is that I think our present regulations do in fact provide for margins of runway length which have the same essential effect as overrun. Let me just emphasize one point, if I may, with resepct to the use of the term "overrun" in, for instance, the military. We know that there are overrun areas provided for at military airports. But lest we assume that this overrun means a margin of runway surface, or a margin of safety which isn't provided for in civil aviation, let me be sure that the committee understands that the military takeoff distances are not predicated on the one-engine out failure occurrence on which civil performance limitations are predicated; that we have every bit the same margin, even where the most generous overruns are provided for in military airports. We merely reach that margin through a different technique.

Senator MONRONEY. It was the testimony of the Air Line Pilots, which was quite impressive to me, however, that these landing and takeoff minimums were arrived at under ideal conditions, probably by test pilots, with perfectly functioning engines, under very favorable wind conditions and under dry instead of wet or icy or slick runway surfaces. I know it is probably hard to get to some of the major in-town airports, but at many of the airports it would be a very simple matter to have a lighter weight surface for an overrun or underrun for an additional safety factor. There was a report yesterday by the Air Line Pilots that they washed out the gear of a 720 jet, I think, on a 7,500-foot runway at Houston. You already lost an Electra on a similar approach at LaGuardia, and of course a DC–8 failure on takeoff at Idlewild. It seems to me that this deserves more than the possible defense that the present minimums are sufficient. These planes are high performance, they are heavier than they ever were, they require more and more pilot proficiency to where the margin of error perhaps is shrinking instead of getting better.

Mr. PYLE. Mr. Chairman, I would like to comment on one point in this connection. I would be very much interested to know the criteria under which this so-called 60-percent insufficient length was derived. This is one that interests me.

Secondly, if I recall—and Mr. Bakke will have to correct me——

Senator MONRONEY. It was 75 percent marginal they declared, on runway length available; only 21 percent that they considered adequate; and 4 percent absolutely deficient.

Mr. PYLE. What they are really saying then, Mr. Chairman, is that the manner in which we arrive at the length of runway, described by Mr. Bakke, they don't believe.

Senator MONRONEY. They believe it is obtained under optimum operating conditions with perfect pilot technique, leaving very little margin for possible error, gusts, or other things.

Mr. PYLE. I question that. I think they know enough about the flying business to realize this isn't so, for the simple reason there is 40-percent margin spoke of by Mr. Bakke. Furthermore—Oscar, you correct me—this does not take into account reversing the propellers. Is that right?

Mr. BAKKE. That is true; correct.

Mr. PYLE. In other words, a DC–6 or Electra, for instance, which has reversible propellers, when this distance is figured, 60 percent, to make it easy a 6,000-foot stopping distance on a 10,000-foot runway—you don't use your reverse props and still stop in that distance. If you reverse your props you can make it in 4,000 feet. So they have really 6,000 feet to play with if you use 10,000 feet as an example. So I really think the problem—I am not unsympathetic to what they are saying, because I think we have to make some additional improvements in this area but I want to make sure the facts are properly set forth.

We, as I think was explained by Mr. Anast the first day of testimony, are working on various concepts of arresting devices to forestall just the situation which happened at Idlewild when, for reasons which we are not familiar with now, the DC–8 did run off the end of the runway. With a hook or some kind of arresting device we would hope that this question, even if something goes wrong and our criteria don't work in an exceptional case, we will still be able to stop the airplane without any damage or injury to the passengers.

Senator MONRONEY. As I understand, the takeoff uses only 60 percent of the runway; the other 40 percent being safety margin?

Mr. BAKKE. No, sir, this is the landing distance.

Senator MONRONEY. How much over the dike at LaGuardia did you figure? You said 50 feet. Where would that put him on the runway length?

Mr. BAKKE. This is 50 feet over the edge of the runway, which is about 160 feet from the point at which he would touch down. The edge of the dike, where his wheels first contacted, is approximately 160 feet from the edge of the runway. In other words, at that point if he were flying the airplane in accordance with the technique demonstrated in the certification, which we certify the airplane is capable of, he should have been approximately 70 feet high at that point.

Senator MONRONEY. How far down the runway would he land?

Mr. BAKKE. How far down the runway would he have been?

Senator MONRONEY. Yes.

Mr. BAKKE. He could have, if he flew at 130 percent VSO, which is 30 percent above the stall speed, and brought it in at 50 feet above the runway, he would have been able to bring that plane to a complete stop and had 40 percent of the runway still remaining, assuming that he were at the maximum landing weight authorized for that runway.

He would have had 40 percent of the runway distance available to him, which would have been better than 2,000 feet left after he came to a complete stop.

Senator MONRONEY. This means he comes in over the dike and he has the plane weighing what?

Mr. BAKKE. I suspect the landing weight must have been somewhere around 80,000 pounds, I presume.

Senator MONRONEY. And he has 5,000 feet in front of him, maybe only 4,900. Call it 5,000. He has 3,000 feet that he is supposed to land in to have his extra 40 percent margin there.

Does it occur to you that maybe these boys, because they do see that mental hazard of only 5,000 feet in front of them, coming in over the dike, try to get too close to the very beginning of the runway? I know every airport I have ever been on you see wheel marks a little short, even if you have a black top overrun or underrun. Some of them must miss it. But it does not seem to hurt if you have a few feet spread out that are not listed as a part of the runway.

Mr. BAKKE. I would sure agree with that. It does not hurt. Every bit of overrun we can provide is certainly desirable. The fact is, after we are all through, we are going to have to draw a line. We can accomplish that line by reexamining, for instance, the 40-percent margin.

This margin has held, now, so far as landing distances are concerned, ever since the performance limitations were first written and I think, with excellent results.

I might say with reference to the landing distance, it is true that we require the demonstration to be made on a dry runway. We have to have common conditions in order to compare reasonably accurately relative aircraft performance.

We have to begin with a common set of conditions. One of those conditions is a dry runway. But I do not believe, Mr. Chairman, that this should be understood to mean that all of the conditions which we laid down are conservative.

For instance, the regulation requires that there shall be no unusual skill required. We do not permit the unusual use of braking. And if we find signs, for instance, of severe tire deterioration in the stopping distance when it has been demonstrated for certification process, we don't accept this kind of demonstration.

There are many techniques and gimmicks which are well known to test pilots that can be used in extracting a little more performance out of the airplane, which by regulation or by administrative procedure we prevent manufacturers from using in order to avoid setting up a highly artificial situation which cannot be duplicated in actual operations.

I am not defending our margins by saying, for instance, that they should never be reexamined. What I am saying is that they have stood us very well, and that I would not recommend that we apply margins on top of margins through different systems.

Applying overrun margins for instance on top of our present method of establishing takeoff or landing distances. If these are wrong, then they are wrong across the board, not just at LaGuardia.

Senator MONRONEY. I am just looking at the list of the fatal and nonfatal. Luckily this was a nonfatal accident, TWA–707, at St. Louis on February 4. The pilot's notation said:

Aircraft ran off end of runway due to surface condition of runway. Insufficient runway length and overrun for adequate safety margin in wet conditions. Substantial damage.

February 6, Delta Airlines, C–46R, Chicago, Ill.:

Aircraft unable to stop on runway length due to poor braking action. Insufficient runway length and overrun for adequate safety margin. Substantial damage.

February 25—this is the third one that month—Delta Airlines CV–440, Chicago, Ill.—a Convair, I believe:

Aircraft landed hard after striking 18–24 inch ridge of ice prior to touchdown. Inadequate snow removal. Substantial damage.

Syracuse, N.Y., on March 24, American Airlines, DC–6:

During landing rollout aircraft started drifting to the left and would not respond to correct action and departed runway. Runway covered with snow and there was an existing strong crosswind. Improved weather and runway condition reporting, runway marking and compact surfaces adjacent to runway would have prevented this accident. Substantial damage.

And so on, to where the list is rather filled with cases like this.

I would like to ask you this: Do we not pay half the cost of the overrun or underrun, if that is necessary, for some impacted surface or some additional surfacing?

Mr. PYLE. Mr. Chairman, with respect to that, we do not include overrun or underrun for the very reasons cited by Mr. Bakke.

I would like to ask, Mr. Chairman, whether we could have a look at that list. I would like to comment on it to the committee. If these are the official comments of the CAB, this is one thing. In these——

Senator MONRONEY. These are the comments of the pilots.

Mr. PYLE. I would like to analyze those.

Senator THURMOND. Could they have a copy of that to answer?

Senator MONRONEY. Certainly.

Senator THURMOND. Could I ask him a question?

Senator MONRONEY. Certainly.

Senator THURMOND. Mr. Pyle, do you have a system of systematically appraising or evaluating the safety devices of each airport where passengers are hauled by common carrier?

Do you have a definite time to do it, a systematic blank that you use to do it, a check list, so to speak, to cover all the points at each airport to determine if any deficiencies exist at the respective airports?

Mr. PYLE. I will ask Mr. Bakke and perhaps Mr. Tippets to supplement my remarks in case I don't cover all the points.

There are several procedures followed. First is the consideration of the airport insofar as the national airport plan is concerned. Whether there are needs for additional improvements as part of the national airport plan, which is presented each year to Congress.

This includes facilities, safety aspects, terminal buildings and all the various needs that go up to make a complete airport from the standpoint of safety, convenience, and comfort of the passengers, and users.

The second is, we look at it from the standpoint of the air carrier operations, the air carrier inspector, as to whether or not it is adequate for use by air carriers, whatever category it might be, such as in pistons, various sizes are checked. This is evaluated on that basis.

We also have the district airport engineer who keeps tabs on it from the standpoint of its overall use as an airport, and this he does in connection with his function insofar as the preparation of the national airport plan is concerned.

There may be other factors that these gentlemen would want to add to that.

Senator THURMOND. I was thinking that, having served in the Army and having made numbers of inspections of installations and so forth, this is somewhat of a similar situation in civilian life, because you have definite things that you are going to look for.

Whether or not your strip is long enough, whether or not your tower is functioning properly, whether or not you have adequate personnel. Any number of things that you will examine when you visit there.

I thought maybe you had a systematic form that you would use to check the various points at every airport where a common carrier lands and hauls passengers. I thought probably you would do this at intervals, too, not just do it once and be through with it; but something which is continuous and will always be continuous, to help keep them on the ball, so to speak, even though there may be some phases of it, such as a terminal.

It might be beyond your jurisdiction; still you could make a recommendation to them, possibly. Certainly if there is any angle of safety involved. I wonder if you are doing that now, if you are inspecting the airports that haul passengers where common carriers operate in and out.

Are you doing it regularly? Are you doing it systematically? Are you doing it in a way that will present a report that reflects the true situation existing at the various airports throughout the Nation?

Mr. BAKKE. Sir, our program in this respect is a highly formalized one. It is conducted on a regular basis. Every 6 months to the best of our ability to adhere to such a schedule, we conduct an airport inspection.

The reporting forms which are used are highly formalized, and I believe it is a systematic method of inspection which does in fact give good assurances of compliance with our requirements.

In addition to that, however, in every en route inspection where any services are provided at airports at which en route stops are made, the inspector serving the particular flight in the en route inspection will inspect such facilities as he is able: the maintenance facilities, the aircraft fueling facilities, the facilities for public protection, things immediately surrounding.

In addition to that, since he rides in the cockpit and is in a position to observe the condition of the ramp, the condition of the runway surface, as to whether it is rough, for instance, things like whether vision across the airport is adequate from all points on the taxiways and runways.

Senator THURMOND. So you are making those inspections now?

Mr. BAKKE. We are.

Senator THURMOND. Do those inspection inspectors also ride in the common carriers to observe their method of operation?

Mr. BAKKE. The latter group are the same personnel.

In other words, the folk who conduct the en route inspections are the same personnel.

Senator THURMOND. They would have to stay at one airport longer than to have a plane land and take off with it. Maybe a day or a couple of days to make a full inspection?

Mr. BAKKE. That is correct, sir.

Senator THURMOND. Then it should be very easy to get out your last report, if you do it every 6 months, and compare that with these figures here and see whether there are discrepancies in the figures that have been turned over by the Airline Pilots Association to the chairman.

If there is any accuracy in these figures, it is very disturbing.

Mr. BAKKE. I think I can tell you right now without any detailed comparison, that very few of the points to which the chairman referred in reading this list would have been listed as deficiencies on our airport inspections.

The reason for this fact is that such things as, for instance, the existence of areas off to the side of the runway are not considered as requirements under today's criteria.

Senator THURMOND. Why don't you consider them as requirements if they promote safety?

Mr. BAKKE. Well, sir, because the responsibility of the regulating body is, to put it crudely, to draw the line somewhere. Where we draw the line in our minimum requirements we do not obviously embrace all conditions that might be considered desirable or might have some merit.

We must obviously include in the list of required items only those which we consider to be reasonably required.

Senator THURMOND. Then do you classify your inspection from the standpoint of essential and desirable? Is that the way that you do it?

Mr. BAKKE. No, sir. Only those that are essential.

Senator THURMOND. And you do not put those that are desirable? I was thinking if you included those that are desirable, and made a recommendation to the airport manager of a particular airport, and would tell him that it would promote safety and would be desirable, it is possible some step would be taken there.

Mr. BAKKE. Sir, our inspectors do have this kind of discretion, and do avail themselves of it. We do not require them to show this type of thing, however, on the reports which I described to you earlier.

This is the type of discretion which we urge our people to use on an ad hoc basis and at the local level.

Mr. PYLE. I think the practical problem there, Senator Thurmond, is that in many instances recommendations are made of a desirable thing to be done.

The economic facts, however, are such that in some instances they are not followed up.

Senator THURMOND. It seems to me that you would want to be on record after your man visits, say, Columbia, S.C.—I remember a few years ago I happened to be in Columbia, the capital of our State,

and Captain Rickenbacker spoke there. He told this group of businessmen that:

> I shudder every day that something may happen here in Columbia. It is dangerous, in my opinion, for these planes to be coming in here.

It was not too long after that until they built another terminal in another place.

Now they have adequate runways and so forth. I don't know whether that one talk did it or not. At any rate, improvements were made.

It just strikes me that if possible you would send a report each time, or make recommendations each time you find anything to recommend along the line of deficiency or desirability, to the airport manager, it would show that you have exercised care in the matter, due care, and that it would put the airport manager on notice that these things are desirable even though they might not be completely necessary to safety they might be so desirable as to prevent an accident.

I throw that out for what it is worth.

We have had so many airplane wrecks now. I ride a lot of planes, as everybody else does. The public is deeply interested in this matter.

Mr. PYLE. Senator, I think this is a thought that we might well want to consider in connection with the possible consideration of aiding and certification processes. There is merit to that. Very definitely.

Senator THURMOND. I think as a whole you have done a fine job, and I want to commend you.

Mr. PYLE. Thank you.

Senator THURMOND. If anything can be done to suggest an improvement, we can always improve; there is no end to improvement. It seems to me we ought to search out every possible cause of accidents, and visualize every possible source of accidents in order to avoid them.

Mr. PYLE. I do not think we do our job unless we have this philosophy, Senator, and these suggestions are very helpful.

Senator MONRONEY. In the part we are talking about now, the overrun and the underrun, the impacted areas on the sides of the runways, all of these properly rest on the shoulders of Congress for not doing them, because we have always insisted this is not a part of the Federal aid matching funds; is that not correct?

Mr. PYLE. I am not sure that I understand your point, Senator.

Senator MONRONEY. We would be wrong in criticizing the local airports in these areas of overrun and underrun, as I understood Mr. Bakke, because there is no Federal matching available for that portion of the runway, for the impacted areas at the sides of the runways, which was advocated as a 10 percent margin I believe by the Airline Pilots Association as an additional safety feature to at least give some degree of protection if the pilot had a crosswind to run off to the side. It should be the duty of the Congress to make these other things available for Federal matching funds if we expect the airports to do them.

Senator THURMOND. And do that, even if we have to leave off some funds for terminals.

Mr. PYLE. I think that the problem which we are confronted with here, Mr. Chairman, is where do you draw the line?

Do you go out 10 feet on each side of the runway with an impacted area, 25 feet, or what?

Somewhere along the line it seems to me that the airplane ought to sit down where it belongs on the runway, or it ought to go around once more. I don't feel that we have created a situation such that it is a hazard every time you come down on a runway.

Senator MONRONEY. We are not saying it is a hazard. We are saying it is an extra safety margin. At least the pilots seem to think so from their testimony, and it was fairly impressive. We do not want to put up with minimum standards and say, "This is the end; you meet the minimum and therefore the planes continue to come in."

What we are looking for is a reasonable degree of additional safety areas, such as overruns and underruns, wider runways, better lighting and things of that kind, and go beyond meeting the very minimal requirements.

This is, I think, the advantage we have in hearing all the users of airports and airspace to make their comments on this.

The continued high incidence of terminal area accidents, whether fatal or nonfatal, are approachable at least with known devices to eliminate them. We cannot get our hands on some of this electronic gear like 3–D radar and others to make the upper airspace as safe as we would like.

We are certainly moving forward and have reached a new state of competence. We are certainly competent to do whatever is necessary to add a little further margin of safety beyond that which is minimal.

Mr. PYLE. I can only say that they are very valid points. I do think we should consider them. When we speak of 50 percent of the accidents happening in the terminal area, it is obvious that takeoff and landing are probably that part of the operation that requires the greatest precision.

Naturally your exposure is greater there. I do not think anyone will deny this. So therefore you are going to have more accidents in the terminal area. It is just a matter of logic.

Senator MONRONEY. It was true when the Wright brothers first flew, and it is true today. We recognize that, because it is more hazardous. Some degree of making it less hazardous would be to the interests of safety and to life.

Mr. PYLE. As you know, I am a fanatic on this question.

This is an area that we are moving into just as fast as we can. I think the visual glide path will be a great improvement.

There will be a standard for Mr. Halaby's selection in the next week or so. I think these will be definite milestones. These should be implemented just as fast as possible, and probably will be.

Senator MONRONEY. Going on to the inspection which Senator Thurmond was talking about, which you make periodically, do you advise the airport management or the supervisors of the manager as to your findings?

Or is it just for the information of the FAA?

Mr. BAKKE. The reports of course are returned to the principal inspector assigned to the air carrier. If the deficiencies are such as to require some limitation on air carrier operation, then the air carrier is notified of these deficiencies directly.

If it appears that the deficiencies are those which can be readily corrected by direct conversation with airport management, such as for instance the repairing of fences or the repairing of ramp surfaces and things of this sort, our inspectors do communicate directly with the airport managers or other officials of the airport who would be concerned.

We attempt, as best we can, to follow that course of communications which will rectify the situation most effectively.

Senator MONRONEY. On the inspections, do you pay any degree of attention to the availability of fire and rescue facilities and proficiency and training of the personnel and the equipment involved on local airports?

Mr. BAKKE. No, sir; we have no mandatory inspection item that includes fire protection services. We do make provision for gratuitous comments, the sort of observations which Senator Thurmond referred to, and from time to time our full crew point out particularly bad situations, or may make recommendations for improvement of the fire-protection situations.

But this is not a mandatory item and is not included in the list of things on which reports must be made.

Senator MONRONEY. Do you think the safety could be improved if more attention were paid to this?

Appendix C, which I will give you, which the Airline Pilots submitted yesterday, on available fire and rescue facilities, they estimate 8 percent good, 35 percent some protection, 57 percent no protection.

You do require, however, in the permitting of scheduled airline service, perhaps beyond the feeder line service, to have some fire protection on the field?

Mr. BAKKE. No, sir; there is no specific requirement to this end, so far as the regulations of the FAA are concerned.

You are aware, of course, of the program which we have initiated to establish standards in this respect. We have published a minimum facilities guide. I believe Mr. Tippets can explain just where this program is.

Mr. TIPPETS. Mr. Chairman, that is precisely where it stands. We have in the last 6 months provided to the communities a suggested standard, based on types of aircraft and possible kinds of fire and crash problems which may prevail.

This is in their hands. It is a suggested standard. This has been developed in cooperation with many agencies in and out of Government, through the National Fire Protective Association. This has been made available to them.

Further, we have, through Mr. Bakke's staff, placed in the hands of the carriers the emergency equipment which is available at major airbases throughout the country.

So we have made some steps to encourage and to provide standards.

Senator MONRONEY. Is there any encouragement given to the local airports? We understand that the military will train airport firemen in methods of extinguishing fires in crashes.

Is there any official encouragement given by the FAA to secure maximum use of this training facility?

Mr. TIPPETS. We have a specialist in this field now visiting the airports across the country, and this is one of his programs, to encourage and to help stimulate training programs with this type of specialist.

Senator MONRONEY. You do recognize this as a rather important feature of safety on the airport?

Mr. TIPPETS. Yes, sir. The operation of this equipment is a very specialized field, with effective personnel who must know how to operate it. Some of it is very complicated and very specialized.

Mr. PYLE. This program actually was started by the Agency with the cooperation of the military.

Senator MONRONEY. Do you mean the training of civilians?

Mr. PYLE. Yes; this is a very valid comment on the part of the airline pilots, Mr. Chairman. We are trying to do all that we can. Unfortunately, this is an area, however, that we get backed up against an economic problem, particularly in the smaller communities.

The purchase of a $50,000 or $60,000 fire engine is a real item of equipment that hits pretty hard. We are trying to do our best to encourage them and stimulate them to get this done. We are hard put to it to put it as a regulation and deny them airline service because they can't meet this requirement. I think this is an educational, encouraging, stimulating program. Any help we can get from anybody we would welcome it, particularly the airline pilots and carriers.

There is one other comment I would like to make while I have the opportunity in this area. We are very much interested in their comment on the lack of runway markers. I have always felt that this is one of the most useful devices which a pilot can have, and yet it is my understanding the pilots and the industry didn't want them. I am delighted to hear they want them. I think we can get them real quick.

Senator MONRONEY. This is to show the additional footage of the runway that is in use.

Mr. PYLE. To me, as a pilot, it is one of the most useful tools you have. Yet there are problems—lighting of them at night, snow coverage, and so forth. They present a few practical problems. They are another obstruction that you have to make infrangible in case someone does run over this. If this is what they feel is needed, I will be glad to nail them down any place we can put them on.

Senator MONRONEY. It is a very inexpensive aid to install?

Mr. PYLE. Yes, sir. A board with a number on it is all that you need.

Senator MONRONEY. The jets would be particularly interested in this, would they not?

Mr. PYLE. Yes, sir.

Senator MONRONEY. They have such great speeds for takeoff, they must have their V–1 at a certain point or they must abort. Unless the runway is marked properly, they would not know when they have passed that point?

Mr. PYLE. That is correct.

Senator MONRONEY. The centerline marking, that is what is referred to, is it, as the runway marking?

Mr. PYLE. This is a painted line down the center of the runway.

Senator MONRONEY. A centerline like that on a highway?

Mr. PYLE. This is correct. It is nose wheel guidance. It is of use particularly at night.

Senator MONRONEY. Those are not paid for by the Government?

Mr. PYLE. We do pay for runway markings on the same basis as other runway improvements. We pay 50–50. I think they may have

in mind another marker, too, and this is why we need to analyze that report, and that is the upright standing markers on runways and taxiways with arrows on it. That may be behind their comment.

Senator MONRONEY. I didn't read it all. They show ramp lighting and marking, taxiway lighting and marking, and different statistics. This was a runway marking installed, on 20 percent good, 38 percent marginal, 42 percent none, which I can't expect you to comment on. I know you were busy yesterday, and many of your people did not have the pilot's statement available.

Let's go to the near-miss situation, which we have been over and over a number of times. Are there any negotiations now underway with the pilots to where the impasse which has seemed to exist for about 2 years can be broken so that we will be able to feed into our experience record the growth or the decline of the near-miss?

Mr. PYLE. You speak of the growth or decline, of those that are reported, Mr. Chairman?

Senator MONRONEY. To receive more reports. We were told, quite positively by the airline pilots, that they consider their own statements would be used against them in assessing fines and disciplinary action, and, consequently, it has dried up the source of a very valuable reporting function. We have gone over it several times, as you know, and it is hard to say who is guilty in this. Certainly it has dried up the reports and caused us to lose, I think, a very valuable contribution at least to the specific areas where there is still some threat of collision in midair.

Mr. THOMAS. Any of us can speak on this one. Actually there has been a decline in the number of near-miss reports. We compared the 20-month period when the Board was receiving incidental reports. During that period of time we received 2,934. These were reports, but the reports were on an anonymous basis. They were not investigated.

During a similar 20-month period, when the FAA was receiving the reports, there were 1,411 incidents that were reported and were investigated, insofar as we could with both pilots, if we were able to identify both pilots.

The number of reports, therefore, did tend to drop off. Whether or not the number of what we might call valid reports tended to drop off or not, I am not certain because we are still getting reports of near-misses.

The question, I think, largely resolved on the matter of immunity of the pilot making the report. Under the Civil Aeronautics Regulations, the Civil Aeronautics Board handling of the report, it was to determine the environment and get some statistical information. There was no immunity. If you wanted to use this word, with pilots if the then CAA or any other agency learned of the incident through some other means and investigated it through some other means. There was never, insofar as I know, any relief of a pilot from his own actions by a mere reporting of an incident, a near-miss or any other, under CAA or FAA, but only for statistical purposes of the Board in determining the number of near-misses that were occurring or were being reported.

Senator MONRONEY. This has been going on for about 2 years, back and forth. It seems to me that with a new Administrator it would be

time to see if you could have a new approach with a set of ground rules so that this flow of information could be resumed to give you a better box score at least on how many of these are occurring.

Apparently there is a difference of opinion between the responsibility or the accountability of a pilot reporting a near-miss as far as the pilots are concerned, and as far as the FAA is concerned. They claim they do not ask for immunity; they merely do not wish their documented words and information given to them on a near-miss report to be used back at them in an action against their license or for civil penalties.

Mr. BAKKE. Mr. Chairman, if I might make a few observations on this program. You will recall that the program which was conducted by the Board from 1956 through 1957 ran through approximately a 2-year period, or four quarters. The first two quarters were tabulated in some detail. However, they included a large number of reports of near-misses that went back sometimes many years, and accordingly were not considered to be particularly valid.

The next four quarters, however, were thoroughly documented and a report was published. The Board observed at this time that the statistics obtained in the sixth quarter of this investigation were largely repetitive of the information gathered during the previous five quarters. Accordingly, after 1 full year's survey, the Board decided that so extensive an examination of these data did not appear to be necessary. That is, a continuation of a program of this scale did not appear to be necessary.

Accordingly, no further report was written and the staff was requested to take another look at the program to determine whether any major modifications of the program were required.

In the early part of 1958 a proposal was circulated which proposed a change in the special regulations then existing which assured the maker of a report that the report would not be used against him nor made available to any other agency. At that time it was proposed that a Board reporting system would be put into being that would not be limited merely to near-collision reports. This notice of proposed rulemaking was published, comment was obtained from all interested persons, and I believe with very few exceptions—and I recall no exceptions—most of the industry was either opposed to the initiation of such a program or was not interested in it.

This work was under investigation at the time the Federal Aviation Act was written. We have recently, in the light of criticisms such as those to which you refer from the pilots of the ALPA, again picked up this work which was left unfinished in 1958, to determine whether there are any reporting systems which have application within our present environment. This work is still underway.

Mr. Thomas, on the air traffic control side, has a similar study underway with respect to the near-miss program in particular. We are planning an early session to determine whether some similar such procedures or perhaps a broader or all-inclusive program does have application today.

That is the present status of it within the organization.

Senator MONRONEY. I gather if you feel you need it, then there is going to be time to approach the men who can supply it with some kind of ground rules through which this flow of information will be resumed; is that correct?

Mr. BAKKE. Yes, sir. I would visualize we would go through a proposed rulemaking. Offhand, I would think some regulatory form would be the simplest way of handling it. This would require consultation with industry persons, including of course the pilot.

Senator MONRONEY. One other question I would like to ask in that regard. On all accidents involving American-made aircraft used in transport work worldwide, do you receive from the manufacturer information regarding these accidents?

Mr. BAKKE. Yes, sir. There is no particular process; there is no specific procedure that is laid down. But I think it is safe to say that we obtain the information either directly, by personal participation in the investigation—for instance, in the case of Brussels we had three of our people, one out of New York, one out of London, one out of Paris, in Brussels either observing or otherwise assisting the Belgian Government the day after the accident occurred. We either obtain it directly by our own initiative, through request of the foreign government involved, or through the manufacturer.

But I would say, sir, that in the majority of cases with respect to new aircraft designs—jets, for instance—we will get it directly.

Senator MONRONEY. Do you get all worldwide accidents on foreign-make aircraft?

Mr. BAKKE. Sir, we get many of them. We do not get all of them. All of the reports that are actually submitted to ICAO and submitted through the international organization we do obtain. There are many States which do not publish accident reports. Some accidents are very difficult to find reports on.

Senator MONRONEY. What I am looking for, as we use perhaps more and more foreign-made aircraft, coming into our fleet, is whether it would not be a good policy to have an interchange of accident information worldwide on these.

For example, the crash between Newport News and Richmond on the Capital Airlines, which testimony at CAB would indicate there might be suspicion, at least, of icing at above freezing temperature outside.

Do you correlate accidents that we have here to certain aircraft with accidents that have occurred abroad in a search of methods to prevent them?

Mr. BAKKE. Yes, sir. With respect to aircraft types that are used here in the United States—the Viscount, for instance—I think we have about as complete a set of accident data, either within the FAA or in the CAB, but certainly between the two of us we have as complete a set of accident data as can be had, so far as final reports are concerned.

Senator MONRONEY. When a series of accidents should occur worldwide, although maybe not affecting us, you would be on notice to change regulations if necessary?

Mr. BAKKE. Yes, sir.

Senator MONRONEY. As I recall the accident of which I am speaking, there had been a recommendation that the deicers be turned on at 10°, I believe, above centigrade, instead of 5°. But it was not until after this accident occurred that the companies were required to use that procedure.

Mr. BAKKE. This isn't a procedure as such. It is actually replacement of equipment to have the probe actuated 10° above freezing instead of 5°, as it had been. This is a matter on which those who are intimately familiar with the system are still in considerable dispute as to the necessity for this modification. It is true, Trans-Canada, for instance, went to the modification voluntarily. Capital is making the modification right at the moment.

Senator MONRONEY. By "modification," is that just on the deicers?

Mr. BAKKE. No, sir; it is not. It is actually the replacement of the present probe.

Senator MONRONEY. What do you mean by the probe? The air intake?

Mr. BAKKE. No, sir. It is a device which is located just behind the propeller spinner. It is in the induction system and measures the temperature of the air which is passing into the turbine. It is a temperature-recording device.

When the system is armed, before entering icing conditions this probe will measure the temperature, and when the temperature gets down to a point 5° above freezing this causes the heat to be added to the structure so as to free the structure of any ice which may form.

The question is do you want this system actuated 5° above the freezing temperature, or do you want it actuated 10° above freezing?

We know of no incident which has occurred in the case of an airplane in which the deicing equipment has been properly employed. We know of a case, for instance, on Capital, in which there was multiple engine failure—momentary failure, by the way. The power on the engines was restored in very short order. But this multiple engine failure was the result of failure by the crew to actuate the deicing system, and subsequently after considerable ice had formed in the induction system and on the ring cowl, the system was then actuated. The resultant heat melted free a very large amount of ice which entered the turbines and caused the engines momentarily to flame out.

As of the moment, I am not satisfied that a convincing case has been made for the requirement for the 10° probes.

Senator MONRONEY. Have you had any static tests on the motors under controlled atmospheric conditions? In other words, we have gone to a lot of trouble to shoot birds to protect turbine-powered aircraft. I am wondering if you had static tests on this particular type motor where there might be some more definitive information developed.

Mr. BAKKE. I don't know of any static tests that have been conducted. There have been many flight tests conducted at the pertinent temperatures under many conditions of precipitation in order to determine whether the 5° probe is adequate to dispose of ice. And all of these tests have been affirmative.

Senator MONRONEY. Are you talking about one that actuates the heat at 5° above freezing, centigrade, as 5° above or 10° above?

Mr. BAKKE. That is right.

Senator MONRONEY. The pilot himself could turn on the heat without having it automatically actuated?

Mr. BAKKE. Yes, sir. And in any event is required to actuate the system.

Senator MONRONEY. Sir?

Mr. BAKKE. And in any event is required to actuate the system even in order for the probe to initiate heat.

Senator MONRONEY. What is your regulation on the Viscount?

Mr. BAKKE. Our present requirement is for the 5° probe.

Senator MONRONEY. It is still 5°?

Mr. BAKKE. Yes, sir.

Senator MONRONEY. Have any of the airlines which use it changed it?

Mr. BAKKE. Capital is making the change to the 10° probe now.

Senator MONRONEY. FAA has not?

Mr. BAKKE. We have not issued an airworthiness directive to that effect.

Senator MONRONEY. On the matter of the DME, what is the date that you are going to require DME equipment to be installed on turbine-powered aircraft?

Mr. PYLE. Mr. Chairman, this is the subject of a meeting with industry coming up on March 22.

Senator MONRONEY. In other words, it is a notice before rulemaking?

Mr. PYLE. That is correct.

Senator MONRONEY. Up to now there is no requirement?

Mr. PYLE. No, sir.

Senator MONRONEY. But the airlines have the facility if they wish to do it?

Mr. PYLE. This is correct. And the point, Mr. Chairman, is that we will have to ascertain the position of industry, the position insofar as how many of their aircraft are already wired for DME, how many DME's they have ordered, how many they have installed, and the capability of a manufacturer or mnufacturers to produce in line with whatever we may feel may be the requirement. There are a number of variables that we must determine.

Senator MONRONEY. In other words, there have been no publicly announced programs by FAA to foster in the past or encourage use of DME by air carriers in general aviation?

Mr. PYLE. I would hardly feel that that is quite correct, Mr. Chairman. We have encouraged the use of it right along.

However, we are not at the point yet of making it mandatory. This is the point we are now investigating.

Senator MONRONEY. You are now at the point of making it mandatory. But have you had publicity or conferences to urge them to install it at their own volition?

Mr. BAKKE. Sir, I wonder if I might observe that ever since the rather sharp change in the orientation of the entire program when we went to the VORTAC system in 1956, it has been necessary to develop a new system of DME which has been under discussion for some time. Not until last year were the specifications or the TSO (technical standard order) governing DME actually published by the Agency. You understand that in the process of developing the technical standard order there was much collaboration between the Government and industry in establishing these standards.

As of the time of the publication of the technical standard order there was no equipment then on the market which met all the pro-

visions of the TSO. The equipment, the Federal gear which was then available, has since been modified substantially to comply. This equipment is now available.

Senator MONRONEY. This is ground equipment?

Mr. BAKKE. No, sir; this is airborne equipment. Up until very recently there was but one supplier, and the equipment that he had marketed did not comply in full with the technical standard order. As soon as we saw our way clear, as soon as we knew that there was marketable equipment available to comply with such regulation, we advised the industry of our intention to regulate. This is the position we are in now.

Mr. PYLE. Mr. Chairman, I would like to point out in this connection that at the time this decision was made, to which Mr. Bakke makes reference, we had an accelerated program for the installation of the ground equipment which was worked out in large measure with industry to meet the needs of the jet.

It is only fair to point out that they are fully familiar with the schedule of implementation, first phase 1, which was the minimum number of VORTAC stations needed for the navigation of jets, and then the additional stations coming in which now, I think, will amount to 343.

They will be in by what date?

Mr. TIPPETS. January 1, 1962.

Mr. PYLE. The 343 stations will be commissioned by that date.

Senator MONRONEY. One matter was brought up, Mr. Pyle, by the navigators this morning in their testimony that some airline, in fact one oversea airline, had declined to put on loran in the station of the navigators, and had apparently had some conferences and some efforts were being made and studied, and I believe it was recommended at lower levels that this equipment be installed on these oversea planes.

I wonder if you know anything about the present status of that?

Mr. BAKKE. Sir, we have attempted to identify the recommendations to which reference was made this morning. I am not sure that we have identified this recommendation precisely. We do have some correspondence that deals with this subject generally, but it does not go into loran specifically.

As a matter of fact, it deals more in terms of the routes that should be flown in view of the navigation problems which have been identified. There was a letter which went from our Operations Division to TWA indicating that we were dissatisfied with some of the navigation on the North Atlantic, and that we requested a meeting with them for the purpose of advising operations specifications.

My recollection is that this was primarily with respect to rerouting of their flights. However, I am not able to report to you the outcome of this effort on the revision of their operations specifications, that is, with respect to the carriage of loran.

Since this time we have republished the proposed part 41 of the Civil Air Regulations which, among other things, governs the capability of the air carrier with respect to navigation. There is a provision in this proposed requirement which specifies that the air carrier shall show that there is sufficient equipment carried aboard the aircraft to permit an adequate navigation over the particular route.

In the past this has been demonstrated to the FAA through the conduct of proving flights by the air carrier. It has been proposed to us that the regulation should contain specific criteria. In other words, rather than a general provision to demonstrate to the satisfaction of the Administrator that specific criteria should be included in the regulation to cover those on the basis of which loran or any other specialized means of navigation would be required.

This proposal is before us now. The comment date for proposed part 41, I believe, is another 30 days off, before we consider the details in rulemaking. I am not certain of that date. I can give it to you in just a moment, however.

Senator MONRONEY. That is not necessary.

Mr. BAKKE. In any event, we plan to come to grips with the question of the application of specific criteria in connection with part 41, which is out for comment right now.

Senator MONRONEY. Thank you very much.

Do you have anything further you would like to add before we recess the hearings for the day?

Mr. PYLE. I don't believe so, Mr. Chairman.

Senator MONRONEY. I know you will all be glad to hear we can't meet tomorrow. We will recess until 10 o'clock Friday morning, at which time we will hear Mr. Francis McDermott, executive director, Air Traffic Control Association, and we hope to reach the Air Transport Association. This may be subject to some minor change because of witnesses who have to leave town.

We thank you for your time and for the information you have been able to give us. We will let you now go back to work for at least 2 more full days.

Thank you very much.

(Thereupon, at 4:18 p.m., the subcommittee adjourned until 10 a.m., Friday, March 3, 1961.)

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AIR SAFETY

FRIDAY, MARCH 3, 1961

U. S. SENATE,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
SUBCOMMITTEE ON AVIATION,
Washington, D.C.

The subcommittee met, pursuant to adjournment, at 10 a.m., in room 5110, New Senate Office Building, Hon. A. S. Mike Monroney (chairman of the subcommittee) presiding.

Senator MONRONEY. The Subcommittee on Aviation will begin its hearings.

We have Dr. William Requarth, of the National Pilots Association, as our first witness today.

We appreciate having you at our hearings, Dr. Requarth. I believe this is the first time that the National Pilots Association has been represented. I had the pleasure of attending your national convention, and I compliment your organization for its efforts to bring about greater aviation safety and the promotion of general safety, which are the objectives of your association.

STATEMENT OF WILLIAM REQUARTH, NATIONAL PILOTS ASSOCIATION, WASHINGTON, D.C.

Mr. REQUARTH. Thank you.

I am Dr. William Requarth and I appear as president of the National Pilots Association. This is an association of licensed pilots from all segments of the aviation community. It is a member-controlled organization. The policy organization is directed by the membership, either through direct mail or by open forums at our annual meetings. The speakers and directors are not paid, nor are we reimbursed for expenses incurred.

I also want to emphasize to you that in giving this testimony I am not a professional airman. I am a surgeon. I use my aircraft for both VFR and IFR flights.

I will skip through part of this. I want to tell you that our segment of aviation is quite a large segment, with 72,000 units. Of these, about 30,000 are business aircraft, which is about 15 times the number of air carrier aircraft. Also, that in 1960 we flew 13 million miles, and that in the next 10 years our fleet will double to about 120,000 aircraft and fly about 25 million annual hours.

I do not point this up to disparage the airlines particularly, but merely to point out to you the size of our segment of aviation, of which the National Pilots Association is a part.

I want to talk to you very briefly about the safety record of general aviation, which is certainly not particularly good. Our worst years were 1947 and 1948, when we had over 1,300 fatalities. Since that time our fatality rate has gone to around 800 a year. In 1960, 835 were killed. However, when this fatality rate is figured per plane-miles flown, the trend is defintely downward.

In 1938 we had 1.4 fatal accidents per million plane-miles. This dropped to 0.2 percent in 1960, which is an improvement of about 700 percent.

I also want to briefly mention the case of midair collisions as a cause of fatality in general aviation aircraft. This is a very insignificant cause. There have been only three collisions between our type aircraft and air carriers in which there has been a loss of passenger lives on the airliner.

But in all three of these instances none of the aircraft were really the usual type of general aviation aircraft. One was a BT–13, another a DC–3, and another a P–38. However, during the period from 1938 to 1960, there were 16 additional collisions between general aviation aircraft and airliners in which no airline passenger deaths resulted.

But in 13 of the 16 there were passenger fatalities in the general aviation aircraft. This merely points out that in collisions between light aircraft and air carriers, the lighter plane comes out much the worse.

The point I would like to make here is that we are greatly concerned that if a collision did occur between a light aircraft and an airliner, with a large loss of life on the airliner, that our aircraft would probably be subjected to severe restrictions.

We think such a collision is a distinct possibility if the air traffic control system becomes more and more complex, increasing the workload and pressure in the cockpit.

You have to realize that in our aircraft, often they are flown by one or two men, and the cockpit work becomes a critical part of the load. There are wide differences between matters of safety in air carrier aircraft and the lighter general aviation aircraft.

Senator MONRONEY. I notice that you are skipping a paragraph on the near misses.

Mr. REQUARTH. I did that on purpose. However, I might comment on that. I want to shorten this a little.

Senator MONRONEY. We will carry your entire statement in the record.

(Mr. Requarth's statement in full follows:)

STATEMENT OF DR. WILLIAM REQUARTH, PRESIDENT, NATIONAL PILOTS ASSOCIATION

I am Dr. William Requarth. I am president of the National Pilots Association. This organization is made up of certificated pilots, both professional and nonprofessional, from all segments of the general aviation industry. It is a member-controlled nonprofit organization, the officers and directors of which are elected by mail ballots. The membership participate in the policy and direction of the organization by direct correspondence and through a series of open forums at our annual meeting. No officer receives either salary or is reimbursed for expenses incurred.

In presenting this testimony, I must emphasize that I am not a professional airman but a surgeon and use an airplane in business both for VFR and IFR flights. Further, this testimony does not represent a detailed statement of

association position based on participation of all members. It is rather the distillation of the best thinking of several of our members who are well qualified to comment and it is thus a cooperative effort.

The function of NPA is esesntially to (1) maintain a Washington office for collection and dissemination of information pertaining to general aviation pilots to our members; (2) to act as intermediary between our members and appropriate agencies or branches of the Federal Government and to supply these agencies with information needed to reach sound and informed decisions; and (3) to educate our members through publications and meetings.

We are a part of general aviation which is all civil aviation except the airlines. Its fleet is the backbone of the civil aviation industry and in all its components is today a business approaching an annual volume of $2 billion yet, it is not the present size of this industry which is important but the tremendous growth which is yet to come. There are now 70,000 general aviation aircraft in use which is 35 times the number of air carrier aircraft. Of these, 30,000 are used for business alone, 15 times the number of airliners. General aviation flew 13 million hours in 1960, or about three times the number flown by the airlines. In the next 10 years, our fleet will almost double to 120,000 aircraft and will fly about 25 million annual hours. During this period, the airline fleet will remain stationary at 2,000 units but due to increased speed and greater size of its units, will carry more passengers more miles. The above comparison is not to disparage the airlines but to merely bring into proper perspective the size of general aviation of which the National Pilots Association is a part.

GENERAL AVIATION SAFETY

The safety record of general aviation, while improving, is far from satisfactory. Our worst years were in 1947 and 1948 when over 1,300 fatalities occurred each year. Since then, fatalities have never reached 1,000 in any 1 year. Eight hundred and thirty-five died in 1960 and this figure holds about steady. However, when figured per plane miles flown, the trend is downward. Plane miles have increased from 129 million in 1938 to 1.7 billion in 1960. The accident rate has dropped from 1.4 fatal accidents per million plane miles to 0.2, an improvement of 700 percent.

Midair collisions.—As a major cause of fatalities in general aviation, the midair collision is insignificant.

There have been three collisions between general aviation aircraft and scheduled air carriers in which passenger fatalities resulted. However, none of the aircraft involved (a BT–13, P–38 and DC–3) have been the usual type associated with general aviation flying. There were 16 additional collisions during this period in which no airline passenger deaths resulted but in 13 of the 16, there were passenger fatalities in the general aviation aircraft.

These statistics indicate that the small light aircraft is not a serious hazard to air carriers and that in midair encounters, the lighter plane comes out much the worse. Regardless of this, we are greatly concerned that, if a collision should occur and there resulted a large loss of life on the airliner, our aircraft would be subjected to severe restrictions. Such a collision is a distinct possibility if the traffic control system becomes more and more complex and increases the pressure and workload in the cockpit.

The reporting of near misses by our aircraft has virtually been abandoned because the FAA usually reacts to such reports by filing a violation against the pilot who reported it. We recommend that a system of reporting near misses be reinstated that will not result in penalty to the reporting pilot.

Basic differences in safety considerations.—There are wide basic differences between general aviation aircraft and airliners in the matter of safety. The air carriers have largely eliminated the hazards we still face such as pilot error and weather penetration. Weather is no longer a deterrent to the airline pilot who flies and lands in weather that stops most other transportation.

About 83 percent of our fatalities are unnecessary and can be prevented. Most are caused by the pilot's lack of knowledge and proficiency. Many would not have happened, if the pilot involved had a little more foresight or had made a greater allowance for his personal limitations. General aviation accidents follow a predictable pattern and can be grouped according to cause. Most result when a pilot trained only to fly in clear weather enters an overcast and no longer has reference to the ground. This has been proven over and over again to be purely a matter of education and no amount of regulation, threats or aggressive enforcement will keep a pilot out of weather he cannot handle. He needs to be educated.

Education.—The military and airline pilot are subjected to an almost constant process of reeducation. In contrast, most general aviation pilots enter a complete educational void after their license is issued. Proficiency and knowledge lag further and further behind as the years pass, either through apathy or because of lack of funds and facilities for refresher activity.

While NPA recognizes that general aviation safety is integrated with and is a part of all aviation safety, our problems are peculiar to our own type of operation. If the airlines need better traffic control, we need education and "quality control."

Our association is now engaged in a project which we hope will help correct this educational void. It is somewhat complex and involved but progress toward "postgraduate" education of the licensed pilot is being made.

I do not propose that the Federal Aviation Agency be asked to take on the full responsibility for an education program. A private foundation might be more successful than a Government agency.

Current educational activities of our association include a 3-day annual meeting which is essentially an intensive refresher course plus the sponsorship of 1-day refresher national pilot forums throughout the country. We have an aggressive publications program from our Washington office to keep the pilot informed on the technology of flying, aviation safety and regulation changes.

GENERAL AVIATION INSTRUMENT FLIGHT OPERATIONS

Scope.—Today, general aviation aircraft generate 300,000 flights annually that follow instrument flight rules and thus become a part of the air traffic control system. In 15 years this number will triple while the number of air carrier IFR flights will more than double. Even more important, today the number of IFR capable aircraft produced in a 4-month period equals the total number of air carrier aircraft (2,000).

This means that the load on the traffic control system in the future will come from us and that it may cause airline delays.

This committee is fully aware that the present traffic control system is both outmoded and overloaded. Let me offer you a concrete example. A pilot, one of our members, is proceeding on an instrument flight plan from La Guardia airport to Dayton, Ohio. The day is October 27, 1960. He is cleared to maintain 5,000 feet and his next reporting point, Urbana, is estimated at 1700 Zebra. He hears a TWA flight give an Urbana estimate as 1701 Zebra, cruising altitude 5,000 feet. Dayton control was reminded that both were estimating the intersection at the same time and altitude. The TWA flight was cleared to 6,000 feet. Our member crossed Urbana at 5,000 feet, 1702 Zebra, TWA at 6,000 feet, 1703 Zebra.

It is obvious that to accommodate the great increase in load, some major changes must be made. What can be done today to increase the capacity now?

Type of instrument flight.—What type of instrument flight operations does the amateur civil pilot engage in? The typical aircraft is either a light twin or high performance four-place single engine aircraft. He will have invested $20,000 to $100,000 in the aircraft and its electronic equipment. Not only the cost but the weight of this equipment is critical because the payload of the aircraft is easily exceeded. His interest in instrument flight may have been stimulated by the limited amount now required for private license. Once exposed, there is a tendency to continue instrument training to IFR qualification in order to increase the utility of the airplane. These pilots do not desire to fly hour after hour on solid instruments; they find it possible to greatly increase the utility of an aircraft by flying IFR a relatively short time, such as during a climb to on top and descent through cloud in the terminal area. Thus, our instrument flight operations differ from the airlines in that the aircraft is lighter, slower, critical on load limitations and is used chiefly in "little" weather IFR flights.

The increased number of aircraft and their wide speed differential has saturated the present system. Cockpit procedures are more complicated. The number of radio contacts, call-ups that aren't answered, estimates, waits to break into radio chatter increases pressure on the pilot and, therefore, the chance of human error. In a few more years, we will not be able to play the traffic game unless it is simplified. ATC deals with two factors notably unreliable—the human mind and radio.

Some segments of our industry want more flying with less protection. I do not believe this is feasible. We are moving from an era of relative freedom in

the air to one of more and more control. Our concern is that increased regulation and restriction may be overdone, not that it is entirely unnecessary. We ask that it be clearly justified.

This committee is groping for a solution and there is a premium on new ideas. I should like to respectfully submit several specific proposals and close my testimony with two general observations that bear directly on the evolution of any future changes in traffic control.

1. Should the Federal Aviation Agency find it necessary to reduce the number of scheduled instrument flights into a specific terminal, we ask that it not be made a blanket restriction. It should not, for example, affect Des Moines, Tulsa, or Dallas unless the need is there. We hope, however, that such restriction will not be necessary.

2. We are opposed to the restriction of general aviation aircraft from terminal areas under certain IFR conditions. If it is imperative that such a restriction be imposed, we ask that it be considered only on an emergency or experimental basis, for example, 3 to 6 months. The restriction should not be applicable in fair weather since this would block charter and air taxi aircraft which bring in airline passengers.

3. Where possible, we would like routes into general aviation airports that avoid the inflow of traffic to an adjacent high density terminal. For example, be cleared direct from Allentown to Tetersboro rather than via Colt's Neck where the aircraft is integrated with Idlewild, Newark, and La Guardia traffic.

4. It is basic to our needs that the present Federal airport program be directed in part to the construction of satellite airports and not just large terminals. Tetersboro in New Jersey and Allegheny airport in Pittsburgh are examples of satisfactory satellite terminals for business aircraft.

5. Attempts to separate aircraft with large speed differentials should be done on a wider scale. Low speed aircraft should move in channels of their own. They could be descended to a low altitude, perhaps 50 miles from the control zone rather than remaining high and mixed in a stack with high speed aircraft.

6. Wider use should be made of low frequency homing facilities to mark an intersection or holding point. The point here is to decrease the cockpit work of using radials from two VOR's.

7. We caution about a collision warning device as any real solution to anything other than an imminent collision. The closure speeds today are measured in seconds. A collision warner does not increase the capacity of the control system, and that's what we're after.

8. We feel that the development of radar has been oversold as the eventual means of keeping all aircraft apart. Two-dimensional radar is distinctly limited. It is fine for managing one airplane—to direct it to a holding point or to the outer marker or to the runway localizer. But as far as anyone being able to look at a scope full of pips and direct the pilots so as to keep them apart (even forgetting the altitude question) it is impossible. That's just not a job for radar. In addition, radar increases the responsibility of the controller who not only must decide where to put the airplane but must tell the pilot how to get there.

We would make the general observation that the ascent should be reversed on traffic control. Responsibility for maintaining a position in a certain reserved block of airspace should be that of the pilot, not a radar controller. Admittedly, today's techniques for precise navigation of aircraft are so imperfect that controllers cannot be certain a flight plan route will be met on time. It follows, then, that we need better airborne navigation equipment.

It is said that our present system is outmoded 10 years. It should be remembered that 10 years ago we had something that was 10 years ahead of its time—distance measuring equipment. Someone killed it, now we must start over again. DME combined with the pictorial display computer makes possible instant and precise position determination. It is far more important than radar and is an easy way to fly without being confined to our present airway system. Using such equipment, ground radar systems would be used only to follow flights, not guide them.

Research and development should be hastened on cockpit navigational equipment that will also automatically indicate future position, thus eliminating cockpit calculations.

Finally, the Federal Aviation Agency should look ahead and develop a means to make instrument flight as simple as possible. The complexities of the pres-

ent IFR system will soon be beyond the capability of the general aviation pilot. Right now, the human brain is working as well as it ever will, and it isn't good enough.

Mr. REQUARTH. We have almost abandoned the reporting of near misses because the FAA usually reacts to such reports by filing a violation against the pilot who does the reporting.

We would recommend that a system of reporting near misses be reinstated that will not result in penalty to the pilot.

I should also say at the same time that the information that is gained from near misses is of a subjective nature, and it can be controversial. I think there is a limit on the actual value of it, but we do feel that it should be reinstated.

Senator MONRONEY. I do not want you to skip that part because it seems to me that there are certain areas in our air traffic control system, and certain spots where frequent near misses or situations in which near misses occur most frequently give us a far greater yield on the information than the corrective action that needs to be taken in separation of traffic than the necessity to file a charge and to punish, perhaps one, or two, or three additional pilots.

I hope that during these hearings this will be so spotlighted that the FAA will be able to work out with the pilot groups some modus operandi where we can get this information and continue this flow in and to work out a system which will be satisfactory to those who must report, if the FAA is to get any valuable information out of this without the pilots being adjudged guilty on the basis of their own reports.

Mr. REQUARTH. We would recommend that some system be reinstated so that violations would not be filed against the reporting pilot.

I would like to point out to you also the basic differences between general aviation aircraft and airliners in the matter of safety. As I mentioned, air carriers have largely eliminated hazards that we now face, particularly that of weather penetration. Actually the airline pilot flies in weather and lands today in the type of weather that would stop most other transportation.

About 83 percent of our fatalities could be prevented. This figure could be 75 percent. I am not certain whether it is 75 or 83, but a high percentage of them can be prevented. Almost all fatalities in our type aircraft are caused by a pilot's lack of knowledge and proficiency. Many of them would not have happened if the pilot involved had had a little more foresight, or had made a greater allowance for his shortcomings.

The great majority of our field accidents results from weather penetration. It results when a pilot trained to fly in clear weather enters an overcast and no longer has reference to the ground.

The University of Illinois Institute of Aviation has proven that within about 4 minutes after a pilot gets into a situation when he has no reference to a stable point, the aircraft is out of control.

This has also been proven over and over again to be a matter of education. There is no amount of regulation, threats, or any type of enforcement that will keep a pilot out of weather he cannot handle.

After all, I am sure they do not get into bad weather voluntarily. It is really a question of their need to be educated. That is the core of the situation.

Senator MONRONEY. Isn't it true, Doctor, that while on summary the report may show a very high incidence of pilot error in the formal reports, that about 80 or 90 percent of these general aviation aircraft accidents have weather as their prime casual factor?

Mr. REQUARTH. Yes, sir.

Senator MONRONEY. A skilled instrument pilot, with a proper instrumentation in his plane, could have flown through this weather, perhaps without any great difficulty excepting a bit of tenseness in the cockpit. But the lack of—the understandable lack of trying to qualify every general pilot as an instrument pilot, and filling the cockpit with all kinds of additional equipment, makes this pilot incapable of getting through marginal weather.

The general purpose must be, as you are bringing out, to try education and understanding, both of the capability of the pilot at that stage of his training, and also the capabilities of his aircraft.

Mr. REQUARTH. That would greatly decrease our accident rate. It is really a problem of education. When we realize, for example, that the military and the airline pilot undergo constant processes of reeducation—this is true in a lot of professions; it is true in my own profession—in contrast, most general aviation pilots, after they once have their license to fly, they enter an educational void. Their knowledge and proficiency legs further and further behind.

As the years pass, either through apathy or lack of funds or lack of facilities, they no longer undergo reeducation.

In other words, the airlines perhaps want better traffic control. We need education and, I might say, quality control. Our association—I won't go into this in detail—is engaged in a project now which we hope will correct this educational void and provide a postgraduate type of education for the licensed pilot.

We do not propose necessarily that the Federal Aviation Agency undertake this responsibility. Perhaps a private foundation might be more succesful than a Government agency.

Our organization is promoting 1-day pilot forums throughout the country as a refresher activity. Also at our annual meeting we have a 3-day intensive lecture series which is essentially a refresher.

Senator MONRONEY. I had the pleasure of seeing that, including not only the lecture series but the flying under the hood and various other things that were being given, such as deadstick landings and other procedures beyond the normal qualifications of general aviation, but which you, through your organization, and on a voluntary basis, were encouraging your pilot members to participate in.

I think it is a very fine program. You had several types of aircraft, several types of equipment, and several procedures that normally you do not find general aviation using as a rule. I think you are to be complimented on this forward-looking effort of the association to help its members and to actually participate in this reeducation and this proficiency training program.

Mr. REQUARTH. Thank you, sir.

I want to comment briefly on general aviation instrument flight operations. We generate 300,000 flights a year that follow instrument flight rules, and, therefore, become a part of the air traffic control system. In 15 years this will triple. The number of IFR flights will more than double. Even more important, today the number of

IFR capable aircraft that are manufactured by the four large aircraft manufacturers in a 4-month period produced 2,000 aircraft that are capable of flying on instruments.

That equals the total number of air carrier aircraft. What this means is that in the future the load on the traffic control system will come from us, and it might even cause some airline delays in the basis.

I know that you are all fully aware that our present traffic control system is not only outmoded but somewhat overloaded. I will skip this example in my statement. I think it is clear enough to all of you that the situation exists, that the traffic control system is extremely loaded.

The big question today is what can be done right now to increase the capacity of the system. I want to briefly give you an idea of the type of instrument flight operations that we engage in. Our aircraft are usually either a light twin engine or high-performance, four-place, single-engine aircraft, and usually the cost ranges in the neighborhood of $20 to $100,000.

We are interested of course in the cost of the aircraft, but also the weight is critical because the payload of our aircraft is very easily exceeded. Also, the instrument flying done by our pilots is not necessarily one in which we fly hour after hour on solid instruments. We have found that we can greatly increase the utility of an aircraft by flying instruments only a relatively short time, such as during a climb during an on-top condition and descending through clouds at the terminal area.

Thus our flight instrument operations differ from the airlines in that we are lighter, slower, lower on critical load limitations. We like to point out that the increased number of aircraft and also the widespread differential is partly responsible for saturating the present system. Cockpit procedures are becoming more and more complicated. The number of radio contacts, callups that are not answered, estimates, waits to break into radio chatter increases pressure on the pilots, and, therefore, increases the chance of human error.

It must be pointed out that we are dealing with two notoriously unreliable factors: the human brain and the radio. Unless we simplify this traffic gain, it will be difficult for us to continue to operate.

Some segments of our industry want more flying and less protection, which I do not personally feel is feasible. We are moving now into an area of relative freedom in the air to one of more and more control. Our concern is that increased regulation and restriction may be overdone, not that it is entirely unnecessary.

We would like to be certain it is clearly justified. I know that you are groping for a solution, and that today there is a premium on any new ideas, something that can be done immediately.

So I would like to submit several specific proposals and then make two general observations that bear directly on the evolution of future changes in traffic control.

In doing this, I do it not as a statement of position based on participation of all the members of this organization. This was not possible on short notice. However, it is the best thinking of several of our members who are qualified to comment.

Along with specific proposals, there is this: First, should the Federal Aviation Agency find it necessary to reduce the number of sched-

uled instrument flights into a specific terminal, for example, because they feel the system is too full, we ask that it not be made a blanket restriction. It should not, for example, affect Des Moines, Tulsa, or Dallas, unless the need is there. We also hope that such restriction will not be necessary.

We are also opposed to the restriction of general aviation aircraft from terminal areas under certain instrument conditions. If it is imperative that such a restriction be imposed, we ask that it be considered only on an emergency or experimental basis, for example, 3 to 6 months. This restriction should not be applied in fair weather, since this would block charter and air taxi aircraft which bring in airline passengers.

Where possible, we would like routes into general aviation airports that avoid the inflow of traffic to an adjacent high density terminal. For example, in getting IFR clearance to Teterboro from Allentown, usually we are cleared via Colt's Neck omni. That is right; yes, sir. When you go via Colt's Neck, the aircraft is usually integrated with traffic from Idlewild, Newark, and LaGuardia.

Senator MONRONEY. This takes you through the whole birdcage?

Mr. REQUARTH. Yes, sir.

Senator MONRONEY. General aircraft could come in at much lower altitudes and stay out of the usable airspace normally used in approach patterns of jets or high performance aircraft, and some routing round the high density traffic pouring in every 30 seconds into these major airports would greatly facilitate the confidence of the pilot and also avoid the additional congestion of airspace in these terminals that are 90 to 95 percent scheduled airline traffic.

Mr. REQUARTH. That is our feeling. In making this statement I want to say that I am not a professional airman. There might be some very good reasons why this diversion is not possible. But we would recommend that, if it is possible.

Also, it is basic to our needs that the present Federal airport program be directed in part to the construction of small airports, not just large terminals. Teterboro, in New Jersey, and Allegheny County in Pittsburgh, for example, are examples of satisfactory terminals for business aircraft. They must be in close to town.

Attempts to separate aircraft with large speed differentials should be done on a wider scale. Low speed aircraft could possibly move in channels of their own. They could be descended, for example, to a low altitude, perhaps 50 miles from control zone, rather than remaining high and mixed in a stack with high speed aircraft. That is the way it is today.

A minor point would be the wider use of low frequency homing facilities to mark an intersection. The point here is to decrease the cockpit work of using radials from two VOR's. Where possible, we feel this would be a step forward.

We also feel that a collision warning device is no solution to a collision problem other than warning of an imminent collision. The closure speeds today are measured in seconds. A collision warner does not increase the capacity of the control system, and that is what we are after.

Senator MONRONEY. Isn't it a fact also, Doctor, that almost all the anticollision devices that so far have been worked on or sought for

development require all planes to have anticollision devices to make them effective; that if the airliner, for example, has them, and no other planes using the airspace have them, then this is very difficult for the other planes to know what direction they should go, because they can't tell the proximity that the other man has, and he may be turning right into your traffic.

Mr. REQUARTH. I believe that is right. I am not acquainted entirely with the present status of these devices, but we feel that they will not be a solution to anything except an immediate collision.

We feel that the development of radar may have been somewhat oversold as a means of keeping all aircraft apart. Certainly two-dimensional radar is distinctly limited. I feel that it is fine for managing one airplane—that is, to direct it to a holding point or to the outer marker or to the runway localizer. But as far as being able to keep a lot of aircraft apart—even forgetting the altitude question—it is just a difficult problem. We wonder if this is really a job for radar. Certainly we feel that it greatly increases the responsibility of the controller who then not only must decide where to put the airplane but must also tell the pilot how to get there. And that is a real load for him.

I want to make two general observations, and this will close my statement.

We feel that possibly the accent should be reversed on traffic control. The responsibility for maintaining a position in a certain block of airspace should be that of the pilot, not the radar controller. Of course, today's techniques for precise navigation of aircraft are so imperfect that controllers cannot be certain that a flight plan route will be met on time. It follows, then, that we need better airborne navigation equipment.

It has been said that our present system is outmoded 10 years. I would like to point out to you that 10 years ago we had something that was 10 years ahead of its time. Someone killed it. That was distance measuring equipment—DME. We feel that DME, combined with a pictorial display computer, would make possible instant and precise cockpit navigation. We feel it is more important than radar, and it is an easy way to fly without being confined to our present airway system. Under these circumstances, ground radar will be used only to follow flights rather than to guide them.

One other point here which is sort of delving into the future. If it would be possible to develop a means to provide the cockpit navigational instrument that would also automatically indicate future position, this will eliminate a lot of cockpit calculations that we go through today.

The point of this is that we feel that we have to have more precise navigation equipment, and we feel that in DME this exists today, and a pictorial display computer will soon be available.

For our type of aircraft instrument flight is rapidly getting too complex. It is soon going to be beyond the capability of the general aviation pilot. I tell you right now that the human brain is working about as well as it ever will, and it is not good enough.

Senator Monroney, I thank you for being permitted to speak.

Senator MONRONEY. Thank you, Doctor, for your statement, and for the participation of the National Pilots Association in this air safety hearing.

I believe you said at the outset that the policy and program of your association is arrived at at a full open meeting at which all members caring to attend the convention participate; it is not a policy directed from the top down, and comes from the bottom up.

Mr. REQUARTH. That is correct, sir.

Senator MONRONEY. This is quite an important thing because it brings into play the actual knowledge and understanding of all the general aviation pilots who participate in the national association.

In reference to limiting air traffic, which is becoming more and more a problem, earlier this week we had testimony that at certain hours in the New York area the takeoffs and landing at the three major airports—La Guardia, Idlewild, and Newark—in the peak period had reached, in the opinion of the chief of the air traffic control, a point of saturation. This is the first time we have had any official admission that there is a saturation point, and that the load is as great as the system can stand, and it can stand no more.

In this respect I note that you advocate very strongly I think a wise and a considered policy of first providing, wherever possible in these high density traffic areas, satellite landing fields or airports for the use of general aviation or business aircraft. This would satisfy most of the general aviation community, would it not, if an airport for their own type of plane and the general speed of the plane and the instrumentation of the plane could have, with access through a lower altitude route and other devices, access to fields that they might call their own, and stay out of the extremely cramped airspace that would be bound in Idlewild or La Guardia or Newark, for example?

Mr. REQUARTH. That is essentially correct, provided these fields are in close enough to be within a reasonable distance of the city.

You realize that our aircraft are business aircraft in part. Many of our pilots come in in the morning, transact their business, and leave in the afternoon. If they are involved with, say a 50- or 60-mile drive, of course it would neutralize the benefit for them.

Senator MONRONEY. The general part of your aircraft, excepting for Bill Lawton's hotrod bombers that some of the boys still like to fly, can still get in and out of a 7,000- or 10,000-foot airport. In such fields as Meigs Field, in Chicago, as you mentioned in addition to others, they are very satisfactory for the general aviation community and generally have approach areas that are separate and apart from the crowded approach zones of these major commercial scheduled airline terminals. This is the type of thing that you would like to see; is it not?

Mr. REQUARTH. Yes. Meigs Field is an example of one that is close in. It does not have instrument facilities for instrument approach.

Senator MONRONEY. So when it is socked in it throws even a greater burden on Midway.

Mr. REQUARTH. Yes.

Senator MONRONEY. That is a very important point. These should be furnished with instrument landing systems, particularly in the metropolitan areas, if they are going to be expected to be used under adverse conditions to keep the general aircraft out of the path of the scheduled airliners.

Mr. REQUARTH. We don't necessarily advocate that we be restricted from the large terminals, but we feel that in the case of our instrument-flight operations that it would be of benefit to both our aircraft and other aircraft if some separation can be maintained.

Senator MONRONEY. In other words, if the airport were as suitable for general aircraft as the metropolitan terminal serving a vast volume of scheduled airline traffic, it is your feeling that the general aviation pilots would prefer their own airport and their own approach areas and stay out of the high density traffic areas?

Mr. REQUARTH. Yes, if the traffic load required that, we would.

Senator MONRONEY. I gather you don't want an inelastic automatic ban?

Mr. REQUARTH. No, sir.

Senator MONRONEY. I don't think anybody does. There are probably nine-tenths of the airports of the country that are perfectly capable of taking on general aviation and the scheduled traffic aircraft as well. There are certain series of airports which you know well where this gets to be a major factor. We find it difficult to talk about cutting down on the acceptance of additional airline schedules by 10, 20, or 30 percent if that reduction is immediately filled with the input of that amount of general aviation traffic.

You can't expect general aviation to be denied, but if they can have what they themselves need built for themselves at landing areas suitable for their work and their use, then you feel that general aviation would not protest if it became vitally important for air safety to perhaps segregate some of our few major airports for commercial airline traffic; is that correct?

Mr. REQUARTH. That is correct.

For example, we consider LaGuardia an airport that is convenient. If it was absolutely necessary to restrict us from using LaGuardia, and an airport could be provided that was in convenient reach of the city with instrument facilities, that would satisfy us.

Senator MONRONEY. In other words, you are getting an informal segregation now, as I understand it, if a general aircraft lands at certain airfields which have such high density traffic and are concentrating on scheduled airlines, most of the general aviation fraternity gets the bum's rush and are told that they have about a 1-minute gate position and to get on out as fast as they can. And it is difficult to find parking or any services for that type aircraft on the field; this is done on an informal basis now. It is discouraging, without any active means to institute a more desirable landing area and a more desirable service for general aviation at their own airport with—as you say—a sort of isolated approach out of the regular approach zones.

Mr. REQUARTH. Yes.

Senator MONRONEY. Do you not think that would be satisfactory in these few particular instances?

Mr. REQUARTH. Yes.

Senator MONRONEY. Thank you.

Many of your pilots fly, as I do, into uncontrolled airports, that is, your airports that perhaps have three 5,000-foot concrete runways and a unicom run by the fixed base operator. But also into these airports without control towers comes a certain flow of feeder airline traffic. Most of the general aviation fraternity fly a square pattern

of circling the field before coming in to see if there is any conflicting traffic, and even contacting the unicom to ask what reported traffic is in the area. I have observed several times the feeder lines reporting not to unicom but to their own company radio which in the past has not been connected or integrated with the unicom channel, and other general aviation traffic has no knowledge of the approach of the DC–3 or whatever equipment the feeder lines were using. Then suddenly you find as you come in to make your turn into the final approach that you suddenly stare a DC–3 in the face coming in just below you.

It seems to me that either the feeder lines, which carry sometimes large numbers of people, should fly a square pattern over the airport for their approach in an uncontrolled traffic area, the same as the general aviation pilots do, or have both report to the same unicom so that all traffic in the area will be listening to the estimated time of arrival, altitude, and position of the feeder line.

Mr. REQUARTH. We feel that straight-in approaches on uncontrolled airfields are probably hazardous. If the field is uncontrolled, certainly the feeder line air carrier should make the regular standard pattern. The exception to this for a number of years was the University of Illinois Airport. However, this is now a controlled airport. But prior to that straight-in approaches were allowed with the consent of the university.

I believe that at the average uncontrolled airport straight-in approaches increase the hazards.

Senator MONRONEY. Being a doctor, I would like to ask you about the attitude of your National Pilots Association as to whether the present medical examination for general aviation pilots is working unsatisfactorily or satisfactorily as far as your association is concerned?

Mr. REQUARTH. As far as I know it works satisfactorily. Speaking as an individual, I feel that the present system of medical examiners, designated medical examiners, is satisfactory. As I brought out before, I feel that what the FAA has asked has been only about what a life insurance company would ask, that is, that the examiner be briefed in advance on what is required of him.

I must also say that this is not the position of general aviation in general. I am speaking as an individual. I do not see that the need for designated medical examiners is a hardship. Occasionally, in certain isolated areas, it might be that the examiners are infrequent, and the pilot would have to travel quite a distance.

Senator MONRONEY. As far as you are concerned, your experience of the ability to recruit competent medical examiners to be certificated is not too difficult for the FAA?

Mr. REQUARTH. I can't comment on that, sir. I don't know if it is difficult to recruit them or not. My understanding is that they have not had any trouble.

Senator MONRONEY. Would you state your name for the record?

STATEMENT OF THOMAS LYON, GENERAL MANAGER, NATIONAL PILOTS ASSOCIATION, WASHINGTON, D.C.

Mr. LYON. I am Thomas Lyon, general manager of the National Pilots Association. I just want to throw in a supplement to that, based on the correspondence we have received at the office.

I think that there are two points that should be made. One, as Dr. Requarth said, there are areas where the doctor population is still too low to provide reasonable convenience to some individuals. In other words, more doctors are needed, particularly in areas of low population density.

And the second point that we have heard some complaints on is that since they have gone over from any licensed doctor to designated medical examiners there has been an increase in rates from the consumer's point of view, and there has been some complaint on this point.

Senator MONRONEY. I think it was only $5 before.

Mr. LYON. Apparently some did it for less than that.

Senator MONRONEY. A medical examination?

Mr. LYON. You can't compile accurate figures. I have heard people say it has gone from $3 to $15 in some areas.

Senator MONRONEY. I thought $5 was the very minimum.

Mr. LYON. Five dollars was apparently the ceiling on the old basis. I believe that is correct. Some doctors actually did it for less.

Senator MONRONEY. You get charged more to talk to a doctor in Washington on the telephone.

Mr. LYON. I think the facts could be questioned here, but there has been a question of opinion on that.

Senator MONRONEY. Would you supply to the FAA the areas where your pilots may be complaining that it is too difficult to obtain a medical?

Mr. LYON. We have been doing that. We have been working with Dr. Goddard trying to keep up to date.

Senator MONRONEY. They are making efforts trying to locate doctors and supply them in these areas?

Mr. LYON. Very definitely.

Senator MONRONEY. The principle of having a certified doctor who has been briefed on the requirements by the FAA you don't think is too onerous and is an assumption of Government authority that is obnoxious to at least the group of pilots that you represent?

Mr. LYON. No, sir.

Mr. REQUARTH. Speaking as a physician, I would say that what they are asking is about what the life insurance companies ask of an examiner when they examine for life insurance. They normally don't go to any doctor. Of course, life insurance companies pay the fee for the examination, I think. I am not in that business myself. Perhaps that would be one difference.

Senator MONRONEY. From what you say I gather that you think there are other safety factors that would be a greater contribution to general aviation, rather than to concentrate completely and wholly on the protests against the certificated medical examiners?

Mr. REQUARTH. I think so; yes, sir.

Senator MONRONEY. Thank you very much.

Senator Schoeppel?

Senator SCHOEPPEL. Doctor, I have a question, I listened to your testimony about some of your satellite fields. We all know that some of these larger airports have their saturation periods. I was in La-Guardia the night before last where we sat on the runway for something short of 3 hours trying to get in the air, and had to go back to refuel, to get enough fuel to get into Washington. There were some

weather conditions, but other things that made a lot of us wonder. Be that as it may, it shows congestion or something, and everybody who goes up wants to get down.

Getting to your satellite airports, your type of flying, I am wondering if you do not actually think that some place down the line, in the interest of safety, in the interest of taking care of this general aviation group which fly these smaller planes for business, rather than strictly commercial types, that you are going to have to limit someplace the entrance into your satellite airports to certain types of aircraft. Do you agree with that or not?

Mr. REQUARTH. Are you speaking of the VFR or instrument?

Senator SCHOEPPEL. The first.

Mr. REQUARTH. Clear weather?

Senator SCHOEPPEL. Yes.

Mr. REQUARTH. I would say that in clear weather it would be pretty far in the future for this to be necessary.

Senator SCHOEPPEL. Sometimes this clear-weather picture drops down. You talk about these satellite airports being of practical value. Has your association been giving any consideration to establishing, or considering, these types of improvements in these satellite airports in some of the metropolitan areas? Have you done any work along that line as an association?

Mr. REQUARTH. No, sir, we have not.

Senator SCHOEPPEL. Do you feel that maybe the proper authorities for airport safety and flying safety, and possibly maybe this committee ought to go into the question of controlling entrance to airports during the next 2 or 3 years?

Mr. REQUARTH. I would say this, to clarify it: It might be possible, for example, that there would be certain segments of fields or runways in large terminals which general aviation would be using primarily; in lieu of this, a field that was in close to the city that we might use. But we would not in general want to be restricted from the large terminals unless there was a satisfactory substitute area that was convenient and in close.

Senator SCHOEPPEL. In establishing these airports, where we are spending hundreds of millions of dollars—and we are going to have to, the way it looks—in metropolitan areas where congestion has been increasing, is it feasible in your judgment to have within that airport itself certain landing strips or landing patterns developed strictly for these smaller aircraft? Or would you remove them completely from these larger airports in some of these metropolitan areas?

Mr. REQUARTH. Senator Schoeppel, I believe that would depend entirely on the exact terminal area. It would be an individual matter. There might be areas where only a satellite field would be suitable. In other areas, it might be possible to do otherwise. For example, Phoenix, Ariz., where general aviation use one side of the field.

Senator SCHOEPPEL. I know. I have been in there many times.

Mr. REQUARTH. At Phoenix they have a prevailing wind which simplifies it somewhat.

Senator SCHOEPPEL. Thank you.

Senator MONRONEY. Thank you very much, Doctor, for your very helpful testimony.

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We appreciate your first appearance before this committee. We hope you will return here many, many times.

Senator MONRONEY. Our next witness is Mr. Francis M. McDermott, executive director, Air Traffic Control Association, accompanied by one of the most distinguished men in aviation, Mr. Oswald Ryan.

Mr. Ryan, we are glad to have you with us, and also Mr. McDermott.

You have a statement. You may proceed in your own way.

STATEMENT OF FRANCIS M. McDERMOTT, EXECUTIVE DIRECTOR, AIR TRAFFIC CONTROL ASSOCIATION, ACCOMPANIED BY OSWALD RYAN, GENERAL COUNSEL

Mr. MCDERMOTT. Thank you, Mr. Chairman. It is certainly a pleasure to be back here again. I was hoping, of course, that you might have taken a page from David Susskind's book and had a pot of coffee out here, but we will get along very well without it.

Senator MONRONEY. We don't expect to stay up so late discussing aviation safety.

Mr. MCDERMOTT. I hope not.

I am certainly pleased to have Mr. Oswald Ryan here. He is certainly well known to your committee, with his 16 years in the Civil Aeronautics Board, and serving as chairman, and 5 years with the Air Traffic Control Association, as general counsel.

In addition, we have several of our board of directors and national officers of the association here in the room as well as many of our members, including some who worked the midnight-to-8 shift last night. This is a measure of their intense interest in the proceedings that have been going on here.

Our statements are brief, and with your permission I would like to read them into the record, and I am prepared to answer any questions that you might have.

Senator MONRONEY. That will be fine.

Mr. MCDERMOTT. In keeping with the express wishes of the committee, our statement today will be very brief. The position of the Air Traffic Control Association on the matter of aviation safety is a matter of public record, and has been consistent throughout the history of our organization. ATCA is not interested in indicting individuals or groups for mistakes of the past. Indeed it would defeat the noble purpose of this committee to simply document the sorry past history of the development of air traffic control, unless we are prepared to benefit by past mistakes, and avoid similar pitfalls in the future. Therefore, we have a grave responsibility to identify the problem areas in air traffic control, in order that corrective action may be taken—and there is no group better qualified to offer such constructive suggestions than the professional air traffic controllers.

A brief word about the association may serve to set the stage for the remarks I have to offer. The Air Traffic Control Association is a professional society of air traffic controllers, pilots, engineers, and corporations. It has one purpose, and that is the enhancement of aviation safety through the provision of an effective system of air traffic control.

Actually the purpose of this association and FAA's Bureau of Air Traffic Management should be one and the same. Certainly these two groups are most knowledgeable in matters of ATC. If the recommendations of this association are couched in more urgent terms than those of FAA, it is merely an indication that the Air Traffic Control responsibility within the Government structure has not completely shed the shackles of the Commerce Department basement.

Traffic controllers have long recognized the deficiencies in the air traffic control system. They have struggled through years of frustration brought about by an inadequate environment and inferior tools. This frustration has been intensified by the gnawing fear of the consequences of performing this highly responsible function constantly aware of the fact that disaster could occur at any moment, despite their best efforts. This is the type of environment that breeds an occasional "Admiral Rickover"—but most Federal employees are cynically aware that for every successful "crusader" on the Government payroll, there are thousands of "dead heroes." Despite encouragement such as that given by President Kennedy, in his appeal to Federal employees to express their "daring and dissent," there is an ingrained reluctance to speak out, even in such matters as vitally important as aviation safety.

It is in this area that the Air Traffic Control Association serves one of its most useful functions. As the professional voice of the controller, we are in a position to state problems and identify trouble spots, even when agency or administration policy might be inhibited in doing so. In taking a stand for aviation safety, we endeavor to work in closest harmony with the Federal agencies and all other elements of the aviation community. To do otherwise would obviously reduce the effectiveness of the association.

The flying public, the group with the most at stake in this matter, has been dismayed to discover the lack of progress in air traffic control problems which has been revealed in recent months. This time we must show the aviation world that we are determined to take a practical approach to the solution of the air traffic control problem. It is not likely that their anxieties will be easily assuaged by sugar-coated platitudes. In order to regain the confidence of the public, we must prove that we are now determined to marshal the best resources available to provide a safe and efficient air traffic control service now; and that we are equally determined to plan, develop, and implement a practical system of air traffic control to cope with the problems of the future.

And this is the way we must proceed: First of all, we must recognize the fact that air traffic control is not a simple clerical or bookkeeping function. The duties of air traffic control are far more demanding than any other function in aviation; the need for highly skilled, intensively trained, emotionally stable, and physically fit personnel is as great as in any other profession; the responsibility for life and property which rests upon the individual controller defies comparison; and the consequences of error, whether it be mental, physical, mechanical, or electrical, are grave, indeed. Therefore, we need to provide the controller with the very best in tools, environment, and working conditions, if we are to attract and retain the dedicated career professionals needed to carry out this responsibility. We also must

provide an atmosphere wherein the voice of the professional controller can be heard in the determination of areas of improvement of tools and environment.

That the actual requirements of the controllers have never been effectively represented is patently clear from the record. The history of the progress, or lack of progress, in air traffic control over the past 15 years clearly shows that each committee, working group, advisory body, or Government board that has been formed to attack the problem of air traffic control has been lacking in practical air traffic control representation. This is not an indictment—it is simply an illustration of the somewhat natural tendency to oversimplify the problem of air traffic control.

The prevailing assumption that air traffic control is an engineering problem that can be reduced to mathematical formula and solved on a computer is wrong. Yet this philosophy has dominated all such groups up to and including the Air Navigation Development Board. Practical air traffic control was not represented on the Curtis committee; it had no effective voice within the Airways Modernization Board; and even within the Federal Aviation Agency, as recently as January 13, 1961, the Administrator proclaimed that the responsibility for determining the needs of air traffic control rested with the engineers in research and development, and not with the air traffic control office. I suggest that you will not find any other example in industry or Government wherein research and development is charged with the responsibility for determining "what" is needed, "when" it is needed, and "where" it is needed.

Secondly, we need to assemble a practical set of operational requirements for a truly effective system of air traffic control. Operational requirements dictated by controllers and pilots. And we need an effective method of monitoring research efforts to insure that these requirements are being fulfilled. Once the problem of air traffic control has been adequately defined, and the supporting efforts have been properly organized, we will commence to make progress.

Third, we should carefully evaluate the organizational structure of the Federal Aviation Agency. Experience during the first 2 years has shown that the Agency has not always been able to respond to its principal responsibility, air traffic control, in the most effective fashion. Specifically, I believe that the Bureau of Air Traffic Management should be given more direct authority to specify: Personnel needs, in terms of numbers, grades, qualification standards, and training; equipment requirements such as communications, radars, displays, computers, et cetera; short-range and long-range requirements involving research effort. We need a centralized authority within the Agency to marshal the required resources, and bring them to bear on the problem of air traffic control.

Fourth, we must immediately take advantage of the off-the-shelf equipments and techniques that are available, and which can bring about improvements in the air traffic control environment. The Bureau of Air Traffic Management can easily provide such a list. Here are some of the things that can be done:

1. Accelerate the replacement program for the World War II surplus radar displays now in use.

2. Expedite the procurement of bright radar displays—television scan conversion—for centers, approach control, and tower cabs.

3. Continue the program for use of rental computers in ARTC centers. Six centers are so equipped now. Plans to install six additional computers during this fiscal year were canceled, pending availability of equipment currently under development. This decision has introduced an automation "gap" of at least 2 years in many ARTC centers.

4. Survey the total equipment needs of air traffic control in the handling of the high altitude traffic. This has become a critical situation, and high-speed jet traffic is increasing daily. Deficiencies are noted in many centers with respect to display, communications, coordination, and general environment.

5. Since the function of air traffic control is burdened with grave responsibility, we should do everything possible to provide the very best environment for the controller. We take due cognizance of FAA's program toward providing new ARTC buildings—certainly a step in the right direction. However, there are many centers and towers today whose physical environment is definitely substandard. This environment could be vastly improved through the expenditure of a relatively small amount of money.

These are simply examples. A complete survey of immediate needs of towers and centers, without regard, for the moment, to budgetary limitations, would be most worthwhile—and we might even discover that we can afford the price.

Fifth, we must make an immediate and thorough review and evaluation of the research and development effort in air traffic control. Each project designed to improve air traffic control should be matched against a set of operational requirements. If a project cannot meet the test, it should be modified, or scrapped. Those projects that can be supported by operational requirements will bear a higher confidence factor because of the test.

The reasons such an evaluation is needed:

1. Experienced pilots and controllers who have been exposed to current air traffic control research projects are frankly skeptical.

2. Capabilities and availability of equipments in the automation, communications, and radar field have been seriously overestimated.

3. Overemphasis on longer range projects has contributed to an attitude of neglect for the inservice improvement program.

I would like to summarize with these points:

1. Recognize the technical complexity and demanding nature of ATC.

2. Compile practical operational requirements for an effective ATC system.

3. Give to ATC the authority and procedures to identify needs, specify requirements, and maintain operating efficiency in system.

4. Intensify program for inservice improvement—taking full advantage of off-the-shelf tools and techniques.

5. Conduct thorough review of R. & D. effort—matching each project against specified operational requirements.

As your committee proceeds with this review, we respectfully submit that you keep in mind the two principal groups concerned with the operation of the air traffic control system. These are, of course, the

pilots and the controllers. The ultimate success of the system depends upon cooperation between these two groups, mutual understanding of the problems involved, and the ability to specify and agree upon what is needed in the resolution of the problem.

These comments and suggestions are offered to this committee, and to the new Administrator of the Federal Aviation Agency as a sincere token of the desire of this association to participate in the development of a sound and practical air traffic control system.

Senator MONRONEY. Thank you very much, Mr. McDermott.

If it is satisfactory to Mr. Ryan, I think we would like to hear his statement before we engage in discussion or questions.

Mr. RYAN. Mr. Chairman, members of the committee, Mr. McDermott has spoken to you on one of the two important phases of the air traffic control problem, namely, the question of ATC facilities and equipment. I shall address myself to a brief review of recent events affecting the personnel phase of the problem—the controller himself. I think all of us will agree that both phases are of vital importance to air safety.

This committee will remember that the controller has only recently been recognized as a major factor in the air traffic control problem. In all of the investigations of air traffic control since World War II, the emphasis was placed upon the need for a modernization of the control system, the improvement of its facilities and equipment, all of which were important.

Little or no attention was given to the human element. Yet the controller is the very heart of the air traffic control system, the man who bears the ultimate responsibility for the crucial decisions that safeguard aircraft against the disaster of midair collision.

Then in 1958 came the first official recognition of the controller and his relation to the problem. This came in the form of the inclusion in the proposed Aviation Act of 1958 of section 302(g) of that act. This was the section, you will recall, which directed the Administrator of the Federal Aviation Agency to make a study of the personnel needs of the controllers from the standpoint of special qualifications and training, special provisions as to pay, retirement and hours of service, and special provisions to insure responsiveness of the air traffic controllers in time of war and emergency, and to report the results of his study, together with legislative recommendations by January 1, 1960.

Your committee, in its report to the Senate, explained the reasons for this section in language that was crystal clear. Your report said that "aside from the question of a unified service and provision for war emergencies," this study was "urgently required."

After describing the burden which had been placed on the controllers, you stated that this personnel study should include "early consideration of ways and means for strengthening the present air traffic control service through special pay, retirement, and other incentive measures." I call your attention to the tone urgency which permeates the language of this report, No. 1811. This was the first official recognition that had been given by any branch of the Government to the air traffic controller himself as an essential part of the air traffic control system and problem. And let me add that this legislative incident had a definite effect at the time in raising the morale of the controllers, thereby improving the climate of safety.

Now what happened to this important project authorized by the Congress?

The Administrator, in organizing the new Agency at the beginning of 1959, set up a top-level working group composed of civil and military staff members within the Agency to conduct the study. The working group had the year 1959 in which to complete its study and formulate its recommendations. During that period representatives of the Air Traffic Control Association met with the working group a number of times, presenting the views of the controllers on the various subjects of the study in an effort to be of assistance to them in the development of a constructive program for the Congress.

And may I say in passing, Mr. Chairman, that when we came to the end of that year we found ourselves in a one-way street. We had given the working group what we considered to be full cooperation. We had given them everything we had, the views of the controllers on the basis of their experience of all of these important subjects of study, and at the close of the period, at the close of 1959, we had received from the working group no indication of their thinking on any one of the subjects.

About 3 months before the deadline date for the transmission of the Administrator's report to the Congress, Mr. Quesada in an address to the national meeting of the Air Traffic Control Association in Oklahoma City had this to say on the question of personnel policy.

"It is my intent," he said, "to propose legislation to the Congress that will not only satisfy national defense as well as civil aviation requirements, but will offer the kind of inducement for career service that will be attractive enough in itself to guarantee a stable personnel structure for the Agency."

He said that he realized "that the job of the controller is highly technical and is subject to great pressures over long nerve-wracking hours of service," and that he was also "familiar with the frequent disruptions an air traffic controller encounters in his personal life."

He then painted the picture of a "blue ribbon organization in which membership is both an honor and a privilege."

After hearing Mr. Quesada's speech, the controllers hopefully concluded that the 302(g) report of the Administrator to the Congress would favor legislative recommendations that would place the controller on a sound professional basis—a blue ribbon service, as he put it—which would thus enable them the better to meet the grave responsibilities which this jet age had thrust upon them.

Came January 1, 1960, but no report appeared. Months followed during which it was reported that the document had been completed but was being held up in the Bureau of the Budget. We later learned that the Agency was having difficulty in getting the agreement of the military branch to that part of the report which was concerned with proposals for assuring responsiveness of the controllers to the requirements of national defense in time of war and emergency.

Then, in the latter part of May 1960, when the report was nearly 5 months overdue, we learned that the Director of the Budget had given the Administrator a clearance to send it to the Congress, despite the fact the military problem had not yet been resolved.

We then thought that the report, with the exception of the military provision, would promptly be delivered, but we were again over-

optimistic. More months rolled by without its being transmitted to the Congress.

The latest pronouncement of this Agency management on the personnel issues of section 302(g) is contained in the address of the Deputy Administrator, speaking for the Administrator, at the association's national meeting last October at San Francisco.

In that address the Deputy Administrator, ignoring the urgency of the assignment given by section 302(g), with respect to personnel policy, offered no assurance of an early report but promised further investigation, impliedly extending years into the future.

Referring to the "Agency personnel legislative program with respect to hours of work, shifts and shift rotation, pay, retirement benefits, and other factors involving controllers and flight personnel," he said: "Let me quickly point out that the basis for justifying such benefits to the Congress cannot be pulled out of thin air. There must be substantial and conclusive, clear-cut evidence to support any position the Agency will ultimately take on this score." Note the word "conclusive" in its legal implications.

He said that "these are long-range programs that will take time to complete." One of the projects, he added, would require 1½ years before the preliminary report would be ready. No mention was made of any evidence accumulated during the 12 months which Congress had allotted the Agency for the study authorized by section 302(g). Nor was any mention made of the extensive investigation of the controller personnel problem which had been made for the Agency by the Flight Safety Foundation under an Agency contract.

We feel, Mr. Chairman, that it is reasonable to assume that the Flight Safety Foundation's report from the reputation of that body would have offered a substantial contribution to the factual basis of a personnel recommendation to the Congress in response to section 302(g).

One of the things which has disturbed the air traffic controllers about the Agency's statement at San Francisco is its apparent inconsistency with the rule of evidence relied upon by the Administrator as a basis for his action in promulgating the recent pilot's compulsory retirement regulation.

Not long before the San Francisco address, the FAA was taken into the U.S. Court for the Southern District of New York by the Air Line Pilots Association which challenged the sufficiency of the evidence on which the Administrator has relied in issuing that rule.

In effect, the pilots charged that the Administrator had pulled out of thin aid the basis for his regulation. They urged upon the court that the Administrator had not presented a statistical case and that he had refused to enter a further investigation which the pilots had urged. In short, they alleged that the Administrator had acted without substantial evidence to support his action.

The Administrator replied that he was not required to present a statistical case or to enter upon an investigation where such was not needed and where public safety was involved. In a sworn affidavit filed with the court in support of their request in opposition to the pilots' request for preliminary injunction the Administrator said:

> Accidents are not necessarily the sole or even the most helpful source of information for the formulation of necessary safety rules. I am sure that the public deserves and Congress expects that in administering the safety rule-

making responsibilities of the Federal Aviation Act of 1958, we should be something more than an agency which is merely responsive to disaster.

The Administrator in the *Pilot's* case had relied primarily on written comments which he had received in response to his notice of the proposed regulations which had been published, and he also relied upon opinions of several doctors whom he consulted. He contended that this constituted substantial evidence and that he was under no obligation to grant a request for further investigation. In other words, that he did not have to have conclusive and irrefutable evidence where safety was involved.

The court agreed with the Administrator. Let me say here that in citing the *Pilot Regulation* case I do not offer any comment on the merits of the rule which the Administrator promulgated. We are concerned solely with the inconsistency of the Administrator's procedural position on the type of evidence required as compared to the type of evidence he requires as a basis for a recommendation for personnel legislation for the air traffic controllers.

The Administrator, in our opinion, cannot be right in the position he took at the San Francisco and at the same time be right in the position he took in the *Pilots'* case. In both instances the exercise of a legislative power was involved. If he was justified, as the court said he was, in using the kind of evidence he relied upon in the *Pilots'* case, he erred in refusing to accept the same kind of evidence as a basis for congressional legislation for a realistic retirement policy for air traffic controllers, and there is no question in our judgment, Mr. Chairman, about there being now available to the Agency ample evidence of the kind used in the *Pilots'* case which can be used to justify air traffic control retirement legislation in the interests of safety today.

Now these were the main events which describe what happen to the important project authorized by the Congress in section 302(g) of the Federal Aviation Act. It is our belief that the delay in the transmission of a personnel program in response to the congressional mandate has been due to a misinterpretation of this section of the act.

From the beginning of the conferences which representatives of ATAC had with members of the FAA working group during the year 1959, it was evident from the start that the feeling prevailed among influential members of the working group that the military issue involving the responsiveness of air traffic control in time of war and peacetime emergencies should constitute the keystone of the arch which they were charged with building, and that questions such as compensation, retirement and hours of service, appropriate to a professional status, were considerations of inferior significance.

More recent evidence that the Agency's top management has considered air traffic control responsiveness in time of war and emergency to be the dominating purpose of section 302(g) appears in General Quesada's recent statement on the television program, "Meet the Press" on January 1, 1961. Asked by Mr. Peter Hackes, of NBC, why the study involving air traffic controllers' hours of service, working conditions, pay, et cetera "had not either been made or reported," General Quesada replied:

The reference that you made to a study was basically a study to provide for the assumption of the traffic control functions by the Military Establishment; on our part, to absorb their function and to provide a continuity of service in the event of emergencies of war.

His answer constitutes a striking illustration of what we believe is a misinterpretation of section 302(g) which has prevailed among the members of the top management, it seems, from the beginning.

The air traffic controllers feel that they have reason for keen disappointment when they reflect that the fulfillment of a long overdue personnel program for the furtherance of airway safety has been delayed and frustrated by a persistent obsession that the development of legislative proposals to insure that air traffic controllers in time of war will not desert their posts and run for the nearest shelters is of primary importance and that personnel measures for the advancement of safety are matters of less importance.

In view of the events associated with the delay of the 302(g) report and the recent announcement of the Agency implying that more years of investigation will be required before any recommendations can be made, the controller members of this association—they have just reached the 10,000 mark within the past few days—urge that the Congress give early consideration to the enactment of personnel legislation which will strengthen the nation's air traffic control in the interest of public safety.

This, in the opinion of the controllers, among other things, calls for a retirement policy which will take into account the impact of the control position on the physical and mental powers of the controller, an impact which limits his productive life and calls for early retirement in the interest of air safety; a limitation of the hours of service of the controller in the complex, high density facilities to a 6-hour tour of duty in the interest of safety; and a compensation scale commensurate with the grave and exacting responsibilities which this jet age has laid upon the controllers.

The need for such action the controllers believe is urgent. I do not mean to say that the unfortunate downward turn in the air safety level in the past year or so can be attributed to the air traffic control. But conditions have been building up in our navigable air which, if not corrected, will thwart the attainment of the maximum safety required by the Federal Aviation Act of 1958.

The mounting pressures and stresses which bear down upon the experienced controllers as they struggle to safeguard high-speed aircraft in overcrowded skies against midair collision demands attention now. We cannot afford the delay of another merry-go-round of investigations when there is already available substantial evidence to support sound personnel legislation for both security and safety.

Let me add, Mr. Chairman: Let me express the hope that if there is implicit in what I have said any criticism of FAA's top management in the handling of this 302(g) problem, that it will be accepted as constructive and not a captious criticism, reflecting in no way upon the ability, the motives or good faith of the gentlemen concerned.

While we find ourselves in vigorous disagreement with these officials as to the urgent character and relative signifigance of the air traffic control personnel problem in relation to safety, we have personal regard and respect for those officials, and we credit them with the same sincerity in their convictions as we are confident we have in our own.

Senator MONRONEY. Thank you, very much, Mr. Ryan.

During hearings on the confirmation of Mr. Halaby, I asked a question about a section you referred to, section 302–G:

> Will you consider this one of the urgent matters along with many of the other urgent matters that are before you so that we can expect legislation to help set up a new improved system as to air traffic controls?
> Mr. HALABY. Yes.

So it is a point of confirmation of the awareness of this situation described here, which is of concern to the committee, and it is a very definite and affirmative answer that legislation will be presented by the agency at this session.

I might say that if it is not, the committee intends to introduce legislation of its own. But we would much prefer to have the Agency, with all of the information at its command, be the one that would propose it and be prepared to defend it affirmatively, rather than criticize or to oppose provisions of the act which we feel would be vital to the improvement of morale and working conditions and the efficiency of the men who man the control towers in the air traffic control centers.

Mr. RYAN. Mr. Chairman, we noted the question which you so well put, and the answer. We were very much encouraged by the answer which Mr. Halaby gave.

You realize that through years with the CAA there was investigation after investigation of this personnel problem which never came to the light of day at the close of the investigation, and then there came this 2 years and 1 month experience, with no report yet in the hands of Congress. So it has placed the controllers in a state of mind where they feel that safety, the anticipation of future dangers rather than waiting upon accidents to provide scientific basis, as it has been called, for action, has become a matter of urgent importance. We hope that the new Administrator will be able to get the report promptly to Congress so that it can be settled in this session of the Congress.

Senator MONRONEY. I am not completely advised as to what went on within the Agency regarding the emergency status. It is the sincere hope of this committee that legislation will be of an omnibus nature, since the very rights, the personal rights of every air traffic controller are involved. His right to retain his job after war, with certain reemployment and seniority preferences, if he remained at his post of duty in what is certainly a wartime function, even though he has civilian status, represents a very serious problem to the controllers, as well as to the committee, and as well as to our staffing of our control towers in the event of a national emergency.

We have had many national emergencies in the past, and the degree to which, by Executive order, this vast body of men can be converted into a quasi-military establishment has been of great concern to this committee, and I think it enjoys the complete and total opposition of most members to sacrifice the civilian status for a "quicky" conversion into a bunch of junior birdmen, saluting and under complete total military law.

So it is not as easy a question as you seem to presume, to separate this.

If it is possible, it is the desire of at least this member of the committee to take the problems up together. If they cannot be taken up

together this year, and if there is still obstinacy on the part of the military to provide for civilian control of the air traffic system with the right of assignment to distant and dangerous points, then we may have to have two bills, one to do the necessary personnel legislation, involving the phases that you have outlined, and then consider a second bill, when the military is ready, proposing what we do in the emergency status provision of the section 302–G.

Mr. RYAN. Mr. Chairman, we think that there is no question that the issues are divisible. As this committee said in Report 1811, aside from these military questions there is an urgent need for an early study of this civil matter. I think the Director of the Budget must have had that under consideration when he gave to the Administrator a clearance last May to send the report to the Congress.

We think, and I think it is supported by the record, that the real mistake in this story, the real fly in the ointment, has been the failure to divorce this military problem from the civil problem. The problems are entirely different. The association itself worked out a program on the basis of its experience. It gave no attention to the problem of military responsiveness. It recognized—it took the same tack that we thought your committee had taken in 1958. It divorced the military responsiveness problem from these questions that go directly to safety rather than to security.

We would hope that we would have the opportunity, if the military problem continues to hold up the passage, to have that separation that you mentioned, Mr. Chairman, and to get before the committee these measures which we believe relate to safety primarily, rather than security.

Senator MONRONEY. I still recognize that the problem could possibly be divisible, and making it divisible would be more advantageous for speedy action. But from the committee's standpoint, from the overall look, we are talking about integrating some 600 military control towers, which are a greater number of control towers than you today operate in this operation of this integration upon which the emergency status of the Agency depends.

It will be necessary, if this is to occur, that at the time the law is written affecting control tower operators on the civilian side, that provision be made to integrate the actual control tower operators who have military status who may wish to switch over to civilian status. The law as it is written, should encompass this shift of more than double the personnel that might be entering the system, and what seniority rights, if any, they would have, and how they would become civilian operators instead of enlisted or officer personnel of the military air traffic control system.

We are talking about a pretty big problem that is going to make more than a casual dent for emergency status.

Mr. RYAN. I recognize that, Mr. Chairman. But the controller's view is that they are fully aware of the difficulty of the military problem. They are fully aware of the fact that the *Guagliardo* case, handed down a year ago last month, has further chilled the military branch. That is the decision which holds that dependents of soldiers or civilian dependents, or civilian air traffic controllers, for example, who would be stationed with military forces overseas or on military bases overseas, cannot be subject to court martial; that when

they go to their posts overseas the Constitution of the United States with its Bill of Rights goes with them.

That threw a great chill into the military, and I understand that that has been one of the greatest obstacles to their being able to reach agreement on the kind of penalties and sanctions, the military refusing to accept what the Agency has proposed.

Now I understand the Agency, according to Mr. Pyle's speech in San Francisco, is trying to work out another plan to reach decision on the military point.

We are fully aware of everything you said about the difficulties of the problem. Everything you said about that is true. But when it comes right down to it, Mr. Chairman, it is a question of fear on the part of the military branch that, as was put by one of the witnesses, you may recall, in 1958 before this committee, that if there is a military man, if there is a man in uniform in this tour and a red alert comes along, that he will stick to his post, but that if he is a civil service controller, he will not show up that morning.

Of course, these controllers who are very proud of their military record have been somewhat humiliated by the thought that all this time should be spent in trying to decide whether these controllers will stand by their posts in time of emergency. But that is all that is holding up this passage—that one fear—and the fear doesn't reflect great credit, great compliment at any rate, upon the controllers.

Senator MONRONEY. The witness will recall I pointed out that in all cases civilians had been given assignments and they had performed equally well in areas of danger as the men in uniform. There is no distinction in patriotism between the color of the uniform or the working suit that the man is wearing. I have no fear of that at all.

But I do hope that as we approach this problem—and it must be approached this year—that it can be done in an overall, rather than a piecemeal, basis.

Mr. RYAN. We recall that you said that to one of the witnesses in the meeting 2 years ago.

We were very hopeful, Mr. Chairman, that this personnel problem, regardless of whether the military is settled this year, the personnel problem, they will have the opportunity to present evidence to you in support of these personnel policies which the speech at San Francisco indicated could not come out of thin air. We don't believe they do come out of thin air. We think we will be able to show that we have substantial evidence to support each one of these proposals.

Senator MONRONEY. Let me ask you, what is the number of the air traffic controllers in the system, both approach and area traffic, as to the total personnel under FAA?

Mr. RYAN. I would say I don't believe there has been an authoritative statement on the matter. The general answer I got when I put the question ranges around actually 12,000 to 13,000.

Senator MONRONEY. Out of the total personnel of the Agency of how many?

Mr. RYAN. Air traffic control personnel of the FAA.

Incidentally——

Senator MONRONEY. That is 12,000 out of how many?

Mr. MCDERMOTT. I believe the figure is approaching 40,000. The figure gets distorted occasionally because they refer to the total num-

ber of people in the Bureau of Air Traffic Management as being 17,000 or 18,000, or half the strength of the Agency. This includes a number of people in the communications field, manning the flight service stations, not active air traffic controllers.

Senator MONRONEY. Does this include the serviceman or your radar and your electronics?

Mr. MCDERMOTT. This does not include maintenance people, Bureau of Facilities or Materiel.

Senator MONRONEY. They are not a member of the association?

Mr. MCDERMOTT. They have a separate association, but we are very happy to have many of them as individual members of our association, supporting our objectives.

Senator MONRONEY. In considering the problem, of course the strain perhaps is not as great, and the hours of duty and heavy traffic conditions, but the degree of expertise, and the degree of scientific and practical knowledge of repair and maintenance are very valuable adjuncts to the system, as well as those who actually have to man the stations. In other words, those who make it work mechanically are not to be ignored in any personnel system.

Mr. MCDERMOTT. No, sir; they are a vital part of the system.

Mr. RYAN. The association has 10,000.

Mr. MCDERMOTT. Our current membership in the association itself is a little over 10,000.

Senator MONRONEY. That is a rather high average for the numbers that you have.

Mr. MCDERMOTT. We think it would be higher. There are some, perhaps, who under the present pay scale feel they can't afford our dues. We are hoping we can do something about that in the near future, too.

Senator MONRONEY. Let me ask you, are there any controllers from the Washington National Airport here in the room?

Mr. MCDERMOTT. Yes, there are several.

Senator MONRONEY. How many planes on an average tour of duty will these controllers have to handle?

Mr. MCDERMOTT. I think we can get a quick response from a man from the tower, one from the center, perhaps.

Mr. JOE RIENO. 105; as high as 105 an hour.

Senator MONRONEY. For how many hours?

Mr. RIENO. In the course of 8 hours or 24.

Senator MONRONEY. In the course of your tour of duty?

Mr. RIENO. Here in recent weeks, with the change in the scheduling, it has dropped as low as 950 for 24 hours.

Senator MONRONEY. You handle 105 an hour, you say?

Mr. RIENO. As high as that.

Senator MONRONEY. That is the peak?

Mr. RIENO. That is the peak.

Senator MONRONEY. What would you say—that it would drop down to an average of maybe 80 an hour on an 8- or 6-hour shift?

Mr. RIENO. I would say an average of 68 to 70 for an 8-hour shift.

Senator MONRONEY. That is the standard workload of the average control tower operator, although there is an experimental operation running today in Washington on a 6-hour basis. Is that correct?

Mr. RIENO. Yes.

Senator MONRONEY. You are on 6 hours today?

Mr. RIENO. A total of 8 hours; 6 on the functions.

Senator MONRONEY. Six on the functions, and two on——

Mr. RIENO. Eating, coffee break, and training.

Senator MONRONEY. But you are in the tower guiding aircraft activity for 6 hours?

Mr. RIENO. A total of 6 hours.

Senator MONRONEY. Every day.

But the other air traffic controllers in other congested areas, that is still eight?

Mr. RIENO. Yes.

Senator MONRONEY. Assuming Idlewild and the La Guardia area were about the same, that would be 560 planes either taking off or landing during the 8-hour stretch?

Mr. RIENO. That is correct.

Senator MONRONEY. That would be about an average.

Mr. RIENO. Yes.

Senator MONRONEY. And these planes would contain an average of about a minimum of 50 people?

Mr. RIENO. I think it is a little higher than that now.

Senator MONRONEY. Let's keep it low. That would be 28,000 lives, safetywise, every 8-hour working day in the hands of the average air traffic controller in a high-density airport.

Mr. RIENO. That is it.

Senator MONRONEY. That is quite an exposure to have under working conditions that are less than adequate; is that correct?

Mr. RIENO. Yes, sir.

Mr. RYAN. Mr. Rieno is the watch supervisor at the Washington tower and former president of this association.

Senator MONRONEY. I have heard it said that the greatest improvement in air traffic control devices that has been brought into the system in a long time was the installation of a carpet in the air traffic control center in the New York area.

Do you have access to a rug yet in the Washington National Terminal?

Mr. RIENO. Due to the VIP's that we have constantly visiting our facilities, Senator, we are very fortunate in having just a rug in our facility. I can't speak for the others.

Senator MONRONEY. Is this center considered adequate, the physical facilities under which you work—air conditioning, and the lighting, and other features that have been complained about by Mr. McDermott?

Mr. RIENO. Absolutely not, Senator. I believe that the Acting Administrator made it very clear the other day when he stated that conditions are disgraceful.

Senator MONRONEY. This generally applies to most of the air traffic control centers as well as the tower operations?

Mr. RIENO. I would say that is correct.

Senator MONRONEY. You have been in several?

Mr. RIENO. Yes; I sure have.

Senator MONRONEY. On the matter of testimony, you mentioned on page 4 the reasons an evaluation of research and development in new instruments is needed, and you said:

> Experienced pilots and controllers who have been exposed to current air traffic control research projects are frankly skeptical.

I would like to have you identify these areas in which you are frankly skeptical.

Mr. McDermott. One item that has been touched on in previous testimony deals with three-dimensional radar which of course is something that we feel requires evaluation, and from all appearances can serve as a very valuable tool for future air traffic control systems.

Part of this skepticism derives from statements to the effect that this will be an operational feature of the New York area within 18 to 24 months.

You will recall that back about 1952 the Air Force had a project for a similar-type three-dimensional presentation which would capture more than one target at a time for display to the controllers. This was funded by the Air Force and I believe was under contract to General Electric.

There are many, many problems in three-dimensional radar. One of the most significant problems is the matter of display: how this information is going to be displayed so that it will be handled in a satisfactory manner. The history of that particular project was that after a few years the Air Force offered to substitute this project as a contribution to the Air Navigation Development Board in lieu of one of their $1 million contributions. At that time, as you will recall, the various services were supporting the Air Navigation Development Board. They offered this project called all star, in lieu of a million dollars. This was refused by the Air Navigation Development Board.

At a later time the Air Force offered to give it to the Air Navigation Development Board with no money considerations whatsoever. This, too, was refused.

This, I think, is an indication of the fact that the problems in the capture of these multiple targets, problems in the display of these multiple targets, as a useful tool of air traffic control can't be minimized. They are very, very significant. We support fully the research that is going on. We think it is a mistake to hold this out as a tool that is going to be available to traffic controllers within 18 to 24 months. We think this tends to create a sense of false security and perhaps would also have a tendency to lessen the emphasis on doing something about the immediate system, inservice improvements.

Another area——

Senator Monroney. Before you leave that, I know and agree with you on point 3 that there is "overemphasis on longer range projects has contributed to an attitude of neglect for the inservice improvement program," but you would not sit here as a representative of the air traffic controllers and wish to minimize or slow down the development of the three-dimensional radar, would you?

Mr. McDermott. No, sir; not at all. However, I would also urge that in emphasizing the need and expediting the research program of the three-dimensional radar that we don't overlook work which can be done right now with things available, such as providing altitude coding on the beacon.

Senator Monroney. I agree with you. I spent considerable time in the hearings on that.

My point is that I fail to see where, except for maybe a misleading target day, that there is anything wrong with the emphasis on three-dimensional radar. I, for one, hope that we can break through. I

thought I heard a news broadcast last night that said it had undergone successfully its first test at Atlantic City.

Mr. McDermott. I saw the press release on that; yes.

Senator Monroney. Of course I hope that when these target dates are announced that they will be hit. I would much prefer to have them anticipate and work toward an 18-month implementation of this for the system, although I am a little doubtful, as you are, that it can be reached. Perhaps if this were kept within the Agency and made a target date there, rather than publicly announced, it would be better. But certainly a drive to get it would give us one of the vast tools which would be I think extremely helpful to the air traffic controller.

Mr. McDermott. Yes, sir; and I am not being critical of this at all. I would like to see this project expedited. However, I think that in this area and in others there has been a tendency to seize upon something which, from a practical standpoint, is going to take a considerable period of time.

I would like to point out that on February 9 of this year, in an article in the Chicago Sun-Times, the Deputy Director of the Bureau of Research and Development was quoted as saying that "The availability in the New York area of three-dimensional radar is still several years in the future."

All I am saying is that statements such as this tend to take the pressure off of some of the inservice improvements and things which can be identified now. For example, if they introduced competition between 3–D radar and doing something further about the altitude coded beacon, or radar landoff, for example, and if both of them were stated as being available within 18 months, one being an inservice improvement and the other a long-term improvement, there might be a tendency to give a lower priority to the inservice improvement, if you thought you had a long-range fix in an equal period of time. This is the sense of the comments that I have offered.

Senator Monroney. You heard the testimony by the air traffic control witnesses and also the research men about the problem of adding more radar clutter on transponders giving codes in the high density areas. It seems to me that they made a rather good case, that it is apt to be as confusing as helpful, particularly with the exaggerated dimensions over a 3-mile land area of the transponder's response perhaps covering up two or three pips that are ground out by the brilliance of the transponder giving the altitude. I would like your comments.

Mr. McDermott. I have been advised that the technical problems of resolving this situation, clearing up the clutter from the beacon turn, is of considerably less magnitude than the problem confronting the 3–D radar. There is a lot of significant work underway now, with a lot of companies having gone a long way toward cleaning up the presentation and removing this interference called fruit and this sort of thing. I think they are at a point where they can make a real significant step forward.

Senator Monroney. In other words, your position is that you would like to see them study ways of doing some of the simple things as they go forward to the glamour girl final instrument we hope to get.

Mr. McDermott. I think this is imperative.

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Senator MONRONEY. We had some testimony also on the positive radar handoff system with which I believe you have been concerned?

Mr. MCDERMOTT. Yes, sir. I have made some comments on that particular problem. I am a little familiar with some of the tests conducted at Indianapolis with the former Administration Technical Development Center. I have a report written by the traffic controller who actively participated in the tests conducted between June 23, 1958, and April 15, 1959. These were tests between the Indianapolis center and the Indianapolis tower. I have a few brief comments from this report.

During the evaluation period devoted to utilizing the TI–440 as the IFR radar departure scope, an innovation shown as the TV marker, devised by AOEC, was incorporated into the unit. Basically, this consists of a control box located at the IFR departure position which controls the movement of a circle which is superimposed on the tower IFR departure scope simultaneously with the display in the center. As the departure controller prepares to handoff a departure to the "C" center radar controller, he places the circle around the target, calls the center controller on a "hot line" and identifies the target by call number.

And then the recommendations:

The TV marker as evaluated in the Indianapolis tower was received with great enthusiasm from a tower standpoint. It definitely decreased the possibility of misidentification during handoff. Another advantage noted was that it decreased coordination and conversation between the center and the departure controller. The TV marker operated continuously without a major malfunction during the entire period. It was the general consensus of opinion of the personnel at Indianapolis tower that the TV marker offers the greatest potential advantages encountered in radar handoff and identification procedures. The surface has just been scratched in determining the potential of this equipment. It is therefore recommended that further evaluations be conducted with reference to TV marker, especially with the possibility of adding various marker displays to allow simultaneous handoffs of more than one aircraft.

We recognize some of the problems that were referred to in the previous testimony. This experiment was conducted by using a slave repeater from the tower radar, having this placed before the center controller. They had coaxial cable installed out there, and it is very easy to transmit this. It can also be transmitted over microwave lengths. However, effecting such radar handoff between two different radar systems has been known for sometime.

Proposals have been developed and submitted which would allow this type of a simple handoff between the long-range center radar and tower radar. We are very happy to hear the announcement that as recently as 2 weeks ago a development contract was issued by the Bureau of Research and Development to proceed with this very application.

Senator MONRONEY. It is your position that the air traffic controllers would like to be able to effect a positive radar handoff; is that correct?

Mr. MCDERMOTT. Yes, sir; very definitely.

Senator MONRONEY. Would this slow the system down?

Mr. MCDERMOTT. I am convinced that radar handoffs can be developed, procedures can be built which will not slow the system down I think this is the consensus of the controllers.

Senator MONRONEY. In referring to the slave you say this is a television portrayal instead of on the area or where you change from different radar equipment from area to approach, that the slave television portrayal would identify the target at this point of handoff.

Mr. McDERMOTT. In the application at Indianapolis the presentation to the man in the traffic control center was a slave from the presentation to tower controller. In other words, he had two scopes before him, one with his long-range center radar and the other the television presentation of the tower radar. The TV handoff was accomplished on the slave, and it was necessary for the controller to coordinate this with his target.

Senator MONRONEY. In the New York complex, for example, you don't have the area radar in your control tower; do you?

Mr. McDERMOTT. No, sir; you don't. But the development presently underway, started a few weeks ago, will allow handoff between the long-range radar and the short-range radar. It will not be necessary to run a slave repeater from the tower to the center or vice versa.

Senator MONRONEY. In other words, the bright display could follow the pip from the area radar into the approach control radar?

Mr. McDERMOTT. A circle imposed upon the bright display in the center, which is displaying a lot of long-range radar information, could appear around the same target on the short-range radar in the tower; yes, sir. This can be done.

Senator MONRONEY. You wouldn't have to throw away the short-range radar?

Mr. McDERMOTT. No, sir. It serves a lot of purposes.

Senator MONRONEY. Would this be by reflection or by transponder? What I am trying to say is can you hand off a reflected pip, or do you have to have a transponder pip to hand off?

Mr. McDERMOTT. A circle can be superimposed about a normal radar return.

Senator MONRONEY. So you would not get a clutter and additional overemphasis of the plane you are handling to the exclusion of other pips on the screen?

Mr. McDERMOTT. The successful operation of the radar handoff does not require the use of the beacon, or the transponder return; no, sir.

Senator MONRONEY. During the pilots' testimony they had some testimony saying that you could have positive radar identification, and that the approach radar man in Idlewild, and then La Guardia, was under no great pressure of high-density traffic at that particular moment of the crash of the TWA and United planes and that therefore under these conditions they should have or could have had a positive handoff even with their then existing and operating equipment. The question comes to my mind, whether that would be a safe procedure to have the pilots expecting this during certain periods when traffic was not dense, and then suddenly find that when you need it the most, under high-traffic operations, to have them say we haven't time to give you this now.

In other words, the system more or less has to be uniform, does it not, to give safety; that you can't expect certain aids where there are only a few planes in the traffic pattern, and then when they become too numerous it fades away and it can't be rendered. Is that a correct interpretation?

Mr. McDERMOTT. Yes, it certainly is. One of the worst things that could happen would be to advertise the fact that you are providing the kind of service that you are not able to accomplish. I think these

services should be standard in the conditions of light traffic as well as heavy traffic. Air traffic control itself has never represented to the pilots or to the world that they are capable right now, have the tools, facilities, and procedures, to effect this positive radar handoff, or even to accomplish continuous radio tracking from takeoff to touchdown. This has never been stated by the controller.

Senator MONRONEY. And you think the pilots are aware of this?

Mr. MCDERMOTT. I think that any pilot who has visited a traffic control tower or center—unfortunately enough of them don't visit these facilities—certainly must be aware of what limitations are today and have been for several years.

Senator MONRONEY. In other words, a little more pilot knowledge of what goes on in the approach radar would be helpful to a part of the airline pilot's training and familiarization with the system?

Mr. MCDERMOTT. I am sure it would, and the CAB a few years ago recognized this and provided in their regulations the authority for traffic controllers to ride in the cockpits of the aircraft to familiarize themselves.

Senator MONRONEY. You get more air time for controllers now than at any other time in history. These boys are in the air during a substantial part of their training at the training center in Oklahoma City.

Mr. MCDERMOTT. Yes, and you will find in towers and centers throughout the country that the controllers take advantage of this. Sometimes schedules don't permit them to fly as often as they like. Many pilots do visit control towers and centers and are quite familiar with what goes on. Sometimes it is a little awkward for them to visit these facilities, particularly where they have a 2-hour layover between flights and the center is located on the far side of the field, and transportation is difficult. But I would, and we have urged more and more of a regularized familiarization on the part of pilots in visiting towers and centers.

Senator MONRONEY. We brought up during the course of the hearings with the FAA that is extremely dangerous in high-density areas and that we might install a separate radar and operator for the purpose of monitoring the placement of an aircraft into the holding pattern, to be sure he does not stray. Would this be possible without too great an imposition on the systems requirement?

Mr. MCDERMOTT. Senator, it is always dangerous to try to invent at the witness stand, and I don't propose to do that. I do not feel that at the moment—I haven't been able to check this previous testimony out with our membership fully—that there is a need simply to put another body at the radarscope for this one particular function of monitoring the entrance of flights to the holding pattern or monitoring their activity within the holding pattern.

At many of our facilities it would be physically impossible to put another man around one of these radars.

Senator MONRONEY. You might get another radar.

Mr. MCDERMOTT. This is a possibility. Then you introduce the problem of coordination. This is one of the most serious things we have now. As we slice areas of jurisdiction, as traffic builds up there is a tendency to reduce the physical area for which each man is responsible. You have to introduce a need for coordination. And

before long you have to coordinate the coordinators. This has been one of the most serious problems that we have been faced with: human frailties, overburdening people with coordination.

Merely setting up another radar position simply to monitor the conduct of flights within a holding pattern at the moment does not appear to be something that we feel is absolutely essential.

Senator MONRONEY. But this is the one vacuum that we have in radar surveillance at the moment. Everyone admits I think, that I have talked to, that from a practical standpoint it is going to be quite difficult to expect a man on the approach radar to monitor the planes in the holding pattern, particularly when there are several there.

You have a constant watch on each individual plane as it approaches the holding pattern. You have a constant radar surveillance as it leaves the holding pattern. You still have the holding pattern without the magic of radar on him. You say it can be effected with the bright display. This may be 6, 8, 12 months, maybe 2 years away. What I am saying is how am I going to feel comfortable in the soup over Preston knowing there is nobody on the ground watching me or the pilot? If he misses his control point, which he has only by a fix on his radio, who will be watching for strays?

Mr. MCDERMOTT. I would say, Senator, that they are watching, and I believe that logs could be produced which would show many, many instances within the past several months where controllers have observed flights straying beyond the limits of a holding pattern, where the pattern has been advised of this and corrective action taken. However, it is not possible at the moment, with the facilities and procedures that are available, to constantly track every flight. There is still a need to depend upon the pilot, to stop him at his holding fix and him maintaining himself in his holding pattern. This is what the pilots want to do, too.

Senator MONRONEY. I am looking for fail-save, however. I know it is the pilot's duty to find his fix and to hold it. But on this particular day—and I think it is quite within the realm of the procedures that approach radar probably having a different ETA of this plane that some way got mixed up and didn't get through to the approach radar man, that the radar was not even on the Preston pattern waiting for him to come out.

Mr. MCDERMOTT. This is a problem that we have under consideration at the moment. Our association will, through its chapters, be considering certain recommendations that we propose to advance to FAA. I think that a solution can be reached. Whether it is necessary to put in another position, which incidentally will take at least 12 months or more, as I pointed out before we are still using World War II surplus indicators, simply because they can't get the bright displays fast enough, so there will be at least 12 months involved in acquiring equipment.

Senator MONRONEY. We are still paying for the drought of appropriations back in 1954 to 1956 and 1957, when this material was available and was not ordered.

Mr. MCDERMOTT. Yes, sir; I am sure we are.

Senator MONRONEY. Do you have a suggestion?

Mr. RYAN. Yes, sir. There are two points here on this proposition of an extra man on radar which I think should be clarified. You are concerned about the aircraft, multiple aircraft in the holding pattern being monitored. That is very feasible. But I ask you, Senator, let's have 5 or 10 marbles in your hand right now, working around in rotation. You identify one of them.

Senator MONRONEY. I am not trying to identify one of them. I am trying to defend the whole package. If one of those marbles strays out of the circle then somebody should be able to do something about it.

Mr. RYAN. This is feasible. You can monitor the volume of targets in a holding pattern.

Senator MONRONEY. Primarily the holding pattern with two separations. But you have such fine tolerances of distance between Preston and Linden, and if you go beyond Preston you are going down a one-way street in the opposite direction.

What I am asking for is some mechanism that will identify a plane that has strayed, to throw up a "tilt" on the marble board, for example, which would attract the attention of the pilot and get him back in his holding pattern, knowing the pilot's responsibility primarily is to get there himself. Sometimes, as we found in the United accident, he doesn't get there.

Mr. MCDERMOTT. I think the most hopeful solution is the attention being paid at the moment to provide a common IFR route in terminal facilities. We have multiple towers as well as the center radar. And this has not been checked out for simulation. There is additional work needed to be done on it. I think it is fairly obvious that if the approach control at LaGuardia, and Idlewild, and Newark, for example, were placed side by side, where they had not only telephone access but immediately human access to each other on matters such as this, that it might provide a higher degree of safety.

Senator MONRONEY. Can you remote that in from the surveillance swing of the radar?

Mr. MCDERMOTT. Yes, sir.

Senator MONRONEY. Remote it into one central place? In other words, you can control traffic into LaGuardia, for example, from a central approach radar station located on Idlewild?

Mr. MCDERMOTT. Yes, sir. This is no problem.

Senator MONRONEY. It is only where the tower is located and the beacon is swinging?

Mr. MCDERMOTT. It is just a matter of microwaving the information from the antenna site to wherever you want to supply it.

Senator MONRONEY. Do you have anything further that you would like to add?

Mr. MCDERMOTT. Yes, sir, two or three additional points I would like to touch on briefly.

Certainly our association wishes to support the recommendations made by the Civil Aeronautics Board for the augmentation of their staff. We think they do a tremendous job with the people who are available in this process of accident investigation.

We feel that the process of investigating the accidents occupies the majority of their time and they have not been able to devote such attention to the matter of accident prevention.

I am not sure that this has been generally known. As I understand it, there is only one man on the staff of the Civil Aeronautics Board who has active air traffic control background. We think it is vitally important, especially in an accident such as the one in New York, where accident control is a major problem, that they have a staff of sufficient number to step in to handle this. And also to be able to devote some time to the other phases of it.

We would like to support their recommendations in this regard. I would like to also touch upon the inservice improvement aspects of the computer program.

I mentioned in my testimony that we are now faced with what we describe as an automation gap. I think there was some testimony the other day to the effect that although there are six computers in, and operating in air traffic control centers today, there are no further plans to equip the centers until the product of research and development is ready for installation, the first one to be delivered to the Boston Center in 1962.

I think it is a matter of record that the FAA went to Congress with their budget for fiscal 1961 asking for five additional inservice off-the-shelf computers. At the time of the negotiation between the House and the Senate on the budget cut, where the FAA was required to identify certain projects that would be dropped in case the cuts were sustained, two of these computer installations were dropped.

These two happen to be traffic control centers in Chicago and Kansas City, the buildings for which would not be available during fiscal 1961 anyway.

But three computers were retained: Oakland, Jacksonville, and Atlanta. These are three of the new military control centers that are supposed to provide the very latest environment for the en route traffic control function. So that the budget approved for fiscal 1961 provided funds for the rental of off-the-shelf computers for these three centers.

A decision was subsequently reached not to go ahead with this project, and we feel that this is a serious mistake.

First of all, the computers that are in and operating at six centers today are providing very useful functions. Without touching upon the very alarming aspects I think it is important to note that we are having a high incident of—they cannot be described as near misses because perhaps the planes do not see each other, but where planes pass each other with less than standard separation.

Many of these are happening because the controller reads or misreads an illegible figure, handwritten on a flight progress strip, or because an assistant controller who has responsibility for determining just where these flight progress strips should be posted, forgets to give this information to a particular controller. These are two functions that off-the-shelf computers can handle and handle very well. They print very legibly. Once they are told in the program how to handle a particular flight plan, they do this over and over again without error.

If this flight progress strip is to be displayed to a particular controller, it gets to him.

Senator MONRONEY. It does not get to him by automation. It gets to him by hand delivery. So you have the same element of human failure there that a handwritten slip with an ETA has.

Mr. McDermott. Not the same element. There are actually two elements involved. One is the preparation of the strips in the first place. The second is the matter of distribution. I will agree that in the matter of distribution there is a possibility that the man might put it in his pocket and forget to give it to the controller. But if the strip is prepared, it is a physical piece that the man has in his hand.

The chances are that he will put it where it belongs.

Comparisons were made between the——

Senator Monroney. There must be some way of putting in a check list so that everything which comes out of a computer gets delivered.

Mr. McDermott. I think this is possible.

Senator Monroney. I have heard a lot of schemes for automation, how you deliver on a conveyor belt, for example. It always worries me that maybe it will be overmechanized in having an electric wizard to walk across a room with a piece of paper.

Mr. McDermott. Of course one of the best approaches would be to find out how to do away with pieces of paper. It is something we will have to live with for some time. The off-the-shelf computers serve a very useful purpose. You made comparison the other day of cost. I would like to point out that the computers that are in operation today were the computers selected 5 years ago as the very latest in the state of the art. The state of the art in computers has advanced tremendously.

If my information is correct, there are off-the-shelf computers available today from at least a half dozen manufacturers that have proven capability for performing all the functions that are hoped to be obtained from the computer being developed under the research and development contract, and at a considerably smaller cost.

Senator Monroney. Of course we have another problem there, that we are hoping to rework and rewire a vast number that have been in our air defense network.

This would seem to me to be a very worthwhile project, rather than leave those that are incompetent or unable to contribute to our domestic air traffic control, if they will work just as well, and I presume before they are finished with this modernization that they will, and it might save us paying out a considerable amount of money to IBM or some of the other commercial companies at $600,000 a year per machine, I believe, on rental.

Mr. McDermott. You are referring to the SAGE system on studies underway?

Senator Monroney. Yes.

Mr. McDermott. I think these studies may very well prove something. I believe the application of the SAGE system or any part of it to the job of air traffic control is still some time in the future.

We are talking now about what can you give the controllers at the moment in these new centers to take some of this clerical workload off their backs.

In this respect I feel that it is far wiser to rent these devices than it is to buy them, because of the rate at which they become obsolete.

In testimony given before the Senate Committee on Independent Offices Appropriations, this was reiterated by the Federal Aviation

Agency witnesses, where they said, in response to a question by Senator Magnuson:

And you rent it from the company that makes it?

The answer was:

That is correct.

And further:

And you believe that it is in the best interests of the whole operation that it is not desirable to buy it?

And they go on to discuss that.

Senator MONRONEY. We want the best we can get in the way of computers, and as fast as we can get them. Whether we buy them from IBM or from a development worked out by Government and manufactured by private industry on equipment which we own is a question we are not terrifically concerned with.

It is just computers that can add, subtract, and multiply and do the necessary mental work more accurately than the human mind can do it, and at a great deal faster pace.

Mr. MCDERMOTT. I think the question touches upon the capability of the research program, which was advertised in the early Modernization Board, whether the product in fact that will be installed at the Boston Center in 1962, and which will be available to additional centers, whether we should wait until this is available or continue with the program which was started 2 or 3 years ago to provide off-the-shelf computers in these centers to close this automation gap which exists now and which is growing larger.

Senator MONRONEY. You inferred in your testimony that the air traffic control people were not represented on the various study groups, and that they were being somewhat ignored.

As I recall the testimony of the head of research, they had a majority, I believe, or more, of air traffic controllers who were engaged in this research and development work. Is that correct?

Mr. MCDERMOTT. I believe the figures that were given, Mr. Chairman, were, in the Bureau of Research and Development, one in four, in the whole Bureau, including the Washington office, was an experienced air traffic control man, and that at Atlantic City, the research center, one in two and a half was an air traffic controller.

I think these figures are essentially correct. I think you have to look at where these people sit in the organization and examine the functional statements of various units in the organization and see whether there is this communications flow which permits the practical experience of the controller to be effectively utilized.

Senator MONRONEY. I am sure if they have one out of every two and a half they must be utilizing them to a considerable degree or we are wasting a lot of money.

Mr. MCDERMOTT. I think that the problem of air traffic control requires an approach to this thing where the controller works on a team basis with the engineer.

Senator MONRONEY. That is right. But with all the great respect I have for the air traffic controllers—and I have a great deal—I don't expect them in addition to all their other duties to become efficient engineers or electronics experts. I think they can tell whether they will work or not and put them to the test to see that they do work, and to

suggest for the inventors and the engineers what the problem is. But I think that you do have a limitation, that you are not going to get yourself a pair of pliers and a spool of wire and be able to make a do-it-yourself kit.

Mr. McDermott. No, sir. I agree with that. It is not our intention to suggest that at all. I think that this team operation is vital in the research effort as is the teamwork between the pilot and controller. But I am saying that from the past history and the existing situation, the traffic controller in the conduct of the research and development tests does not have the voice as to what should be undertaken and how the results are to be evaluated.

I think one good example of this is this brief report I cited on the TV manager. This was a report from a practical controller who had worked on the thing. I think we have heard testimony here that people higher up on the evaluation of this thing decided that it was not feasible to proceed in this direction.

I think that just as it would be entirely wrong for a traffic controller to feel that he should master the art of engineering, it is equally wrong for engineers to feel that this problem of air traffic control can be simplified to the point where it can be worked out on a slide rule.

I just suggest that if we approach this on a team basis we can make a lot of progress.

Senator Monroney. Do you have anything to add, Mr. Ryan?

Mr. Ryan. Mr. Chairman, Mr. Wogan, of the Washington Center, Air Route Traffic Control Center, wants to offer briefly a point which was suggested to him by what you are concerned about, the holding pattern.

Mr. Wogan. I am Jesse Wogan. You made mention of the fact of who will watch these airplanes when they are in a holding pattern. When they are in a holding pattern there is not any danger of them leaving this holding pattern as long as communications are good and his radio is working fine.

The danger is the entry into the holding pattern by, the point you are making, with a jet. He is coming in too fast and he uses up more space than is delegated to him. This is to relieve you of the thought that these airplanes in the holding pattern will deviate from the pattern and conflict with another. They do not do this in actual practice. The danger is an airplane coming into a pattern too fast and overrunning it and getting into airspace where it does not belong. This is in my mind what happened at the Preston pattern.

Senator Monroney. I was bringing up a point that if somebody is monitoring this whole bag of marbles in the holding pattern and one marble rolls out of the bag, I would like a fail-safe system of calling his attention to it, because it can be a very fatal error as it proved to be at Preston.

Mr. Wogan. That is the point I am trying to make. The error was not after he was established in the pattern.

Senator Monroney. I know. He never got into it.

That is fundamental. But somebody with a radar looking at that particular holding pattern that day, could have detected that he had gone beyond his limits.

Mr. WOGAN. Here again more often, almost in every instance, the airplane approaching this pattern at this speed is told of his position from the pattern, so that he has sufficient time if he takes heed of this warning to slow down to a speed that he can enter this holding pattern and stay within the confines of the airspace.

Senator MONRONEY. I realize that. I highly approve of the reduction of speed 3 minutes out of the holding pattern to 200 knots an hour, to give him a chance to find his fix. But what I am looking for is the man who sometimes for some reason unknown goes beyond it anyway, and to be able to have knowledge of that when he goes beyond where he is supposed to be.

Of course, I think the separation of holding patterns such as I think you mean in the Washington tower was recommended, and I think now has been effected, where you have two conflicting holding patterns in the Washington area, was a great contribution to air safety.

Mr. WOGAN. Thank you, sir.

Mr. MCDERMOTT. I have one further comment, Mr. Chairman. Our association, as you know, was a party to the investigation of the accident in New York. We do not wish to make any comments on what is the Board's responsibility on this. But there have been a great many comments on what is the Board's responsibility on this. There have also been a great many comments on the controllers involved. I want to say from my appraisal of the situation that the man who is working the radar at the center was doing the job exactly as his knowledge of the procedures told him to do, to the best of his ability with the tools that were available, and the fact that he was not constantly watching the radar target every step of the way is not an indication that he was remiss in his duties. He was performing other functions such as are presently his responsibility.

Senator MONRONEY. He was watching traffic 200 miles back, as well as the approach to the pattern.

Mr. MCDERMOTT. I don't think his responsibility went that far back, but it went as far back as Allentown. Under present procedures when he had cleared the flight to a fix and given the flight an altitude, his responsibility as far as this flight was concerned—I am not saying it ended there, but he was not required to keep his eye glued to this particular target all the way in. He was in communication with this flight because it was necessary to accept all the varying reports in order to move traffic.

But I think the record will eventually show that this man was performing exactly as the present procedures and environment permitted.

Obviously we would like to see an environment that would permit an absolutely fail-safe operation in this regard. These controllers—and I think I understand what Senator Engle meant the other day when he said we provide radar for no more than giving a controller a ringside seat in a midair collision. I am sure he meant this in the kindest sense.

We have seen the reaction of some controllers to having been exposed to this ringside seat. They pay a terrific price as evidenced in the Brunswick crash. I think you will find in the New York incident two or three controllers never went back to the job of traffic control simply because they had a ringside seat.

Senator MONRONEY. Do you have anything further, Mr. Ryan?

Mr. RYAN. No, thank you.

Senator MONRONEY. Thank you very much, Mr. McDermott and Mr. Ryan, and your colleagues for giving us this helpful testimony.

The committee will stand in recess until 2 o'clock, at which time we will hear the Air Transport Association, represented by Mr. Stuart Tipton.

(Whereupon, at 12:35 p.m., the committee was recessed, to reconvene at 2 p.m., of the same day.)

AFTERNOON SESSION

Senator MONRONEY. The Subcommittee on Aviation will resume its hearings.

This afternoon we have Mr. Stuart G. Tipton, president of the Air Transport Association. Mr. Tipton is a veteran at testifying on air safety matters and other matters of aviation interest.

We are again happy to welcome you and receive your testimony, which we always find very valuable and of great assistance in informing the committee on many problems confronting the aviation community.

STATEMENT OF STUART G. TIPTON, PRESIDENT, AIR TRANSPORT ASSOCIATION OF AMERICA; ACCOMPANIED BY WILLIAM B. BECKER, DIRECTOR OF OPERATIONS AND ENGINEERING; WALTER A. JENSEN, DIRECTOR OF THE OPERATIONS-AIR NAVIGATION AND TRAFFIC CONTROL DIVISION; STANLEY SELTZER, ASSISTANT DIRECTOR, AIR NAVIGATION AND TRAFFIC CONTROL; AND ALLEN W. DALLAS, DIRECTOR, ENGINEERING DIVISION

Mr. TIPTON. Thank you, Mr. Chairman.

I also am delighted to have the opportunity to come before your committee, because it gives us an opportunity to bring to your attention both the achievements and the problems of the industry which your committee has been active in dealing with over the years, and we do appreciate it.

I have with me today, in the interest of making certain that we can provide the committee with the information it wants, a number of the staff members of the association's operations and engineering department. I include Mr. William B. Becker, on my right, who is director of operations and engineering; Mr. Walter A. Jensen, director of the operations-air navigation and traffic control division, on my left; on his left is Mr. Stanley Seltzer, assistant director, air navigation and traffic control; on Mr. Becker's right, Mr. Allen W. Dallas, director of our engineering division.

I would like to file with the reporter a brief biography of each of these gentlemen in order that the committee can identify their qualifications and determine their fields of special interest. (The above-mentioned biographies are on file with the committee.)

Mr. TIPTON. At the outset I would like to explain our proposed approach today.

In reviewing the various phases of airline operations which bear on safety, and identify the work of the airlines in achieving safety, we found it much too detailed to present to the committee in oral form. Consequently we have in part and are completely preparing a more extensive analysis on that subject which I would appreciate an opportunity to put in the record, rather than presenting them orally.

Senator MONRONEY. That will be agreeable.

Mr. TIPTON. Second, I had intended to present the written testimony that we had presented to you in full, but in reviewing it it appears to me that in view of the great amount of testimony that has come before your committee that it might be repetitious in some respects. Consequently, I would like to present the testimony that we have filed with you for the record, and just hit the highlights of it as I go along, if that is all right.

Senator MONRONEY. Your statement will be printed in full in the record at this point and you may highlight it as you choose.

(The statement is as follows:)

My name is S. G. Tipton. I am president of the Air Transport Association of America, which is composed of substantially all of the certificated, scheduled airlines of the United States. Our membership includes domestic trunklines, international and oversea airlines, local service airlines, all-cargo lines, helicopter carriers, and airlines that operate in the new States of Hawaii and Alaska.

Appearing with me today are staff members of the association's operations and engineering department. They include Mr. William B. Becker, director of operations and engineering; Mr. Walter A. Jensen, director of the operations-air navigation and traffic control division; Mr. Stanley Seltzer, assistant director, air navigation and traffic control; and Mr. Allen W. Dallas, director of the engineering division. I should like to file with the reporter, for inclusion in the record, brief biographies of each of these gentlemen.

One year ago I appeared before this committee to discuss the progress that has been made in air transport safety. You will recall that I stated that while the accident record for 1959 was not a good one, the record over the years is one of which all concerned with aviation should be proud. For 1959 the fatality rate per 100 million passenger-miles—the generally accepted figure for indicating the safety record—was 0.74. This was the eighth straight year that the rate was less than 1 passenger fatality per 100 million passenger-miles. It was a rate three times as good as the fatality rate applicable to passenger automobile travel.

Regrettably 1960 was not a good year either. For a variety of causes, which apparently were not interconnected, we had nine accidents involving fatalities to passengers. Because of the larger capacity of modern transport aircraft these increased the fatality rate to 0.86 per 100 million passenger-miles.

We do not intend to rest on the record for 1959 or 1960. There is no satisfaction in saying that it is three times as safe to go by air as to drive. Our industry does not live by a standard that compares our safety rate with someone else's. We have our own standards and goals, and they are quite simple. They are to eliminate accidents and to achieve a rate of zero.

Public acceptance of air transportation is proof of the fine safety record the airlines have made over the years: The wide and ever-increasing use by the public of air transportation is proof of the safety and reliability of airline operations. Chart No. 1, attached to my statement, shows clearly the enormous acceptance rate of air transportation over the years. I know of no other form of transportation that has grown at such a rate. The chart shows that in 1938 the airlines carried less than 2 percent of all intercity passenger miles; the rails 65 percent and the buses over 33 percent. The situation has changed so markedly that today the airline industry is the prime intercity mover of passengers in the United States, operating over 49 percent of the total passenger-miles and carrying 52 million passengers.

Even more dramatic is the public's increasing use of air transportation in the field of over-ocean travel. In 1938, only 4 percent of those traveling between the United States and other countries went by air. In 1960, over 75 percent went by air—4.5 million air passengers as contrasted with 1.5 million steamship

passengers. This record indicates not only the growing awareness of the public of the speed and dependability of air transportation, it also indicates the fact that the public is convinced that air travel is a safe means of transportation.

The aim of air transportation safety planning is, of course, to prevent accidents. While, as I stated, we have never had a completely accident-free calendar year, I think it is interesting to note that we have managed to keep the number of accidents far below what might be termed the "exposure rate to accidents." This is shown in chart No. 2 attached to my statement. Back in 1938, when the industry was in its infancy, and air transportation was rather primitive according to today's standards, we experienced seven fatal accidents. But the chart shows that over the years, as the industry operated more aircraft, faster and farther, the number of accidents did not increase in proportion. It zigzagged, within rather narrow limits. In 1960, when revenue-plane-miles totaled over a billion—just about 10 times the amount of flying, or exposure, which existed in 1938—there were 9 fatal accidents. By contrast, in 1946, when the revenue-plane-miles totaled only about one-third of the 1960 figure, there were 11 fatal accidents. Holding down the number of such accidents is, to us, an indication that the industry's safety measures are valid and effective.

I stated that the fatality rate of the airlines was not good for 1959 nor for 1960. That's because in the airline business we and the public have become accustomed to an ever-improving record year by year. That has not been the case for the last 2 years.

While there is cause for concern over these accidents, there is no need for drastic revisions of the air transport operation. We are safe now and we are getting safer, but it must be understood that safety is an accumulative process; it does not start or stop on signal. It is not a year-to-year affair. It must be measured period by period.

Chart No. 3, attached to my statement, demonstrates the passenger fatality rates over the last 25 years, on 5-year averages. The downward trend is encouraging. It proves our contention that the historic pattern of safety for the industry is improving. The 3-year rate for the period 1938–40 was 3.17, the high point. Every 5-year period after that shows a decrease to the point where the period 1956–60 is now 0.55.

I am confident that the next 5-year average will take the rate down even more. That is because we are taking steps today and making plans today that will have their full effect years from now.

Scope of our testimony: The subject of planning for aviation safety obviously is much too big a one for me to cover adequately within the time limits of this hearing. Since the letter which we received on February 1, 1961, from the chairman of the committee inviting us to testify at this hearing, and the opening statement made by the chairman on February 20, indicate that the committee is chiefly interested in examining suggested improvements in air safety which may be dictated by recent air transport experience, my testimony will deal principally with that subject.

I would like also to summarize some of the more important elements of aviation safety planning: The high quality of airline aircraft; the comprehensiveness and thoroughness of the airlines' inspection and maintenance programs; and the meticulous care with which airline operations are planned and executed. With the committee's permission I would like to file, for inclusion in the record of the hearing, a statement dealing with these subjects in more detail.

Airline aircraft are the standard of excellence for the world: Safety in the air, of course, requires the use of safe and reliable aircraft. The airlines believe that the aircraft which they operate are the best in the world.

The importance in the construction of civil transports of the experience gained in the military field by airframe and aircraft engine manufacturers, the exhaustive research and testing of transport aircraft conducted by the manufacturer, by the military, by Federal agencies such as NASA and FAA, and by the airlines, and the cooperation which exists between all of these elements in pooling experience and know-how, is a subject too large for the hearing today. I think those facts can be summarized by stating what is the proof of the pudding—this country's position of world leadership in air transport manufacture. As of January 1960, over 4,400, or 85 percent of the 5,200 civil transport aircraft in use in the free world, were manufactured in the United States. This didn't just happen. It is a recognition that our aircraft are the best.

The inspection and maintenance programs of the airlines insure continuous airworthiness: Preventive maintenance is the keystone of the airlines' inspection and maintenance programs. These programs of the airlines are almost incredibly comprehensive and detailed operations. Time does not permit me even to try to summarize their scope and operation.

Perhaps there are two statistics which best characterize the comprehensiveness and thoroughness of the airline programs in their field. The first relates to the size and detail of the maintenance manuals which each airline maintains for each type of equipment it operates. These manuals, which are developed by the airline and the manufacturer, and which are filed with the FAA, cover each component of the aircraft and engine, describe in detail each part making up the component, and specify the procedures and methods for the inspection, testing, and overhaul of each part. A typical set of manuals for the Boeing 707, for example, consists of thousands of pages. Stacked on their sides these volumes would be 10 feet tall.

To perform the meticulous and comprehensive inspection and maintenance provided in these manuals, costs the airlines approximately $500 million during the 12-month period ending June 30, 1960. This amounts to about $1.4 million per day to inspect and maintain the approximately 1,800 aircraft which the airlines operate. It amounts to about 33 percent of the total direct operating expense of the airlines and about 25 cents of every revenue dollar taken in by the airlines.

Road-the-clock planning and vigilance characterize airline flight operations: The element of aviation safety represented by the selection, training, and qualification of flight crews, the thoroughness and care with which airline flight operations are planned, the checking and doublechecking which takes place before and during each flight, and the continual monitoring undertaken by an airline until the flight is safely concluded, is so large and detailed a subject that a full discussion of it could not be included in our statement. Accordingly, we have included this subject in the statement which we are planning to file for the record.

However, it may help the committee to understand the almost unbelievably detailed planning which goes into each airline flight, to know that one of our member airlines has concluded that in some respects machines can do the planning job better than men, and is now using electronic data processing equipment for flight planning. Others are evaluating the use of such equipment for this purpose.

The care and thoroughness with which the airlines train and test flight personnel is demonstrated by the fact that the industry spent on the order of $60 million last year on this function alone. This sum does not include such aids to training as a jet-flight simulator, which costs about $1.5 million per installation, and approximately $75,000 a year to operate.

The airlines are proud of both their inspection and maintenance programs and the planning and conduct of their flight operations. We are convinced that these programs are sound and are properly carried out. We do not believe any important element is missing or is wrong. If either were the case the situation would be corrected immediately.

As I stated previously, it does not appear to us that the accidents which occurred in 1960 fall into a pattern. In the absence of any such pattern the industry cannot pick out any one area for corrective action. The program must cover the entire operation. Consequently, our industry is maintaining the high standards which govern maintenance and operations. It is making every effort to intensify, wherever that is possible, the planning, inspection, monitoring, checking, and doublechecking done in connection with those functions.

A program for the advancement of safety in flight: The airliner of today is vastly different from its counterpart of 2 years ago, or 10 years. Not just in the airframe, but in many safety producing items that are never seen by the passenger. The electronic safety gear for a modern jet transport comes to a little more than $900,000 per aircraft, almost one-fifth of the total cost of the aircraft itself. The weight of this equipment is about half a ton.

I would like now to list for the committee some of the things we are doing, and are planning to do, and some of the things that need to be done by the airlines and the Federal Government in collaboration, to advance air safety. In compliance with the guidelines laid down by the chairman in his opening statement on February 20, my testimony will deal principally with improvements in the areas of air navigation and air traffic control, terminal area facilities,

weather, and aircraft design. Since number of the improvements which I will discuss promote safety in several of the areas in which the committee is interested, it was not feasible to assign them to individual areas.

VOR: In the early 1950's the Civil Aeronautics Administration developed the very high frequency omnidirectional radio range, known as VOR. This is a static-free navigation system which provides aircraft equipped to receive it, track guidance by means of radial beams emanating from the VOR ground facility. By means of these beams the pilot can fly a bearing to or from the facility.

The airlines quickly realized the great value of this navigation system and encouraged the CAA to establish a VOR airway structure as the primary navigation system. To further this worthwhile project the airlines, through the association, pioneered the development of low-cost ground VOR facilities.

Although most air traffic control and air navigation procedures using VOR can be accomplished by a single airborne VOR installation, the airlines have chosen to install dual facilities. There are two important advantages of a dual installation. One is that the second airborne VOR provides a check on the first. Moreover, it enables the pilot more easily to take fixes along the track he is flying.

Although the use of the VOR system is not required, even today, by Federal regulation, virtually every airline aircraft has a dual installation of this equipment. The VOR system has become the backbone of the air navigation system of the United States. The airlines are proud of the part they played in fostering the use of VOR.

DME: We believe that the distance measuring equipment—DME—now being installed in airline aircraft will become a very important airborne electronic safety device. As I stated, the VOR system gives the pilot his bearing. DME complements this directional information by telling the pilot how far he is from the ground VOR station providing the bearing. The pilot simply tunes to a VOR station for his bearing, then he watches the meter of the DME equipment tick off the miles. This remarkable device works whether the pilot is approaching or departing from a VOR station. Not only that, it can tell the pilot how far VOR stations are off to the side.

Until recently several factors made it impractical for the airlines to install the airborne equipment. These factors included a lack of sufficient number of ground stations, a lack of available, reliable airborne equipment, and a lack of fully developed and thoroughly established traffic control procedures to permit effective use of DME. This situation has been remedied to the extent that several airlines are already proceeding with aircraft installations of DME. Although no regulation requires it, the airlines have embarked on a program of installation of DME on each airline aircraft, on an installation schedule consistent with the problems which still remain. The airline timetable: all turbojet aircraft by January 1, 1963; turboprop aircraft by July 1, 1963; pressurized piston-powered aircraft by January 1, 1964, and all other airline aircraft by January 1, 1965.

Obviously the airline program is only a part of the complete picture. The installation of the airborne equipment will mean little unless the system on the ground keeps pace. Presently only 254 of the 725 VOR ground stations are equipment with DME. FAA plans now call for complete DME coverage at all these stations, plus the installation of 158 new stations by 1966. We are pleased to be able to inform the committee that the FAA has advised us that they intend to go forward with this program with great vigor.

One additional step needs to be taken in this important field. Unless all other users of the airspace, operating under instrument flight rules, are equipped with airborne DME installations, the safety factor provided by this equipment will be materially lessened. With some 1,800 aircraft, the airlines are, in terms of numbers of aircraft and hours in the air, a minor user of the airspace. Chart No. 4 shows this clearly. General aviation operates about 76,000 aircraft, of which many fly under instrument flight rules. This latter category of aircraft should be equipped with airborne DME. Accordingly, we strongly urge the FAA to take such action as will result in the installation of this equipment by the entire IFR segment of aviation.

This is certainly an area in which action by the airlines and the FAA today will show results in the accident record in years to come.

Integrated flight instrument system and standards for altimeter static system maintenance: The installation in the new jets of what are called integrated

flight instrument systems is another important step forward in flight safety. Commercial aircraft flying established airline routes are assigned to fly on crossing courses at altitude separations of 1,000 feet, up to 29,000 feet, and at 2,000 feet separations above that altitude. The integrated flight instruments systems have improved the pilot's ability to fly at his assigned altitude, as well as giving him more accurate airspeed information—important for structural integrity, safe takeoffs and landings, and accurate computation of fuel requirements. This improvement is brought about by a computer which automatically makes the necessary corrections in the instruments, for temperature, angle of flight, air flow, mach number, and installation characteristics.

Since each airplane's safety is dependent upon the position of other airplanes as well as its own, reduction of separation errors is an important contribution to safety. To further improve the accuracy of altitude and speed information, the airlines, through the association, established a committee about 2 years ago to formulate and keep current industry techniques and standards for the inspection and maintenance of speed and altitude measuring devices and their associated systems. This committee's work is well underway, and we are confident that it will be a valuable contribution to safety. The committee is coordinating its work with interested military and Government organizations and with ICAO and IATA.

The air traffic control radar beacon system: In the early 1950's the use of radar was introduced into the field of air traffic control. The airlines and the CAA worked closely together to develop the needed procedures. This was an important forward step.

However, the anonymity of the radar blip and radar susceptibility to interference by certain weather phenomena, such as heavy rain and wet snow, soon made it apparent to the airlines that a secondary radar system was needed.

This system, which has become known as the ATC radar beacon system, simply stated, consists of ground interrogators and airborne transponders. The interrogator, which is built into radar ground stations, automatically "asks" the plane where it is and who it is. The transponder on the plane gives the "answer." The transponder is so coded that the traffic control personnel on the ground not only know exactly where the plane is, in relation to their station, but its identity.

The airlines helped lead the way in the development of this important aid to air traffic control. As a concrete demonstration of their interest in the system, they equipped a number of their aircraft to assist the CAA in the evaluation of the ground equipment.

The airlines found that the system would, indeed, provide an extra safety measure. They offered to equip with the airborne portion of this system if the CAA would supply the necessary ground facilities. They prepared specifications and voluntarily programed installation of the equipment in some of their aircraft.

Contingent upon the establishment by the FAA of a firm program, including a commissioning schedule for ground equipment and agreed operational procedures, the airlines are today prepared to install their part of the system on this timetable: turbojet aircraft—installations already completed—these aircraft were so equipped when placed into scheduled service; turboprop aircraft—within 12 months; pressurized, piston-powered aircraft—within 24 months; all other aircraft—within 36 months.

Unfortunately, the ground implementation of the radar beacon system has been very slow. This is not to say that FAA has failed to recognize the need for action. To the contrary, FAA ordered improved equipment some time ago, but the manufacturer has been unable to make the required delivery. Additional plans for increased use of the radar beacon are also being developed. Meanwhile, however, air traffic controllers are still working with rather elementary ground equipment which cannot make fullest use of the capabilities of the system.

The radar beacon system is an important safety measure. Of particular importance is the information it can furnish the ground stations regarding the altitude of reporting aircraft. The installation of this system, air and ground, should go forward as rapidly as possible.

Communications: It is self-evident that air traffic control is an important element of air safety. The lifeline of air traffic control is adequate communications between aircraft and air traffic controllers. In recognition of this the airlines have long taken the leadership in programs to provide adequate air-ground communications. Without Federal requirement the airlines installed

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multichannel, static-free, very high frequency communications equipment in their aircraft, capable of utilizing more than the total number of frequencies used at any time for air traffic control purposes. The airlines have fostered and supported the use of direct controller-to-pilot very high frequency communications, thus eliminating the delay and possibility of error resulting from a communications "middleman." To meet the need of the FAA for more and more voice channels, required by the ever-increasing number of control positions and functions, the industry voluntarily gave up 2 megacycles of the VHF communications spectrum previously licensed for airline company radio stations so that 40 additional VHF channels could be made available for air traffic control. Airline aircraft are being equipped with 360 voice channels, making it possible for them to communicate with any ATC function.

While much has been done in this field, much remains to be done. First, the FAA project for the provision of direct oral communication between the pilot and the air traffic controller should be completed. Currently, the majority of the Federal airways are equipped for this direct method of communication. This program should be completed as rapidly as possible to provide direct air-ground communication coverage of all navigable air space at the earliest practicable date.

Second, the FAA must, by regulation, specify the minimum communications equipment required to be carried by aircraft operating under instrument flight rules or at airports served by control towers. While it is difficult to believe, the fact is that no such requirements exist today except for the airlines. The FAA has estimated that it will need about 300 voice channels for air traffic control purposes. Generally speaking, military pilots have available to them, on any one flight, only about 20 channels for this purpose, although their equipment has a capability of many more. In the field of general aviation, less than half of the multi-engine aircraft in this group, according to an FAA report, are equipped with 50 or more channels. Obviously the air traffic control system will not work well unless all of the aircraft which use it have all of the airborne equipment necessary to communicate on every channel needed for air traffic control purposes.

The voluntary IFR program and positive control: To a large extent safety in the air is dependent upon an effective traffic control system. In recognition of this, the airlines in 1956 started to develop a program calling for step-by-step transition to put all airline operations under instrument flight rules (IFR). This program is not positive control, but it permits the air traffic controller to provide separation for a greater percentage of the aircraft in the air traffic control system.

Implementation of this program began early in 1957 when all airline aircraft operating at or above 18,000 feet were placed under IFR. In May of 1958 the airlines lowered the previously established floor to 10,000 feet, and on July 1, 1959, the program was further advanced by voluntary elimination of visual flight rule climbs or descends at or above 10,000 feet.

The next step will, with some limitations reduce the altitude floor to 5,000 feet. This voluntary program has resulted in ground and en route delays, circuitous routes, and the acceptance of less than optimum altitudes.

It has, therefore, reduced on-time performance and imposed heavy economic penalties on the airlines. However, we believe that these penalties have been justified because the program has provided procedural separation between the participating aircraft.

Third, while voice communications form the backbone of today's air traffic control air-ground communications, the airlines and the FAA recognize clearly that with the ever-increasing amounts of traffic handled over the airways system, this will not provide for adequate communications in the future. Semi-automatic and eventually fully automatic air-ground communications will be necessary. The FAA is working on this problem. Since, as I said, air-ground communications are the lifeline of the air traffic control system, it is vital that work on these problems be advanced with all the resources and intelligence that can be brought to bear.

This program covers airline aircraft only, and while other segments of aviation do not participate fully in it, it is gratifying to note that many business and military aircraft do so.

While the voluntary IFR program resulted in a major improvement in the working of the air traffic control system, the need remains for positive control. By that we mean the positive separation between all aircraft in the system, under all weather conditions, in areas and on routes of high density. Positive

control is now in operation on three transcontinental routes between altitudes of 17,000 and 22,000 feet, and in an area basis between the altitudes of 24,000 and 35,000 feet in the vicinity of Chicago and Indianapolis. This is shown on chart No. 5. On these routes and in these areas, positive separation service for all aircraft is provided. This is the way to provide maximum protection.

The airlines realize that positive control cannot be accomplished overnight, nor can it be made to apply to all airspace. It increases the work of the air traffic controllers and thus will have to be implemented as personnel and equipment limitations permit. Moreover, positive control requires that participating aircraft be provided with modern communications equipment with a substantial number of frequencies, airborne radar beacon transponders and good quality navigation equipment.

Not all operators of general aviation aircraft are capable of buying and operating this type of equipment. For this reason the airlines believe that in low density areas and below certain altitudes in nonterminal areas, airspace should continue to be available to aircraft not equipped to participate in positive control. Our intention is to provide safe transportation. It is not to deny the right of any airspace use to others.

Collision avoidance system: The only real solution to the midair collision problem is a fail-safe, positive air traffic control system. However, as a safety doublecheck, but not as a substitute for that system, the airlines, over a number of years, have attempted the tremendously difficult task of guiding the development of an airborne electronic collision avoidance system and proximity warning indicator.

The requirements for a successful collision avoidance system are staggering. It must continually gather data on all aircraft in a vicinity, sort this data, analyze the potential threat created by each aircraft and, if necessary, predict the evasive maneuver.

Furthermore, the system must not interfere with the air traffic control system. This places a further burden on the avoidance system since it must gather data that are sufficiently accurate so that only a relatively minor movement of the aircraft is necessary to avoid collision, without violating altitude or airway assignments.

Several years ago the airlines set up a special committee, through the ATA, to find a workable system. All the findings of this group were turned over to the FAA and now the air transport industry and the Federal Government are working together to find the answer, through the Collision Prevention Advisory Group, known as COPAG.

There are indications that all this work will soon begin to bear fruit in the development of equipment which offers the the promise of doing at least a part of the collision avoidance job. The industry will continue to work on this problem through the advisory group, and we urge the FAA to expand its efforts in this area.

Specification by FAA of a minimum list of airborne navigation and communications equipment: As I stated previously, the airlines, over the years, have added more and more electronic devices to their aircraft to secure reliability and safety of operation. Most of these devices are provided in dual installations to afford additional safety an cross-checking.

Other elements of aviation, for reasons of economy, and sometimes by reason of lack of understanding, operate aircraft with what we consider less than the minimum equipment required for safe operation. For example, there are over 8,000 general aviation aircraft capable of carrying three or more persons which are currently equipped with only a single VHF transmitter and a VHF receiver. The transmitter provides only three frequencies which can communicate directly with traffic controllers. The pilot must use the single VHF receiver for both his navigation and communication services. These aircraft can be legally operated under instrument flight rules, and many of them are. Moreover, the Minimum Performance Standards specified by the FAA for electronic equipment carried by aircraft apply only to airline aircraft.

While air transport aircraft are of the type which are equipped with more expensive and sophisticated electronic devices, the air traffic control system must accommodate all types of aircraft, large and small, expensive and inexpensive. While it is possible to separate types of traffic on some parts of the airways system, in the vicinity of airports and in the high density IFR areas leading to them an intermingling of the many varieties of aircraft types inevitably occurs.

Aviation safety, therefore, requires that all these aircraft have whatever equipment is necessary to safely and efficiently fit them into the air traffic control system. Obviously, it is the responsibility of the FAA to say what the minimum complement of this equipment and its minimum performance capability is.

The search for complete safety in the air becomes a vain quest if only one segment of air traffic has the necessary equipment. We strongly recommend appropriate regulations by the FAA to require a more realistic complement of equipment for all IFR operators. We believe this should include an adequate communication capability, appropriate charts, VOR, DME, and a transponder beacon.

Airports and landing aids: Our national system of airports is vital to our air commerce and our air transport system. Aviation safety, to a large extent, depends upon the location of our airports and the way in which they are designed and equipped.

The Federal Airport Act has been the basis upon which the Federal Government has participated in airport development. The interest of the members of this committee in legislation which would continue this act is most encouraging.

We believe that the act should be continued at a level which the facts demonstrate is necessary to meet the Nation's needs. In allocating Federal funds under the act, the FAA should give careful consideration, as it has in the past, to projects which are related to the safety and reliability of the aeronautical use of our national airport system. This is, of course, a subject which will come before this committee at a later date. However, it is such an important one and has such an important bearing on aviation safety that we thought it appropriate to mention it at this time.

Of the approximately 570 airports served by the airlines, only some 250 are provided with control tower service. A constant effort should be made by the FAA and the Congress to expand this much-needed service to the remaining airports as rapidly as possible.

Exchange of traffic information at noncontrolled airports: In the interim there is another step which can be taken to provide added safety at airports without control towers. Most of these airports have communications access to what are known as flight service stations of the FAA. These stations formed the basis of the communications system between air traffic control and aircraft during the years when there was not direct communication between flight crews and air traffic control centers. These flight service stations are capable of communicating with all classes of air traffic.

We suggested several years ago, and now repeat our suggestion, that safety at airports without control tower service would be improved if aircraft operating into those airports were required to communicate with these flight service stations and obtain reports as to the presence of traffic in the vicinity of the airport. While this is no substitute for control tower service, it would be a safety measure since it would alert the pilot to the presence of other traffic in the area.

Straight-in approaches at noncontrolled airports: Several times during the hearing it has been stated that straight-in approaches should not be permitted at airports not equipped with control towers. This subject has been reviewed by the airlines several times over a period of years. Our conclusion has always been the same. The airlines believe that straight-in approaches by transport-type aircraft to uncontrolled airports are safe, and, as a matter of fact, safer than making a circling approach around the airport prior to landing. Our basic reasons for believing straight-in approaches are safer are as follows:

1. Since turns during the approach are minimized, both pilots are better able to see other traffic.

2. Any requirement that an aircraft join or follow a traffic pattern around an airport involves greater probability of an unsafe situation occurring, since aircraft are flying in close proximity to each other for a greater period of time.

3. Air carrier aircraft, due to their greater speed and turning radius during a circling approach, are usually outside of the traffic pattern being used by the small private aircraft. Therefore, an airline aircraft conducting a circling approach will, in effect, be coming straight in on final approach at the time the smaller private aircraft is on base leg inside the pattern of the larger and faster aircraft.

4. At some airports terrain proximity and clearance cause problems to airline aircraft which can be overcome only by use of a straight-in approach. These problems may not affect the circling pattern of small aircraft. Although it is particularly true in the western part of the United States, there are also airports where this is true in the East—for instance, Williamsport, Pa.

Air traffic control separation of IFR air traffic is only provided in controlled airspace. For IFR operations in the vicinity of the airport, this means that the FAA must designate the control zone, if an aircraft making an instrument approach is to receive air traffic control protection throughout the approach. Although the FAA has designated control zones at a number of airports, there is still much work to be done in designating them at other airports to provide for the safety of all instrument approaches.

Little needs to be said to this committee regarding the value of the various lighting aids. You have consistently aided us and aviation in general by pointing out the necessity for implementation of approved approach and runway lighting systems. Although the FAA's programs with respect to approach lighting are advancing reasonably well, there continues to be the problem of convincing individual communities and their airport authorities of the necessity of providing the required land for the installation of approach lights. This is an area where cooperative effort by FAA, the pilots, and airline management can be of assistance in dealing with the airport authorities.

At those locations where standard approach lighting is either not required or cannot be justified by the FAA, the airlines believe that a pair of high-intensity flashing lights known as runway end identifier lights (REIL) are of great value. These assist the pilot in locating the end of the runway. A token program was established by the CAA several years ago but because of certain technical installation difficulties is just now coming into being.

It is our view that the FAA should provide a most extensive program for the installation of these lights at the lower traffic activity airports which do not now qualify for standard approach light systems. No such FAA program now exists even though the cost of such a program would be extremely low relative to the increased safety provided.

To assist the pilot in attaining the desired angle of descent to the runway during visual conditions, the FAA evaluated five different lighting systems and selected one of British design. This decision was made in June of 1960, too late, unfortunately, to make the necessary provision of funds in the budget for the current fiscal year. Accordingly, we have urged that the FAA reprogram existing funds so as to purchase as many as possible of these visual glidepath indicators.

The FAA has been quite active in its work on improving runway lighting and has tested a number of lighting systems at its experimental center at Atlantic City. These tests have demonstrated the feasibility of what are known as narrow gage lighting systems. While they have not as yet resulted in a national standard, it is hoped that this goal can be achieved in the very near future. Numerous runway extensions are now being constructed without narrow gage lighting because work on this problem was not started soon enough.

Lastly, an airport aid which is receiving increasing prominence and endorsement is the measurement of runway visibility in terms of runway visual range. In simple terms, runway visual range is a method of providing the pilot with the most accurate available indication of the visibility along the runway. Obviously, safety is increased as we provide the pilot with more and more accurate knowledge of airport weather conditions. Visibility is one of the most important of these conditions, and we therefore attach great importance to the programs of the FAA and the Weather Bureau to provide runway visual range at all major airports.

Bird strikes: Another matter that the association and the airlines have been working on vigorously is the problem of bird strikes, and particularly ingestion of birds by turbine engines.

We have been working for years to minimize the effects of bird strikes on the airframe and windshields. As a result, our transport category aircraft are able to withstand such strikes.

The transition of our industry from piston to jet aircraft has caused us to examine the bird strike problem from the standpoint of engine ingestion. Turbine engines require tremendous quantities of air for efficient operation. They could

be likened to giant vacuum cleaners. Any object that enters the intake airstream is destined for a quick trip through the engine. As turbine equipment came into operation, occasional bird strikes necessitated premature engine removals.

The involuntary introduction of a large bird into a jet engine has serious consequences. Damage is incurred either through the bending of guide vanes leading to the compressors or through the bending of compressor blades. Such damage calls for immediate repairs and usually removal of the damaged engine.

In the late summer of 1960, even before the tragic Boston accident, the association called upon the Fish and Wildlife Service and the FAA for assistance in solving this problem. Both of these agencies went actively to work upon it.

Recently it was learned from tests, held as a result of the Boston accident, that the introduction of several small birds in rapid succession into a jet engine causes a momentary power loss in the engine. We believe that this report greatly intensifies the need to reduce bird concentrations on and around airports.

The response of the Fish and Wildlife Service to our request for assistance has been most gratifying. While the Service could not assure us of control measures that will produce a birdless airport, they have suggested measures which, if followed by airport operators, will make the airport environment less attractive to concentrations of birds. These recommendations are contained in Wildlife Leaflet 429, jointly released this month by the Fish and Wildlife Service and the FAA.

Wildlife Leaflet 429 does not close a chapter in aviation safety. From our discussions with ornithologists, we have learned that there is interest in the development of a humane device or repellant, including what are termed "bird management chemicals," that will make areas on the ground unattractive to birds. The airlines are cooperating in evaluating tests of these methods, some of them barely out of the laboratory. From the information to date, we feel that these scientific efforts are on the right track. Time and encouragement of them should produce results.

Research efforts such as are now going forward, and there are many of them, require close supervision by the Fish and Wildlife Service. Airport inspections by their ornithologists is a new endeavor for the Service. Financial support will be required for these activities beyond the temporary grant of $100,000 made last year to the Service by the FAA. We urge the Congress to provide the needed additional funds to carry on this supervision and inspection.

Weather reporting: Through the ATA Meteorological Committee, the airlines maintain close working relations with the Weather Bureau, the FAA, the CAB, and the military air weather services. This committee, which is one of the oldest industry committees, having been created 24 years ago, is composed of airline representatives who are experts in the field of meteorology.

This airline committee has been an effective professional voice in pioneering many developments in the field of weather forecasting and weather communications. For example, this group pioneered the use of the frontal analysis approach to weather forecasting. It spearheaded the establishment of the National Weather Facsimile Service, a weather communications service, with outlets in most airline dispatch offices, which prints weather maps, forecasts, and analyses of both surface and aloft weather conditions. The committee's efforts led also to the establishment of the High Altitude Facsimile Service, which distributes meteorological information, both nationally and internationally, applicable to jet flight altitudes.

Most recently the committee's work in the field of speedier weather communications resulted in the development by the FAA of weather teletype networks, with outlets in all airline dispatch offices, that operate at 100 words per minute. The increased capability of this network provides airline dispatch offices and flight crews with more current and comprehensive weather information—which definitely improves the safety of flight operations.

As a matter of fact, the airlines are an important arm of the Weather Bureau. Of the total of 744 airport locations where surface weather observations were made, as of January 1, 1961, Weather Bureau personnel made them at 259; FAA personnel made them at 229; and airline personnel made them at 256.

Observations of conditions in the atmosphere above the surface are made by the Weather Bureau at approximately 100 locations, by releasing balloons equipped with transmitters for reporting pertinent data. To supplement these

observations, the Weather Bureau has connected, by teletype, 7 of the major airlines to Weather Bureau forecast offices in 10 of the major cities of the United States.

The pilots of these airlines submit to their companies regular reports of weather conditions encountered on their flights, and via these teletype lines, these reports are passed on to the Weather Bureau for distribution over Government networks to other Weather Bureau offices, the FAA, and nearly 2,000 private subscribers. These airline "eyes aloft" report the presence of thunderstorms, turbulence, icing conditions and cloud cover above and below the flight level. These mobile observing platforms make flight safer for other aircraft, and the program has been enthusiastically received by the entire aviation community.

Moreover, the Federal Government and research organizations call upon the airlines from time to time to engage in special in-flight observation programs. During recent winter months the airlines operating between the Rocky Mountains and the Alleghenies took special weather reports of clouds covered at selected times for the University of Chicago. The purpose of this program was to expand on available knowledge of cloud cover associated with winter storms. Next month, the airlines will be called upon to report, at selected intervals, the presence or lack of turbulence. The purpose of this project is to expand available knowledge concerning the phenomenon known as clear air turbulence.

The industry intends to continue to cooperate closely with the Weather Bureau and other organizations interested in weather.

Weather minimums: It became apparent during the course of the hearings that some clarification is necessary regarding the application of takeoff and landing weather minimums. The civil air regulations clearly prescribe takeoff and landing minimums for the scheduled airlines. The FAA presribes these minimums, which are determined according to standard criteria. Any violation of these rules subjects the airline or the pilot, or both, to penalties.

An individual airline either applies the minimums prescribed by the FAA or, as is frequently the case, itself establishes minimums which are more strict than those of the FAA. In any event, the minimums for each airport are clearly set forth as a part of the carrier's operating certificate.

Looking for a moment at takeoff minimums alone, it should be noted that the FAA does not prescribe such minimums for general aviation aircraft. These aircraft, unlike airline aircraft, are permitted to take off without regard to weather conditions at the airport.

Landing minimums, on the other hand, apply to all operators of aircraft, airline, corporate and private. Generally speaking, the same minimums apply to all segments of aviation. This is true notwithstanding the fact that existing regulations require the airlines to—

(*a*) Have their captains qualified into the airport;

(*b*) Provide a dispatch system including a complete company-controlled air/ground communications network;

(*c*) Have each airport specifically approved for each carrier's operation; and

(*d*) Assure the FAA that necessary weather information is available at the airport.

These added requirements quite obviously result in an extra margin of safety for airline operations.

Aircraft design: A tremendous amount of time, effort, and money are expended on the development and design of a new transport aircraft, so that it will be as perfect as humanly possible when it is ready to enter service. An idea of the tremendous effort involved can be realized from the fact that the manufacturer of a new jet transport spends approximately $50 million on engineering and development, another $50 million on FAA certification tests and customer demonstrations, another $50 million for tooling and production accessories before the first airplane is delivered to a customer, and expects to spend a final $50 million in product improvement as the aircraft come off the production line.

In spite of the almost superhuman effort to make new airplanes as perfect as possible, some mechanical and structural faults usually begin to appear after the aircraft are put into service. Most of these faults are found quickly by the preventive maintenance programs conducted by the airlines. However, some are not found until the aircraft have been operated for some time.

Serious faults encountered in an airline's operations are made known to all other airlines and to the manufacturer by means of an FAA daily report, which is immediately distributed by the ATA to all its members and to all manufacturers. Thus, other airlines can quickly apply preventive measures to prevent similar failures in their aircraft, and the manufacturer concerned can plan to schedule corrective action.

From time to time, in the more serious cases, the FAA makes such corrections mandatory to all airlines, within a given time schedule, by issuing airworthiness directives. For example, last year one of the new jet airplanes experienced structural fatigue failures in the landing gear, resulting in several landing incidents. After each incident the FAA, the airlines and the manufacturer conferred to analyze the situation and to initiate immediate inspections and parts replacements, which was followed by permanent modification of the component.

A more notable example was the recent Electra structural problem. In this case, the speed of the airplane was reduced to provide safe operations during investigation of the trouble. This investigation was most extensive and was participated in by the airlines, CAB, FAA, NASA, and the aircraft and engine manufacturers. The net result was that after certain modifications, the airplane was given a clean bill of health and is now pronounced fully airworthy at its original speeds.

There is attached to my statement, as appendix A, a list of examples of mechanical and structural modifications made to airline aircraft and engines since January 1960. You will note that the list includes aircraft types ranging from the venerable DC–3 to the latest jet aircraft in service. It proves that the search for safety does not end when an aircraft is certificated as airworthy. It goes on as long as the aircraft is in service.

Commendation of the FAA: The industry-supported enactment of the Federal Aviation Act of 1958, which created the Federal Aviation Agency, because it believed there was urgent need for an independent Federal agency with proper authority to control the use of the airspace by both military and civil aviation, to provide the necessary navigation aids, and to undertake the research and development needed to move safely and efficiently increasing amounts of air traffic.

The FAA has been in existence a little over 2 years. While we have not always agreed with the actions it has taken, and we won't in the future, we would like to commend that Agency for the overall job which it has done. It has moved up vigorously to discharge the responsibilities given it by the Congress. It has to its credit solid achievement in the fields of air navigation and traffic control, airspace management, and research and development, and we confidently expect that the Agency will continue its fine performance.

Appendix A

Examples of Mechanical and Structural Modifications Since January 1960

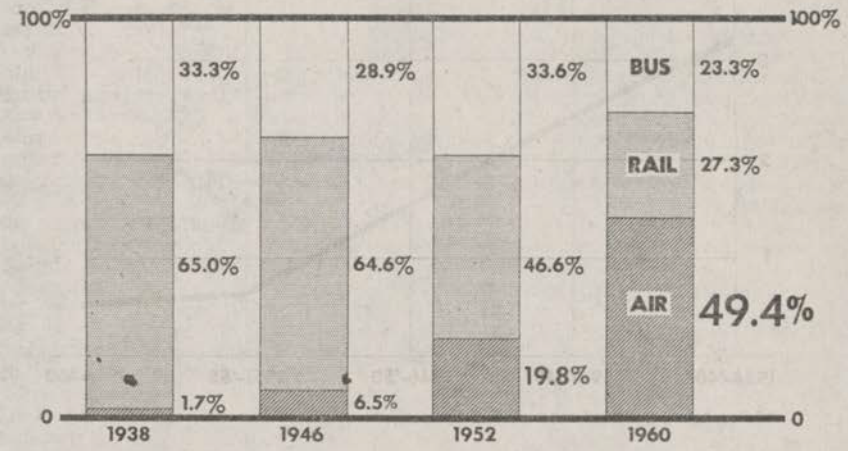
1. Boeing 707: Reinforcement of wing foreflaps.
2. Viscount: Installation of oversized spar bolts.
3. DC–6: Rework of spars.
4. Lockheed Constellation: Reinforcement of main landing gear.
5. Wright turbo compound engine: Installation of new valve body in oil control valve.
6. Rolls Royce Dart engines: Replacement of impeller shafts.
7. Hamilton Standard propellers: Alinement check.
8. Martin 202 and 404: Reinforcement of wing spars.
9. C–46: Modification of heat source in cargo compartment.
10. DC–8: Inspections for cracks in wing sections.
11. Allison engines: Correction of third-stage turbine blade failures.
12. Wright helicopter engines: Reinforcement of connecting rods.
13. DC–3: Modification of rudder controls.
14. Electra: Modification of a.c. and d.c. distribution box.
15. Vertol Helicopter: Rework of rotor blades.
16. CV–340 and 440: Rework of landing gear actuating cylinder rod assembly.
17. F–27: Modification of rudder trim tab hinge brackets.
18. P. & W. Turbojet engine: Inspection of combustion chamber case rear flange.
19. Aeroproducts Prop: Inspection for blade thickness.
20. DC–8: Reinforcement of spar caps.

(Charts 1 through 4 follow :)

CHART 1

AIRLINES NOW PRIMARY FORM OF INTERCITY TRANSPORTATION

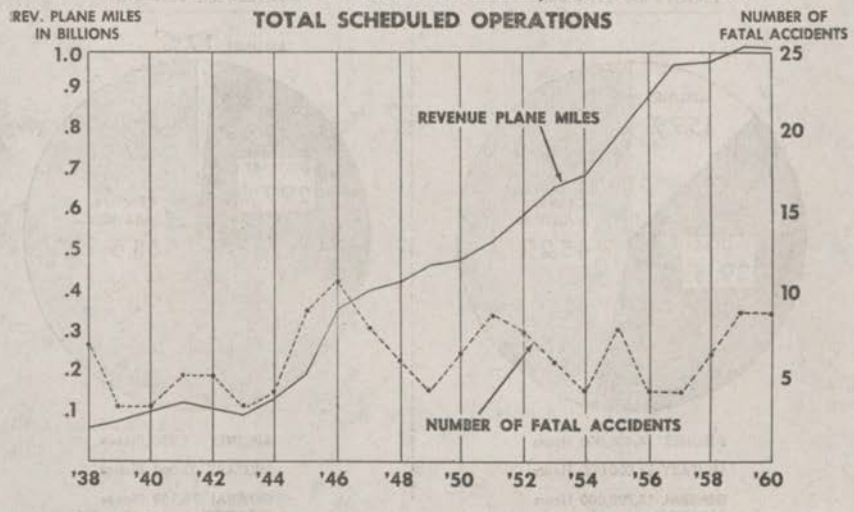
By Percentage of Total Public Intercity Passenger Miles



Sources: ICC, CAB, NAMBO

CHART 2

NUMBER OF FATAL ACCIDENTS AND REVENUE PLANE MILES, 1938-1960

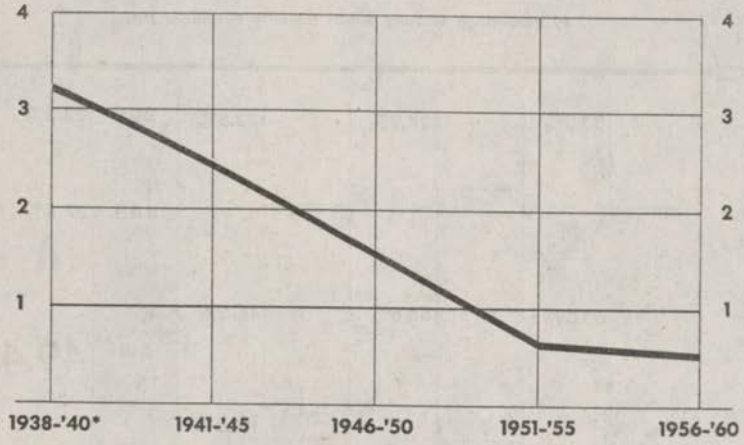


Source: Civil Aeronautics Board

CHART 3

FATALITY RATE PER 100 MILLION PASSENGER MILES, 1938-1960

5-YEAR AVERAGES, TOTAL SCHEDULED OPERATIONS



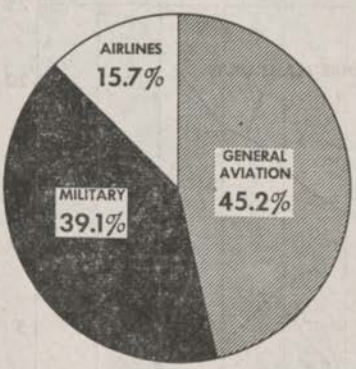
* 3 Year Average

Source: Civil Aeronautics Board

CHART 4

USERS OF THE AIRSPACE—1960

Hours In The Air

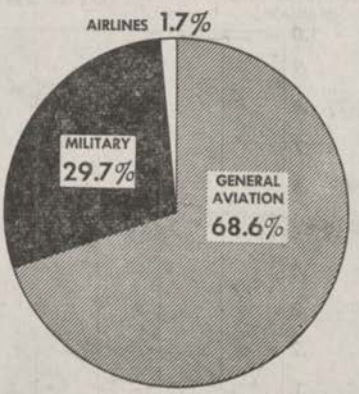


AIRLINES 4,400,000 Hours

MILITARY 11,000,000 Hours

GENERAL AVIATION 12,700,000 Hours

Planes In The Air



AIRLINES 1,850 Planes

MILITARY 33,068 Planes

GENERAL AVIATION 76,150 Planes

APPENDIX B

AN ARBITRARY LIMITATION ON THE AMOUNT OF AIR TRAFFIC WOULD NOT CONTRIBUTE TO SAFETY

A question has been raised during the hearings whether safety in the air would not be enhanced if the amount of air traffic handled by the air traffic control system were reduced on an across-the-board basis. We do not think that such action would contribute to safety.

The air traffic control system now has built-in automatic limitations on the amount of IFR traffic. These automatic limitations take two forms. The first is the application to traffic of the FAA's established separation standards. The second results from the flow control restrictions issued by the various air traffic control centers.

It is the purpose of the FAA's separation standards to provide safety from collision. Controllers do not, and are not authorized to, reduce these standards when traffic increases. They apply whether separation is to be provided for 2 aircraft or 20 aircraft on a given airway. All IFR aircraft must obtain flight authorization from air traffic control and since the controller only authorizes such traffic to the extent that compliance with separation standards can be met, clearances are denied when the controller is unable to provide the required separation. In such cases the aircraft have to wait until proper separation can be provided.

The second built-in limitation in the air traffic control system results from the authority of the air traffic control center to issue flow control restrictions when it determines that the number of IFR aircraft seeking clearance to a given terminal area would exceed the number that can be handled without inflight delays. These restrictions may take a variety of forms, including a limitation on the number of aircraft per hour permitted to enter a given terminal area, the number of aircraft cleared to use a certain airway, or to use certain altitudes in the terminal area or on the airway. At times the air traffic control center may completely stop any additional IFR traffic from entering a particular area. These restrictions are applicable to all classes of IFR users—airlines, business aircraft, military aircraft, or private aircraft.

We believe that these built-in limitations provide a more realistic and flexible method of traffic limitation than would be possible under any across-the-board type of limitation.

Moreover, any limitation of this latter type would not be effective since it is not feasible to make it apply to VFR traffic. Since flight plans covering VFR flights are not filed with air traffic control, ATC has no way of determining in advance the potential demand upon a given area. In addition, except for the service provided by control towers, the air traffic control system does not handle VFR traffic, nor is this type of traffic in regular communication with ATC, which is necessary to permit effective flow control.

We believe that steps should be taken to place more VFR traffic under air traffic control. For example, VFR traffic approaching a terminal area could be required to communicate with the control tower, at a specified distance from the airport, for the purpose of receiving a clearance to enter the airport traffic pattern. When, in the judgment of the controller, traffic volume so warrants, the controller could restrict VFR aircraft to hold at outlying fixes until such time as further clearance is received. Further, approach control radars might be utilized not only to provide VFR traffic information, but to provide separation. Both of these techniques are now being evaluated by the FAA. We feel that FAA's efforts along these lines are to be commended and we urge exploration of similar techniques for application on a wider basis.

As I have previously testified, the only real solution to the midair collision problem is a fail-safe positive control system, which provides positive separation between all aircraft in the system, under all weather conditons, in areas and on routes of high density. This is the goal toward which we should be striving. It is not necessary, however, to provide positive control of all airspace. In low-density areas and below certain altitudes in nonterminal areas, airspace should continue to be available to aircraft not equipped to participate in positive control.

Mr. TIPTON. As I say, we regard these hearings which we have had this year and the year before on safety as very valuable to our industry for many reasons.

At the outset of this discussion, in which we will cover many phases of airline operations, not only current ones but also those safety improvements that are proposed, I would like to present some data which bears upon our safety record and which tends to bring the safety record of the industry into perspective.

There is no question but that in the course of its operations over these years the industry has been plagued by a number of accidents, and there also is no question but that the goal of the industry, and the only goal that will ever satisfy the industry, is a completely accident-free record. But we must nevertheless look at our record with the thought in mind of determining what achievements have been made.

We must recognize that air transportation is three times as safe as moving by private automobile. We must recognize also that the industry for quite a number of years has progressed with fatalities below a single fatality for each hundred million passenger-miles.

Senator MONRONEY. Would you interpret that: Is it not correct that if you just figured an average, if you had one person flying, on a theoretical law of average basis, that person would be able to complete nearly 100 million passenger-miles before, you might say, his "number was up"?

Mr. TIPTON. That is one way to consider it. Another way is to consider the passenger safety rate, the percentage of passenger trips that are completed in complete safety; 99.99943 percent of all passenger trips taken on American-flag lines in the past year were completed with safety. That is better than the famous and familiar 99.9400 percent—considerably better.

Another way that you can appraise the safety record of the industry and bring it into perspective, is to consider public acceptance. The American public is a discriminating public and they do what they choose to do. There were 52 million passengers last year who chose to fly on the airlines. The airlines over these years have achieved a record of now carrying 49 percent of all the total passenger-miles carried in the United States.

In the international field, 75 percent of all passenger traffic has gone by air, which indicates that we have convinced the public, and they are convinced, that air transport is safe. I draw attention to the chart which shows the progress of the industry in this respect started in 1938, which shows the percentage of passenger traffic that moved by air—1.7 percent, over these years that have passed.

We have now raised that to 49.4 percent in 1960. That in itself, that record, is a great tribute it seems to us to the public recognition of air transport safety.

Another way that I think we can consider the accident record in bringing all of this into perspective is the number of accidents that have happened during these years. We have been accustomed to measuring safety records in terms of the number of passenger fatalities per hundred million passenger-miles. Let's look at it another way, the number of fatal accidents in terms of airplane-miles, which tends more accurately to reflect the safety record in terms of the exposure.

Mr. TIPTON. If you will note the chart in this instance, you will note that in terms of revenue plane-miles our record has been going up very rapidly, and the number of accidents has stayed relatively

stable, so that viewing it from the standpoint that I have just described, the record of the industry has been an excellent one in that the accident record has not in any respect accompanied the rate of exposure. So, we can take comfort, and we can take pride in that record.

Another way of looking at this in order to fix it in proper perspective is to recognize that safety progress does not come annually, so to speak. You do not make progress in this industry in spurts or dramatic events. You make progress in this industry toward safety over long periods: the purchase of equipment, the development of facilities which takes place over long periods. So let's look at the industry's accident record in terms of 5-year averages instead of taking it year by year.

Mr. TIPTON. When you look at it in that way you have the picture shown by this chart, which shows a dramatic downward trend in accident reports.

This is stated, of course, in terms of the fatality rate per hundred million passenger-miles. So there, when you consider this a little bit more accurately, in my opinion, if you are measuring safety progress over 5-year periods, you show that our trend is down.

I have no doubt that as the years pass, that trend will continue downward, because many of the programs that we have underway, that the FAA has underway, are programs that do not have their effect in a single year, but have their effect in small increments over the years.

I want to make it quite clear that in this presentation of the facts of our safety record I am not taking the position that the industry should be in any respect complacent because we do have accidents.

And so long as you have accidents you have a problem, and that is the reason this committee is reviewing it; that is the reason the airlines, the FAA and others concerned, are constantly concentrated on this problem.

This constant concentration is the reason for the downward trend. And we must maintain this constant concentration in order to maintain that downward trend.

Let me go over rapidly the sort of things that the airlines do now, as part of a constant——

Senator MONRONEY. Before you leave that this also includes, in the last 18 months, probably the most significant development as to speed, range, weight, and sophistication of airline equipment that has ever taken place since the first DC–3's were put on the line, does it not?

Mr. TIPTON. There is no question about it. The technical, the drastic technical change which has taken place over the last 18 months, is the most drastic, the most revolutionary that we have ever undertaken. And as the record shows, that continues to be reflected in a downward trend, and that is where we want to keep it.

Senator MONRONEY. To keep it in perspective—and this is what we try to do in these hearings—is not to view with horror the fact that we had unfortunately climbed a few percentage points in the hundred million passenger-miles flown over some of our best years, but that we did undergo a revolutionary change as to speeds, as to the demands on the aircraft control systems, on the airports, personnel, and on maintenance and almost every phase, including weather, the time element having shrunk so greatly for an ever-increasing portion of our fleet that is in turbine-powered aircraft, which made a very violent

adjustment necessary, and the fact that the industry has survived this transition period without an enormous increase in passenger fatalities and equipment accidents is something that we should not ignore in our study of this.

And the fact also, I believe, before we leave this, is that now you are carrying almost as many passengers—I thought it was more, but your figures show six-tenths of 1 percent less than than combined intercity traffic of all the railroads and of all the buslines.

So that as we find aviation becoming double the capacity of the passenger transportation of either of these forms of passenger transportation, we must expect, as a matter of course, greater demands upon the air traffic control facilities on safety devices and other services that the Government must render as you move from a few percentage points in the total passenger transport picture to the major factor for the movement of people throughout the domestic routes of the United States and over the oceans as well.

I think that we are somewhat concerned with increasing appropriations necessary to maintain the system, but we must understand that this is because you have come to carry 52 million passengers a record number of miles around the entire globe.

If it is to do this work safely then it must be facilitated with the attention of Government to supply the navigational aids, airports, such as we have historically supplied to ocean-borne transportation through the lighthouses and the Loran beams and the Coast Guard and the other facilities, including the rivers and harbors facility development that went with these other forms of transportation, not to mention a half an empire that was given away to the railroads to facilitate their part in the transportation picture in their day of great growth.

Mr. TIPTON. The point that you just made is really one that is not always recognized. There are not too many people—not withstanding our efforts to tell them—who recognize that air transportation is the prime mover of passenger traffic in the country.

Sometimes it dawns on us with a little surprise that over this very brief span of years that the industry has achieved that place in the Nation's economy.

The very fact that we do constitute that important a place in the Nation's economy I think does put some obligations on the Government. Of course it also places some obligations on us. When we form that great a part of the transportation system of the United States we pick up responsibility for doing the job supremely well.

That imposes on us the responsibility of picking up our problems and very frankly looking at them, turning them around and solving them.

We have that responsibility. We think that we are carrying it out effectively, and we hope to continue to be able to do that. To describe how we do that in very brief terms—and it will have to be brief because this is a long and detailed story—take a look at airline equipment. That is the No. 1 decision in the safety as well as the economic area.

In buying airplanes that of course is one of the hardest jobs an airline does, and one of the hardest jobs of the manufacturer. The results of U.S. efforts, combined airline manufacture and military,

we have wound up by providing 85 percent of all of the 5,200 civil transport aircraft in use in the free world. We have provided 4,400 out of the 5,200 in use.

That demonstrates quite clearly that we are operating the best transport aircraft that can be had. There are a lot of other more detailed arguments about that, but there again the record tends to speak for itself.

Another big area in which we must concentrate and do concentrate is in the inspection and maintenance programs. We get good airplanes, we operate them well, and our obligation is to inspect and maintain them to the very highest standards. That of course is another long story.

Just to illustrate it, the manuals that govern the maintenance and inspection of the Boeing 707, which include the detailed instructions on every bit and piece of that large airplane, consist of thousands of pages which, stacked on their sides, would be 10 feet tall. That is the detail of the specification that goes into the maintenance and inspection of that airplane.

In addition, as far as maintenance is concerned, and another very brief illustration of what I am talking about, we spent approximately $500 million during a 12-month period ended June 30, 1960, on inspection and maintenance alone. That amounts to 33 percent of the total direct operating cost of the airlines and 25 cents out of every revenue dollar we take in goes for inspection and maintenance.

Those two rather simple illustrations indicate the extent to which the industry is devoted to carrying out its inspection and maintenance responsibilities well.

The operation of the airline system, which includes the selection and training and qualification of crews, the conduct of flight operations and the checking and double-checking that goes on during each flight, and the constant monitoring of the entire operation, here again that cannot be described, because it has to be watched actually to have it understood.

One simple illustration: a number of our airlines now are doing their flight planning by electronic data-processing machines rather than any longer relying upon the older methods of flight planning. And the rest of the industry is evaluating the use of such equipment to accomplish the same thing.

Training, another subject on which the airlines are constantly devoting their attention; we spent $60 million, we estimate, on this function alone in the operation of the airlines and, that does not include a number of things such as our flight simulators which cost $1½ million per installation and cost $75,000 a year each to operate.

Those are very brief illustrations of the point that I am trying to make here, which is that the airlines are concentrated on this objective.

As we look back upon the accidents as they have happened during this year and in prior years, there does not seem to be a pattern which would permit us to move in and fix something immediately and achieve a great and dramatic result. We have to review operations as a whole and take corrective measures across the board.

I would like to turn now to the type of corrective measures that we are in the process of making and have definitely programed for the future, a program that will unquestionably advance the safety of our operations.

I should point out one thing. In the area of electronic equipment, which forms such an important part of the navigation and safe operation of the airplane, I was amazed to find, on inquiry, that that does form such an important part of our operations that with a modern jet transport you have approximately $900,000 worth of electronic equipment on board that airplane to aid its navigation and operation.

That is just almost 20 percent of the total cost of the aircraft itself. To take up the programs that we have in mind, I should say that these programs are going to relate primarily to air navigation and traffic control, terminal facilities, weather, and aircraft design.

Turning first to the air navigation and traffic control area, I will speak very briefly about VOR, because that is the basis of our air navigation system at the present time. It is a development in ground equipment which our industry has strongly supported from the time in the early fifties when the CAA first developed the equipment.

We quickly realized the great advantages of that static-free and more reliable system. We immediately proceeded to draw up the specifications and secure the building of the necessary airborne equipment. And in order to help our smaller members who operate from airports that might not get this newer equipment, we actually developed in the basement of one of our electronics experts a low-cost ground VOR which has done a great service in providing an available piece of equipment at a much reduced price.

We proceeded also—and this I hasten to point out, is not because we were regulated into doing it—we hastened to install VOR. It is not one VOR installation but two, and that is virtually a universal equipment situation on all of our airplanes now. That is good progress and we are finding the system to be much more effective and greatly improved as the result of that.

It would have been of course quite impossible to accommodate the traffic unless the CAA had developed that new equipment and also we had developed the airborne gear to go with it.

Now we have to make another step forward in that same area to aid the pilot in positioning himself, to aid controllers in making certain where he is, and that is distance measuring equipment (DME).

You, Mr. Chairman, and this committee, are very thoroughly familiar with the vicissitudes of the development of the DME, the long debate about it, and the final solution.

I suppose if we had not had the long debate we might be further along now. We have been working hard on that during the past few years in order to secure the development of safe and reliable airborne equipment.

We feel now that we are in a position to move forward at a good pace in installing DME because we are quite certain that that is going to be a valuable safety advance.

Our timetable: All jet aircraft by January 1, 1963, turboprops by July 1, 1963; pressurized piston-powered aircraft by January 1, 1964; and all other airline aircraft by January 1, 1965, for installation of DME.

Other work on the ground must accompany this, of course. At the present time only 254 of the 725 VOR ground stations are equipped with DME. The FAA has a program which they have informed us

they are going to press vigorously to have completed DME stations, plus the installation of 158 new stations by 1966.

That is a definite program on which we are working actively right now. As a matter of fact, Mr. Halaby and I will meet with manufacturers to have a discussion of this before very long.

There is one point about DME, and also it cuts across the board, and that is in finding the necessity for advanced airborne equipment it is important that other users of the airspace also move ahead in equipping themselves on conduct operations under instrument flight rules.

The airlines are relatively a minority user of the airspace, and we can jointly develop programs for better airborne equipment for the improvement of our operations, but they are not fully effective unless other users of the airspace conduct similar programs.

Mr. TIPTON. I might point out this chart which illustrates the part that airlines play as far as the ownership and operation of airplanes and the conduct of operation are concerned.

In terms of hours in the air, the airlines have 15.7 percent of the total hours. In terms of planes in the air, we have 1.7 percent of all the airplanes, active airplanes, operating.

So we are a part of the problem, obviously. But we are not by any means the whole problem.

I think planning and steps must be taken to make sure that as we go along improving, getting DME, for example, that planning be done across the board on this.

Senator MONRONEY. But isn't it a fact, Mr. Tipton, that, according to the testimony, almost all the 2,000 military aircraft are equipped and have been equipped for some time with DME?

Mr. TIPTON. Yes, I think that is the case. They have the TACAN installations in the aircraft and on the ground.

Senator MONRONEY. In other words, this serves the same distance measuring facility that DME does, except that it is made by another manufacturer and was one of the problems that messed us up for quite a while on getting DME advanced. Airlines didn't know what kind of equipment to buy because it was scrimmage between the military and the civilian ideas and the agencies that controlled them.

Mr. TIPTON. One of the inevitable results of the solution of the TACAN–DME controversy was that the airlines had to secure the development of DME-airborne equipment, because we were equipped to use VOR. Consequently, we had to secure that development. We believe we have just about done it, and that is the reason that the present program I described is feasible.

Senator MONRONEY. Your chart, however, on your general aviation fleet flying and using airways generally at 5,000 feet or below, although business aircraft and others will penetrate higher airspace, by and large about 90 percent of the general aviation fleet would fly at levels not used generally excepting in landing patterns by commercial aviation.

Mr. TIPTON. I don't know about the 90 percent, Mr. Chairman. Do you have figures on that?

Mr. SELTZER. I don't have the figures but I might point out that the reference that Mr. Tipton makes as to these aircraft being equipped is a reference to those that would participate in the IFR system as opposed to those that would be flying VFR.

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Mr. BECKER. I think this should be carried a little further. We have a lot of airplanes, scheduled airlines, particularly local service aircraft, and short haul traffic which operates below 10,000 feet. I believe your figure of about 90 percent below——

Senator MONRONEY. Below 5,000.

Mr. BECKER. I would say below 10,000.

Senator MONRONEY. I was thinking of the great mass of planes in the general aviation fleet, Piper Cubs, Pacers, Cessna 170's, Comanches, and others. Generally because of pilot comfort and just short hops, the pilots are not inclined to violate much traffic above that.

What I am trying to say is that we shouldn't wait until the development is here and when all high-performance aircraft will have these at the earliest possible time and then the other aircraft, nonpressurized, will get them quickly. We hope the general aviation fleet will have them, but I think neither you nor I will live when you will put DME on a Piper Cub. You may want it on a Comanche, or on a twin Cessna, or an Aerial Commander, but you would not ever expect to find too much of this placement on the average general aviation weekend flyer's machine.

Mr. TIPTON. I think that is entirely right. So far as the airlines are concerned, they would propose to go ahead with this program whether anybody else goes ahead with another program or not.

Our suggestion with respect to DME is for instrument flight rules. If they are going to operate on instrument flight rules we believe that they must be equipped to deal with a far more complex problem that we have now than we have had in years past. We also don't mean to say that they ought to do it tomorrow. The important thing here is that those who propose instrument flight operations plan in the direction and move in that direction because as I pointed out we find it impossible to put DME on tomorrow. But we did feel it necessary to plan positively in that direction so that at a particular time we will be done with it.

Senator MONRONEY. In other words, it is not a matter of forcing the airlines to take it; they are taking it just as rapidly as they can without even regulations being promulgated.

Mr. TIPTON. Yes, that is right. There has been no regulation promulgated. As a matter of fact, there is no regulation that requires us to have VOR, even one VOR, and there is no regulation that requires us to have two of them. Nevertheless, we have them, because that, we have found, is the way to conduct a safe and reliable operation.

Senator MONRONEY. For the benefit of the record, DME, coupled with VOR, gives you the greatest known placement of accuracy in your relationship to the ground and with your relationship to your bearing and the general progress of the plane, does it not?

Mr. TIPTON. Yes. I would ask Mr. Becker to answer that further.

Mr. BECKER. This is the system that the United States has agreed upon, and we agree with that system. There are some other systems that have been advocated to do this same type of thing. We think that this, because of several reasons, is the best system.

Senator MONRONEY. But the pilot with the DME will be able to tell with a very small degree of variation exactly his position with reference to the ground, both on his distance and on his bearing.

Mr. BECKER. Correct.

Senator MONRONEY. This, then, would enable perhaps the system, not only to be more safe but to carry a somewhat larger amount of traffic.

Mr. BECKER. It gives him a good check on his position; a better check than he has today.

Senator MONRONEY. Also, it will give him a better ETA to make greater use of scheduling acceptance of the aircraft coming into the high density traffic areas for landing, rather than holding in the immediate perimeter of these high-density airports, will it not?

Mr. BECKER. That is correct.

Senator MONRONEY. He can slow down his aircraft, he can hold over Cincinnati rather than holding over Red Bank or some place in the immediate proximity if his known time of arrival cannot be accommodated.

Mr. BECKER. That is right.

I might indicate a little further on this that DME, you see, the DME that the U.S. carriers have been putting into their airplanes, had to be developed, as Mr. Tipton said. They could not go out and buy the same equipment that the military were putting on their airplanes. The two would not fit together.

Senator MONRONEY. But the military equipment does fit into the system with the same degree of accuracy as far as the distance measuring function is concerned. As I understand it, the TACAN has some directional advantages that were deemed to be important in the military field but not necessarily so in the civilian field.

Mr. BECKER. Yes, sir.

Mr. TIPTON. To turn to another mark of improvement, and also the illustration of a further problem in these days, I would like to refer to the integrated flight instrument systems which have been installed in the new jets. They tend to solve the problems of absolute accuracy in the ability for a pilot to fly at his assigned altitude and to give him accurate airspeed information.

The improvement that I referred to has been brought about by a computer which automatically makes the necessary corrections in the instruments, for temperature, angle of flight, airflow, mach number, and installation characteristics. That is a tremendously important factor in the safe conduct of our operations, in that the movement of aircraft in the traffic control system is, of course, dependent upon accurate determination of those factors.

We have done further work on that by appointing a committee—it has been some time ago—to spend time in determining that proper techniques and standards for the inspection and maintenance of speed and altiture measuring devices and their associated systems. We are pooling the knowledge of a variety of capable men to develop these techniques in order that we can continue to make progress in this important phase of our work.

There is another part of our program which relates to the present and future use of radar in air traffic control. We have long worked with the CAA and the FAA in the development of radar procedures and the use of radar in traffic control. Of course, as is well known, the anonymity of a radar blip, and the susceptibility of the equipment to interference by weather has made it reasonably plain that some kind

of a secondary radar system is needed, and that has been plain for some time.

A number of years ago we started a proceeding toward the installation of the secondary radar system. We have on all of our jet airplanes now what is called a transponder which identifies the aircraft and indicates where the aircraft is if the appropriate equipment is on the ground.

We have worked with the FAA in testing this equipment and we have developed a further development of our transponder program in line with a time schedule. We have transponders on all of the jet aircraft at the present time. They were bought with that equipment on them.

The continuation of our program is conditioned upon implementation of the equipment on the ground. We will equip our aircraft, the turboprops, within 12 months after that has been accomplished, and our piston-powered airplanes within 24 months, and all other aircraft within 36 months.

Actually, the ground implementation of the radar beacon system has been quite slow. I believe the FAA has had a considerable problem in getting delivery of equipment with which they were satisfied.

We believe the secondary radar can make a tremendous contribution to air traffic control and to the constant improvement in safety, because it does permit absolute identification, and it will permit, if procedures are developed to use it, we believe, identification of altitude as well. Obviously not a direct identification of altitude, but nevertheless by utilizing it properly, and utilizing the codes that are available, it can give altitude information to the air traffic controller.

So we are very anxious that the FAA program on which they have been moving will be brought to a conclusion, at which time that will permit us to move forward with the airborne equipment.

Senator MONRONEY. Did you hear the testimony of the FAA air traffic management that they were fearful that this use for altitude identification might add further clutter to the radarscopes and be self-defeaing, even so far as hiding the reflected pip that would perhaps be obliterated by the magnified and enlarged version of the coded identification?

Mr. TIPTON. I would suggest that Mr. Seltzer comment on that.

Mr. SELTZER. I believe I heard some of that testimony. They have reference to the currently available equipment, and I concede that the currently available equipment has many limitations which make the use of that ground equipment somewhat undesirable to the controller.

We foresee, however, that with the acquisition of the multichannel ground decoder equipment, which FAA has on order, that this will provide additional benefits to the controller and give him a better piece of equipment than he currently has available.

Further, the FAA commented with reference to the radar beacon target size. This, too, is of disadvantage to the controller; one that we recognize. However, in recognition of some of these disadvantages, what we are suggesting as immediate uses for the beacon would take into account these disadvantages and minimize their objectionable features to the controller while at the same time deriving what safety benefits are possible.

Senator MONRONEY. To get this down to a practical application, the La Guardia approach control radarman saw the approach of an unidentified aircraft on a collision about 2 or 3 minutes, I believe, before the time we believe the collision occurred. Had the United plane been identified at this altitude, which the approach radarman would have known was conflicting, he would then have been able at least to give the plane under his control—the TWA plane—a 180° to get out of the way of the conflicting course.

Mr. SELTZER. If the controller had knowledge of this, yes. It is unfortunate that today's equipment does not present such a display to the controller.

Senator MONRONEY. What you are talking about is a possible identification. I compliment you for going beyond what present techniques call for and looking into the future. He could have quickly had the identification of the conflict in altitude as well as direction and could have at least controlled his own plane that he was working into another course.

Mr. SELTZER. Yes, sir.

Senator MONRONEY. Today, with a plane flying at high speed, with the movement across the scope, the controller would perhaps come to the conclusion that the man was far outside the altitudes at which traffic was moving into the approach areas of the two airports.

Mr. SELTZER. The controller had every reason to believe from his observation that the other aircraft would be procedurally separated from his target.

Senator MONRONEY. This gives perhaps a very good margin of safety if the man on the ground is able to read in the identification what altitude he is working while waiting on three-dimensional radar.

Mr. SELTZER. That is correct.

Mr. TIPTON. I believe that there is much work that we can do in the use of the transponder with radar equipment that they are now in the process of getting.

Senator MONRONEY. It doesn't require redesign?

Mr. TIPTON. No; they are getting it, as I understand it. I am sure we don't see now the benefits of the combination of the new ground equipment and the equipment that we have on our jets and will have in our other airplanes.

It seems to me, in discussion with my associates here, I am convinced that when that becomes available, ingenuity will permit us to establish procedures that will improve our present situations a great deal. These obstacles are there. We just have to overcome them by utilization of this new equipment, and it can be done.

Senator MONRONEY. I am told that even today, with all the codes—some 60, I believe that you have on the transponder—that manually operated, the pilot changing the code, with of course the pattern of operation on the ground being acceptable, would be able to indicate the altitude by manual control; there had been rather simple modifications to where this could be geared into his altitude, and to give this automatically as he is in these areas.

Mr. TIPTON. I don't know whether that can be done with the present ground equipment or not. Would you care to comment on that?

Mr. SELTZER. I might mention this: We have explored such possibilities, and one thing we are cautious of is not to introduce a com-

plexity for either the pilot or the controller in constantly switching altitudes with the current equipment. However, we have considered the stratification. In other words, a code for a given volume of airspace as opposed to each individual altitude to make it simpler for both pilot and controller.

I might add, Senator, that in the transponder devices that we have specified for airline aircraft, provisions are made for future acquisition of a device which will be coupled with altitude-indicating information so that the altitude, the specific altitude, is reported automatically.

Senator MONRONEY. But your position now is that you could stratify them to where traffic, say, from 5,000 to 10,000 would have a different transponder beacon than that from 10,000 to 15,000; is that correct?

Mr. SELTZER. Some such form as that, yes.

Mr. BECKER. I think that there is a degree of improvement that we can get out of the transponder today, but we have to sit down, and the FAA has to sit down and really think this out and work it out so that if you set up a different procedure you won't make things worse instead of better. This needs a lot of looking into.

Senator MONRONEY. While we are on transponders, do you agree that a modification should be in them to show that the transponder is working outside of the plane?

Mr. SELTZER. This is an item that has been considered numerous times. The end result that you seek to achieve, Senator, is that you want to know whether or not the controller who is controlling the flight is able to see you. We have had indications in some of our fleets where we carry dual transponders that both are functioning properly and one radar, but another radar is unable to see the target at all. So we would have gotten an indication in the aircraft that the device was working, yet the cognizant controller was not seeing the aircraft.

Senator MONRONEY. In other words, it has to be working perfectly at both ends?

Mr. SELTZER. Both ends of the circuit must be complete.

Senator MONRONEY. It might need a little light on the radar, also, to know whether it is picking it up?

Mr. SELTZER. Yes, sir.

Mr. TIPTON. I think the important point here is that this is an important avenue to go down. It has lots of problems in it and we have to concentrate a lot of brains and ingenuity in it, and that is what we are doing. The FAA is doing it, and we are doing it, too. We think we will have success.

To turn to another important element in the air traffic control, relating to communications, communications is the heart of the matter, getting information back and forth between air to ground in order to plan an air traffic control system.

We have worked hard on that in the airline fleet. We have for a long time static-free, very high frequency communications equipment in our aircraft. Again, I want to emphasize this as I will emphasize

some more. We did that without anybody regulating us into doing it. That has been acquired, and we have found that it is very valuable.

Another major step is, of course, the direct communications between controller and pilot. There were years when communications between controller and pilot had to go through the airline operations office, or in some cases through the FAA communications station. We have had this program for some time of direct communications between pilot and controller in order to eliminate the middleman. That has made our traffic control system much more effective. But at the same time it increased the burden upon FAA communications by a great deal, and in the process of that the industry transferred, voluntarily, to the FAA I think it was last year, possibly the year before, two megacycles of the VHF communications spectrum which we have had for many years licensed to airline communications. We gave that to the FAA for the use in air traffic control.

I don't recall—there may be some instances of this—anybody ever giving up voluntarily the possession of a radio frequency before. We believe we did the right thing and we are also proud of having done it. We believe that as part of this communications problem there are a number of things that remain to be done. The first is to continue this program of direct communications between controller and pilot, and continue that to its conclusion.

Second we believe that the FAA should, by regulation, make sure that all those operating on instrument flight rules are carrying adequate communications equipment. The FAA estimates that it will need about 300 voice channels for air traffic control purposes. At the present time military pilots have available to them only about 20 channels for this purpose, although their equipment has a great deal greater capability.

In general aviation less than half of the multiengine aircraft in this group are equipped with 50 or more channels. The air traffic control system will not work well under instrument flight rules if those who are participating in it do not have adequate communications channels.

There again I think planning must be done again, not tomorrow, but planning must be done to solve this problem over a period. Of course the solution toward which we are all pointing in the communications field is the semiautomatic or fully automatic air/ground communications, on which the FAA is working and on which I am sure they have reported to the committee.

The one issue that arose during the hearing on which there was some discussion, and on this I am going to ask Stan Seltzer to make a comment, and that relates to the wisdom or advisability of the so-called phase 1½ program as it relates to air traffic control.

Would you comment on that, Stan?

Mr. SELTZER. The criticism voiced regarding the so-called phase 1½, FAA's air traffic control computer program, is not well founded. The business machine computers currently being utilized in six air traffic control centers are commonly referred to as phase 1 computers. These computers will not be capable of serving a semiautomatic air traffic control system for which FAA is planning in phase 2 of the data-processing program.

We are informed that computers will be available in the immediate future which can handle phase 1 functions and which will have the additional capacity with certain supplementary equipment to handle phase 2 functions.

In recognition of this fact the FAA plans to install computers of this kind in the Boston Traffic Control Center in the fall of 1962. The installation is referred to as phase 1½.

In simple terms, phase 1½ describes the installation of a phase 2 computer to do a phase 1 job temporarily.

We support this action since it will permit a more rapid and efficient conversion to phase 2, and thus to the semiautomatic air traffic control system. While the phase 1½ program at Boston is a good one, we would like to caution against the natural inclination to add refinements to it the extent that it would delay the operational use of this equipment—I speak here of the computer itself—not only at Boston but at the other locations where computer equipment is now urgently needed.

Senator MONRONEY. In other words, you would favor rental of the off-the-shelf computers for these certain areas that the air traffic controllers testified are needed immediately?

Mr. SELTZER. I don't think I said that exactly. What we are saying here is that we recognize the value of the computer in the air traffic control environment. We further recognize that the off-the-shelf business-machine type computer has limited capacity, and thus it will have a limited life in the air traffic control system.

FAA's longer range program for phase 2 would require a computer of greater capacity. What we suggest, and what we support, is the idea of putting in whatever currently available computers there is, with greater capacity, to do the job today so that that same computer will be capable of being coupled in with the phase 2 job.

Senator MONRONEY. In other words, you want the most modern computer available at the earliest possible time?

Mr. SELTZER. Exactly.

Senator MONRONEY. If this happens to be the one that the FAA Research Center is working on, and which will not be tried out for 18 months, would you feel then that there was anything wrong, since this is on a rental basis and not a purchase basis, and it doesn't require any other refinements to the system excepting the automatic computation of the ETA over certain points and other data that they are now performing in the New York center, that there would be anything wrong to go ahead, use them until you get the new ones, and then turn them back to the owners and terminate your rental contract?

Mr. SELTZER. We have even suggested, Senator, the possible rental of the new computers of greater capacity, rather than purchase. We have suggested that with a larger capacity computer—the main thing that we have suggested here is that we not find ourselves in the position of being prepared to go into a further step to help the controller in updating, which is one of the vital functions he needs, and find ourselves with a computer that will not do the job and then have to delay the use of computer equipment in that facility while the new one is installed and the old one removed.

Senator MONRONEY. I am less than an expert on computers, I might admit, but if a plane for some reason or other finds itself greatly slowed down for one reason or another, because of unanticipated headwinds, flying around thunderheads or something like that, would these computers make unnecessary the close and careful watch of the area air traffic controller to feed then into the system the new ETA's and the change of schedule which this detour or delay has occasioned?

Mr. SELTZER. You have touched on one of the biggest failings of the current business machine computer. The current business machine computer has no provision whereby the controller, on line, can insert corrected data such as cited in your example. This is one of the reasons we feel that if FAA would proceed with greater capacity computers it would accept such equipment as soon as it is available, and we feel that the controller will reap a benefit at an early date.

Senator MONRONEY. In other words, if correction can be fed into the system and go all through the notice throughout the line, and immediately update the new ETA or the new course of the aircraft?

Mr. SELTZER. That is correct.

Senator MONRONEY. But the old ones will not do so?

Mr. SELTZER. That is correct.

Senator MONRONEY. It has to be done manually and corrections all down the line must be made; is that right?

Mr. SELTZER. Yes, sir.

Senator MONRONEY. I can see where that intermixture would be somewhat terrifying at times, because if someone didn't get the word manually, then you would have a possibility of a bad gap in notification of this plane's change of ETA, which could have possibly happened, when at least the arrival over Preston would be at a different time than the present computers had told the approach radar that the man would be there.

Mr. SELTZER. I believe if the details were known—I don't know all of them—I would gather that the estimate to which you refer was computed manually rather than by a controller.

Senator MONRONEY. Or he may not have gotten the word that his approach route was shortened, which was a very short time before his arrival on the heading toward Preston?

Mr. SELTZER. That is correct. I don't think the computer in that case was of any use to the controller.

Senator MORONEY. But when the change of routing was given, if the man giving that change was compelled to feed that into the computer or to notify everybody concerned, he would have had a little better knowledge at the landing end of when this plane was coming in?

Mr. SELTZER. If he had the availability equipment to do that, I think it would be of help.

Mr. TIPTON. Now to turn for a very brief report on our voluntary IFR program, as you will recall, Senator——

Senator MONRONEY. Before you leave communications, could I have your comment on some of these glamour-girl systems such as automatic printers that they are apparently working on now, to avoid again the chance of error or the pilot hearing wrong, or writing wrong, if this automatic printer communication could go into the cockpit.

Mr. SELTZER. We have conducted various staff studies to explore the practicality and feasibility of such devices, and we frankly are very much interested in the possibility of applying such devices to the traffic control system.

One thing, too, that we feel should not be overlooked in that regard is the fact that if you supply the automatic data link to which we were referring here—automatic communications—that such communication system must be capable of working with any kind of automated computer system or data-processing system which the controller has. Unless that is done, we will only complicate the controller's job by piling upon him heeps of communications which he cannot handle.

Senator MONRONEY. You do have, however—I noticed in the photographs submitted by the navigators in their testimony—three systems which are quite large and apparently quite cumbersome, where they do have automatic communications, typewritten, from ground to plane?

Mr. SELTZER. Yes, sir; that is correct. In fact, some airline aircraft—not domestic aircraft, however—do have a receiving teletype. FAA, I believe, demonstrated to you, at least showed the committee, a very small device capable of installation in a three-inch hole in the cockpit panel, which is a miniaturized teletype and is capable of being used on an existing channel. This to us has possibilities.

Senator MONRONEY. You may proceed.

Mr. TIPTON. You may recall we reported our voluntary IFR program to the committee some years ago. It is a system by which airline aircraft, even in contact weather, operate under instrument flight rules. That was a gradual program which came down in various steps. In 1957 all aircraft above 18,000 feet were placed under IFR; in May 1958, the floor was reduced to 10,000 feet; in July 1959 the program was further advanced by voluntary elimination of visual flight rule climbs or descents at or above 10,000 feet. And the next step, which is now in process, will reduce the altitude floor to 5,000 feet. That has involved us in no end of difficulty, and I am sure it has imposed some additional or considerable additional workload on the air traffic control system.

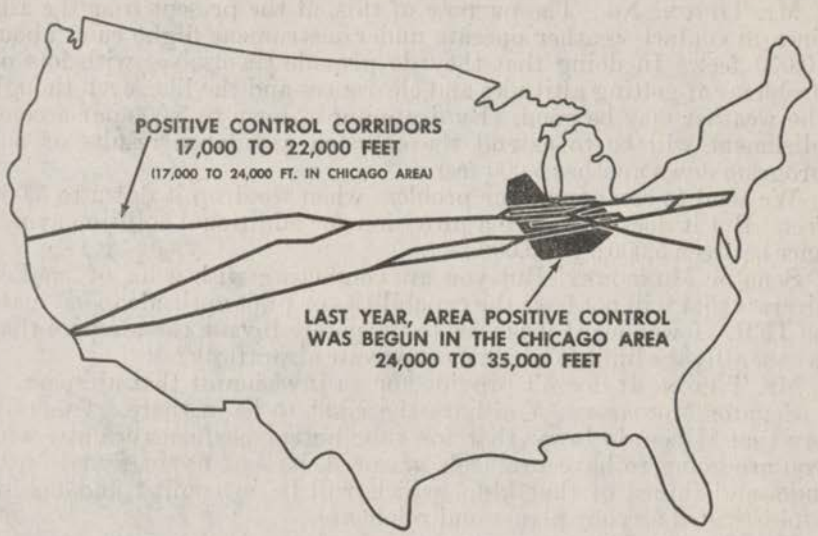
But it unquestionably, in our opinion, does provide additional margin of safety insofar as airline aircraft are concerned. The program covers only airline aircraft, but many business and military aircraft follow the same course.

As we have had occasion to testify before, we believe that the ultimate solution to this problem does require positive control. We have made, as has been reported to the committee, some progress in that direction. Experimentation is now being conducted in the Chicago/Indianapolis area which we understand, or at least based on our own experience, is working very effectively.

(The map referred to follows:)

CHART 5

THE POSITIVE CONTROL PICTURE—1961



Mr. TIPTON. We might take a look at the chart that is on the stand at the present time which indicates the present positive control corridor, from 17,000 to 22,000 feet, extending across the country, and then an experiment in the shaded area around Chicago and Indianapolis, between 24,000 and 35,000 feet.

We think progress is being made, and we think that that is the way in which progress can be made, to move up on positive control in those areas where it seems to be particularly necessary and feasible at any time. Gradually, we will come to the conclusion that we think is right. Inevitably there will be large areas in the country where instrument flight rules or positive control in contact weather is not applicable because there will be many aircraft, and we are sure there will always be many aircraft, which have no interest in participating in operations in areas requiring this kind of control.

I think it is important that it be recognized that our strong recommedations over this long period for positive control were not made for the purpose of denying the right of airspace to somebody else, but to provide for safe transportation. We think those objectives are quite consistent, and all it requires is a continuation, and hopefully an expedition of the work that has already been done and the achievements already made.

Senator MONRONEY. While we are on this, I notice you say you may lower the floor to 5,000 feet. This is to get apparently more clear IFR clearances so that you will not have the succeeding ground rules, the waiting for scarce altitudes that can be assigned at the more limited layer of space at 17,000 to 23,000, and so on.

Mr. TIPTON. No. The purpose of this, at the present time the airlines in contact weather operate under instrument flight rules about 10,000 feet. In doing that they do provide themselves with lots of problems of getting altitudes and clearances and the like, even though the weather may be good. By dropping it down to 5,000 our accomplishment will be to extend the collision avoidance results of our program down another 5,000 feet.

We tend to compound our problem when we drop it down to 5,000 feet. But it does introduce a provision for additional collision avoidance between 5,000 and 10,000 feet.

Senator MONRONEY. But you are conflicting with a lot of smaller aircraft that will not have the capabilities or pilot aptitude to navigate on IFR. I wonder if it is wise to purposely invade the airspace that is generally the limit to which most private aircraft fly?

Mr. TIPTON. It doesn't provide for an invasion of that airspace.

Senator MONRONEY. You have the right to be in there. I merely say that if you do lower that for your higher-performance aircraft, you are going to have problems of speed, lack of navigational aptitude, and things of that kind, which will be in conflict and not so sophisticated as your planes and pilots are.

Mr. TIPTON. This program applies only to airline traffic.

Senator MONRONEY. I know, but if you put a jet or Electra at 5,000 feet, you are going to scare the dickens out of a lot of Pipers and Cessnas and all. If you look up suddenly and here comes head on an Electra, and your plane is not fast enough to get out of the way, you hope the Electra is fast enough to get out of your way.

Mr. TIPTON. We are not going to put him there if we can help it. But if we do put him there, the program applies. A jet, as you know, we can get a jet out of that area just as fas as we can get them. And other aircraft, also. But we do operate largely in approach and takeoff in the area from 5,000 to 10,000 feet.

Senator MONRONEY. That is understandable. But then he is supposed to be coming in under radar, we hope, approach radar, in many places, and we hope under very close surveillance, at least. I hope in these steps—and I will be greatly concerned—if the high performance aircraft is going to be cleared to go from Oklahoma City to New York, say, some day at 5,000 feet, I don't want to be flying there.

Mr. TIPTON. Mr. Becker?

Mr. BECKER. Maybe I can clarify this a little, Senator. Today we have airplanes, jets and turboprops, DC–7's, DC–6's, Constellations, and so forth, flying at altitudes generally above 10,000 to 15,000 feet. This program that we entered into several years ago provided protection between those scheduled airline aircraft. It only separated and provided additional safety one airline aircraft from another airline aircraft, and in addition, to the extent that the military and the business aircraft went into the same type of program, it provided safety from them as well.

Now, when we reduce that floor to 5,000 feet—in other words, say, all airline aircraft operating at 5,000 feet and above—all it does is pick up some other airplanes that fly down there anyway—DC–3's, F–27's, Convairs, and that type of aircraft. And then again it only protects one of those airplanes from another one of those airplanes flown by a scheduled airline aircraft crew.

Senator MONRONEY. It has that effect. But it has the effect of putting high performance aircraft—your jets and Electras on a short hop at 5,000 feet. They don't have to get up. They do as well at 5,000 feet as they do at 20,000. If instead of waiting an hour for clearance at 15,000 feet, these boys take a clearance at 5,000 feet, there is going to be an awful lot of small aircraft blown out of the sky by even the prop wash.

Mr. BECKER. But they can do that, today. Today or yesterday, an Electra airplane could fly at 5,000 feet without clearance.

Senator MONRONEY. That is right, but under IFR clearance system, under the voluntary program, you are keeping them at a higher altitude.

Mr. BECKER. No, that is where you are wrong, I think, sir. Today, if I am in an Electra and I want to fly from Miami to Jacksonville, I can fly at 5,000 feet, 4,000 feet, or 8,000 feet, VFR.

Senator MONRONEY. That is right, but you don't have any airline pilots flying VFR?

Mr. BECKER. Oh, yes, we do. They are not required to fly IFR. They are only required to fly IFR if they go above 10,000 feet. If they wish to stay below 10,000 feet and fly VFR, fine.

Senator MONRONEY. I thought all flights were supposed to be cleared on IFR?

Mr. BECKER. No, sir.

Senator MONRONEY. Excepting feeder flights.

Mr. BECKER. No, sir.

Mr. TIPTON. That is this program, this gradually dropping down, which involves the IFR.

Senator MONRONEY. Let me ask you another question. I read an interesting article in the morning Times where we were able to monitor several airways at one time with the monitoring aircraft that the FAA has. In other words, they could fly one path and check the beams of several. What I want to know about this, of your lines, and I presume that is your single traffic lines that go out there—a single-track road, you might say—a double-track road because you are flying on one side of the beam going one way and the other side of the beam going the other—will it be possible, as we have air cargo and other greater uses of air lanes, we hope, to use these same beams with directional finding equipment to where lane A would be the primary lane on the right, lane B would be the primary lane, we will say, on the left; but you could move over 6 miles and take lane B on the right, and lane B on the left, and therefore you would be able to four-track the airways without any additional installation of airway beacons by merely having some directional-finding equipment in the cockpit that would give you the beam that you were so far off the regualr course?

Mr. JENSEN. I would like to comment on that.

In the first place, your initial comment on flight inspection: These tracks that the flight inspection aircraft are flying are for the purpose—as you indicated—of checking the facilities on the ground, and I don't think that need be mixed in with your additional question about flying lanes.

I think that second question——

Senator MONRONEY. I merely mention that as an electronic breakthrough that they can locate these beams from one flight path.

Mr. JENSEN. As to whether or not you can establish parallel tracks at the moment with VOR alone, the system radiates out from the VOR stations in such a way that there is not a readily available facility for doing this job unless further equipment than just the VOR is put in the airplane.

If we go to putting in the distance measuring equipment, this provides a little more flexibility in determining our position, but still doesn't in itself provide this facility of flying parallel tracks.

There is the additional thing that can be installed, which you saw in the early days of the hearing, a pictorial display. There is another aid called a course line computer which is somewhat different in principle than a pictorial display, but also—either one of these devices, pictorial display or course line computer would permit, with proper procedures and all the rest, the establishment of parallel tracks of the type you describe.

Senator MONRONEY. Don't you anticipate that may become necessary, particularly on some routes, within the next few years?

Mr. JENSEN. I wouldn't want to put a time period on it. It depends on the amount of traffic and the facilities available and the routes that are now available based on VOR. But it is my personal view that the day will come when we will make use of this type of procedure of parallel tracks in the air traffic control system.

Senator MONRONEY. When the electronics are whipped it will be just as safe as if you were going out and building a separate highway or separate lane; is that correct?

Mr. JENSEN. Actually, I think it will provide great utility and the flexibility it would make available to the traffic controller and the pilot, to go where he wants to go, without some of the complexity now involved in some of these terminal areas that you have heard about many times during these hearings.

Senator MONRONEY. That may be one of the reasons you would need a high-speed computer, to be able to carry that double load along that same one beaten track.

Mr. JENSEN. Actually, in some of the equipment I mentioned, there is a computer in the airplane which helps out in these problems.

Senator MONRONEY. Thank you.

Mr. TIPTON. Also I might add to that that this is going to also require the radar improvements that the FAA contemplates and about which we have had some discussion already.

Senator MONRONEY. Doesn't your area radar cover a pretty broad span? It just doesn't focus on one airway. You get a good deal of territory off on each side, 50 or 75 miles.

Mr. SELTZER. Yes; that is correct. Mr. Tipton had reference to the improvements in the air traffic control beacon system.

Mr. TIPTON. Now on our work on the collision avoidance system: As we have said before and say again, the avoidance of midair collision is a fail-safe, positive air traffic control system. Nevertheless, as a supplement to that, we are very anxious to have developed a collision avoidance device that can operate independently of the air traffic control system. We are finding that extremely hard. The reason it is hard is that the equipment must continually gather data on all aircraft in the vicinity, sort it out, analyze the potential threat created by each aircraft, and, if necessary, predict the evasive maneuver that is involved. It mustn't interfere with the air traffic control system. That is a tough set of specifications to meet.

We have worked on the problem through a special committee. The FAA has been working on it through the Collision Prevention Advisory Group. They are working on it now. There is some indication that this work will soon begin to bear some fruit in the development of equipment which offers the promise of doing at least part of this collision avoidance job. We can't make any positive predictions on that as yet. We only report that work is actively being done, and we hope it can be successful.

Senator MONRONEY. Both of the lines they are working on, however, would entail, for the use of it to the maximum degree, that both aircraft have the anticollision equipment.

Mr. TIPTON. That is correct.

Senator MONRONEY. In other words, you use the ground bounce on one system that is undergoing study, and on another ultra-high-frequency radio beam that is picked up on an instrument from one plane on the instruments of another plane?

Mr. TIPTON. That is right.

We started off to achieve the other result, in which the equipment on board one airplane would not require, to be effective, equipment on the other airplanes in the vicinity. On that, up to now, we have completely broken our pick.

We turn now to airports, and I won't say much about that because I assume our committee will be having hearings on the airport problem. We can just say that it is completely clear that constant airport improvement is a very important factor in the maintenance of safety in aviation. I hope that we can continue to make that kind of progress.

Senator MONRONEY. I hate to delay the hearing, but don't you find that in your estimate of air safety, in the instance of damage to aircraft and loss of life, that terminal area accidents are still the most prevalent of all accidents? This is a major point where air safety begins and where air safety ends.

Mr. TIPTON. Yes; I think that is true.

Senator MONRONEY. Your lack of comment on it is more or less to reserve it to a later time rather than to diminish its vast importance in the scheme of air safety?

Mr. TIPTON. That is exactly right. In failing to discuss that any further, or emphasize its importance, I just reserve it for a later time.

Senator MONRONEY. Before leaving this terminal area, there are two or three things that are quite important.

I think the Airline Pilots raised a rather significant point when they mentioned that perhaps the certification of airports directly by the FAA as class A, B, C, and D, and the threat to withdraw these various

categories of ratings in order to effect and speed up improvements in vitally needed areas affecting air safety, might be one device where we can bring the local municipal governing body or subsidiary in control of the airports up to standards without taking catastrophic action and the FAA notifying the airlines that they are not to fly into this airport, period.

It seems to me, as a citizen who knows something more than just casually about politics, that perhaps a prewarning of Airport A at Schenectady, or some other city that they are about to lose their grade A rating unless certain things are done to remove obstructions or to lengthen runways or to improve firefighting equipment or a lot of things that would be important additions to air safety that had been overdue and long delayed or ignored in various requests, that you could effect the minor changes and less expensive installations by the public opinion of the city. To let it go until it is so dangerous before you communicate with the people of the city who are paying the expense of the airport, by threatening to withdraw all air traffic out of there, scheduled airline traffic out of there, it is too late then. It may take 4, 5, or 6 months to effectuate the necessary improvement that could be made in a shorter time if you had some way of warning them of the deteriorating condition of the airport.

Mr. BECKER. Of course, the Federal Aviation Act and the Civil Aeronautics Act preceding it provided for the certification of airports by the Agency. This has never been done. The question as to whether it should or should not be done—I am now speaking of certification of the airport, with the right to withdraw that certification—whether or not that is appropriate, we haven't thought much about recently. But I would like to draw the attention of the committee to the fact that today, before an airline can use an airport, a scheduled airline can use an airport—this does not apply to nonscheduled operations—a scheduled airline before it can use an airport, that airport has to be approved in all respects by the FAA. This goes to runway, taxiways, ramp areas, safety precautions for the passengers boarding the aircraft, et cetera, insofar as the safety items are concerned. This does not apply to the terminal, how plush the seats are, how many cigarettes you can buy, and that sort of thing.

Any time the FAA, through its inspections, which are periodic, of these airports, feels that an airport should not be utilized by an airline, it can take action. It has several ways of taking action. It can in emergency suspend operations into that airport, or it can ask the airline to delete that airport from its certificate. It can take action, or it can take action before the CAB.

But there is another thing that today is required of an airline when it gets a certificate: it is responsible to see that that airport remains safe for its operation. In other words, if a chuckhole should develop in the middle of a runway overnight—and they have in our roads here, of course; and this could happen, and has happened on airports—or a runway starts to break up, and the responsibility, notwithstanding whether an FAA inspector is involved, the responsibility is on the airline to stop its operation. And this has been done.

This is the extent to which we operate today.

Senator MONRONEY. You have, is seems to me, a sort of a gap in the positive radar handoff, so to speak, from items that are less than

safe but not as extremely and apparently dangerous as a big hole in the center of a runway. In other words, I can name a dozen different airports where municipal councils and airport commissions and others have dillydallied over installing high-intensity approach lighting, proper runway lighting, removal of obstacles from the end of the runways, maintenance of inadequate overrun or underrun, blast fences, and things of that kind, to where it seems to me that we are getting into an area where you have some need for communication, and to make that communication and criticism of the airport condition effective by less than the catastrophic announcement that sudden death will occur on the airline service of all certificated airlines if this is not done tomorrow afternoon.

What I am trying to do is only to flash a warning so that it moves from the realm of "mañana" and postponement, or we can get by with this another year and we will take care of it with next year's budget, until you get right up on the front step, get it before the people of the city, if necessary through a release to the newspaper that the airport is going to be downgraded if certain things are not met and met promptly, to give you a definite spur of action by your Federal authorities who must know of the existence of these things that are less than safe on many of our municipal airports.

Mr. TIPTON. There isn't any doubt that the present machinery for assuring safety of operation on airports is affected. We don't operate there any more, or we operate very light loaded.

Senator MONRONEY. But it is sudden death as far as the airline service is concerned, when there is no intermediate warning or punishment.

Besides that I was shocked to hear the FAA say that their only means of enforcement was through the airlines themselves. You are the poor guys who have to pay the landing fees, and obstinate or enforcement action by you might lead to retaliation by raising landing fees or removal of an airline's boarding gate to the north end of the field. It seems to me that we are shirking our duty and responsibility for air safety to say that we are not big enough to enforce this, or even spur it on with greater speed, but that we must rely on the airport user, who is at the mercy of this very commission, to be our enforcing agent.

Mr. TIPTON. As Mr. Becker has pointed out, we haven't reviewed this recently. I would be reluctant to take a position one way or another on it without thinking about it some more. But we had better start thinking about it, because there is no question that the situation you have outlined is a right one, and that certification is provided for in the law, and it is an important matter for FAA consideration, it seems to us.

Mr. BECKER. May I say one other thing, Senator.

I think it might be wise. You indicate the number of accidents or percentage of accidents in the terminal area, and it is relatively high. A very brief look at it puts the percentage of airline accidents, fatal and nonfatal, over the year 1960 in the area between 30 and 35 percent of all accidents. That would include some accidents in Alaska, where airports, some of the them, are pretty primitive.

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Senator MONRONEY. This is so simple to solve, and yet you have year after year this continually steady impact of inadequate ground facilities for takeoff and landing that add to our accident exposure. And just by the grace of God you didn't climb about 50 percent in your traffic fatalities because people were able to walk away from the Mexican DC–8 takeoff crash and the Electra crash going into La Guardia. These would have made your accident record look entirely different if it hadn't been for the heroic action of the crew in the Electra short landing at La Guardia, or in the failure to get the DC–8 off the runway and into the blast fence at Idlewild.

While we are on the terminal area, I would like to know the attitude of the Air Transport Association that if in the interests of air safety greater separation of landing fields, airports, is required, would you then be prepared to use these airports if they had to be built 25 miles or up to a maximum of 50 miles away from our high density traffic areas?

Mr. TIPTON. That would present, I think, very hard problems. Not for airlines, particularly, but for the people who tried to use them. Our objective has been to shorten the time between where the fellow wants to go, which is downtown, and the place where he gets on his airplane.

If it were essential to the interests of safety that they be put well out, then I would be reasonably sure we would not object. But I think that we must work in the direction of perfecting our air traffic control system so as to preserve and maintain the convenience of passengers and shippers and, at the same time, maintain a high standard of safety.

I would hate to contemplate the necessity of putting our airports, say, 50 miles from the place where people were going, because then you have ground transportation problems. If you use air transportation for the remainder of the journey, helicopters or other similar type aircraft, you would create a further traffic problem in moving these high volumes of people to these outlying areas.

I believe that with constant attention to the air traffic control problem—and there is constant improvement—that we can avoid taking such extreme measures to maintain a proper level of safety.

Senator MONRONEY. I wish I could be that hopeful. I don't have quite that much faith in our electronic inventors that you can continue to crowd the physical limitations of airspace with more and more flights which will be required.

We know traffic is going to grow. We have air cargo coming in; we have more and more planes with higher performance coming in. And I think we are less than realistic if we don't realize that there will have to be more airports built to accommodate these.

Merely building airports without building the airspace around them doesn't solve the question. It merely complicates the problems of air traffic control by more and more entry of more and more traffic into the same amount of airspace. The only way that I know that you can enlarge that airspace is to do what was done with Dulles International. People will squawk to high heaven because it is quite a way out. What is the distance?

Mr. BECKER. About 20-odd miles.

Senator MONRONEY. But you brought in a lot of new airspace into the landing pattern around Washington. You got it out of conflict with Bolling, Anacostia, Andrews, Washington International, and Friendship.

This will be an interesting test operation, at least, to see how the public will accept the transportation and what can be done through high-speed highways, limited-access highways, to shorten the ground time, even though you have increased the distance of the airport from the center of the city.

Mr. TIPTON. I must say, in answer to your question, I would focus a little bit on the 50-mile figure, which is farther than you would like to consider from the center of the city. I think that we will, unquestionably, need additional airports as time passes. Our progress has been in that direction. And they do have to be fitted into traffic control patterns. Where that will lead us I am sure none of us can quite tell. But I think that that is one of the reasons we must concentrate on maximum improvement of air traffic control, in order to maintain our airports as conveniently to the city as we can and at the same time maintain a proper level of safety.

I don't know that you and I are in disagreement in what we are thinking.

Senator MONRONEY. I think we are to as the urgency of this. I am taking New York, for example, as being the most crowded air traffic center, and the one that will continue to increase in the development of traffic more than any other place. You say it may come in a few years. I think it is going to take 5 years at a minimum from the time you turn the first spade of earth, let alone quieting the taxpayers down. That has to come even before that time.

But 5 years from the time you start moving ground before the planes will be landing on them.

We know what this traffic volume is going to be, and how it has increased. Today is actually too late, I think, for New York to be digging the ground on its next airport. I think you are going to increasingly run into compromises with limited airspace, or limitation on airline schedules, diversion of traffic, unless something is done to correct it in that area.

I think the same thing is true of Chicago, and it is true of Los Angeles. I don't think Los Angeles International can possibly accept the traffic that is going to be coming in there. You will have to go out to Ontario or someplace to get another airport.

You have conditions at Miami where you can wait 2 hours for takeoff now.

I feel that we are lagging tremendously in our planning for what we know will be there at the time the airport can be completed under a full draft. With all the money in the world you can't buy time. We have crowded all the money that is necessary into Dulles and we are still 18 months away from using it for landings.

Mr. BECKER. For the first time a step was taken in the area that you are talking about when this committee—and you personally—put in the bill that developed and resulted in the Federal Aviation Act of 1958, because that was the first bill and first legislation that gave an agency of the Federal Government authority to disapprove, in some cases directly and in other cases through indirect methods, the location

of an airport from an airspace point of view. That has been with us 2 years. We think it has been very helpful and we think it will be more helpful as time goes on.

But that was the first time that there was any grasp of this situation. Your point, I am sure is that, yes; but let's get on with it.

Senator MONRONEY. Not only that but I see down the road where I will come in a direct collision course with the ATA and the airline operators because I think our committee is going to be increasingly concerned with the ever-increasing volume of traffic that must go into these high density traffic areas, with the irregular delays that occur.

I mean we are not raising airspace formally, but sitting on a runway 2 and 3 hours for clearance to get off, as you do sometimes in the peak hours at New York, you are actually limiting the schedules that are going off at peak hours.

These things have to be regularized. If you can't do them with the additional airspace and additional airports, then they may have to be done by giving someone the authority to say that these schedules must be made on a basis that the system can stand at the peak hours and that some peak traffic must move to less desirable hours because the system can't carry it, or that the planes can't all get off at 5 or 6 o'clock as their schedules call for, and if you are really going on this flight, come out at 7 and save the passengers the inconvenience of waiting at the end of a runway for the clearance of the flight to go from New York to Washington, or vice versa.

I think we have a problem there that sooner or later we are going to have to move on. It is awfully hard for one airline voluntarily to say I am not going to put any more flights into New York because the system won't carry them, and then find its competitors scheduling two flights at that hour.

Mr. TIPTON. That is a very tough problem. The only machinery that we have now, and the only machinery that at least I see can be useful in this area, is our air traffic control system which controls the flow of traffic and prevents getting undue density in a particular area at a particular time.

The effect of that, of course, is to cause schedules to be delayed, to sit on the ground. I am very conscious of that. I did it in New York the day before yesterday, where I spent 3 hours and finally gave up, and just as I gave up the pilot got his clearance, they slammed the door, and away he went.

But it seems the only feasible way to do it now because these peaks are created not by airlines but by people who want to go some place at a particular time, or come back at a particular time. We have never had any success in trying to correct the habits of the American public. They want to do what they want to do. Of course, a very high percentage of the time it all works.

If there isn't instrument weather, it is a pretty good day and a pretty good flight, it works and the passengers' convenience is accommodated. Ever so often we get one of these situations where it doesn't work. The question is, should we take some steps based on those times when it doesn't work and inconvenience passengers at the times when it does work? An increasingly high percentage of our flights are completing their operations with 15 to 20 minutes of on-time.

It presents us with a problem as to what to do about those people. We suffer acutely in these instrument operations where delays take place. We not only suffer from complaints, but also, of course, economically.

I don't know what the course of action is that can be followed, other than improvement of the air traffic control system. In this connection, I would like to include at the end of our prepared statement, our views on this matter.

Senator MONRONEY. The air traffic control system can only handle that which it is capable of handling. The question arises, how long a queue are we going to have line up clear back to the terminal of planes waiting to takeoff at a scheduled hour that experience shows us will not be met? I get a little burned up to hear the loudspeaker come on with an announcement that there will be an hour delay because of air traffic control. The hour delay is because they have scheduled more flights than the airline itself knows from experience will get off at that hour.

Mr. BECKER. We have a problem here that you recognize from some of the statements you have made during this hearing, and that is the fact that a scheduled airline is only a portion of the flights in this area. There are military flights, private aircraft, national business association aircraft, and it is an across-the-board problem.

In the New York area—we have some figures on this—the amount of traffic into the area from both a scheduled and nonscheduled point of view into the Port Authority airports has reduced 1960 over 1959. There are less flights going in there today.

Senator MONRONEY. Is that ATA membership, or is that international as well?

Mr. BECKER. This is all flights. We have some figures if it would be helpful to the committee, as an indication of how it is running.

As you no doubt know, we have had a scheduling committee for La Guardia for some 13 years. We reduced the scheduled airlines, U.S.-ATA members schedules, into La Guardia Airport starting about 1948. We had to reduce the schedules because we had this problem that you are talking about. We moved flights at that time over to Newark, and since then some of them have moved to Idlewild.

We found, though, early in the game, as soon as we pulled our flights out, that the nonskeds and the general aviation filled the slots, so we weren't any better off as an industry than we were before.

This, of course, has been greatly relieved in the New York area because of the later use of Idlewild Airport. But the fact is that as soon as we pull out schedules, somebody else puts them in. So it is someone—if we are going that way—someone has to take the bull by the horns and tell a lot of other people that they can't fly on certain days. This is a real difficult problem in our way of life.

Stan Seltzer has some figures which may be helpful, or at least will give an indication of how it has been going in the last year and a half.

Mr. SELTZER. These figures, Senator, were taken from FAA traffic activity reports per calendar year 1959 and calendar year 1960.

Airline operations into La Guardia, as an example, during 1959, totaled slightly over 206,000 flights for the year. During 1960, these numbers were reduced to 173,000.

Senator MONRONEY. There was a temporary diversion there, wasn't there, due to the work?

Mr. SELTZER. This is partially due to the work where the traffic was minimized to help that situation.

Senator MONRONEY. And diverted to Newark and Idlewild?

Mr. SELTZER. Some of them went over. I would point out that while Idlewild increased, Newark decreased. During 1959 Newark traffic decreased by some 11,000 flights of the airlines, while at the same time other than airline traffic increased from 25,000 to 47,000 or 48,000.

The same thing happened at La Guardia. During 1959 La Guardia had nonairline traffic totaling over 68,000 flights, and during 1960 the year the airline traffic decreased the nonairline traffic increased to over 69,000.

Senator MONRONEY. That is 1,000?

Mr. SELTZER. Yes, sir. In Idlewild, there was an increase from 30,000 of the nonairline traffic in 1959 to 35,000 in 1960.

Senator MONRONEY. What was the airline increase?

Mr. SELTZER. The airline increase at Idlewild in 1959 was 209,000, and in 1960, 239,000.

The total traffic movements, as we have computed them here, based on——

Senator MONRONEY. I didn't get Newark.

Mr. SELTZER. The Newark figures, airline, 151,000 for 1959, and 140,000 for 1960. Nonairline traffic at Newark, 1959, 25,000; 1960, 47,000.

Senator MONRONEY. Teterboro?

Mr. SELTZER. Teterboro has no scheduled airline traffic at all. The total traffic for 1959 was 224,000, and for 1960, 220,000.

Senator MONRONEY. It actually went down while the others went up?

Mr. SELTZER. Yes, sir. Incidentally, Senator, I noted in the FAA report from which these figures were taken that they had some general comment to the effect that total landings and takeoffs during fiscal year 1960 had gone down some 2 percent as I recall the figure.

Mr. TIPTON. In the New York area?

Mr. SELTZER. I don't mean to imply it is New York. Across the board in the United States.

Senator MONRONEY. Of course, you have high performance aircraft carrying more passengers in fewer planes.

Mr. SELTZER. That is correct.

Senator MONRONEY. The thorny problem is whether certain extremely high density airports couldn't be reserved to the scheduled airline traffic alone, and that will be facing us one of these days because there seems to be no other way to where you can divert the traffic. Teterboro, I would assume, has improved in its service in the period of a year. I understand they do all they can to encourage private aircraft to use it, while they do all they can, within the limits of insults and lack of service and a few other things, to discourage the use of Idlewild and La Guardia. But it still doesn't seem to keep them away.

Mr. SELTZER. I happen to have the total New York area traffic figures, which include La Guardia, Idlewild, Newark, and Teterboro for 1959, if you would like to have those.

Senator MONRONEY. I would like to have those.

Mr. SELTZER. The total for the Metropolitan New York area for these named airports totals 926,000; and the total for 1960 strangely enough, was also 926,000 for these same airports. It is within 150 or 200 of being identical there, Senator.

Meanwhile, the airline traffic for the same period at these airports was 566,000 for 1959, and went down to 553,000 for 1960.

Senator MONRONEY. I am glad to have those figures in the record.

Mr. SELTZER. I want to point out here, I also have the figures which show that the nonairline total for these same New York airports in 1959 was 359,000, and for 1960 it was 372,000.

Mr. BECKER. With respect, Senator, just to Idlewild and La Guardia—just taking those two airports—the domestic commercial movements—that is, airlines—reduced about 1.8 percent; by about 5,000 flights. The oversea commercial movements reduced about 2.1 percent, about 1,000 flights. The noncommercial movements into these two airports increased 3.6 percent, or an additional total of over 2,000.

The total plane movements into those two airports combined has reduced about 1 percent. That is commercial and noncommercial in the year period.

Senator MONRONEY. You may proceed.

Mr. TIPTON. I have a few more comments concerning the ground facilities in the terminal area. One relates to control tower service. Our carriers served about 570 airports. Of those some 250 are provided with control tower service. We regard it as extremely important that that percentage of control tower service to the airline-served airports be increased as rapidly as we can. I don't believe I need argue that at length. The control tower on these airports is of great importance.

Another further element, which is in some respects related, is the establishment of control zones around airports. Air traffic control separation is only available in controlled airspace. There are a number of airports which are not in control zones, and, therefore, air traffic control protection is not available. We hope that progress can be made in designating these airports as controlled zones in order to maintain safety of instrument approaches.

Lights are another area to which we have devoted a great deal of attention, and we hope great progress can be made. We have already had some discussion of that because, as you point out, as far as runway lighting is concerned, to some extent approach lighting does depend upon the action of the individual municipality or airport authority that has control over the airport.

Senator MONRONEY. Now that we have tested both the high intensity and centerline approach systems, we have adopted the system after intensive tests at Atlantic City, and we have improved the runway lighting, is there any reason in the world for not getting on with the job?

Mr. TIPTON. I would like to have Walt Jensen comment on that. He has devoted a very high percentage of his waking hours to that question for a very long time.

Mr. JENSEN. Let's take them up in order. I think you mentioned approach lighting first. I see no reason, with the present state of

affairs, that there need be anything else done but to implement it, as you said. The standard has been approved for several years, and the job is to get on with putting the lights in. Insofar as——

Senator MONRONEY. And getting the easement on the property to hang them on to.

Mr. JENSEN. That is part of it; the major difficulty in many areas of getting the lights in. That is part of the job that must be done.

Senator MONRONEY. And this is where you have a divided, split personality. You have a municipal authority of some kind that is charged with getting this, and while we supply I think all the cost on approach lighting, do we not?

Mr. JENSEN. The equipment is purchased by the Federal Government and the installation, the land for the installation, as I understand is a problem for the local municipality.

Senator MONRONEY. We have advocated many times that if the municipality doesn't furnish it, we should go out and acquire the land by eminent domain, condemnation, easements, or whatever method is necessary, and then take the cost out of the next allocation of Federal funds that go to the airport so that we could get some way to break this bottleneck of resistance to the minor cost perhaps of land acquisition.

Mr. JENSEN. I must add, to be fair about this, that I think the approach light system is looking better. There is this problem of getting land. It has caused a considerable problem at certain individual airports. It has been cleared up at some of the most difficult ones recently, and lights are going in.

The FAA budget has been increased to get lights. There are more of them coming through. I think the approach light situation is looking better than it did a year ago when we were here.

Senator MONRONEY. And we will have standard systems so that a pilot will not have to adjust 8 or 10 different times during the course of a cross-country flight to a different kind of approach lighting on each airport that he goes into.

Mr. JENSEN. All of the new ones that are going in are in accordance with the standard, to the best of my knowledge. There is no exception to that. The ones that they replace have been in many cases nonstandard and we are getting a better picture all the time. However, it will take time to finally remove the last of the old left-hand row systems and any other systems that don't conform to the standard.

But this is progressing, and FAA will have to comment as to when they would anticipate full standardization.

Senator MONRONEY. Do you consider, as a representative of the industry, that approach lighting off of only one end of the instrument runway is adequate?

Mr. JENSEN. No, sir. I think it was in one of the hearings in the Capitol Building of your committee, I believe, that I brought approach plates from London and from Idlewild and pointed out to the committee the difference between the facilities available at two ends of one of the international operator's runs.

I think this was a rather dramatic difference between what we had in the United States, and it has been mentioned again in this hearing, the difference between what we had and they have.

Since that time an additional ILS, with a full set of standard approach lights, has been put in at Idlewild and at Newark. As you were told, a system is now in the process of being installed at La Guardia. There are multiple systems going in at other airports around the country to the maximum of two per airport. This may not be enough, and probably isn't enough at some of the major airports. But this is a problem of catching up.

I presume it is logical to put two in at many of the larger airports before we try to get a third one in.

Senator MONRONEY. Two are certainly better than one, and one is better than none, of course. But it seems to me that in most places your wind will generally be from one general heading, either going north or south, and that if you are going to have that many instrument runways, then they ought to be lighted on both ends to be adequate.

Mr. JENSEN. Insofar as visual glide paths, I think it is understood by now that these are primarily important guidance in the vertical plane, and that they are supplemental to the guidance of the approach lighting system and not a replacement for it. I want to emphasize that because earlier in the hearings there was a little misunderstanding or possible misunderstanding about that.

Senator MONRONEY. That came about because we were told that this runway where the Electra had its short landing—I have forgotten the number of it; it is the northeast-southwest——

Mr. JENSEN. Thirty-one.

Senator MONRONEY (continuing). That we were only going to have the visual glide, and even now it is not contemplating putting on that busy airport high intensity centerline lighting, although the channel is now closed to navigation and would be available for approach lighting standard.

Mr. JENSEN. I think that the main problem on that runway, and certainly the main interest of the carriers up there right at the moment, is to provide this guidance in a vertical plane that is given by the visual glidepath indicators. I would like to encourage the FAA to go a little faster than they indicated to you previously in getting that equipment available for the New York area. This has gone through these governmental procedures rather slowly, but the decision among the five different candidates for visual glidepaths was made, as far as the testing was concerned, last July, and on September 26, 1960, the FAA announced the overall FAA decision as to what the recommended lighting would be. We foresaw that there might be some difficulty in budgeting for this, in getting these available to be installed, and we wrote a letter to the FAA pointing this out in April of 1960, saying it is obvious that one of the five candidates is going to be selected; start your budgetary processes; get it in gear and don't wait until you have made the selection before you find out where some money is coming from.

Unfortunately maybe this is a requirement of the governmental budgeting, but there doesn't seem to have been very much progress in that regard and we are still hearing that these lights will be purchased as soon as possible. We think that maybe some transfer of funds, or whatever, should be done very promptly so that actually you can be

given dates rather than promises because this is a very important safety item.

The air carriers in the New York area are very conscious of it and are calling us up weekly asking when will these lights become available.

Senator MONRONEY. As I understand it, the cost was not in the range of an excessive amount. Do you recall what a set of lights costs?

Mr. JENSEN. Yes, sir, it varies greatly by the facilities available at the airport in the way of existing wiring. It may vary from $10,000 up to $40,000 per installation.

Senator MONRONEY. Depending on the wiring?

Mr. JENSEN. Yes, sir.

Senator MONRONEY. The actual lights were how much?

Mr. JENSEN. I don't have a figure for the units themselves.

Senator MONRONEY. They must run under $10,000.

Mr. JENSEN. They are under $10,000 by a rather significant amount.

Senator MONRONEY. Then the magnitude of the order right now is to get the hardware, controlled by the actual purchase of the lights, and then as the lights become available, supply the funds for their installation.

Mr. JENSEN. I would like to encourage that.

Senator MONRONEY. I would like to have the FAA take note of that. It will take some months to manufacture them. At least we will save that much time. Certainly on airports that have built-in dike hazards off the end of these runways, this visual glidepath is of extreme importance.

Mr. JENSEN. You mentioned runway lighting. And I think we are here talking about the narrow gage lighting installed in the runway, as it is on the new instrument runway at Idlewild.

Just briefly, I think the state of affairs is not quite as you describe it. A standard has not yet been reached on that. Testing is still going on at Atlantic City.

Senator MONRONEY. Is this at the touchdown point or the general outline of the runway?

Mr. JENSEN. This is within the boundaries of the width of the runway, approximately 30 feet either side of the runway, as I recall the figure. It is imbedded within the runway surface, flush lights. And also this includes center line lighting beyond the touchdown point.

This is yet to be fully and officially decided as to a standard for this being worked out at Atlantic City.

Senator MONRONEY. How about the touchdown point?

Have they decided on a standard system for that?

Mr. JENSEN. I don't quite follow you in that there is no particular lighting which is just the touchdown point. It is a mat of lighting from the end of the runway for a segment—and this in contention somewhat at the moment—for about 3,000 feet.

Senator MONRONEY. This is to light the black hole, as the pilots call it?

Mr. JENSEN. Yes, sir.

Senator MONRONEY. And we have some fluorescent lights at Washington National on that?

Mr. JENSEN. Yes, sir.

Senator MONRONEY. That is what I am talking about.

Mr. JENSEN. I apparently misspoke myself in saying 30 feet each side of the runway. It is 30 feet of the center line of the runway.

Senator MONRONEY. What I am trying to identify is touchdown brilliant light where you eliminate what the pilots call the "black hole," just where they leave the air and touch down.

Mr. JENSEN. It is.

Senator MONRONEY. It is standardized?

Mr. JENSEN. No; that is not standardized. This is the lighting we are now talking about, the narrow gage lighting, the lighting for the so-called black hole.

It was put in at Idlewild on the basis that it appeared it would be standardized on this basis in order to get it in that new runway. But the official standardization papers have not yet been, to the best of my knowledge, yet arrived at.

Senator MONRONEY. Thank you very much for your attention on lighting. This is surely something that we can move on with at a more rapid rate than we are doing.

Mr. TIPTON. Shall I proceed, Mr. Chairman?

Senator MONRONEY. Yes.

Mr. TIPTON. One program on which we thought we should comment relates to bird strikes. For many years we have had problems with bird strikes, and manufacturers and others have worked on that particular phase of the problem.

Senator MONRONEY. I thought you would use some other term than "strikes." I thought you had had enough of that.

Mr. TIPTON. We have had enough of it, I can assure you, of both bird strikes and the strikes you are talking about.

For some time prior to the Boston accident we have been discussing this particular problem with the Fish and Wildlife Service. I believe this is about the first time the Fish and Wildlife Service has been called upon to aid in such an extensive way in connection with air transport safety problems. They responded with great willingness and great effectiveness, and have tackled the problem in helping airport operators get rid of the birds on the field.

It is possible that this has been referred to already in the hearings, but they have produced Wildlife leaflet 249 which does give instructions to airport operators on how to deal with this problem.

Needless to say, that is not the last word that is going to be said with respect to that problem. But it is under active work and we believe extremely effective work.

Senator MONRONEY. What I understand from this is that today the only known method you have to guarantee against this is a sort of bird patrol in a jeep to be on notice that the starlings are invading that particular area of the airport.

Mr. TIPTON. That I believe is correct. The problem on which the Wildlife Service and others are working is to make the airport an uncomfortable place for the birds to be.

Senator MONRONEY. I understand that the birds outsmart the inventors, that someone invented an automatic firing device to explode a little natural gas to pop ever so often, and the birds, after a few days

of that, realized it was harmless and they now laugh at the inventors' genius on that method of scarecrow.

I also understand that one of the major petroleum companies in my State has devised a chemical which you are apparently discussing or alluding to here. It is quite of interest to me to learn that they are now attacking it through what is called bird management chemicals.

Mr. TIPTON. That is right. And of course the problem is made difficult by the very tendency of birds and animals to outsmart the human being. So that the problem is not without difficulty.

Senator MONRONEY. How does the bird management chemical work now? It intrigues me.

Mr. JENSEN. I am not the bird management chemical expert, Senator Monroney, but as I understand it, there is a method by which they are using some of this chemical with some of the natural food for the birds, and it temporarily stuns the birds in such a way that their normal reaction is that they decide not to come back to this area. It has to be very carefully looked at so that it does not do harm to the birds and yet does its mission. It is at the present time under evaluation. It is too early to say whether it is an answer, or an effective answer. It has not been thrown out as one of these answers that won't work, as many have been in the past.

Senator MONRONEY. Would it be practical to say that the purpose of this would be to give the starlings a case of blind staggers and, as I understand it, even other birds coming in over the outer marker for a landing on that airport, observe the untoward or intoxicated condition of the starlings then present on the airport and that they decide to go to another alternate airport.

And then, on sobering up, these birds that have been so affected are then able, with a very heavy hangover, to fly away to some other landing place, preferably some government building, undoubtedly.

Mr. JENSEN. You have just established yourself as an expert on this subject, Senator. That is the way I understand it.

Senator MONRONEY. I am glad to get this straight, because it intrigued me, particularly because it proves that Oklahomans can invent anything.

Mr. TIPTON. I hope the psychology of the birds is different from the psychology of human beings. I have really never seen a human being who will completely stay away from a place simply because he got a hangover.

To pass rapidly to another point that possibly is more manageable than birds, there was a lot of discussion during the hearings concerning weather minimums. To report to the committee as to how this particular problem is handled with respect to airlines, as far as airlines are concerned, their minimums with respect to each airport both with respect to landings and takeoffs are specified in connection with the carrier's operating certificate.

Senator MONRONEY. Do all have the same?

Mr. TIPTON. Not necessarily. The minimums are prescribed. The basic minimums are prescribed by the FAA.

Senator MONRONEY. For that particular airport?

Mr. TIPTON. For that particular airport.

Senator MONRONEY. But all scheduled airlines operating off of there are tied to the FAA minimums?

Mr. TIPTON. That is the minimum. We cannot go below that. But then we establish an airline, any airline, individual airline, may establish different minimums for its operations.

Senator MONRONEY. All scheduled airlines operating off of that particular airport have the same minimums? They can go above the minimums for takeoff, but not below the minimums?

Mr. TIPTON. Not below them. If we violate those minimums, we are subject to severe penalties, and violating a weather minimum is a very serious thing.

Senator MONRONEY. This rule does not apply to nonscheduled flights, charter, or general aviation; is that correct?

Mr. TIPTON. It does not apply to general aviation.

Mr. BECKER. I think we had better start a little bit over again on this, if I might.

Senator MONRONEY. Surely.

Mr. BECKER. In the case of a scheduled airline, the FAA establishes for an airport a set of basic minimums. If you have five airlines going into that airport—I am talking now for simplicity——

Senator MONRONEY. Take Washington National.

Mr. BECKER. The instrument approach system, the ILS, basic minimum, is 200 and one-half mile for landing.

Senator MONRONEY. 200-foot ceiling and one-half mile visibility.

Mr. BECKER. There is another basic minimum that goes in there, too, and that is a runway visual range minimum, which is different, and in the case of Washington it would probably be that. In that event you have basically a 2,000 feet runway visual range—and that is gotten by the transmissometer—and no ceiling applied.

I am getting into too much here.

Senator MONRONEY. What do you mean by "no ceiling"?

Mr. BECKER. You cannot come down below the basic minimum for an ILS approach, which is 200 feet. But on the other hand, the ceilometer does not have to show 200 feet at the time you make the approach. This gets complex, and I would rather straighten out the first point first if I can.

That Washington National—let's assume you have an ILS and no runway visual range. The basic minimum is 200 feet and a half mile visibility for everybody.

Capital Airlines may elect to have put in their operating certificate their own minimum of 300 feet ceiling and three-quarters of a mile visibility.

That is the lowest to which they may come.

American Airlines may select, say, we will not make an ILS approach into that airport unless we have 300 feet ceiling and a mile visibility.

My point is here to indicate that for the scheduled airlines, though there is a basic minimum below which the FAA will not approach a landing—that being 200 feet ceiling and a half mile visibility—the airlines in their own certificate may have higher minimums prescribed, and then they themselves may not come below those minimums.

Now take the nonscheduled.

Senator MONRONEY. If they come below that minimum, would they be violating an FAA regulation?

Mr. BECKER. Yes, sir.

Senator MONRONEY. Even though it was their own rules?

Mr. BECKER. Yes, sir. This is what I was trying to clarify. The nonscheduled carrier may come into that airport, in the case of ILS there are minimums or higher—300 feet and three-quarters, I believe. Unless they are stationed at the airport, and then they can get special authority to use the "minimum minimum." The private pilot is in the same position for landing. These are specified in a part of the Administrator's regulations. For takeoff, however——

Senator MONRONEY. Before we leave the landing: Suppose Jerry Cobb, one of the astronauts, came in for one of these aviation to-dos and the whole east coast was socked-in, and he had only a few minutes of gas left and had to be brought in by radar. In the case of an emergency a private plane or a scheduled airline could come in if there is no other airport open by declaring an emergency?

Mr. BECKER. Yes, sir. An emergency situation is a different thing.

Senator MONRONEY. They would explain that to the tower and they would have fire equipment and everything else out there waiting for him?

Mr. BECKER. Yes, sir, and there would be some justification and some writing to the FAA to explain this. He may be in violation, for example, in not having looked at his preflight plan—not having preflight planned his flight sufficiently well to put in enough fuel and things like that. This might catch him still.

With respect to takeoff minimums the airlines also have prescribed in each certificate—each airline certificate has prescribed takeoff minimums set forth in it for Washington National, for instance. These vary.

There is a sliding scale provision provided. There are various different sets of minimums that are applicable. These always vary within a company, depending on type of aircraft flown. For example, the jet minimums today are higher for landing than other aircraft.

Takeoff minimums are higher under certain circumstances. They are also higher for a pilot while he flies the first 100 hours of that airplane.

General aviation does not have a prescribed takeoff minimum insofar as we can determine.

Senator MONRONEY. They can go off any time they feel like it?

Mr. BECKER. That is right, but I think the nonscheduled airline, because of the provisions of part 42, do have prescribed takeoff minimums, as do the scheduled airlines.

Senator MONRONEY. That gets me to the point that I want to get at. If they take off, say a nonscheduled line or certificated line, at below minimums for takeoff, then there is no law that would allow the control tower operator or the manager of the airport to notify the company that they are not to take off and that if the company decides to take off too forcibly, by a movement of the ground equipment or something in front of the aircraft, to block the takeoff?

Mr. BECKER. Under today's set of varying types of minimums, minimums for takeoff, it would be most difficult for a controller or set of controllers in the tower to know what the minimum would be for any particular carrier.

Senator MONRONEY. We had testimony from your airline dispatchers, who seemed to be a very competent and knowledgeable group, on this, and they knew all of the difficulties, and you have specialists who are there working on it. You get charters, nonscheduled operations coming in carrying sometimes 100 people, GI's and others, with no dispatcher, no advice. The decision is just made by the pilot himself.

With all these varying minimums I wonder if we are not leaving a gap there such as we apparently saw in this Toledo crash where bad judgment on the part of one man, the pilot, maybe weary and tired from flying a long period of time, who is anxious because of economic reasons or others to complete the flight, might not be—given more authority to weaken our safety provisions—if he had taken off under the extremely adverse conditions that then existed at Toledo, there is no doubt in my mind that there would have been an action filed against his certificate.

This doesn't do the dead people any good to have his certificate, or doesn't do him any harm beyond that which he already had.

Mr. TIPTON. This one is kind of hard because we have to consider, in terms of the general working of airport traffic control, that the controllers are handling a good bit of traffic and their judgment at those times must be good. They have got a considerable burden to maintain anyway. So that we have been concerned about the imposition upon controllers of the additional responsibility of telling a pilot proposing to take off that he can or he can't, depending upon his weather minimums.

As Bill Becker has decribed here, the FAA has used, and the airlines have used, as well, the establishment of weather minimums on a very flexible basis to accomplish a type of safety regulation varying with the circumstances, the experience of the pilot, the kind of equipment, the kind of air navigation facilities there. So that the minimums are quite different and they get kind of complex. That will be another thing that that controller would have to deal with. We consider this possibility, which we throw into the hat here: rather than placing upon him this what amounts really to an enforcement responsibility, it might be a useful thing to accomplish the same purpose in a marginal way to instruct the controllers to ask the pilot whether he has takeoff minimums, and demand a yes or no answer on that, which directs his attention to that possibility and directs his attention to the fact that he has to commit himself one way or another. That might achieve a result of the kind we are talking about without imposing upon the already pretty well burdened air traffic controllers the responsibility in such a complex area.

Senator MONRONEY. I don't want him to make the arrest or anything of that kind. But it seems to me that if he is reporting to all in-coming traffic and out-going traffic that the ceiling is 200 feet, 100 feet, or 50 feet, and if the visibility is a quarter of a mile, then if that is below the manimums for takeoff of that particular aircraft, if he is carrying passengers for hire, whether scheduled or nonscheduled, charter or whatever it is, or air taxi, that there should be some enforcement provision perhaps of the airport manager to just put down some equipment in the middle of the runway and notify

him that there are cars parked in the middle of the runway and no takeoff will be allowed.

The poor people in the cabin don't know anything about it. When you have to have the pilot take his flashlight and feel his way around the ramp to find out how to taxi out, and when he gets to the end of the runway, with a pretty heavy load, and the control tower operators asks him how many lights down the runway he can see, and he says, "I can see three," and the pilot says, "I am ready to go," and the control tower man says, "Cleared for takeoff," this is a little bit of an anomaly to at least under these conditions to put human life, which is buying the transportation, trusting in Federal regulation for safety, to such exposure.

Mr. SELTZER. I think your point has just recently been taken into account by FAA.

Shortly before we came over here we got a copy of a notice that they have just issued to their controllers, advising them that they shall deny takeoff clearance to any aircraft carrying passengers or carrying for hire whenever the prevailing visibility is below a given value.

Senator MONRONEY. That is the answer then.

Mr. SELTZER. That has just come out. It was sent out as a notice to airmen and instructions to controllers.

Senator MONRONEY. So this would put any common carriage of any kind, or charter flights, or any taxi or any other type of commercial flight, under a positive denial of clearance?

To go one step further, if this is violated, then the airport manager or someone could block the runway with equipment, can't he?

Mr. SELTZER. I suppose there are other actions that can be taken beyond that. The provision that the FAA issued merely notified the public and instructed the controllers to deny takeoff to any aircraft, scheduled carriers included, carrying passengers or carrying for hire, whenever the weather is below the set value.

The only exemption to that was if the aircraft is not—and states very definitely—he is not carrying passengers or carrying for hire.

Senator MONRONEY. Or cargo?

Mr. SELTZER. Yes, sir; I believe it very specifically includes that.

Senator MONRONEY. This seems to be getting at the point that we raised. You may proceed.

Mr. TIPTON. One further point, and then we are finished.

There was some discussion of the condition of the field at La Guardia. We thought we would report to the committee the work that has been done in preparation for this rehabilitation and reconstruction program at La Guardia field. This construction, of course, was anticipated and a program was laid on to avoid an unsafe condition on the field. Some of the measures were these: that any obstructions on the airport surface would be provided with lighting and marking, even though the obstruction was not on the runway; that there would be no operations on 31–13 runways if there was more than a 15-knot crosswind; no airline aircraft would be permitted to land downwind on that same runway; the runway reference lights are provided on 13–31 and 33, and then as the construction progresses the taxiways have been changed and new nose wheel guidelines are being provided.

In addition to that, a group or committee was created to constantly review the situation at the field.

It consists of representatives of the airlines, the Airlines Pilots Association, the management of the airport, and the FAA, to review the conditions on the airport, and survey them constantly, and to report and to take care of anything that they felt a necessity for taking care of.

Runway lengths on 31–13 have been reduced somewhat. The effect of that, and the way that is safeguarded, is to apply the normal rules for landing and takeoff on the foreshortened runway, which results in reducing the amount of traffic you can transport into or out of the field.

One thing, as I believe Walter Jensen has already said, we are very anxious to get the visual glide slopes on both ends of runway 31–13, and the sooner the better.

Mr. Chairman, that concludes our presentation.

I believe I have submitted for the record all of the material we brought before the committee.

Senator MONRONEY. I have two or three questions in closing.

What is the attitude of the ATA and its members on the proposed reduction of speed 3 minutes from the holding pattern in high-density areas?

Mr. BECKER. The proposal, as I understand it, is to reduce speed within 50 miles of a terminal area.

Mr. JENSEN. I am familiar with this, Senator Monroney. The airlines have informed the FAA, I believe as far ago as last September, that we were in support of their procedures regarding holding patterns, which included the slowdown prior to entry into the pattern, by 3 minutes.

Senator MONRONEY. In other words, speed before holding pattern is not enough, and speed in the holding pattern is also important?

Mr. JENSEN. Yes, sir.

Senator MONRONEY. What is the attitude of the ATA on the suggestion—I believe it is out now—on proposed rulemaking, or asking voluntary compliance I think at the present time, of the airlines, on reporting outages in radio navigational facilities?

Mr. BECKER. That is a regulation at the moment. They are following it. In fact, there is unanimous approval of it. We were prepared to try it out on a voluntary basis if it took too long to get the regulation out. But the FAA made it an emergency type regulation, so it is now effective.

Senator MONRONEY. And you have no objection to it, representing the airline operators?

Mr. BECKER. The general position of the airlines we have heard no objection to it.

Senator MONRONEY. We have heard pilots, strangely enough, objecting to it. This is why I am wondering if the operating branch of aviation had objections.

Mr. BECKER. No, sir, not to date. I am not saying that there may not be an occasional objection to a particular thing. A lot of it will depend, Senator, on how this is applied. There are some vagaries in the regulation which may lead to differences of opinion from time to time. These are going to have to be worked out. But the basic

philosophy of the regulation as it is limited to about five outages—and they are specific; rather specific—we have heard no rumblings or objections from the operations side of the airline, the management side.

Senator MONRONEY. It seems to me that this is a very mild order to at least alert a little bit more the people on the ground that there may be some extra help that might be possibly given, as there could possibly have been in this approach to Preston with apparently some loss of navigation facilities in the United plane. If a man on the ground with radar knows that there might be some trouble, he could go way beyond the call of duty and try to give a little extra help in vectoring him in.

Mr. BECKER. The reason I said we have little problem: there is some prefatory material in the regulation which goes a little farther than the regulation itself. We have written the FAA a letter with respect to that with the hope that this will be clarified, so that we won't have a gray area in there where the pilot could get himself in trouble, or somebody looks like he might get himself in trouble when he really isn't in trouble. We want that rectified. We have written a letter to the Administrator on it.

Senator MONRONEY. One other question. Do you find that as a result of frequent strikes, and particularly strikes of wildcat or unauthorized type of strikes, that there is a degree of discipline that in normal course is good but which takes a downward turn either immediately before, during, or after the strike?

I have heard many airline passengers comment on this. I have even heard some of the people engaged actually in the operation of the aircraft comment on it as being nonconducive, at least, to conditions of air safety in the cockpit and the attitude of some of the operational people in the aircraft itself.

Mr. TIPTON. The question touches on what is inevitably a real problem.

Discipline in the cockpit is very heavily ingrained in the crew as they are trained and as they are checked and so on. So the performance of their duties becomes as nearly automatic and effective as you can get it.

The problem of personal animosity that may arise out of strikes introduces into the cockpit an element that we would like to avoid.

Senator MONRONEY. In other words, we have heard a report, published, of threats, intimidation and means taken to prevent members of a union from going to work during the course of an unauthorized or a disclaimed or wildcat strike. Fear has been expressed that these threats or other action that might be taken could carry on even as resentments after the strike and lead to some diminishment of the tranquility that is so necessary in a cockpit.

Mr. TIPTON. I think that these flight crews are responsible people and they know their jobs and they know their responsibility. As I said, we think it is awfully important that in the future strikes such as we have had and which have been publicized so recently would be solved, and we hope that steps will be taken by President Kennedy and Secretary Goldberg in creating the tripartite commission that will result in that settlement.

It has plagued us a long time. It has inconvenienced passengers, and economic penalties have been great. We think that the time has come when that must be solved.

Senator MONRONEY. I find one more question that I haven't asked yet.

The tape recorders which proved so greatly accurate in the United crash—and I understand in the DC–8 crash, even, at Idlewild—on takeoff: Is the ATA cooperating and helping in trying to provide an easier reading method of the tapes so that the performance of the aircraft or any malfunction that would be recorded in normal flight will be transmitted to the service or maintenance facility for correction as a result of this additional safeguard on the plane?

In other words, I think this is a great instrument, it costs a lot of money, and if it could funnel into the maintenance network warning signals that the tape might show of certain structural, mechanical, or even heavy turbulence that the aircraft might have passed through which might escape the pilot's notice in his checklist, that it could be helpful as an instrument of better maintenance on the aircraft.

Mr. DALLAS. So far the airlines have not used these tapes very much for maintenance purposes. The only function on the recorder for this purpose would be the acceleration. This instrument is really not accurate enough, most of the airlines feel, to be used for this purpose.

Senator MONRONEY. We had some problems that came up on the Electra where heavy landings might have been sufficient to weaken the motor mounts. One thing that makes these important is the very difficult job of translating the tapes for use. The FAA said they were seeking easier methods and mechanisms for reading these tapes.

Mr. DALLAS. These particular tapes are of a certain nature. They are of aluminum or steel. The only way that you can read them is with a magnifying glass. It is a simple instrument in that respect, and it is just plain hard to read, Senator. There is nothing that you can do about it but get your magnifying glass, or a reader which incorporates one, and follow these little wiggles on the line against time, and make your analysis. That is the kind of instrument it is.

Senator MONRONEY. I understand that it is capable of taking a lot more readings than it does, that you have more inputs that you can put into it on structural stresses, or other things that might be of value in the maintenance department if they were shown up on previous flights.

Mr. DALLAS. This particular instrument, unless modified, will not take additional channels at the present time. You may not know, but the FAA has scheduled a meeting next week in Atlantic City, an industry-FAA meeting, to discuss this whole subject of flight recorders. One of the subjects on the agenda is to discuss the pros and cons of more sophisticated instrumentation to do the things that you are talking about. How this will work out we do not know at the moment. It is a terrifically complex job.

Senator MONRONEY. I understand, incidentally, that the American flight recorders, being on metal, have already proven their worth; and in the Sabena crash, this was a photographic process which was destroyed by the heat of the crash, and there is no accurate record

of exactly what the performance of the aircraft was prior to its crash on approaching the airport at Brussels.

Mr. DALLAS. I understand that. Of course, if these records are not available after a fire, you have lost all the advantage.

Senator MONRONEY. Are there any further comments?

Mr. BECKER. I might add one thing there. With respect to these flight recorders, this is one of the reasons that the airlines were very hesitant over a period of years to put a flight recorder on that you couldn't read easily. This is one of the problems we had with it.

We are required to put it on by regulation. We think it is all right for what it is doing. But to do the kind of job that might have to be done, it just doesn't work. You have to have a more sophisticated type of instrument. But in the interim period the airlines, in this case, were required to put something on that they really didn't think would do the kind of a job that, if they were going to put it on, that they wanted it to do.

Mr. DALLAS. Your point about the hard landing, Senator, I understand what you mean, and it sounds like a desirable thing to do. But this instrument is not very accurate. If I were running an airline, I wouldn't like to depend on no damage just because the instrument said there was no damage. In other words, I would not have enough confidence in this instrument that we have today to believe it in these particular cases.

Senator MONRONEY. Thank you very much.

Is there anything further?

Mr. TIPTON. Nothing further, except to thank you, Mr. Chairman, for spending so much time on our problems. We do appreciate it. We hope that with all this attention that we can keep moving as we have in the past.

(The following information was subsequently submitted for the record:)

STATEMENT OF THE AIR TRANSPORT ASSOCIATION OF AMERICA REGARDING QUALITY OF AIRLINE AIRCRAFT, AIRLINE INSPECTION AND MAINTENANCE PROGRAMS, AND PLANNING AND EXECUTION OF AIRLINE OPERATIONS

QUALITY OF AIRLINE AIRCRAFT

The same companies are building transport airplanes that built them 30 years ago at the dawn of the modern all-metal multiengined transport airplanes. All this experience and accumulation of knowledge has been gradually incorporated in new models and, of course, in the latest turbine-powered planes, to make them safe, comfortable, and fast. Each model has gained in excellence of design from its predecessor.

The latest model jetplanes cost more than $5 million each, and even at this price a manufacturer today may have to sell at least 150, for a gross of $750 million, before he can break even. An idea of the tremendous effort involved in a modern large jet aircraft can be visualized from a few figures. The manufacturer spends approximately $50 million on engineering development alone and another $50 million on FAA certification tests and customer demonstrations. Another $50 million is needed for tooling and production necessities before the first airplane is delivered to a customer. Also another $50 million may disappear in product improvement before the 150th airplane is finished.

The whole process, from the time the manufacturer decides to go ahead on a new design until the first airplane is ready for delivery, takes from 5 to 6 years. The manufacturer uses his vast backlog of know-how, plus the substantial amount he can tap elsewhere. Each new design profits by the following inputs:

The manufacturer's experimental testing program

The smallest gadgets up to complete fuselage and wing sections are tested under all sorts of operating conditions for reliability and strength. Small valves, switches, etc., are cycle tested until failure, and the fuselage is intentionally punctured under operating pressures and loads. Engine installation components are tested for resistance to fire and heat, and schemes are devised to try to fail landing gears and control systems under load. The complete airplane is exhaustively tested in flight under adverse conditions, with the data being recorded by a battery of modern scientific instruments. The manufacturer's testing program is almost incredibly exhaustive and complex.

The testing programs of other miscellaneous manufacturers supplying equipment to the prime airplane manufacturer

Engines and propellers are separately certificated by the FAA and must meet the most rigid requirements. The engines and component parts receive thousands of hours of testing under operational conditions to assure reliability. The large number of other components, such as electrical and hydraulic units, must meet the FAA and the airplane manufacturers' specifications before acceptance. All of this equipment receives exhaustive testing by its respective manufacturers to assure its meeting such specifications.

Previous use of features and equipment in the military services

Naturally, military airplanes are the first proving ground for many of the latest innovations in airplane and engine design. The same transport manufacturers build the military equipment, and thus all new commercial transports have built-in corrections of the mistakes made in military planes during previous years. The engines used in the commercial transports of today are developments of military versions with large backgrounds of operational testing. In addition, the engine manufacturers spend large sums in the development of the commercial versions. The success of this total effort is reflected in the fact that modern American-built jet engines, in commercial service barely 2 years, are approaching 3,000 hours in service between overhauls.

The experimental work of Government and other research agencies

Since its inception about 1920, the NACA (now the NASA) has led the way in the United States and in the world in the field of basic aeronautical research. Its work, published in thousands of technical reports, has been an important factor in increasing the efficiency, safety, and reliability of modern aircraft, both military and commercial. The aircraft manufacturer upon inception of a new design utilizes the latest NASA information. From the safety standpoint the NASA has contributed greatly in the fields of aircraft structures, flight stability, and fire protection, to mention only a few. Also, the military operates large research and development facilities in aviation, the benefits of which are utilized by the manufacturers. In addition, the FAA maintains research and development facilities whose purpose is primarily to facilitate the transition from basic research to hardware for practical use. Further, private institutions, including the manufacturers themselves, contribute greatly to the total aeronautical research effort of the country. All together, the manufacturer taps a vast store of knowledge, all of which is applied as appropriate to new-model aircraft.

The experience and knowledge of the airlines

The demands of continuous service in scheduled airline operations soon expose any weaknesses in equipment. The United States scheduled flag carriers alone fly more than 4½ million hours per year. The oldest DC–3's in service are approaching 60,000 hours' total flight time, and many of the later four engined planes such as the DC–6's and Constellations are over 30,000 hours. The airline findings have been accumulating over the years and have been constantly passed on to the manufacturers. This immense proving ground of experience has had a tremendous influence toward the improvement of modern transport aircraft.

Besides this constant flow of information to the manufacturers, the airline experience is directly transferred to a new design before and after negotiations for purchase. In a typical case, the manufacturer, after careful study of current airline operations, submits a proposed design to a prospective customer—a particular airline. The airline, if serious about purchase and previous to final price arrangements, sends a corps of engineers to the manufacturer's

plant. They include experts in aerodynamics, structures, powerplants, and in hydraulic, electrical, and other systems. These experts comb the manufacturer's early specifications with a fine-tooth comb, making hundreds of changes to suit their experience with respect to efficiency, safety, reliability, and ease of maintenance. Such changes may require: Redesigning the cockpit to standardize with other planes in the airline's fleet; changes in cockpit visibility, and low-speed flight characteristics; better control systems; more metal fatigue testing; more reserves in generators, pumps, pressurization equipment, etc. Also, for maintenance, many additional features such as more openings for better access, better corrosion protection, more test fitting attachments, etc., may be specified.

The specifications are thus revised and the final prices negotiated. Later on, these same experts return to the manufacturer's plant and go over their previous requirements in detail with the manufacturer's design engineers to make sure their objectives are properly complied with and fully understood before the designs are frozen. More changes are made later, but of course they are subject to contract modifications. This is an expensive operation, but the airline knows that it is money well spent to assure more perfect operation later when the airplanes are flying the line.

The FAA regulations

The airworthiness of transport planes is highly regulated by the FAA. These regulations have grown with the industry and have stood the test of time. A great majority of them are the result of service experience gained throughout the years in both commercial and military operations. Others are based on industry and Government knowledge of what is a reasonable safety level. The regulations cover a broad front, ranging from a safety belt or the need for a fluid drain, to the strength of a wing or the maximum load that may be carried. In essence they are minimum standards, which are exceeded to a lesser or greater extent a thousand times in a typical airplane, but they do guarantee a high level of safety for equal application to all airplanes regardless of the manufacturer. They are of high value to the manufacturers and the operators, and of course to airline passengers, because they constitute a handbook of standard safety measures, accepted by everyone and tested by at least 30 years of operational experience.

In conclusion, a summary of the design evaluation processes conducted by the manufacturer may be enlightening. The manufacturer makes a conscientious effort to eliminate nonessential systems, to predict possible failures and to establish the probability of hazardous consequences. Every effort is made, first to minimize the probability of hazardous failures, and then to minimize the consequences of the remaining possible failures. This has called for dual reliability in essential systems and for extensive application of the fail-safe design principle. Also, special attention is given to design features to reduce the opportunity for human error. Examples of applications of this philosophy are:

(1) Structural design is based on the philosophy of multipath load distribution. Careful detailed design is used to reduce the possibility of structural failure and loads are distributed through a multiplicity of structural members to minimize the possibility that any single structural failure might result in catastrophic consequences.

(2) Plug-type doors are used in the new jets to eliminate the possibility of decompression as a result of hinge failure or improper locking.

(3) The fuel pumps which supply fuel to the engines are dual for each engine, each pump being operated by separate electrical systems. In the remote event that both pumps fail, the engine-driven fuel pump will provide fuel to the engine.

(4) The operation of each engine is independent of other engines, but if for any reason fuel is not available to an engine from its own tank, it may be operated using fuel from any or all of the remaining tanks.

(5) In case of an engine fire warning in the cockpit, incorrect emergency procedures are avoided by providing a single switch which the pilot pulls and which simultaneously isolates the electrical and fluid systems of that engine at the wing.

AIRLINE INSPECTION AND MAINTENANCE PROGRAMS

Safety, of course, is the paramount objective of maintenance, but safety cannot be separated from good regular service to the public since they are inextricably woven together. If it were humanly possible for an operator to give

perfect service, so that all flights were always conducted according to schedule as far as mechanical matters are concerned, he would also attain perfect mechanical safety. Lacking absolute perfection he cannot, however, afford to be lax in this field, because of the necessity of maintaining his competitive position in the industry. An airline simply cannot wait, like the average automobile owner, for things to give trouble before they are serviced or overhauled. Frequent mechanical delays at the gate or en route would irritate passengers who, on the next trip, would flock to another airline that knew how to avoid these delays. In acknowledging these simple principles of good management, the airlines spend a great deal of their income on maintenance to assure regularity of service, and they know that this is the right way to attain the highest degree of safety.

In order to realize the maximum service potential of modern airplanes, they must be utilized to the fullest extent possible. It is difficult to attain an average of 10 hours in flight per day per airplane, but some long-range fleets approach this figure, and occasionally exceed it. Time on the ground must be allowed for servicing and maintenance and for loading and unloading. Also the scheduling of convenient flights is a large factor in limiting utilization. All things considered, an average of 10 hours per day utilization per airplane is considerable, and any complex machinery operated to this extent requires a lot of attention to keep it working relatively trouble free.

As previously mentioned, if an airline is to stay in the business of scheduled transportation, it has no choice but to highly organize its maintenance efforts. An idea of the extent of such organization may be obtained from the fact that the scheduled airlines spent approximately $500 million for maintenance during a period of 12 months ending June 1960. Using figures for this same period, this is about 33 percent of the total direct dollars spent for all operations, which includes $350 million for fuel over which the airlines have no control. If the fuel were subtracted from the total direct costs, the maintenance costs would then approximate 44 percent of remaining total direct costs.

The modern concept of airline maintenance is that all work and replacement of parts must be prescheduled to the greatest extent possible and then carried out in strict accordance with the schedules. This is exactly what is done on all types of airplanes comprising an airline fleet—from the oldest to the newest types.

Obviously, the scheduling of airline maintenance and overhaul is a complicated business. It is all directed toward the objective of always having each airplane of a large fleet ready at the gate on time to begin its flight as scheduled. At this point an airplane must be well nigh perfect mechanically, since the law prohibits takeoff otherwise. It is obvious that this mechanical perfection required at the gates before takeoff cannot be achieved by slipshod planning and trusting to luck on the part of an airline's maintenance organization.

Advance maintenance planning to achieve the all-important on-time departure objective begins on a new model airplane in the manufacturers' plants before a prototype is built. As previously mentioned, airline engineers, working with the manufacturers' engineers, see to it that maintenance simplicity and accessibility are incorporated to a large extent into the original design. Ease of inspection begets safety besides saving time. Each manufacturer, during the operation by the airlines of his aircraft, collects voluminous reliability and maintenance data on his products which he stores for use on new models. Thus, each new airplane type is better than the last in this respect.

Before the prototype of a new model is flown, a committee is formed, consisting of technical representatives of the airlines who will fly the new model and the manufacturer's engineers. Each item of equipment is analyzed as to its probable safe life in hours, and this becomes its initial overhaul period for all operators. Likewise, all structural elements are closely scrutinized and the initial inspection periods that the airlines will use are established along with the details of how the inspections are to be accomplished. This total effort, costing many thousands of man-hours, is documented and presented to an FAA Maintenance Review Board for approval. Government experts study the documents in detail after which meetings are held with the airlines and the manufacturers, during which every item is reevaluated and many are revised for more conservatism before approval is obtained. These documents then become the initial basis for each airline's overhaul and maintenance program.

During the time a new airplane is under construction, the manufacturer establishes a course of instruction to familiarize the airline and the FAA with

the new design. The course is given in classrooms in the manufacturer's plants, utilizing extensive visual aids and the actual airplane parts and components. This knowledge is then transformed and elaborated into the individual airline courses which are established and maintained at the airline bases for the benefit of the many mechanics who will later be engaged in maintaining the airplane. This comprehensive effort is required training to qualify personnel for maintenance of this particular equipment.

Also, during the time the airplane is being built, the manufacturer is busy preparing the maintenance and overhaul manuals which describe and illustrate the thousands of parts and components, and which prescribe in detail the various processes and methods for assembly, disassembly, inspection, repairing, and troubleshooting. These manuals, which contain thousands of pages of detailed technical information and illustrations, are standardized for ease of use by the airlines by conformance to ATA Specification 100.

Using this basic information from the manufacturer, the airline then develops its own comprehensive maintenance manuals which specify in the minutest detail how all maintenance functions on the airplane are to be conducted. They describe operation by operation how each unit is to be taken apart and put back together again, and what test requirements it must meet during the process and after it is reassembled. These airline manuals are filed with the FAA and in a typical case of a large jet airplane they would form a stack approximately 10 feet high if placed one on top of the other on the floor.

In planning its maintenance program for a new model airplane, an airline must organize for two separate functions. One is overhaul, and the other line maintenance. The overhaul function is performed at large fixed overhaul bases employing perhaps thousands of people. Airplanes, parts, and components are routed to these bases on a prearranged schedule where they are completely overhauled and made as good as new for another specified run in service. Line maintenance is performed by another group of airline people located at certain stations along the airline routes, and its primary function is servicing and inspection on a prearranged schedule. Between the two functions the airplanes are kept in a continual state of airworthiness.

The procedures by which the airlines conduct overhaul and line maintenance vary somewhat with the airline, but their objectives are the same—safety and reliability. Great strides have been made in developing new methods and procedures during the last 10 or 15 years. The original method, which has all but disappeared, was to disassemble or completely tear down the complete airplane after about 8,000 to 10,000 hours of operation. This was called a major overhaul. Of course, line maintenance performed its inspections periodically between major overhauls. This system of maintenance has gradually given way to a more modern philosophy which is generally referred to as preventive or continuous maintenance. It is not only more efficient overall but, more important, it is vastly superior with respect to the safety and reliability of parts and equipment. Its most important feature is the detecting of trouble before it occurs, but at the same time it tends to level out peaks and valleys in manpower required and in material and parts flow.

At the present time most of the airlines have adopted this system of preventive maintenance and it is gradually being improved. The general idea of the system is to divide all of the maintenance work to be done on a fleet of airplanes as they accumulate hours of flight into equalized time blocks. Some parts and equipment must be inspected or replaced frequently and others at longer periods of time, depending upon their susceptibility to wear or deterioration. The work scheduled for each time block takes this into account, with the frequent items being handled at each block and the longer life items being taken care of during recurring multiples of each block according to a preplanned schedule.

From the safety standpoint this system has the advantages of (1) checking, testing, and replacing parts and components early in the operational life of each airplane, whether they need attention or not, and (2) constant attention to all parts as the fleet goes through its operational life. It is expensive for the first 2 or 3 years of operation of a new fleet, since a lot of unnecessary work is done; but it does expose early trouble spots and is considered vastly superior to the old method in most all respects. Since mechanical perfection is unattainable, the airlines begin to find deficiencies and faults in new airplanes after they are put into operation. Most of these are found by the scheduled preventive maintenance programs conducted by the airplanes. Others

are found in routine operations. A daily mechanical reporting system utilized by the industry announces serious troubles on a daily basis, to other operators of the same equipment to prevent reoccurrence by immediate appropriate action, and to the manufacturers for planning permanent corrective action. Besides the serious items so reported, the airlines continually find less serious faults which are, in some cases, corrected immediately by the airline and in others they are passed on to the manufacturer for study. As a result of all this, the manufacturer continually issues service bulletins to aircraft owners covering corrective modifications and/or inspection mandatory to all operators within a given time schedule by issuing airworthiness directives.

PLANNING AND EXECUTION OF AIRLINE OPERATIONS

The day-in and day-out conduct by an airline of flight operations involves an incredible amount of planning, checking, and doublechecking to assure that the highest degree of safety in air transportation is realized. The airline operations and supervisory personnel who accomplish this must work on an around-the-clock basis since much of what they do must be accomplished long before the flight departs. These personnel have the continuing job of sifting through all of the detailed information applicable to individual airline flights and developing this information into specific flight plans which leave nothing to chance.

Long before a flight crew leaves home for the ride to the airport, company operation technicians have begun their work. Much depends on the time a flight actually will depart. The scheduled time of the departure of the particular flight is, of course, ordinarily established many weeks in advance. How closely this scheduled plan will actually be adhered to, however, will depend upon a number of factors. Ceiling and visibility at the departure airport, weather conditions along the general route of flight, ceiling and visibility at the destination airport—all bear on the actual departure time. Forecast traffic delays both at the departure airport and en route also enter the picture. Up-to-the-minute information on the availability of the aircraft to be used must be considered. For example, if the particular airplane that is scheduled for use on a particular flight was unable to depart on the preceding day from another airport on the airline system, it might not arrive at the airport of departure in time to be thoroughly serviced and checked in time for use on the flight being planned. If so, the availability of another aircraft must be considered. These types of current information are brought to the operations technicians and dispatchers of an airline by airline communications systems established for the purpose. The crewmembers who have been assigned to take a particular flight most also be confirmed to be available. If a crewmember should be sick, it must be assured that a replacement crewmember is available who is fully qualified and ready for the flight.

Having estimated the approximate time of departure of the flight, a specific plan of operation for it is painstakingly developed. Let us look at some of the specifics of this process as they would apply to a typical turbojet aircraft flight from New York to Dallas.

A careful selection of the several possible routings that could be followed is made. Hundreds of weather reports from ground stations and aircraft are culled to determine whether there is any weather condition—wind, icing, or tubulence—that might have an effect on the safety and comfort of the flight. Whenever such weather conditions are detected, airway routings that will bypass them are selected. FAA notices regarding serviceability of electronic navigational aids are studied to make sure that all en route aids necessary for a particular airway routing are in good operating condition. Furthermore, notices of any out-of-service navigational aids which are off the planned route of flight are made known to the pilot in the event that for air traffic control reasons which develop during the course of flight he will know what alternative routings may be available. Selection of the best airway routing is also governed by air traffic information. For example, particular airway routings may be blocked by air traffic control from civil traffic so that military exercises and operations in a particular area may be conducted safely.

These same factors—en route weather, status of navigational aids, and air traffic information—are also carefully considered in planning the particular altitudes which will be used in the flight from New York to Dallas.

Also accomplished in the early flight-planning stages, and gradually refined as the time of departure draws near, is a careful analysis of the forecast weather at the various possible alternate airports which conceivably might have to be used for the flight. If weather conditions at the takeoff airport in New York are below certain FAA-specified minimums, an alternate airport within 2 hours flying time and whose ceilings and visibility is forecast to be at least equal to that required for landing purposes will be selected. In the case of the turbojet flight from New York to Dallas this might be Baltimore's Friendship Airport or any one of a number of other well-equipped airports where a safe turbojet landing may be made and where the least discomfort to the passengers would be caused.

Operations technicians and dispatchers of the airlines also carefully analyze the various possible alternate airports for Dallas, the destination airport, and select the most desirable ones to be used in the unlikely event weather conditions at Dallas should worsen beyond that forecast. Here again the alternate airport finally selected will be one whose weather conditions are forecast to be well above those conditions required for a safe landing and one which is fully equipped to service a turbojet airplane and to care for the passengers with a minimum of inconvenience to them. Alternate airports often selected for turbojet flights destined for Dallas are Tulsa, Okla., and El Paso, Tex., airports which are fully equipped for safe jet landings and takeoffs.

The preliminary planning so far described for the flight between New York and Dallas has been accomplished by operations technicians and by certificated flight dispatchers, highly trained flight operations specialists whose training and qualifications are discussed below. The dispatcher still has much to do to assure the safety of the flight. By now he has received from the traffic department a statement of the number of passengers and the weight of cargo, mail, and express which has been planned for the flight. Bringing this information together with the planned routings, planned altitudes, and planned alternate airports, he is ready to estimate the amount of fuel to be carried on the flight, utilizing performance data meticulously prepared by the aircraft manufacturer and the airline's engineering department, and tailored for the particular airport and type of aircraft. This performance data will also be useful to him in another area of important planning which he must accomplish. He must determine precisely the actual operational weight of the airplane at the time of its takeoff from New York and assure that the planned weight is within the performance capability of the airplane. Carefully considered within the performance data which he uses will be such variables as the temperature and runway wind condition forecast for the takeoff, the precise elevation of the airport and the length of the runway to be used. All of these considerations are carefully planned in advance and initially determined by the dispatcher.

The flight crew arrives and the check-on-check really starts. On aircraft requiring a flight engineer, the flight engineer proceeds to the aircraft and begins his doublecheck of the mechanical adequacy of the airplane. In the operations office, the captain and the first officer prepare the final detailed flight plan and check it over with the dispatcher. Adjustments may be made to the fuel load or to the payload. Another alternate airport may be selected. An airway routing may be modified. A flight altitude may be changed. Any or all of these final changes may be made if safety requirements dictate or if the most current flight planning information so requires.

The plan for the flight from New York to Dallas cannot be finalized unless both the dispatcher and the captain are completely satisfied with it and are willing to take responsibility for the flight by signing the plan. Here again there is a doublecheck—the plan must be approved both by the man on the ground and the man in the air.

Before the flight crewmembers actually arrive at their stations in the aircraft, ground personnel have serviced and loaded the aircraft at the ramp in accordance with precise instructions on the fueling, loading, and ramp handling necessary. Cargo, mail, and express will be loaded aboard the airplane according to a carefully developed plan which will assure correct distribution of the load within the cargo compartments. Equally precise instructions are given to those who will fuel the airplane. Every precaution is taken to assure that the exact amount of fuel which has been carefully planned by the pilot and dispatcher responsible for the flight is actually put on board. Instructions on these ground duties are incorporated in detail in the company operations manual. Fulfillment of these instructions to the letter is continuously supervised by company supervisory personnel.

With the flight crew at their stations the check-on-check procedure continues. In a typical airline jet aircraft, before engines are started, 36 separate items such as controls and instruments aree checked and inspected to be sure they are functioning properly. After the engines are started and prior to takeoff 32 additional controls and instruments are checked. During every step of these checks, the crewmember making the check does so by checking his actions against carefully itemized cockpit checklists. His actions are under the supervision of another member of the crew. This concept of "going by the book" and check-on-check continues for the entire duration of the flight. An integral part of this process, which the airlines have been giving even more stress since they commenced turbojet aircraft operations, is the constant importance for flight crewmembers to anticipate problems in advance and to dispose of them before they materialize—in other words, the importance of keeping ahead of the airplane.

A commonly held misconception is that the responsibility for a scheduled airline flight is solely on the captain and his flight crew after takeoff. In the case of scheduled airline aircraft this is not so. From the moment of takeoff until the time of landing, the airline's flight dispatchers are following the course of the flight, and monitoring the up-to-the-minute conditions of the weather, navigational aids and other such factors to assure that the flight crew has the benefit of any changes in the information on which his flight plan is based. For example, reports by earlier flights over the New York City-Dallas routing of icing condition along the airway, are immediately recognized by the flight dispatcher as of significance to the flight destined for Dallas. He quickly relays the information to the captain by company communications. This inflight report is also immediately furnished to the local weather bureau office for information to other flights than those of the airline in question. Thus, long before the captain actually approaches the area in which icing can occur, he may request and be given a clearance by air traffic control to change his airway routing so as to bypass the area.

The typical jet flight to Dallas will also have the protection afforded by an operating airborne weather radar. This device enables the pilot to have early information on any areas ahead of him where thunderstorm turbulence activity is occurring. With appropriate clearance from air traffic control he is able to skirt the bad weather affording the passengers maximum safety and comfort in their flight.

During the course of the flight to Dallas, the flight crew is in constant touch not only with air traffic control, but is in touch with the company dispatch system through company communication. Dispatch will advise the flight as neecssary of any significant changes in the status of the terminal facilities around Dallas. For example, assume that the glide slope of the instrument landing system at the Dallas airport becomes inoperative. The company dispatch system receives this information, analyzes its significance and is ready to notify and assist the flight immediately if there is any possibility that the new information may not have reached the captain via FAA communications or might otherwise cause the flight a problem. In any event the Dallas-Fort Worth terminal area is served by two well-equipped airports which regularly handle airline jet aircraft. Both airports have instrument landing systems which assure a safe approach under the lowest weather conditions which have been approved by FAA for landings.

Having outlined very briefly some of the many things routinely done by an airline to assure safe operations, it is important to have some conception of the comprehensive measures which are taken to assure that all the airline personnel who are involved in the job of planning and conducting individual flights are indeed fully qualified to do so.

The airlines are extremely selective when hiring men to perform flight crewmember and dispatcher duties.

The prospective copilot trainee must meet rigid physical requirements. He must meet the requirements for an FAA first-class medical certificate. He must have 20/20 uncorrected vision. Most airlines require him to pass a company physical examination as well. He must have had the experience and met and passed all the requirements for an FAA commercial pilot's license and for an FAA instrument rating. He must hold an FCC radiotelephone license. Previous piloting experience required of such trainees varies with individual airlines; however, a typical one is as follows: A minimum of 1,000 hours of certified flight time as pilot or copilot on airline aircraft, or equivalent experience,

preferably obtained in military service operations. Recent concentrated flight experience, including 2,500 hours of flying of which 1,500 hours has been logged as first pilot, approximately 350 hours in night flying, and 100 hours in simulated or actual instrument time. These are the requirements which a pilot applicant is to meet before being hired and before he is eligible for airline flight training. Correspondingly exacting requirements apply to the selection of flight engineer trainees.

Applicants with college education are given preference by the airlines in selection of pilot trainees and flight engineer trainees.

Few dispatchers are hired from outside the airline. Most airlines fill dispatcher positions by promotion or transfer from within the company. The preferred men are those who have had long experience in flight or ground operation work. As a result, many openings are filled by men who have been assistant dispatchers or meteorologists and a few jobs are filled by men who have flight experience as pilots. In any event, before such a selectee is permitted to exercise his responsibilities as a dispatcher he must have been duly licensed by FAA as an aircraft dispatcher.

Once an airline has hired a trainee and once the trainee has met his FAA licensing requirements, he is ready for the initial indoctrination and equipment training and the numerous tests through which the airline trains and weeds out any man not fully qualified to execute the piloting or dispatching responsibilities to which he is to be assigned.

The newly hired flight crewmember who will operate airline aircraft begins his training with a ground indoctrination course which typically consists of more than 90 hours of classroom time and many more hours of homework. This indoctrination training typically covers a whole host of subjects. Crew duties and responsibilities are covered in detail. All applicable civil air regulations, civil aeronautics manual material, and company policies are thoroughly reviewed. Various navigational techniques and every type of navigational aid and navigational information to be used are reviewed. A thorough understanding of the theories and application of meteorology to airline operations is achieved. Communications procedures, emergency procedures, and ramp and hand signals are covered in detail. A course in airway traffic control is given. A complete spellout of the authority and responsibility of each crewmember and of pertinent ground personnel is given. A course on dispatching procedures and en route operational techniques is included. The crew becomes thoroughly familiar with the design and operation of the many systems of the aircraft to which the trainee is to be assigned. The airline ground school indoctrination course includes visits to flight dispatch offices, pilot scheduling offices, meteorological offices, and sometimes air traffic control centers for familiarization purposes.

After the ground school has been mastered, it is followed by intensive training in the aircraft on which he will serve, including takeoffs and landings during day and night, normal and emergency flight maneuvers, and flight under simulated instrument flight conditions.

The flight and ground school subjects, of which only a few have been mentioned above, are given to members of the flight crew, not only during their initial indoctrination but during transitional training prior to assignment to new aircraft and when being upgraded from copilot duties to captain duties. At least once a year, refresher courses are given in many of these subjects. Through these courses crewmembers and dispatchers alike are thoroughly indoctrinated in new equipment or new procedures which are to be placed into effect. Also, in these refresher courses any weaknesses which have been detected during the periodic checks given by the company to these personnel and which are known by the company check pilot and instructors involved are counteracted by concentrated training. These refresher courses involve not only flight but ground training.

After ground school and flight training but before a new airline pilot commences service during scheduled operations, the trainee is given a check flight in the aircraft on which he is to serve under the supervision of a company check pilot or an FAA inspector to determine whether his proficiency, in fact, meets the high standards of the airline and the FAA. The same is true of a copilot who has been with the airline for a period of time and who is transitioning to a different type of airplane.

Pilots who have served with the airlines as copilots for a period of time and who are considered capable of assuming command duty as captain are confronted with a whole new series of training and checking before they may assume command of an airline aircraft. The first additional requirement

which all must have met is to have obtained a special FAA license, especially required for airline captains. He is unable to obtain this rating until he has demonstrated his ability to fly the particular airplane type through all of the many maneuvers and procedures which he could encounter during normal and emergency operations of the aircraft. This demonstration must be made to a company check-captain and is often made to an FAA inspector as well. The prospective captain is still not ready to assume full responsibility for commanding the aircraft. At this point he is assigned to serve as captain on a regular operation of the airline but his every move in serving as captain is monitored by a check-captain who accompanies him until he has demonstrated unquestionably his ability not only to fly the airplane during regular airline operations but to command the operation.

To sum up, it is only after many hundreds and in most cases thousands of hours of experience as an airline copilot, after having been subjected to extensive training, and after having passed satisfactorily numerous flight checks and written examinations, that a pilot is considered qualified and permitted to take full command of an airline transport aircraft.

Operations personnel who perform the many jobs that have to be done in connection with an airline flight on the ground—the scheduling, the planning, the servicing and the monitoring of the flights—have correspondingly comprehensive training to be accomplished and tests to be passed before they may be assigned to duty. Qualified company instructors conduct classes for flight dispatcher in aircraft systems, flight planning and all the many ground school subjects, with few exceptions, that apply to pilots. Ground personnel who will service the aircraft at the ramp have been instructed as to the procedures to be followed in fueling, loading and ramp handling the aircraft. For some of this training company instructors travel from station to station to perfect personnel along the system in the techniques to be followed. In other classes company instructors teach cabin personnel their duties and responsibilities for the safety and comfort of the passengers.

The comprehensive planning and action taken by an airline to assure safe flight operations does not, however, end with this extensive training and examination process. Those efforts are equaled in the extreme care and detailed planning given to assure that these various personnel have complete and clear guidance as well as reminders of how to do their job properly. This job is performed on the typical airline by supervisors and specialists who have a constant duty to develop and maintain the clearest possible written instructions to the various personnel concerned and to assure that these personnel adhere to these instructions. The instructions are usually set forth in the company's operations manuals. Airline operations manuals are sets of documents which total anywhere from 1 to 3 feet in thickness, depending mainly on the complexity of the particular airline's operation. They are divided into sections so as to make them understandable to the various types of personnel who will have to refer to them. Assurance that airline personnel are compyling with these carefully developed manuals is obtained by the constant surveillance and monitoring of their actions by supervisory personnel. A typical large airline has a unit of more than a thousand highly qualified and experienced men and women whose primary duty is to assure through supervision of others that particular aspects of the planning and operation of the airline's flights are conducted safely and properly. Needless to say, the airlines have chosen these people on the basis of merit and ability over a matter of years. It is from and through these airline supervisory organizations that suggestions and recommendations for making airline operations safer are constantly flowing and being acted upon.

Senator MONRONEY. We expect to see you here several times during the balance of the year on various aviation matters. Thank you for your time and the completeness of your testimony.

The committee will stand in recess until Monday morning at 10 o'clock. We will meet in the Post Office and Civil Service room, 6202, of this building. We will hear at that time the National Association of State Aviation Officials, the Aircraft Owners & Pilots Association, and possibly the flight engineers on Monday morning and Monday afternoon.

We will not be able to meet on Tuesday because of a conflict with our attendance at the Air Research Center in Atlantic City.

On Wednesday, we will meet at 2 p.m. in this room to hear the Weather Bureau, the National Airport Operators Council, and Mr. Link.

The committee will now stand in recess until 10 o'clock Monday morning, again reminding you it will be upstairs, room 6202, the Post Office and Civil Service Committee room.

(Whereupon, at 4:55 p.m., the subcommittee was adjourned, to reconvene at 10 a.m., Monday, March 6, 1961, in room 6202, New Senate Office Building, Washington, D.C.)

AIR SAFETY

MONDAY, MARCH 6, 1961

U.S. SENATE,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
SUBCOMMITTEE ON AVIATION,
Washington, D.C.

The subcommittee met, pursuant to adjournment, at 10 a.m., in room 6202, New Senate Office Building, Hon. A. S. Mike Monroney (chairman of the subcommittee) presiding.

Senator MONRONEY. The Subcommittee on Aviation will resume its hearings on aviation safety.

We are honored today to have an old associate and friend of the committee, Mr. A. B. McMullen, from the National Association of State Aviation Officials.

Mr. McMullen, we welcome you back to our witness table.

STATEMENT OF A. B. McMULLEN, EXECUTIVE DIRECTOR, NATIONAL ASSOCIATION OF STATE AVIATION OFFICIALS (NASAO)

Mr. MCMULLEN. My statement is very short. It will probably save time by reading it. I have a couple of inserts to make that will fall into place better if I read my paper.

Senator MONRONEY. That will be fine. Proceed in whatever way you wish.

Mr. MCMULLEN. My name is A. B. McMullen. I am the executive director of the National Association of State Aviation Officials, NASAO, whose membership consists of the aeronautics commissions and departments of the various States.

Mr. Chairman, you and the members of the Senate Commerce Aviation Subcommittee are to be highly commended for your continuing interest in the development of aviation, and I thank you for allowing me the time to submit a brief statement during these hearings on aviation safety.

I am a firm believer in long-range planning, and it is my opinion that many of our present aviation safety problems have been caused by a lack of planning and coordinated long-range development. Mr. Halaby expressed the situation another way recently by saying:

> The United States is now reaping the results of neglect to aviation development.

There is much to be done and the recommendations I am about to make pertain primarily to one phase or segment of aviation—the airport—and the recommendations pertain to the future as well as the present.

As operation or movement of aircraft begins at the airport, or heliport, it would appear logical to begin any study of aviation safety at the airport.

We now have, and for the foreseeable future will have, operational aircraft with takeoff and landing area requirements varying in length, from zero for the VTOL—vertical takeoff aircraft and helicopters—to a requirement of 5,000 feet and more of runway, for the larger and heavier civil transports and military aircraft using our civil airports.

Takeoff and landing airspeeds of different type aircraft vary greatly; and after the various types of aircraft are airborne, their difference in speed varies even more, creating collision hazards where different type aircraft use the same airport traffic pattern. This collision hazard is aggravated and increased by the relatively high angle of climb of jet aircraft, which reduces the pilot's field of vision, and by the many instruments and controls which require his attention within the cockpit during landing and takeoff. The turbulence in the rear of heavy aircraft can be dangerous to the operation of small aircraft.

Mr. Chairman, at a previous hearing I presented for the committee's information several of the posters that the National Association of State Aviation Officials publish monthly. In other words, they distribute one of these multicolored posters each month through the various State departments of aeronautics, in those States that have an aeronautics commission or department, to all the airports and larger operators for posting in offices and places where pilots will be sure to constantly see them.

I invite your attention particularly to this one on this particular problem of turbulence entitled "Give Big Aircraft a Wider Berth. Fly Safely." I will present a few of these for your information.

Therefore, the mixing of—and maintaining safe separation of—aircraft of different types and speeds on and in the vicinity of airports, will become one of aviation's most important problems, insofar as both safety and efficiency are concerned; and, in my opinion, safety and efficiency complement each other and must be considered simultaneously. I would like to read a quote from an address of James T. Pyle, Deputy Administrator, made last October 5 before the National Transportation Association in a meeting in New Orleans. He said:

> Air carriers operate just over 2,000 aircraft. General aviation included 69,000 aircraft at the end of 1959, logging more than three times the flying hours of domestic scheduled air transports. In the 5-year period since 1954, general aviation's proportion of itinerant operations at airports with FAA control towers grew from one-third of the national total to almost one-half.
>
> Without question, the enormous growth of general aviation reflects a healthy, prosperous aviation industry. I foresee continued healthy growth. The challenge, however, is one that is most sobering. The real challenge faced by general aviation is one of safety. Unless this challenge is met during this decade, there will be real trouble.

This problem is not as pressing now as it will be as the number and types of aircraft increase. The collision hazard may be expected to increase as numbers of aircraft increase, just as automobile collisions have increased with the number of automotive vehicles on our highways.

We now see hundreds of small, relatively slow speed aircraft based on and operated from our largest terminal type airports. In many cases, it would contribute to both efficiency and safety if these small aircraft were provided with well designed, conveniently and properly located secondary or general aviation airports in the metropolitan areas.

However, before we can expect general acceptance and use of these secondary airports, they must have adequate facilities, such as paved runways, lights, weather, repair and refueling service, reasonably comparable to that obtainable at the terminal airports, plus convenient and reliable surface transportation to and from the city.

The FAA has recently determined that general aviation use of scheduled air carrier airports begins to decrease when total scheduled air carrier operations exceed 30,000 per year. Sixty-two airports now have traffic exceeding this figure, and 37 more have scheduled air carrier operations exceeding 20,000 per year.

A study now being made by NASAO indicates general aviation use of the larger "controlled" airports may haves decreased from 5 percent to 10 percent during the past year. This decline apparently is not due to the general decline in business, or recession, for it is taking place in States where aircraft registrations and aviation gasoline sales have increased.

It appears that operators of personally owned aircraft are becoming "fed up" with the often slow or disinterested service—the loss of time experienced in taxiing great distances from and to landing or takeoff points, or places for discharging their passengers or the storing and servicing of small aircraft at the larger airports—plus the lengthy traffic delays and the relative hazards of operations in a traffic patern filled with aircraft of all types, speeds, and operating characteristics, and pilots with varying degrees of skill and experience.

But, where is the owner of the small aircraft going to find a home for it within a reasonable distance of the city, other than at the terminal airport? Los Angeles and Washington, D.C. are examples of metropolitan areas where general aviation airports are giving way to housing projects and industrial development at an alarming rate, forcing hundreds of aircraft to use fewer airports, and the owners to travel increasing miles of heavy traveled streets and highways to reach their aircraft. Here in Washington, five of the seven general aviation airports closest to the city have been sold for other uses during the past 10 years. These are Erco, Schrom, Beacon, Congressional, and Falls Church.

In the Los Angeles area, there were 64 airports in 1940. Today, there are 12 public use airports, 10 of which are publicly owned. The other two, Lockheed and Hughes, are of course owned by large corporations engaged in aircraft manufacturing, or they would probably be closed also, with the landing area used for residential or industrial purposes.

The point I wish to emphasize today is the need—from a safety viewpoint—for the development of a well-planned system of publicly owned airports and heliports, particularly in metropolitan areas. There is urgent need for:

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(*a*) The development of additional publicly owned secondary or general aviation airports and heliports in metropolitan areas, to permit greater dispersion in the future of aircraft with different flight characteristics and transportation uses; and

(*b*) Additional parallel runways on existing terminal type airports, which would make possible the separation of large and small aircraft in traffic and landing patterns.

The development of carefully prepared and currently maintained national and statewide airport plans are essential, of course, but the development of the metropolitan area airport plan and system is the most pressing, insofar as safety is concerned, to both persons in flight and persons and property on the ground. It is in these areas that we have and will continue to have the greatest concentration of aircraft of all types, which may soon range from the home-to-office VTOL air vehicle, to the supersonic transport.

The area airport plan for our largest cities should incorporate all areas within a radius of about 50 miles from the center of the city; within this area, the location of all airports, heliports, and seaplane bases needed to provide for the maximum population and industry requirements that could possibly be imagined, should be pinpointed. Detailed plans of this type, if not in existence, should be prepared now, in order that the airport systems may be developed with a minimum of cost and a maximum of safety.

Selection of airport and heliport sites to be developed should take into consideration the requirements of:

(*a*) The commercial carriers of persons and cargo; that is, the scheduled and large nonscheduled air carriers;

(*b*) The corporations and business concerns, that operate a wide variety of aircraft types, who would like to land their air vehicles as close to their factories, warehouses, or offices as possible, but still have free access to the large terminal airports where expedient transfer from the company plane to the scheduled carrier may be made. This accessibility to terminal-type airports should not be denied to any legitimate user, and I do not intend my remarks to infer that small non-airline-type aircraft should be prohibited from using the terminal-type airports, as there will be occasions when the public interest can best be served by joint use;

(*c*) The individual who uses his small plane for business or personal transportation, just as all of us use automobiles for transportation, and who would like to land his plane close to his home or business;

(*d*) the air navigation, traffic control, and separation problems that exist or will exist as more persons take to the air in all types of aircraft, and of course (*e*) the general public; that is, the taxpayer and the user of air transportation.

In this connection I would like to invite your attention to a matter which has a direct bearing on the maximum use of the system of airports in the metropolitan area. The planning of airspace must take place simultaneously with the development of the airport system plan. In this connection, NASAO and several other industry associations have long recommended raising the floor of the controlled airspace to 3,000 feet except of course in the immediate vicinity of the large airports. This would permit the flight of aircraft to and from most of

the secondary general aviation airports without the necessity of communication between the FAA traffic controller and the pilot flying below 3,000 feet except during IFR weather. This should materially reduce the radar, communications, and traffic control workload and provide better service to flight plan traffic. It should also expedite general aviation traffic into and from metropolitan areas, thereby reducing air traffic congestion and collision hazards.

On February 21, 1961, about 2 weeks ago, FAA took a major step in this direction by beginning to raise the floor of controlled airspace from 700 to 1,200 feet, or 500 feet below minimum en route instrumentality, whichever is higher, along certain routes and in certain areas.

If raised to the 3,000 feet NASAO and other groups recommended, the safety of flight and general utility aviation aircraft would be increased in many ways.

Mr. Chairman, I think what I have said, is obvious, but, briefly, if the terminal airport were located in this area in front of me, representing the city, if the terminal airport were located in this general area, and the secondary airports were located at strategic locations around the perimeter of the city and in the suburbs, and sufficient controlled airspace was established to permit normal takeoff and landing from the terminal airport, the traffic from these outlying airports could move from Washington to Philadelphia to similar type airports below the 3,000 feet level—Philadelphia, Chicago, or any place they might want to go—without interference with the flight plan traffic above 3,000 feet.

This plan wouldn't take anything away from anyone. If the small aircraft wanted to fly above 3,000 feet they would simply conform to the traffic rules that applied above that altitude. If pilots of the larger aircraft that normally fly "flight plan," desired to fly below 3,000 feet, they could, but they would have to conform to the see-and-be-seen concept that prevailed below 3,000 feet.

The proper planning and development of an adequate system of airports, heliports, and seaplane landing areas will not only increase the utility of the various types of aircraft in a given area, but will simplify the air navigation and traffic control problems, thereby contributing directly to aviation safety.

The planning and the development of these airport systems should be a cooperative and coordinated project with local, State, and Federal governments, and industry, jointly participating—with the Federal Aviation Agency placing a much higher priority on the secondary or general aviation airport in the Federal aid airport program than it has in recent years.

Mr. Chairman, in skipping over part of my prepared statement I have just realized that I have skipped over one very important sentence that I would like to emphasize, and that is that the accessibility of terminal type airports should not be denied to any user. I did not intend my remarks to infer that small, normal type aircraft should be prohibited from using the terminal type airports as there will be occasions when the public interest can best be served by joint use.

My recommendations are based on, as I said, the future more than in the present, but we should begin now to plan and develop this secondary system of airports to alleviate the traffic at larger airports from here on out.

On the matter of aircraft accident investigation NASAO strongly recommends that the investigation of all aircraft accidents remain the responsibility of the Civil Aeronautics Board so long as the Federal Aviation Agency has rulemaking authority and is responsible for the enforcement of the rules and regulations governing the operation of aircraft and for the installation, maintenance, and operation of all air navigation and communications facilities.

There is only one other item I would speak to, and that is on the matter of the decommissioning of the low-medium frequency radio ranges which a few years back were the backbone of our air navigation and communications system but are now being replaced with high-frequency VOR-type aids.

The VOR high frequency aid, of course, can only be heard on a line-of-sight basis, which means that in the mountainous areas unless these low-medium range frequency ranges are retained, you will be unable to communicate with any of the navigational aids or communications facilities when you are flying below the ridges, in the valleys, and at places where much of the small airplane traffic is conducted.

We have continually recommended and still do that these low-frequency ranges be maintained in the mountainous areas until and if—I doubt if there ever will be—sufficient high frequency ranges are established to permit receipt of communications and signals anywhere in these areas that you now receive through the low frequency ranges. These ranges are already in being, they are in operation, they require no purchase of equipment, no installation costs, and we think what the operation and maintenance cost would amount to would highly justify retention from the safety and utility standpoint.

Senator MONRONEY. This would be only in the areas where it would be impossible for low-flying aircraft to receive the radio signals, is that correct?

Mr. MCMULLEN. Yes, sir.

Senator MONRONEY. You have no objection to pulling them out where the VHF would be capable of receiving any type of plane even at a 2,000- or 3,000-foot altitude?

Mr. MCMULLEN. With this exception: We approve the plan which was adopted several years ago to retain some 88 of these low frequency ranges, well spaced throughout the country, so that you would have area coverage for weather broadcasting, for civil defense activities, and for use where you would be flying so low that sometimes you couldn't obtain satisfactory communications from a high frequency station.

Senator MONRONEY. Most of the smaller aircraft now that use radio at all are going to the very high frequency radio use, are they not?

Mr. MCMULLEN. I would think that would be correct.

Senator MONRONEY. As new planes come in they are equipped with the better and more modern radio facilities. I am impressed by what you say and the emphasis that you put on airport development. You mention the loss of five out of seven general aviation airports in Washington in the past 10 years. You mentioned today that in Los Angeles there were 64 airports in 1940, and today there are 12 in use, 10 of which are now publicly owned, and the other 2 maintained by aviation companies.

Would you feel, when the Federal Aid to Airports Act is brought up, that due to this disappearance of the general aviation airports, or airports where nonscheduled service has been finding its home and is now being taken over for housing developments and industrial locations, that some reference might be considered in the funds available to each station to where a certain percent would have to be spent for general aviation airports?

In other words, general aviation airports have always been eligible under the act for the matching funds, but there have been precious few, I think, that have been built. I happen to know of two in my State which are quite good, and built particularly for general aviation, with good hard surfaced runways and facilities of all kinds. One now even has a control tower because of the large volume of traffic coming in there.

I wonder how we are going to get the point as to the needs of general aviation across to the State authorities whose job it is to communicate with the local airport commissions for the establishment of general aviation airports.

Mr. McMULLEN. Mr. Chairman, I don't know exactly what you mean by saying that you have to get it over to the State authorities. I think the State authorities are well aware of the need for the development of general aviation type airports.

This question of Federal funds and the manner in which they have been used for development of general aviation type airports has been given lengthy and close study by the various State departments of aeronautics that I represent.

We have considered the advisability of recommending the specific earmarking of a portion of the Federal aid funds for general aviation airports for some time.

We have now reached the conclusion rather reluctantly that it will be necessary if we are to develop this system of airports, national system of airports, including both the large and small types of airports, to earmark—that is the Congress will have to earmark—a specific amount of the funds for general aviation type airports if they, too, are to normally receive an adequate consideration in the administration of the program.

NASAO has just completed a very lengthy review of the Federal Aid to Airports Act, and it proposes or will propose a number of amendments, one of which is that 25 percent of the funds be specifically earmarked for general aviation airports.

But with a provision in the act that the State and the Administrator may mutually agree that if the funds are not needed for general aviation airports they will not be frozen but can be used on larger type airports, or vice versa.

That is if the amount of funds allocated to States, if the 75 percent earmarked for scheduled air carrier airports is not needed on the larger airports, then the Administrator could of course agree to spend more on general aviation airports if they are sponsored by communities with available matching funds.

Senator MONRONEY. Isn't it true, Mr. McMullen, that one of the difficulties we face is the inertia, that the attention has been directed in the past several years toward getting ready for the jets, and to build up your runways to strengths that can carry planes, and with lengths

that can give safe takeoffs, rapid turnoffs and things of that kind that necessarily have to go into the major metropolitan airports, and that the cities apparently have been so absorbed with their local funds that we have been getting precious little attention by the cities where you need these extra satellite airports to handle general aviation?

Mr. McMULLEN. You are speaking now of the metropolitan areas?

Senator MONRONEY. Yes.

Mr. McMULLEN. That is entirely correct.

Senator MONRONEY. And that the price to which the land has risen in most areas with the spreading out of our cities makes it almost obligatory on the fixed base private airport operator who has been operating as an individual or as a private enterprise to withstand the very tempting offers of excellent prices for the land that he has heretofore had dedicated for aviation?

Mr. McMULLEN. That is right. He can make so much more out of it by selling his land, and it becomes very difficult for him to make, in many cases, sufficient from his aircraft operations to pay the increasing taxes that build up as the cities grow and build out closer to his airport.

Senator MONRONEY. I note in one place—and this is the first time that I have observed it—north of Love Field in Dallas there is a very splendid general aviation airport for executive aircraft and others, and for the first time I believe in our aviation experience we have seen a control tower placed on this airport that is operated under free enterprise.

Do you approve of that where you do have a facility that is still owned and still being operated profitably for general aviation, that whatever facilities would be extended to a public airport, if the volume of traffic is there, and if the operation is relieving traffic off of the major airports, that it would be the duty of Government to install controls on such airports?

Mr. McMULLEN. I certainly do.

Senator MONRONEY. This might help to solve a few of our problems, though it is not likely that many will be able to start out and develop that amount of traffic.

Mr. McMULLEN. There is no reason why not, if private individuals and capital are willing to build and maintain an airport that would have to be provided with public funds if they did not, that the FAA should be prohibited from providing traffic control.

Senator MONRONEY. In the matter of so-called reduction of traffic in our very high density traffic areas which has been discussed repeatedly by this committee, we keep coming back to the question that it will be very difficult to ask the scheduled lines, with huge planes and all, to cut their traffic down, or to cut their scheduling down, if, as they do this, general aviation picks up whatever vacancy of airspace that the scheduled carriers have made way for.

Mr. McMULLEN. That is right.

Senator MONRONEY. Your suggestion is that rather than prohibit this by law or eliminating completely any airport, as I understood you to say, no matter how dense the traffic, that the best answer is to provide a better landing field for the specialized field of general aviation, and that a great volume of traffic will then be diverted there if the airport is properly located, with easy access from the air, and also by

surface to the center of the city? You would recommend that we try that before we try to classify or segregate airport traffic, even in most high density areas?

Mr. McMULLEN. Well, you cannot really segregate them unless you have some place else for them to go.

Senator MONRONEY. I mean even where you have some place else to go, would you suggest that?

The committee is very reluctant of course to take such a course.

Mr. McMULLEN. That is done by regulation at the present time. I am convinced in my own mind that if there were general aviation airports, as well located as the terminal-type airport, with comparable facilities and with comparable surface transportation facilities, that you will not need to prohibit general aviation use of terminal-type airports.

The people would just prefer to go to these airports rather than be subjected to mixed traffic with the long delays. I know you and I have sat for 15, 20, 30, and even as much as 45 minutes at the end of a runway ready to take off, waiting for traffic to clear. Whereas on a general aviation airport, if only light plane traffic were not using it, I would be off in 4 or 5 minutes or less.

So I think the traffic would naturally gravitate that way.

Senator MONRONEY. If they are properly located, if they are not put great distances from the city. Actually they could be located closer to downtown because of the low performance, slower speeds, and lower altitude approaches and lack of noise problem than your major airports could be.

Mr. McMULLEN. In many cases. The only thing is—Mr. Halaby stated this before this committee a week or so ago—we are now suffering from negligence of long-range planning and proper development. It is really difficult, starting this development of a system of airports now, to obtain the land that you must have, much of which is now used by or planned for housing developments and industries to where the value of land has gone up so high that communities are reluctant to pay the price, when they have so many other utilities and municipal services that must be met, such as schools, sewers, and streets.

We must start now to not compound the error that we have made in the past.

Senator MONRONEY. Coming to another type of airport that I have been concerned with—and this is in the area of very small cities—county seats and towns that will have very great difficulty in qualifying even under the most extreme interpretations of the Federal Aviation Act for airport aid, towns where maybe only two or three planes today may be based, which would be very difficult to get Federal aid for, yet the towns have an urge and a desire to have some type of airport.

Do you know of any State which has a plan for a State-aided airport, or a plan which would permit county commissioners or county supervisors to use a part of their farm market funds to perhaps put in a half mile or three-quarters of a mile hardtop strip on land the city may be able to acquire by donation or by civic funds?

It seems to me that we are going to have to reach down lower than we can today in the Federal-aid-to-airports program since it now requires an engineering plan and a great deal of design, sometimes costing almost as much, I fear, as the completed airport would if it were

on a do-it-yourself basis for a small village or a town of 3,000, 4,000, or 5,000 population.

Mr. McMULLEN. You are referring now to the subject of State and local financing of airports?

Senator MONRONEY. Yes, sir. For a place which cannot hope to have an airport for several years. Usually I have found that when they get a hard surface runway the growth of locally based planes comes very rapidly. But you cannot get the funds unless you have the base planes and the traffic in, and if you have no airport you necessarily don't have many planes or traffic.

Mr. McMULLEN. I don't have the complete figures with me this morning relative to State aid. But NASAO, AOC and the AAAE have recently completed a national survey to determine the number of airports that should be developed or the number of existing airports that should be improved during the next 4 years.

We asked the question during the survey, in addition to how much money would be needed, how much in the way of State and local funds would be available for this type of development.

The States estimate that they will have over $61 million for the type of developments you have just referred to.

Senator MONRONEY. $61 million?

Mr. McMULLEN. $61 million, for a 4-year period. About 30 percent of the States, at the present time contribute financially to the development of airports.

In most States under the present administration of the Federal-aid-to-airports program, that is about the only sort of assistance that most small communities can look to for outside financial aid, because of the rigid regulations and the policy of the FAA that has existed during the past several years, and the high priority that they placed on the larger terminal-type airports.

Senator MONRONEY. What I have in mind—and I have become a lobbyist in my own State legislature to change the State laws, is to allow the diversion of say up to $25,000 a year of county highway funds which the county normally would be spending to black top or to improve county roads.

The diversion of just enough funds to perhaps build three-quarters of a mile of county road would give the county seat town the opportunity, if the land were already bought or could be acquired by gift or public subscription, to have a pretty good hard top runway of three-quarters of a mile, with it being built out of the county highway funds—the funds that are disbursed usually from the State gasoline tax as the county's portion to use on its county road program.

I feel that this, since many of the States do have gasoline taxes which apply also to aircraft gasoline, that this would be one way of making maximum use for aviation out of a very small diversion of the county highway money. And it would render great public service to the people who are also paying that tax who live in the county seat towns and the smaller towns to have access to an airport where something as large as a twin-engine airplane could safely land.

Mr. McMULLEN. What you are suggesting is not an impossibility, but you know perhaps better than I how jealous one department is of its funds and its prerogatives.

I think if you attempt to obtain a transfer of funds that had been specifically earmarked or appropriated for highways or any other purpose to airports, that you will run into considerable opposition and create opposition if not enemies from people who otherwise might be your friends.

I don't mean to say that it cannot be done, because many years ago I was director of aviation in Florida, but my title was chief of the aviation division of the State roads department.

Of course, with my close contact, being a part of the State road organization, I got a tremendous amount of assistance and I did just exactly what you are saying.

The State highway department would furnish roadbuilding equipment, in one or two cases providing the asphalt to give them a chance to experiment. They used new-type asphalt for experimental purposes. The State highway department mowed all the airports in the State. When mowing the highways they would simply, when coming to the airport, pull in and mow the airport. That was their contribution to aviation.

At the moment the Missouri State Legislature has before it a bill to create an aeronautics commission but it looks like they may strike the aeronautics commission and create an aviation division within the State highway department very similar to what I operated in Florida. That is possible. So with aviation growing as it is, and as important an industry as it is, and with the specialized use and the specialized engineering and knowledge that is required to efficiently design and develop airports, it is my opinion that aviation would be better served if it were served by an independent aeronautics agency.

We found that out right here at the Federal level. We tried administering aeronautics under the Department of Commerce, and mixed with the Civil Aeronautics Authority.

We have finally come around to a 100 percent simon-pure aviation agency to administer aviation. It is my opinion that in most cases you will find it is more efficient to operate that way at the State level.

Senator MONRONEY. To illustrate what we are up against, here at the Nation's Capital, you say that five of the seven general aviation airports closest to the city have been sold for other uses during the past 10 years. There is absolutely no publicly supported or maintained general aviation airport in the Washington vicinity today?

Mr. MCMULLEN. None except the Terminal Airport.

Senator MONRONEY. Here is the Nation's Capital closest to the national aviation associations and everything, where we have a complete vacuum as far as facilities being provided at any degree of public expense for the evergrowing number of general aviation planes that are right here in Washington and used by people of Washington. So if we cannot do it here, it is going to be quite difficult to do it in Iowa or in the western parts of the United States.

It seems to me that it would be perhaps well if some general advisory committee or something could be established within the FAA to consult, from the general aviation standpoint, with the airport division to do everything possible to try to stimulate a great development of general aviation airports.

Mr. MCMULLEN. I could not agree with you more.

I made a count of airplanes in the Washington area about 4 years ago and I found that there were 10 times as many aircraft based on the privately owned airports in the Washington area than there was on Washington National, which was the only publicly owned airport available for general aviation aircraft.

There are no public funds, no public assistance being provided to those 400 or 500 airplanes that were based on privately owned airports.

Senator MONRONEY. We are spending some $80 to $90 million for one commercial airport, Dulles International. It seems to me that we have completely ignored as a metropolitan area the need for additional general aviation airports, and the fact that all but two of those that existed 10 years ago have disappeared and become housing developments, would indicate to us right here what is going on throughout the country.

Mr. MCMULLEN. That is right.

Senator MONRONEY. Senator Schoeppel, do you have any questions?

Senator SCHOEPPEL. No, I do not. I am sorry, I was late getting here. I will read your statement, Mr. McMullen. I note that you are representing the National Association of State Aviation Officials?

Mr. MCMULLEN. That is right.

Senator SCHOEPPEL. It is well to see your organization getting into this picture and making your views known. The very thing the distinguished Senator from Oklahoma has pointed out here, that general aviation, and some of these airports facilities, with the encroachment of all kinds upon them, are getting into a cramped position. I don't know what can be done about it but it is well to have these matters before us for consideration.

Mr. MCMULLEN. That is the point I was trying to make.

Senator MONRONEY. Going to another subject, you mentioned a recommendation that you are making to raise the floor at which personal traffic will be flying, to prove more or less a free airspace for general aviation up to 3,000 feet.

Do you think that is enough? It seems to me that 3,000 feet above the terrain, which I presume is what you are talking about—and not 3,000 feet above sea level——

Mr. MCMULLEN. Yes, sir.

Senator MONRONEY (continuing). It seems to me that under normal conditions flying across country in general aviation that 3,000 feet, while it would help, would not be what would be advantageous to an ever-increasing general aviation fleet in use of the airspace.

We have testimony from ATA only Friday where they are talking now about lowering to 5,000 feet the airspace to be used for IFR flight plans, and that all space above 3,000 would be more or less controlled airspace under IFR and that all commercial planes exceeding the feeder lines file IFR flight plan rules.

I wonder what your reaction is to lowering the IFR airspace, which has come down as you know from some 17,000 to 10,000 and is now proposed at 5,000, whether that is not going to squeeze the general aviation into a more and more compact use of the lower airspace.

Mr. MCMULLEN. Of course, raising the floor to 5,000 feet would give general aviation that much more freedom. But in making our recommendations we gave careful consideration to the needs of the scheduled air carriers for as many flight levels as we could give them,

and we also took into consideration the obstructions such as the television towers which are now reaching 2,000 feet above the surface of the ground, and as a sort of a compromise, 3,000 feet would give us clearance of all the television towers and still a little room before you run into the scheduled flight plan traffic.

It is the very minimum. That is why I say it should be raised to 3,000 feet because that in my opinion is the minimum that would provide a usable and useful low level area where people could, if they did not want to conform to controlled airspace regulations, fly without reference to them.

Senator MONRONEY. Thank you very much, Mr. McMullen. We appreciate your comments. We will have you back when the airport bill is before the Congress.

Mr. MCMULLEN. We hope that will be soon.

Senator MONRONEY. Your next witness is Mr. Glenn B. Iverson, vice president of the Flight Engineers' International Association.

Do you have anyone that you wish to accompany you to the stand?

STATEMENT OF GLENN B. IVERSON, VICE PRESIDENT, FLIGHT ENGINEERS' INTERNATIONAL ASSOCIATION, WASHINGTON, D.C.; ACCOMPANIED BY JOE SULLIVAN, GEORGE WHITING, H. E. YOUNG, JR., JOHN JUDGE, AND STAN SABALIS, FLIGHT ENGINEERS

Mr. IVERSON. Yes, sir, I have five people with me.

Senator MONRONEY. You may have them come forward.

Mr. Iverson, we are glad to have you before the committee. We will be glad to have you present your testimony in your own way.

Mr. IVERSON. Thank you, sir.

Mr. Chairman, we have submitted previously a lengthy statement containing a reprint of an article from the Saturday Evening Post, and a pamphlet entitled "Safety in the Jet Age." These two items compare the progress of the flight engineer from the pistons to jets, and we would like this information submitted for the record along with our prepared statement that we are prepared to make at this time, a summary of our original views.

Senator MONRONEY. You do not wish it necessarily published in the hearings of the committee?

Mr. IVERSON. No, not necessarily.

Senator MONRONEY. We will receive it for the record of the committee, but not to publish it.

If you have a short summary of it we will be glad to use it, if you care to brief it down.

Mr. IVERSON. I have a summary, which I am prepared to read at this time.

I am Glenn B. Iverson, vice president engineering for the Flight Engineers' International Association. Our association is grateful for the opportunity to appear before this committee and make known our views in the area of flight safety and accident investigation. We will be pleased to answer any questions you may have on these matters, or supply any further information or evidence you may require.

Because of the wide range of subjects to be discussed, and because of anticipated questions from this committee respecting our testimony,

I have asked some flight engineers to be present. If I may, I would like to introduce them to you, with a brief résumé of their background and experience.

On my far left, Mr. Stan Sebalis, who has been employed by Pan American Airlines since 1939, and a flight engineer since 1942. He is a licensed airplane and powerplant mechanic and holds a current flight engineers license.

Mr. Sebalis served as flight engineer on Boeing 314 Clippers across the North Atlantic. He has been a CAA flight engineer-examiner and check flight engineer and is currently qualified on Boeing 707 equipment.

Mr. Sebalis participated in the initial inauguration of commercial jet equipment and helped train and qualify the first group of blind flight engineers on the Boeing 707 in his capacity as Boeing 707 check flight engineer.

Next is Mr. John Judge, who has been employed by Pan American since 1941, and a flight engineer since 1944. He is a licensed A. & P. mechanic and holds a flight engineer license.

Mr. Judge has served as flight engineer for Pan American continuously since 1953. He has been a flight engineer and designated examiner for 2 years and is currently qualified on DC–8 equipment.

Next is Mr. Harry Young. He is a graduate of Parks Air College with a B.S. degree and has been employed by TWA as a flight engineer since 1941. Mr. Young is a licensed A. & P. mechanic and served as flight engineer-instructor, training Air Force personnel on B–24's. He served in the Air Transport Command as flight engineer instructor and has been a chief flight engineer, international division, and chief flight engineer, Atlantic region, for TWA, which includes both domestic and international operations. Mr. Young is a member of this union's A.S. & E. committee and accident investigation team.

On my immediate right is Mr. George Whiting. He has been employed by TWA since 1953 as a flight engineer. Mr. Whiting is a licensed A. & P. mechanic and in 1943 was a flight engineer for the Navy Bureau of Aeronautics, engaged in experimental and test work on land and sea aircraft. He was also employed by Convair prior to coming to TWA as a flight engineer on B–36 equipment; engaged in experimental and test work. Mr. Whiting is a member of the TWA Air Safety and Engineering Committee and is an active accident investigator.

On my extreme right is Mr. Joe Sullivan, who has been employed by American Airlines since 1949 as a flight engineer. He holds a current A. & P. mechanic's license and a flight engineer's certificate. Mr. Sullivan holds a B.S. degree and has served in various capacities with American Airlines as ground and flight instructor on all phases of equipment introduction. He has been active in the flight engineer field since 1941 and served on B–29 and B–36 equipment in the Air Force, and is currently qualified on 707's.

BRIEF HISTORY OF THE FLIGHT ENGINEER AND HIS ASSOCIATION

The earliest use of flight engineers on scheduled airlines in this country was made by Pan American World Airways in the 1930's first in the old twin-engine Sikorsky flying boats and later in the famous

Martin China Clipper four-engine flying boats. Prior to World War II, Trans World Airlines (then Transcontinental & Western Air) placed into operation the first modern pressurized four-engine transports. These aircraft carried a fully equipped flight engineer station and panel manned by a technically trained flight engineer.

After World War II, the many large pressurized four-engine transports which are still in use today started coming off the production lines. Some of this equipment, such as the Lockheed Constellation and the Boeing Stratocruiser, were designed to include a flight engineer as a member of the operating crew. Others, such as the DC–6, were designed to be operated by two pilots.

In 1948, following a series of fatal accidents to the DC–6, the Civil Aeronautics Board issued a regulation requiring the carriage of a flight engineer on all aircraft whose gross weight exceeded 80,000 pounds. The Board's reasons, in part, for this order were:

> The Board's reasons and grounds for its conclusions are set forth hereafter. There are only three aircraft types now being produced, or expected to be produced in the foreseeable future, which are in the class of four-engine aircraft certificated for maximum takeoff weight in excess of 80,000 pounds. These are the Lockheed Constellation, the Douglas DC–6, and the Boeing 377. Despite the automatic devices which are available and installed in such aircraft, they have so many items calling for the pilots' attention and are so complex in operation that the pilots' ability to accomplish all duties imposed upon them may at times be exceeded, if provision is not made for a flight engineer. The flight engineer will contribute substantially to reduction of pilot fatigue and resultant accident-provoking sequences. In particular, the flight engineer can relieve the pilots of burdensome mechanical duties which, if required to be performed when the aircraft is being flown on instruments, when there are difficult navigational problems, when radio communications are erratic, or when the pilots are attempting to follow complicated traffic control procedures, and accomplish instrument approaches, would be exceptionally onerous. The flight engineer is able to perform important duties and add to safety of flight, even when riding in the jump seat of a plane in which no flight engineer station has been provided.
>
> In addition to the foregoing, the flight engineer with a specialized engineer will be useful in case of fire or other malfunctioning, both in overcoming the difficulty and restoring normal functioning, and in relieving the pilots of various mechanical duties, particularly those which would require one of them to leave his pilot's station, while they concentrate on flying the aircraft during any period of emergency. The flight engineer will also contribute to the level of safety by assuming responsibility for propert completion of ground maintenance for the correction of any malfunctioning which has been discovered in flight.

During the same year, 1948, four federally-chartered groups of flight engineers on American Overseas (now merged with Pan American), Eastern, Pan American, and Trans World joined together to form the Flight Engineers' International Association. On December 7 of that year the new group was granted a charter by the American Federation of Labor, to represent, and bargain for, the craft and class of flight engineering.

Today, this association represents over 3,000 flight engineers flying on 11 U.S. airlines. Each airline group represented has its own chapter and each chapter in turn has its own elected officers.

In addition, FEIA maintains affiliation with nearly 2,000 flight engineers from foreign countries. This total represents nearly all of the world's flight engineers. FEIA is affiliated to the International Technical Institute of Flight Engineers, with headquarters in Paris. The institute is a medium for the worldwide exchange of technical

information. The FEIA is also affiliated to the International Transport Workers' Federation, with headquarters in London, England.

The slogan of the FEIA is "Air Safety Through Engineered Flight." These are not idle words, as the FEIA maintains a very active and extensive technical program under the direction of the vice president of engineering in the international office. This technical program takes two forms:

1. FEIA AIR SAFETY AND ENGINEERING COMMITTEE

This committee is made up of subcommittees on each airline chapter, each under the direction of a chapter chairman. The primary purpose of this committee is to deal exclusively with technical and engineering problems encountered in the field of flight engineering. To assist in the compilation of the needed technical information, each flight engineer is provided with a self-mail type reporting form, one copy of which goes to the international office and the other copy to the airline chapter chairman concerned. When occurrences of an airworthiness nature are revealed in such reportings they are evaluated and communicated to the various interested parties such as the airline concerned, the manufacturer, the FAA, the CAB, et cetera. In many instances, these committee investigations are the result of evidence uncovered during the course of the committee members' participation in an accident investigation.

2. FEIA ACCIDENT INVESTIGATION PROGRAM

FEIA maintains a staff of over 125 accident investigators among the flight engineers of the airlines represented.

These investigators participate in an accident investigation as part of the official Civil Aeronautics Board Investigation Team. The chairman of each Chapter Air Safety and Engineering Committee directs the accident investigation program on that chapter. Accident investigators are appointed from the most competent and qualified flight engineers available and represent experts on each type of equipment flown by that airline. The investigator and the chapter chairman concerned are responsible for submitting a report of their findings as to the probable cause of the accident to the International Office, for forwarding to the CAB, and for action with the FAA as may be required.

For example, two of our flight engineers spent 6 weeks in Milan, Italy, during the accident investigation of a TWA Lockheed of 1649A in June of 1959. These men pinpointed the probable cause of the accident as an internal explosion of fuel tank No. 7 in their report to our International Office and to the CAB. Additional testing in the laboratory and in flight supported our findings (which was accomplished only through our insistence that the fuel vent system of this tank jeopardized the safety of this aircraft). On January 27, 1961, the FAA issued an airworthiness directive requiring modification of all No. 7 fuel tank vent systems on Lockheed 1649A aircraft.

We were also active and successful in campaigning for a modification to the Lockheed Electra pressure refueling system, as a direct result of our participation in the recent Electra accident investiga-

tions. The effect of the malfunctions associated with this system became so grave that the structural integrity of the wing was placed in jeopardy.

I have pointed out only two instances of our efforts to enhance air safety; there are many more, but I think they show the ability and technical competency of the flight engineer and the work he has done and will continue to do in the field of air safety.

COCKPIT DESIGN AND AIR SAFETY

An unparalleled parade of advertising claims preceded the emergence of the current crop of turbine transport airplanes. It was claimed that the human element in the operation of these new airplanes would be considerably reduced. The cockpit display would be greatly simplified and would be considerably less complex than the latest piston transports. This reduction in complexity would allow these new aircraft to be quite safely operated by two pilots.

We know now, however, from actual operating experience, that such simplicity existed only in the minds of the advertising departments.

By virtue of the absence of specific requirements for a flight engineer in the Civil Air Regulations, some large jets were designed for a two-pilot operation, even though the operating rules under which they would be operated required the carriage of a flight engineer.

The flight engineer's station was minimized as the factories sought to design the cockpit around a two-pilot operation, because of economics and political pressures applied by special interest groups. This design approach was summarized by one large jet airplane manufacturer in a letter to the CAA (1958), in which they noted that:

> On certain nonrevenue flights, such as ferry or test, the airplane can be flown safley by a pilot and copilot only.

The result of such action can be clearly seen today in the cockpit of any modern jet. The end product is a configuration that embodies little of the design requirements as recommended by the SAE S–7 Committee, whose primary function is to establish the criteria for cockpit design.

In effect, present cockpit layout distracts the pilots from their jobs of flying and navigating, and in addition has made virtually impossible for the flight engineer to perform his job satisfactorily. In analyzing cockpit design requirements, an eminent scientist in the field of applied psychology, Dr. Robert B. Sleight, has noted that—

> the failure to provide necessary activity room for the operator in crew station layout may place the aircraft in jeopardy. Such aircraft should not be designed, if designed they should not be built, if built, they should not be flown. Many aircraft, even those recently developed, have crew stations so designed as to make operator activity difficult or even impossible.

The same distracting influences that we know have caused accidents in the past have been engineered into the present jet fleet.

Let us look at a few instances where we feel the industry has failed to profit by past experience.

The fire control panel on some previously designed aircraft was located on the forward instrument panel between the pilots. This can

cause confusion and distraction to a pilot at a time when he can ill afford to be distracted from his normal duties of flying as an instrument approach or during takeoff.

On March 25, 1958, a Brainiff Airways DC–7C crashed on takeoff at Miami, Fla., killing nine people. The official CAB accident report noted that the probable cause was due to the failure of the captain to maintain altitude during an attempted return to the airport following an engine fire.

The report stated that the captain displayed poor piloting technique by allowing his attention to be diverted from his flight instruments during the engine fire emergency procedures being performed by other crew members.

On February 1, 1957, a Northeast Airlines DC–6A crashed on Rickers Island, N.Y., during takeoff, killing 20 people.

The official CAB accident report stated that the probable cause was failure of the captain to properly observe and interpret his instruments and failure to maintain control of the aircraft. The CAB report on page 22 stated:

> It is customary for the first officer to monitor the flight instruments during an instrument climb out. According to his testimony, First Officer Dixwell monitored the engine instruments and the flight instruments until the command was given for METO power. He then devoted his attention to monitoring the flight engineer's actions without further reference to the flight instruments. This action, according to the testimony, consumed quite a few seconds and lasted until his attention was attracted to the outside immediately prior to striking the ground.
>
> Had First Officer Dixwell had the opportunity to devote his attention to the flight instruments during this critical period in the flight, he would undoubtedly have detected the deviation from course.

This first officer's preoccupation with the duties being performed by the flight engineer is typical of the distracting influences inherent in the SAE Type II or three-abreast cockpit.

I have cited only two cases among many, substantiating the need for design change in only one area of cockpit layout.

One would think that after the two fatal crashes such as these a responsible industry would see that this situation was remedied immediately, as the cockpit design of both aircraft involved in these accidents was of the SAE Type II, or three-abreast type, with their inherent built-in distractions to both pilots.

The built-in distractions of a three-abreast cockpit are compounded during night operations when the forward instrument panel lighting must be kept at a low level to permit the pilots to properly observe air traffic, weather, and radar scopes.

This low level of lighting makes it very difficult to monitor the small and distant engine instruments. In addition, the illumination of any engine or system warning light presents an immediate and unnecessary distraction to the pilots.

The Douglas DC–8 cockpit was originally designed according to SAE S–7 Committee standards, but was altered to the present unsatisfactory configuration because of political and economic pressures.

Senator SCHOEPPEL. With reference to this statement, sir, what political pressures do you have reference to there? Could you spell it out, briefly?

Mr. IVERSON. Briefly, sir, the airlines, in an attempt to do away with the flight engineer, have pressed the manufacturers for a two-pilot design.

Senator SCHOEPPEL. You make reference there to political. Is that what you mean by that term "political"?

Mr. IVERSON. Yes. I did not mean politics as such. I meant activity within the airline industry.

Senator SCHOEPPEL. Very well.

Senator MONRONEY. That should then be properly interpreted as industry pressure, rather than political pressure?

Mr. IVERSON. Yes, sir. That was a poor choice of words. That would be a better statement.

It is interesting to consider the experiences and operating philosophy of the world's most experienced operator of commercial jet aircraft, British Overseas Airways Corp. It will be recalled that this airline began the operation of pure jet Comet airliners approximately 5 years before the advent of jet operations in this country. The early Comet aircraft were designed for a two-pilot operation and consequently no provision was made for the carriage of a flight engineer. In due course the carriage of a flight engineer was deemed necessary, and subsequent Comet aircraft were delivered with a separate built-in flight engineer's station.

When BOAC ordered the Boeing 707, they called upon this previous jet experience and had many changes made to the cockpit layout, at considerable additional expense to themselves. These changes had the effect of reducing the engineering workload on the pilots, and relocating these engineering systems, and so forth, to the flight engineer's station.

When BOAC recently ordered what may be the last of the subsonic jet transports, the VC–10, they specified that all of this jet experience be summed up and reflected in the cockpit layout, in the design stage.

The result is a pilot's station which is clean and uncluttered, yet contains the latest in radio-navigational aids and automatic landing provisions. Four primary engine instruments are provided in the pilot's panel and all of the rest of the engineering, including a duplicate set of throttles, is located at the separate flight engineer's station.

If we continue to allow air safety to be the subject of political and economic pressure, then we are not fulfilling our obligation to the traveling public and we make a mockery of our responsibility and the industry we represent.

The cause of safety is not enhanced by finding that an accident was caused by "pilot error," when, in fact, it was not pilot error at all, but rather was poor cockpit design which permitted the pilots to be distracted from their primary duties of flying and navigating the aircraft. Speed of operation at takeoff leaves little time for monitoring and cannot be tolerated at the expense of inattention to flight.

Indeed, a study by Pan American World Airways as long ago as February 25, 1947, noted that a pilot can make a maximum of 120 eye fixations per minute on his instrument and controls and that in the successful conclusion of an instrument landing he requires 100 fixations per minute.

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The concentration required of the two pilots while performing take-offs, landings, difficult and crowded terminal-area penetrations, etc., in modern high speed jet aircraft is obvious, and such distracting influences of an engineering nature must be designed away from the pilot's station.

Part 4(b) of the civil air regulations must support the operating rules by specifying the requirement for a separate engineering station and the controls which must be located there.

Neither the manufacturers nor the airlines should have the final arbitrary authority to set the specifications and design criteria for cockpit layout. These specifications for cockpit layout should be and must be set by the Federal Government through the FAA and spelled out in the civil air regulations.

FLIGHT ENGINEER REQUIREMENTS, DUTIES, AND TRAINING

Part 35 of the civil air regulations deals with the certification of flight engineers. It outlines the certification.

RECOMMENDATIONS

Cockpit design: The first essential to be considered in cockpit design is the function of the individual operating crew members, that is, pilot, copilot, and flight engineer. The second essential to consider is that of the operating procedures.

Cockpit design philosophy must recognize that air transportation vehicles are, and will be, complex machines, whose safe operation must be entrusted to specialists.

The pilots must be recognized as specialists in the increasingly complex field of piloting, aerodynamics, radio-navigation, and so forth. They must be provided with an uncluttered working area and all distractions of an emergency nature must be designed away from their station. They must not be involved in a round of duties of an engineering nature which detract from these very high piloting demands.

The flight engineer must be recognized as an essential member of the operating crew, with specialist engineering knowledge of the complex airplane and its systems, and it must be recognized that if maximum benefit is to be extracted from the flight engineer, he must be provided with a separate engineering station.

Cockpit design criteria should properly consider the worst possible set of circumstances which can, and often do, occur in the course of normal airline operations, and not ideal circumstances. For example, an instrument approach in poor weather and icing conditions, with poor communications, and an engine out is an operating situation far from ideal, yet which has been experienced many times in the past, and will continue to be experienced. The flight deck layout must be predicated upon such operating circumstances such as this, as this is not the time to have the pilots involved in a succession of mechanical or engineering duties.

Also, the cockpit must be designed to provide for the safe operation of the aircraft by the average airline crew, and not by highly skilled and knowledgeable engineering test pilot personnel. Such above-average skilled personnel simply do not represent the average airline pilot.

The SAE Type II—or three-abreast—cockpit must not be considered in future aircraft design, as the intermingling of systems common to such layouts is simply not conducive to maximum safety. Cockpit safety is not enhanced when we see a design which permits three people being responsible for accomplishing the same function at the same time.

The ever-increasing degree of pilot skill and concentration needed in present turbine aircraft, with the need for more precise terminal area navigation, plus weather watch and weather-navigation must not be unnecessarily disrupted or distracted by factors of an engineering nature which are easily taken care of by the flight engineer at the separate engineering station.

Cockpit design philosophy and criteria must be such as will permit undivided pilot attention to the job of safely flying and controlling and navigating the airplane, and at the same time provide the flight engineer with the engineering instruments and controls as will enable him to accomplish his intended purpose on the airplane. This can be done only if guideposts for the designer are built into the Civil Air Regulations.

The FEIA will provide evidence from its files to those who doubt the position we have taken on this question of cockpit design.

RECOMMENDATIONS

In our brief to this committee we have devoted 31 pages to supporting statements and recommended changes that we believe must be made to improve flight engineer certification and training requirements in the interest of safety.

Briefly to summarize, our recommendations include:

1. Raising the experience requirements, knowledge level, and skill of flight engineers applicants.
2. Requiring type certification of flight engineers on piston and jet equipment.
3. Provide for flight engineer proficiency checks every 6 months.
4. Require the carrier as well as the individual to keep adequate and concise records of flight engineers flying time, training and check rides, type ratings, recurrent training, and proficiency checks.
5. Define the duties of the flight engineer and his function clearly so that he will be utilized to the fullest extent in the interest of safety.

Flight engineer requirements, duties, and training:

Part 35 of the Civil Air Regulations deals with the certification of flight engineers. It outlines the certification rules and qualifications for flight engineers. The operating rules (parts 40, 41, and 42 of the Civil Air Regulations) contain the requirement for and the training of flight engineers.

These Civil Air Regulations are not specific in outlining the duties, functions, responsibility, and training of flight engineers, and have been the subject of much controversy and arbitrary interpretation over the recent years.

There is a desperate need for regulations which more specifically define the flight engineer's duties and functions. The present Civil Air Regulations definition of a flight engineer states, in effect, that the flight engineer "will assist the pilot in the mechanical operation of the aircraft."

This is both a broad and inadequate definition of the flight engineer's duties and is subject to wide interpretation. His preflight and postflight duties are not specified, nor are his inflight troubleshooting or analysis writeups or responsibilities specified.

Under the stress of intense economic and industrial pressures, the carriers have been forced to intensify their efforts to minimize the role of the flight engineer. During the course of a recent public hearing on the matter before the FAA, the carriers (through the Air Transport Association) stated that the possession of a pilot's license should enable that crew member to perform the flight engineering function, and that, in effect, engineering specialization was unnecessary.

Those who advocate this dilution of the flight engineering function are deliberately abandoning their responsibility in the face of economic and industrial pressures, and are ignoring the fact that modern-day aircraft operation is a highly complex and specialized function, and long past the "jack-of-all-trades" era.

First, let's consider motivation, and the U.S. Air Force approach in selecting flight engineers. Air Force Manual 51–9 dated December 1954, notes that:

> At first it was planned that the flight engineer would be the third pilot. Cross training was to require all pilots to know the duties of the airplane commander, copilot, and flight engineer, and, in flight, these would rotate their jobs. It was not feasible for a third pilot to be in the aircraft.
>
> From a standpoint of ability, convertible skills, and cross training, the use of pilots appeared ideal. But from the standpoint of availability, primary interest, attitude, and *motivation*, this reasoning did not prove very successful. So another source of flight engineers was urgently needed. [Emphasis added.]

It was then decided that—

> * * * men with previous mechanical training and experience would be a very good source of flight engineer students. With proper screening, this problem was successful, for these men proved intelligent and highly motivated.

This motivation factor is equally as applicable to present-day airline operations. Indeed, following a recent turbine aircraft accident, to a carrier who utilizes the flight engineer position as stepping-stone to a pilot position, the CAB found in a survey that the average aircraft inspection before flight by this crew member consumed approximately 8 minutes time, compared to the average of 1 hour taken by the specialist flight engineers on the same equipment on another carrier.

On another carrier which recently suffered a fatal accident, and which also uses nonspecialist flight engineers, we have found that it is common practice to make any preflight aircraft inspection at all, but rather to board the aircraft directly, just before departure time.

Strangely enough, the Civil Air Regulations do not spell out the requirement for a preflight inspection by the flight engineer, despite the fact that in the daily operation of our current turbine fleet, the specialist flight engineer spends from 45 minutes to 1½ hours in a preflight inspection of his aircraft to insure full airworthiness. Such flight engineer is personally motivated to make sure of the airworthiness of his own aircraft.

The FEIA has voluminous evidence of the contribution to safety of such specialist approach to the job of flight engineering. Documented evidence of this nature has been submitted to the FAA on

many occasions, and our files of such evidence are open to all who would seriously question this specialist approach.

The same is true of in-flight troubleshooting and analysis, in connection with flight safety. Voluminous evidence is available to show how, by virtue of extensive knowledge and training, the flight engineer has restored to serviceability a wide variety of malfunctioning or inoperative navigational and communication equipment aboard the aircraft.

Senator SCHOEPPEL. Mr. Chairman, I would like to ask a question here.

Senator MONRONEY. Yes, sir.

Senator SCHOEPPEL. From the standpoint of the operation of these aircraft, I know you fellows have had some dispute here between pilots and your own organization. I am hopeful—and I say this kindly—that somehow it can be resolved in a practical way.

The public generally is getting pretty sick and tired of being tied up on these transportation operations for long periods of time because of some dispute within certain operating phases of the industry.

I say that kindly, because my mail reflects a tremendous lot of it. Maybe it is only because I am on this committee.

Let's go to the $64 question here. I have a little conversancy with some railroading operations because I had a brother who was up in the cab of the locomotive in two capacities: as fireman and as engineer, and later, down the line as a conductor, in successive periods of advancement.

The pilot of a ship when he comes aboard, I understand that he supersedes the captain in charge or anybody in charge. When that pilot comes aboard he takes charge of the ship in bringing it in from the standpoint of the flight checks, from the standpoint of the functioning of this plane before it leaves the ground. I have been informed, at least it is my idea, that the pilot, in his check, has the right to say whether he takes that ship off or not.

Is that generally true?

Mr. IVERSON. Normally, sir, the pilot does not do any checking. The flight engineer does all the preflight inspection of the airplane.

Senator SCHOEPPEL. The point I am getting at is who makes the final decision from the standpoint of the operating of that craft?

Mr. IVERSON. The captain is in command.

Senator SCHOEPPEL. That is generally in the series and in the line of command, that responsibility has to rest on somebody's shoulders. Therefore it rests upon the captain in charge or whoever is in charge of that plane, is that correct?

Mr. IVERSON. That is correct.

Senator SCHOEPPEL. When you run into some of these operational difficulties that you say you see on inspection, who would take precedence on that?

Is that something you desire to have spelled out in rules or regulations? Just how would you handle that?

Mr. IVERSON. Right now, as I pointed out here, there are no regulations saying that anybody shall do the preflight on an airplane prior to service. Any flight crew member. It does not say that the flight engineer shall do a "walk-around" inspection. Our files are full of

incidents regarding cases where flight engineers have found airworthy items which needed to be and must be fixed prior to flight.

Senator SCHOEPPEL. The reason I ask these questions, I think we ought to have something in the record here, at least from this Senator's standpoint, as to how that would be handled or how it should be handled or how it should be covered by rules or regulations; whether it would be practical, or whether it would be impractical.

Mr. IVERSON. We are not suggesting in any way that we detract from the captain's authority. The captain is in command and he has the right and the responsibility to say whether the airplane shall be taken or not. But the captain has to rely on someone for knowledge of what the problems are with the airplane.

Since the regulations do not spell out that the flight engineer shall conduct a preflight prior to takeoff, you can just come out, get on the airplane and fly off, and there may be something wrong with it that would cause a system to fail or jeopardize the safety of that flight.

So this should be, we maintain, spelled out in the civil air regulations, that this is a duty and a responsibility of the flight engineer, because he does it daily now.

The regulations do not recognize this.

Senator SCHOEPPEL. Thank you very much.

Mr. IVERSON. The recent collision of the United Air Lines DC–8 and the Trans World Airlines Constellation over New York City has tragically highlighted the fact that in-flight analysis of malfunctions and corrections can be made on turbine aircraft, providing the flight engineer is properly trained and is privileged by the air carrier to perform such actions—a fact which, in the absence of specific civil air regulations, is widely interpreted and practiced by the carriers.

It will be remembered that the United Air Lines DC–8 reported prior to entering the New York traffic area that one of its VOR navigational receivers was inoperative. In a letter to Mr. Joseph Minetti of the CAB, former FAA Administrator E. R. Quesada stated that an inoperative navigational receiver (VOR) would require "more effort on the part of the flight crew in their radio navigation." We believe this to be particularly true when one considers the speed of the DC–8 and the short distances involved. General Quesada continues in his letter to Mr. Minetti by noting that the U.S. Government had in the last 5 years—

> spent over a half billion dollars in ground installations throughout the United States for navigational assistance to aircraft.

These statements serve to dramatize the extreme need for facilities and devices which will better enable the pilots to accurately and safely navigate over high-density airways. However, this great investment for the purposes of safety becomes useless should the receiving equipment aboard the aircraft become inoperative. This requires that the airborne radio and navigational equipment must be equally reliable, if aircraft are to safely traverse our airways and crowded control areas without the danger of collision.

To preclude the flight engineer from technical training as will enable him to troubleshoot and restore such communications and navigational malfunctions makes no more sense than it would be for the FAA to deny ready maintenance to its ground navigational facilities.

We cannot discount the fact that in the instance of the United DC–8 that had both VOR systems been working properly, one of the pilots might have noticed the passing of the Preston intersection and immediate corrective action could then have been taken. This is not to say that it is our opinion that such was the cause of the accident, nor do we make such a statement at this time. It is an incontestable fact, however, that at the speed the aircraft was operating and with the short distances involved, the pilots would have had a much more simple job of radio navigation providing both the VOR systems were functioning properly.

During the course of the recent CAB hearings held in connection with the United-Trans World collision, it was established that there were four identical VOR and VHF communication receiver units on the DC–8, which were interchangeable. The FEIA representatives asked United Air Lines witnesses if the crews were made aware of this during training. The reply was:

> Flight engineers normally would not conduct any maintenance activity. Whether they are aware of this fact, I do not know.

This philosophy is quite prevalent among operators and others who advocate all-pilot crews. There is motivation to skip detailed technical training as will insure one member of the crew becoming sufficiently familiar with the systems and components on board the aircraft to permit the analysis of malfunctions and the taking of corrective action whenever possible. Such all-pilot philosophy was corroborated by the same United Air Lines witness who stated:

> I don't believe there is any requirement at any time in flight for the replacement of navigational equipment.

The important point here which applies to all operations on all carriers is that with proper training and with operational duties clearly spelled out, the flight engineer can, in many instances, restore faulty electrical, communication, and navigation equipment to full operation while still in flight. Conversely, he cannot do this if the carrier forbids such practices and/or the flight engineers are denied such training. In our opinion, an airline operation which precludes the training of the flight engineer in such functions is overlooking a very important and logical avenue toward improved safety.

In this respect it is interesting to note BOAC's attitude toward the in-flight troubleshooting of radio and navigational equipment. The BOAC flight engineers are given a 2-week course in basic radio and radio-aid theory, followed by 2 weeks of specific training, analyzing and troubleshooting of the aircrafts communications and navigational systems.

Because of the tremendous capital investment in jet equipment, the airlines understandably are motivated toward high utilization and lower "down for maintenance" time. Because of this, ground maintenance and troubleshooting are reduced to a minimum. The logbook entry, "Unable to duplicate on the ground," is more prevalent today because of the operational environment of the jet aircraft which cannot be duplicated on the ground. To ground run a jet as maintenance used to do on piston airplanes in an effort to duplicate various flight malfunctions is practically unheard of today, because of the high cost of doing so, plus noise abatement restrictions, et cetera.

In a notice of conference, dated January 18, 1961, with respect to airborne recorders, the FAA noted, page 2, that:

> The introduction of turbine-powered airplanes into airline operation has also caused a tremendous change in the previous concepts relating to the economics of operation. The airplanes are more expensive, more complicated, and their ability to produce profit is increasingly sensitive to the many variations affecting the operational life of the aircraft. The importance of "down for maintenance" time, resulting in missed schedules, poor utilization, and high material costs, all greatly affect the margin of profit. Achievement of the highest possible standards in these areas, therefore, is a major objective.

The evidence is incontestable that in the ever increasingly complex field of flight operations, safety is more and more dependent on vigilance and dedication. These qualities, based on a specialized knowledge of the machine, were never more required. Yet, despite this evidence, we see an industry that is trying to minimize and destroy the specialist role of the flight engineer.

Why and how? The answer is both sinister and its effect insidious.

Speaking before the 10th annual meeting of the Cornell-Guggenheim Aviation Safety Center in Washington, D.C., on May 23, 1960, Mr. Harry Guggenheim noted the relationship between airline economics and flight safety. He noted:

> We are meeting at a time when our air transport system has reached a crisis. Since our last annual meeting on May 18, 1959, aviation accidents and fatalities have risen markedly. At the same time the financial difficulties of the airlines as a whole, which were strongly foreshadowed in my remarks last year, have reached a climax. I suggest now again, as I strongly indicated last year, that these two matters have a connection, and that unless something is done to improve the financial plight of the airlines, we can expect not only to see the service suffer, but the deterioration of air safety as well.

Under the stress of intense economic and industrial pressures, the economic health of the airlines has been burdened to the prejudice of safety by the addition, for example, of a fourth man or third pilot on the flight deck. The carriers, in turn, seek relief in other directions, as for example, in the dilution of the regulations respecting the flight engineer to the extent that the recently added third pilot can do the flight engineer's job.

This demand for "equal training" has seen a 6-week training course for flight engineers on Lockheed Electra equipment reduced to 4 weeks because such was the duration of the pilots course. In another instance, the flight engineers training program was cut from 8 weeks to 4 weeks by the same techniques and pressures.

Senator MONRONEY. Is that the result of the company saying they could qualify flight engineers, or was that the result of any FAA action?

Mr. IVERSON. That is the result of the company.

Senator MONRONEY. The company?

Mr. IVERSON. Yes, sir.

Senator MONRONEY. At the present time there is no time schedule for training and minimum requirements?

Mr. IVERSON. There is coming out—I think it became effective the first of the year—a minimum training standard under the FAA regulations. There are certain minimums spelled out at this time.

Senator MONRONEY. While we are on that, does that include instruction on repairs and maintenance of airborne navigation equipment?

Mr. IVERSON. They proposed it in their format. It included specialized training in in-flight troubleshooting and analysis of malfunctioning equipment. But it isn't spelled out in regulation at this time. This is the intent of their program. However, it is not spelled out as such anywhere today.

Senator MONRONEY. This would apply to anyone serving in the engineer's post, whether he be a member of your organization or a member of the pilots' organization?

Mr. IVERSON. That is correct.

Senator MONRONEY. They all have to take the same standards?

Mr. IVERSON. That is correct.

That such practices exist indicates a definite inadequacy in the present civil air regulations pertaining to flight engineers. Raising the standards of flight engineers training and qualifications to an adequate minimum level of safety can no more be left to the discretion—or interpretation—of the carriers than could a voluntary request for the installation of airborne weather radar or flight recorders, yet the relationship of a properly trained flight engineer to safety is an even closer one.

Those civil air regulations pertaining to flight engineer training and the approval of flight engineer training programs should be revised to provide for sufficient training to permit the flight engineer to perform in-flight analysis and maintenance of the systems and engines. In addition to this, the airplane operating manuals should clearly spell out procedures which would charge the flight engineer with the duty and responsibility of carrying out this function.

Our organization has, on many occasions, made detailed recommendations to the FAA for improvement in regulations pertaining to flight engineers. These recommendations have been substantiated and documented by flight engineer technical reports of actual incidents compiled all over the United States and Europe. Progress on these matters appear to be imminent during the early part of 1960. General Quesada testified at the hearings conducted by Senator Monroney on January 11, 1960, in Washington, D.C., that:

> We have made similar surveys of the training programs being carried out by a number of air carriers to qualify flight engineers for assignment as a member of flight crews. Based upon this, we have developed a completely revised part of the regulations governing issuance of certificates to flight engineers. This will shortly be issued as a notice of proposed rulemaking.

A public conference was held by the FAA on June 28, 29, and 30 to review flight engineer requirements. All segments of the industry were represented. To date, a notice of proposed rulemaking has not been issued.

Senator MONRONEY. I thought you just said that they had.

Mr. IVERSON. I would like to explain that. In the conference on June 28, 29, and 30, we talked about specific qualifications for flight engineers in all phases of operation. The manual, or the text of the information put out by the FAA, which I was referring to prior to this, which was approved the first of the year, and is in effect now, only spells out the hours of training, for all practical purposes, and it is not what we feel is adequate at all in any way.

Senator MONRONEY. In other words, it wouldn't go to navigational equipment or radio, electronics, and things like that?

Mr. IVERSON. That is correct. It is subject to interpretation like all the rest of the regulations covering flight engineers. This manual that they put out was approved by the FAA for pilot training originally, back in June 1960, I believe. And then they did not change the manual whatsoever. The manual stayed right in it. This was only subject to pilots and navigators and so on, but excluded the flight engineer.

Then at a later date they put out a two-page letter saying, "Now this manual pertains to flight engineers," and only a two-page letter saying how it would pertain to the flight engineers. So it isn't clear at all, and it is once again subject to interpretation.

Similarly, a public conference to review flight engineer training requirements was held by the FAA in Washington, D.C., on September 19, 1960. A proposal was submitted to the industry by the FAA which embodied many principles and features which would have greatly improved the minimum standards of flight engineer training. These recommendations were contained in Document No. 40.290–1: "Approval of Training Programs," dated August 17, 1960. I would like to expand this. This recommendation was prepared by the Maintenance Department of the FAA and dealt with all training facilities of the flight engineer and spelled out specifically training functions that would be undertaken by the airlines. This, as I said, was prepared by the maintenance section, and after it was prepared the flight engineer responsibility was transferred from the maintenance section to the operations section of the FAA. This document more or less just died on the vine.

It is hoped that the increased standards recommended by the FAA proposal will shortly be issued as a notice of proposed rulemaking. We feel that there is an urgent need for a more realistic flight engineer training program, based on the complex actualities of modern day commercial aviation life.

More realistic flight engineer training standards are needed as, aside from specific training deficiencies, the criteria for establishing minimum standards of flight engineer training in the present training regulations contains the same weakness as is present in other flight engineer regulations; that is, they are subject to broad interpretation by the carriers and by the FAA field inspectors.

We believe that the traveling public is justifiably concerned over aviation safety, and would rest easier in the knowledge that one member of the flight crew possessed an intimate knowledge of the complex machine in which they were flying. But don't look to industry to sponsor or even support such philosophy. Only you and the Federal Aviation Agency can do that.

PROCEDURES

The airplane operating procedures, both of a normal nature as well as those of an emergency nature, are as important to the safe conductance of a flight as is the mechanical integrity of the airplane itself.

The safety of flight demands a well-drilled and competent flight crew team—pilot, copilot, and flight engineer.

Standard operating procedures—SOP—where every crewmember is trained and checked in the performance of specific functions and duties, is as important in commercial aviation as it has been found to be in military aviation.

The flight engineer, in his capacity of handling the engineering function aboard the aircraft in flight as a member of the FAA-certified minimum operating crew, likewise should be clearly aware of his specific duties and functions during both normal and emergency conditions. Yet we continually experience situations in which the flight engineer is trained in certain duties and procedures only to find that in actual scheduled operation these duties have been arbitrarily assigned to another crewmember. The hazards, in the event of an emergency, of training crews in one manner and then operating in another, is obvious.

To prevent such unsafe practices, the duties of each crewmember and the procedures to follow in both normal and emergency operations should be clearly indicated and assigned in the appropriate FAA-approved flight manuals, and no deviation should be permitted.

The question of crew duties and procedures must be given more thought and research in the design stage, so that duties and procedures become a function of design and cockpit layout, and thus preclude interference and confusion between crewmembers during the course of these duties and procedures.

In some aircraft today we find an intermingling of duties and procedures which cause confusion and prejudice flight safety. For example, one operator of Lockheed Electra equipment has stated in its flight manual that the flight engineer should, after setting up takeoff and METO powers—

quickly move his arm out of the way so as not to interfere with the use of the flap lever and radio controls (i.e. by the pilots).

Another case in point which illustrates the absurdity of crew procedures and crew duty assignments practiced today is that of an Electra operator whose procedures require that in a quickly developing emergency in which the captain is flying the aircraft, he should turn the flying of the aircraft over to the copilot and personally take care of the emergency. This means that if an engine failure or fire occurs during a critical regime of flight, such as during the takeoff, the captain is initially distracted by such emergency, the evidence of which is displayed immediately in front of him by virtue of the three-abreast cockpit, and then he must disrupt his takeoff concentration and hand over the takeoff to the copilot. The captain is now required to shut down the engine or otherwise handle the emergency, to the exclusion of what may be marginal takeoff conditions because of weather, et cetera.

Meanwhile, the flight engineer, who was put on the airplane by CAB order in 1948 for the very purpose of relieving the pilots of such mechanical preoccupations, sits idly by and merely reads the checklist.

In fact, it was with the knowledge that such travesties of safe operating practices exist that this association was prompted to draw this specific matter to the attention of the investigating authorities during the recent Boston Electra accident. We do not say that this irrational operating procedure, rather than the bird strike, was the

cause of the accident. But we do believe, and have so stated, that the circumstances of this emergency, in combination with the operating procedures described, constituted an accident-prone situation which has been predicted by flight engineers on many occasions.

Senator MONRONEY. I don't quite follow you there. I wish you would elaborate a little bit there on how the cockpit procedures, with the engineer given more responsibility, would have been conducted at least to escape from the situation which you rightfully describe as being caused by external means.

Mr. IVERSON. I would be happy to.

The Lockheed Electra which crashed at Boston, as you are probably familiar with, was only in the air for about 27 seconds. That was the time it took to break ground until it hit the water.

The operating procedures say—and I have photocopies of them here—that in this 27 seconds should the captain be flying the airplane, making the takeoff, when this engine went out he was to hand the control of the airplane over to the copilot, and then the captain was to shut down the emergency and go through the actuation of all the switches in accordance with the checklist that the flight engineer was reading.

In 27 seconds this is a ridiculous situation. Why can't the procedures be as they should be set up, with the captain making the takeoff and if an engine failure happens, that the flight engineer shuts it down. That is what the CAB intended in putting the flight engineer on the aircraft originally. There is no reason for the pilot to hand over the controls to the copilt and then himself mechanically position and operate all these controls when the flight engineer is there to do it.

Senator MONRONEY. Still it was up to the captain of the plane, if he had wanted his power cut when he first noted the bird ingestion, to give the order to the engineer to cut power, or maybe to use reverse thrust.

Mr. IVERSON. The operating procedures spell out that the captain will shut down the engine. He must personally do this himself.

Senator MONRONEY. It would probably have been faster at that point than delay.

I am trying to get your point here. It seems to me that if you had observed the bird ingestion and the obvious loss of power on the one engine, and perhaps two, and that if the plane had not yet pulled so far off the runway that the pilot could not have put it back on, or even rolled into the water, it would have been safer than trying to pull it off on two engines or perhaps three, as he did.

The plane is supposed to be able to take off on at least three engines, and perhaps two, under normal conditions.

Mr. IVERSON. But the time element involved here, our position is that by virtue of the procedures being used, they caused this distraction and confusion because they are not utilizing the people who could most easily do this job of the engine shutdown. All the tools are right in front of the flight engineer, and he could easily have done it on the captain's command. And yet the operating procedures say that the captain shall shut the engine down.

Senator MONRONEY. Is this three abreast seating that you are talking about?

Mr. IVERSON. Yes.

Senator MONRONEY. No separate engineer station?
Mr. IVERSON. No, sir.
Senator MONRONEY. He would have used the controls rather than the pilot; the same controls?
Mr. IVERSON. Pardon?
Senator MONRONEY. He uses the pilot's controls?
Mr. IVERSON. Yes.
Senator MONRONEY. They are right there in between all three.
Mr. IVERSON. Yes, sir; anybody can grab them.

FLIGHT TIME LIMITATIONS

In part 40 of the Civil Air Regulations, which covers domestic operations, a crew member may not be scheduled for more than 8 hours, flying time in any 24-hour period or for more than 30 hours in any 7 days. However, in part 41, which covers international operations, a crew member may be scheduled for 12 hours in any 24-hour period and 32 hours in 7 days.

In part 42, irregular air carrier operations, flight time limitations are spelled out for pilots only, leaving the flight engineers, navigators, and radio operators completely without any protection in the Civil Air Regulations.

This situation has been brought to the attention of the proper authorities many times with no results. On June 12, 1956, the CAB issued draft release 56–17 which said:

> In some instances, standards are receiving separate attention in the Bureau and will be processed separately. Such items include flight time limitations." On October 14, 1957, the CAB comments on draft release 56–17 stated: "Any changes in flight time limitation standards will be the subject of separate rulemaking procedures." On December 1, 1960, the FAA issued draft release 60–19 and said: "Due to the complexity of the issues inherent in flight time limitations for flight crewmembers, the Bureau is making a separate study of the current limitations and will present proposals to amend them in a separate rulemaking proceeding. Accordingly, the currently effective flight time limitations for flight crewmembers are retained in this proposal with the understanding that they will be the subject of a separate and subsequent proposal.

The last time any agency proposed a change in flight time limitations was on June 8, 1955, in draft release 55–15.

Since 1955 there have been many changes in the industry that have had a direct effect on flight crew working conditions. The introduction of the faster and more complex turbine equipment has raised serious problems relating to flight time limitations, and fatigue is a far greater problem on turbine equipment than we have experienced on piston equipment. The constant checking of fuel computations and the readjustment of power as the result of the turbine engines' sensitivity to changes in outside air temperatures and pressures, plus the need for constant attention to the electrical, pressurization, and other systems operating at the peak of their performance capabilities, makes it impossible for any relaxation of the high degree of alertness needed by the flight engineer in the performance of his duties. The turn pattern of equipment has changed, on duty time has increased, time away from home has increased on international operation, and because of the high utilization and speed of the equipment there are no multiple crews carried on the jets.

In the recently conducted FEIA–FAA medical survey which investigated complaints of flight engineer fatigue in jet operations all of the flight engineers tested complained of an increased level of fatigue associated with flying jet equipment which became more prevalent after approximately 3 months' time. They also complained of eyestrain and irregular sleep cycles.

It is interesting to note the action taken by one foreign international carrier—KLM—in this regard, that takes into consideration the time of departure in establishing a maximum on-duty time for flight engineers:

Report for work between—	*Maximum duty time (hours)*
00:00–04:00	8
04:00–05:00	9
05:00–06:00	10
06:00–07:00	11
07:00–14:00	12
14:00–15:00	11
15:00–18:00	10
18:00–21:00	9
21:00–24:00	8

Senator MONRONEY. In other words, as shown by your table here, the maximum duty on time is between what you might call normally the night hours?

Mr. IVERSON. Yes. This is geared to an increase of on-duty time as to the hour of departure.

Senator MONRONEY. Do you figure onduty time or preflight time, or what?

Mr. IVERSON. Onduty time encompasses preflight time, inflight time, and postflight time.

Senator MONRONEY. In other words, this 12 hours maximum shows here, or the 8 hours, would include the makeready for flight, precheck, which you say sometimes consumes 1½ hours.

Mr. IVERSON. That is right.

Senator MONRONEY. And the posttime, which would probably include another hour for battening the ship down before leaving it?

Mr. IVERSON. Yes, sir. And the en route time. Probably Mr. Judd would be more qualified to give you a specific incident, say, out of New York City to Milan, Italy, where they have en route stops. On the ground, say, for an hour or so, en route, making three or four stops. This, of course, adds to the onduty time and builds up excessively after a while.

You can be on duty 20 or 25 hours and actually only get 8 hours flying time.

Senator MONRONEY. You are paid by the flight time?

Mr. IVERSON. Yes.

Senator MONRONEY. Not by the onduty time?

Mr. IVERSON. Some contracts do have onduty time stipulations written into them for a monetary allowance, but not all of them.

Senator MONRONEY. Do any of these include transportation to and from the airport?

Mr. IVERSON. Yes; some contracts do.

Will you repeat that question?

Senator MONRONEY. Do any of your contracts include transportation to and from the airports—surface transportation—as a main part of your pay scale?

Mr. IVERSON. I know that there were some that did at one time. I can't say whether there are any at the present time or not.

Some hours of duty time are geared to departure time. To expand a little more on that, this interruption to the sleep cycle we feel is very important. Say you are on a 12-hour flight internationally which starts at 6 o'clock in the morning. This is a lot easier to take than an international flight of a 12-hour duration which starts at, say, 3 o'clock in the morning, or 1 o'clock in the morning, because on a 6 o'clock departure you are able to get a solid night's sleep which you are normally accustomed to during the dark hours. However, with the 3 o'clock departure in the morning you have to sleep during the day prior to going out, and most times your rest is inadequate, and then have to have the same amount of time with possibly the same amount of rest before departure.

That is what this KLM scale is predicated upon.

On all flights exceeding the above limits a second flight engineer shall be carried.

The time of departure has as much bearing on crewmember fatigue as the hours of flight. More emphasis must be placed on the social aspects involved in future determination of flight time limits and time away from home.

Immediate efforts must be addressed to the problem of flight engineer flight time limitations on jet operations with the objective of bringing these limitations down to a more realistic level.

Senator MONRONEY. I gather from what you just said that you consider there is a greater element of fatigue in being an engineer on a pure jet than on a piston-driven aircraft; is that correct?

Mr. IVERSON. Yes, sir.

We conducted a joint evaluation program with the FAA and the flight engineers where a number of flight engineers were tested by designated doctors that the FAA chose to investigate the fatigue problem on aircraft. I would like to quote from one. This is Dr. Bruce Lehmer, in Los Angeles. He said, in the conclusions:

It is obvious that the fatigue is due to (a) increased tension due to jet flight, (b) irregular schedules——

Senator MONRONEY. Wait a minute.

Due to jet flight? That means that the normal hours in the plane, or his duties as an engineer, add to the tensions.

Mr. IVERSON. I think both enter in here. Say that your increased hours such as on duty time are certainly increased, and your thinking in operating the jet, your tempo, is increased because you have cut your flying time in half, practically, with the same duties to do in just half the time.

Also in jet operation you have other things to think about.

Senator MONRONEY. Because preflight duties are greater, or inflight duties are greater?

Mr. IVERSON. Both are greater.

Senator MONRONEY. I am trying to follow you.

I can't find that there is any fatigue element that would be comparable to listening to all those motors pounding outside on a piston-driven aircraft.

Mr. IVERSON. In studies over the years by the Air Force, they indicate that fatigue is much higher in the Air Force jet operations. They have cut their flight time to 50 hours maximum for crews in the Air Force.

It is true that the noise level isn't as high, but you are doing the same amount of work, and in some cases more work in a less given period of time in jet operations than you are in piston flight.

Senator MONRONEY. But you are watching four motors and all the signals that come up on your panel on pistons, and I understand on jets you don't have nearly as many instruments, gages, and things of that kind.

You mentioned the fuel consumption having to be checked more exactly because of temperature variations and speed and wind. But aside from that, isn't the experience on jets that there is far less mechanical failures of the engines, at least, and that they are more reliable in full flight than the old-fashioned piston engines?

Mr. IVERSON. You brought up one very important point, Mr. Chairman, and that is that the belief seems to be common throughout the industry that this is a simple airplane, has less gadgets than its predecessors. This is not true. The complexity of these jet airplanes, the number of dials, switches, and total levers and buttons to operate is much higher than in piston equipment.

Senator MONRONEY. Are there more in connection with the mechanical operation of the flight, its engines, for example, than there are on piston aircraft? I recognize there is pressurization and all kinds of gadgetry within the cabin for passenger safety and passenger comfort. I just wondered if the engines require as much attention by the engineer as the old-fashioned piston-driven engines?

Mr. IVERSON. If you are referring to the number of displays and instruments relative to jet engines on the 707 they are about the same as previous piston equipment. However, you have to jockey these engines in flight just as much or even more than the old piston engine.

Senator MONRONEY. But you said that the shorter period of time in flight was more fatiguing because you had to do this operation faster. Actually, I would think, as an outsider—I must confess my ignorance on this point—say, that 6 hours of flight is less fatiguing and exacting than the 10 hours or 15 hours of flight used to be in the old, slower aircraft.

Mr. IVERSON. No; that is not true today, sir.

From our findings of what the engineers feel, and the laboratory reports from this physical study that we conducted—let me explain it this way—the feeling is, and has been for years, that this was a simple machine; it was going to be so much simpler than the pistons to operate. This is a fallacy. There are just as many dials and gadgets and monitoring demands upon the individuals—and more—than there were in the piston fleet.

It is true that there are probably, number for number, one or two less instruments connected with an engine instrumentation display on a jet than there would be on an instrument display on, say, a Constellation. However, the jet engines you have to constantly be setting and resetting, monitoring through flight because we are subject to change due to outside air temperature and other elements.

Also you have to watch your fuel much more closely because you burn it at a much higher rate. The workload in the cockpit is just as high, on the work level, as pistons.

Senator MONRONEY. I understood you to say it is higher and more fatiguing.

Mr. IVERSON. Yes; that's right. Because the level is about the same, or a little bit higher, but your time is cut in half. So you have to work faster to do the same number of things in less time. This is where the fatigue comes in.

Senator MONRONEY. What do you work faster at?

Assuming the plane has reached its flight altitude, and is heading for Rome or London: after you are in flight you have the fuel problem, and the adjustment, of course, to outside temperatures, and things of that kind to be sure you are using a minimum amount of fuel required, what else is there involved in the way of valve settings or adjustments on the panel?

Mr. IVERSON. Say, your pressurization, your air conditioning, which are very involved and complicated in operation at high altitudes.

Senator MONRONEY. I thought that was fairly automatic.

Mr. IVERSON. I beg your pardon?

Senator MONRONEY. I thought the pressurization was fairly automatic.

Mr. IVERSON. It is automatic, if it works. But there are times it doesn't.

Senator MONRONEY. How many times does it fail on the average trip?

Mr. IVERSON. I don't know.

Mr. Sebalis?

Mr. SEBALIS. On many of the systems on the jet aircraft, specifically the 707 that I speak of, we have had quite a few problems in air conditioning and the basic pressurization. We have had systems modified, and remodified. We are getting more and more reliable with our experience.

Senator MONRONEY. But it is still presumed to be working right and it is automatic?

Mr. IVERSON. Yes.

Senator MONRONEY. So only in malfunctions do you have to do this?

Mr. IVERSON. That is correct.

Senator MONRONEY. On how many trips monthly would you say that you have malfunctions?

Mr. SEBALIS. That is a hard question.

Senator MONRONEY. Of course, you have to monitor the gages, I am sure, to be sure there is no malfunction. That is your duty, is it not?

Mr. SEBALIS. Yes, sir. I would have to do some searching of the records to find this out, sir.

Mr. IVERSON. Mr. Young would like to add to that.

Mr. YOUNG. Mr. Chairman, I know the prevalent opinion is that the jet is more relaxing; not as tiring as the other airplanes. From the standpoint of vibration it is a much smoother flight, both for crew as well as passengers. I know in my own case, as an engineer, I have been quite surprised to find that it is true in my own case, as in others, that I am more fatigued at the end of a flight, even though such vibration, for example, which is the principal point that is reduced on jets, has practically been eliminated.

I don't have an answer for this. I do know that I am more fatigued.

Also from the standpoint of duties, for example, the jet engine seems to be much more sensitive to changes in temperature. We find

very abrupt change in temperature at the altitudes at which we are flying. Sometimes it requires continuous changing of engine powers in order to maintain the speed desired.

Also, from the standpoint of the engineer, these engine controls and instruments which we have to manipulate and monitor, instead of being a matter of 24 to 30 inches away, they are up on the pilot's panel some 3 to 4 feet away.

Senator MONRONEY. This is in the three abreast seating?

Mr. YOUNG. No. On the jets, the 707, this is with the engineer seated behind the copilot.

So that at night especially, with just red lights on in the cockpit, I am straining to read instruments two inches in diameter from a distance of some 4 feet. Then I have to reach to the limit of my reach in order to get the engine controls to maintain the setting.

This, I think, must induce extra fatigue, the strain to read instruments.

Also the fact that I have found personally, for example, in the heating of the airplane in order to maintain a comfortable temperature, the so-called automatic controls are very slow in their response. So that with abrupt temperature changes I am continually having to reset and adjust temperatures because the automatic device does not do it rapidly enough.

Those are just one or two points thaat perhaps enter into this, causing the increased fatigue.

Mr. SULLIVAN. Both Sebalis and Young are overwater flight engineers. In my own case, flying domestically, in many cases nonstop San Francisco to Idlewild, I go along 100 percent with what Mr. Young just mentioned.

I would also like to go back a ways to earlier comments where responsibilities of the flight engineers, preflight and in-flight were brought out.

I will speak to what I might call the high key operation of the jet-type aircraft. I would like to take something out of context. The company I work for, which I am very proud of, recognizes me as a technical member. I would like to quote from our operating manual.

The flight engineer is the technical expert in the crew. His specialties are engines, electronics, air conditioning, fuel, hydraulics, and instrumentation. The captain can refer technical questions to him for analysis. He will keep all required reference material immediately available for consultation.

The same paragraph was included in our L–1–88—that's the Lockheed Electra type equipment—operating manual.

As a result of that, we receive—this is American Airlines—although not in training, I would say—we do receive a considerable amount of technical material on these various systems.

In flight, from my own experience—and I have been on the aircraft a little over 2 years now—I have noticed again the high key operation and the resultant flight, coast to coast, domestic flight. In order to keep the airline operating requires a thorough knowledge, day in and day out, an almost 24-hour-a-day regard for the jet operation from the standpoint of anticipating, detecting and correcting malfunctions in flight when they come about. This not only entails the aforementioned systems, which some operators like to call flight systems monitor, but this also deals with the flight controls in some cases,

and navigation and communications systems as was mentioned earlier when words were mentioned regarding the United incident.

On many occasions I have detected—which is my job—ahead of time things that were not obvious to pilots and navigation systems, and have had to go down into the basement upon occasion, in the case of the 707–123 type aircraft, and the 707–720, and help correct these in flight in order to reinstate the flight instruments.

If you have strong winds and so forth, and you were flying across the country, San Francisco to New York, in 5 hours, especially at night, with small instruments and so forth, and you with a white flashlight and a red flashlight, after a period of time trying to stay on top of the situation and the basic problems that come up much of the time in flight, and the instruments do not accomplish what they were supposed to, you have to take remedial action in flight to do this.

To sum up, I have a feeling for the high key of the operation, and staying on top of the situation from the anticipation, detection and correction of malfunctions in flight. This requires a 24-hour study on my part.

Mr. IVERSON. Recommendations: Flight time limitations. The regulations as presently constituted have pushed human endurance to the limit, leaving no reserve for emergencies, yet the crews are expected to have some hidden reserve which keeps them going.

It is unrealistic to suppose that crews operating under part 41 are endowed with more stamina than those under part 40. Allowing 12 hours of flight time, as in present part 41, can lead to a 16- to 20-hour duty time or more. This is obviously an unsafe condition.

Senator MONRONEY. Part 40 is the scheduled airlines, so-called trunk airlines, and part 41 is those that are given exemptions?

Mr. IVERSON. No, sir. Part 40 is regulations governing domestic operating airlines. Part 41 is regulations governing international carriers.

Senator MONRONEY. Part 42 then applies to the nonscheduleds?

Mr. IVERSON. Right. Part 42 is nonscheduled. Therefore, we urge the FAA to take immediate action regarding flight time limitations for flight crews with the objections of bringing these limitations down to a more realistic level.

We specifically propose that part 42—the nonscheduled—be amended immediately to spell out flight time limits for flight engineers, navigators and radio operators, and that flight time limits be standardized for all operations.

We recommend that the flight time limits be predicated on the hour of departure in an effort to reduce fatigue caused by irregular sleep cycles.

We further recommend that future regulations regarding flight time limits give more consideration to the social aspect involved.

FLIGHT RECORDERS

The use of the flight recorder in the past has been limited to those aircraft that are certificated for operation above 25,000 feet and all large turbine aircraft. Only recently has this provision been extended to cover not only passenger operation, but also any ferry test or training flights and crew check flights. However, the requirement for the recorder is still tied to certification above 25,000 feet.

The flight recorder is used primarily to gather information for use in accident investigation. I think it is significant to note that the information from the flight recorder was available to the CAB in only 2 instances in 1960 in connection with 17 fatal accidents which killed 499 people. We believe this is proof enough to substantiate our recommendation that flight recorders be a required item on all aircraft engaged in air carrier operations as we proposed in our comments on draft release 60–18.

On January 11, 1960, before this committee, it was stated and agreed that there was justification for flight recorders on all air carrier aircraft regardless of their certificated altitude and that flight recorder information would be most helpful in connection with all accidents by providing the evidence needed to initiate whatever changes were necessary to promote safety and prohibit the recurrence of a fatal accident.

It was also stated, however, that it was hard to justify the need for recorders on certain equipment because the cost of the recorder reflected an increased percentage of the total value of the aircraft. It is our contention that justification should not and cannot be based on economics if we are to advance in the field of accident investigation and air safety in the future.

Also in regard to flight recorders we feel that a genuine effort should be made to expand on the use of the recorder through an industrywide program of evaluating hard landings and turbulence penetration incidents. We believe a program of this nature would be of extreme value in arriving at an acceptance or rejection standard of airworthiness of aircraft involved in such conditions of flight that would not be subject to human interpretation and error.

The CAB report of nonfatal accidents covering all U.S. air carrier operations for 1960 shows 11 incidents of in-flight turbulence, including 2 evasive action incidents which resulted in personal injury in 7 cases and minor damage to the aircraft in 1 case. This same report shows only one incident involving a hard landing that caused substantial damage to the aircraft. In both cases, I am certain there were many instances that went unreported that could have an effect on the airworthiness of the aircraft involved.

A case in point is a hard-landing incident that occurred on July 17, 1960, on a Boeing 707 which deformed the engine pylon. The aircraft was inspected by maintenance and determined to be airworthy for a routine departure. The flight engineer refused to fly the airplane either on a scheduled departure with passengers or a ferry flight to the overhaul base for he did not consider it to be airworthy. The aircraft was ferried to the overhaul base by another crew and it was determined that the structural damage incurred was so severe that the aircraft should not have been ferried and indeed was unairworthy.

Senator MONRONEY. Is this the finding by the FAA, CAB, or the company?

Mr. IVERSON. It was the finding by the company.

This engineer, in his technical report to the FEIA, said:

In conclusion I would like to state that had I not been able to get the captain's wholehearted cooperation in this particular incident I would have had to refuse to fly with my job at stake, as has happened a couple of times in the past. If

the flight engineer had some Federal regulations clearly backing him up the operation would be much simpler and safer.

I would like to read a letter dated January 30, 1961, to the docket section of the FAA regarding draft release 60–18. It is not in your brief:

GENTLEMEN: We concur with the intent of draft release 60–18 in that the present flight recorder requirement should be expanded to cover not only those aircraft being operated in the transportation of passengers, but also to include any operation for the purpose of flight crew checks, ferry, test, and training flights. There can be do double standard of safety. The recorder is required on these aircraft in the interest of safety and as a basis of information in the event of an accident. By limiting the use of the flight recorder to passenger operation only, it would seem that we are admitting or contending that this is the phase of operations which is most unsafe, and that flight checks, ferry, test, and training flights are free from accident. By not encompassing all phases of operation in the requirement for flight recorders in the past, we have not fulfilled our obligation to the traveling public flying in other aircraft in close proximity to such ferry, test, or training flights, or to the people on the ground over which they fly. If flight recorders are required in the interest of safety during schedule operations, they are equally applicable to all other phases of operation. However, this is not enough.

In the proposed revision to part 43, section 43.32, it is proposed that the recorders be installed only on those aircraft certificated for operations above 25,000 feet. Once again, we say there can be no double standard of safety. Are we now saying that those aircraft certificated for operation above 25,000 feet are more accident prone than those certicated for a lesser altitude? If we are going to aid in the investigation of accidents, obtain information for accident prevention, act in the public interest for the benefit of all, then we must provide regulations in this instance for flight recorders on all certicated aircraft used in air carrier operations regardless of weight or altitude.

With regard to accident prevention, we propose that the Federal agency, the air carriers, and all interested parties concerned give careful and immediate consideration to the adoption of an industrywide evaluation program pertaining to "hard landings" and "turbulence." A program of this nature would necessitate the full cooperation of all parties concerned and would be of extreme value in arriving at an acceptance or rejection standard of airworthiness of aircraft involved in such conditions of flight that would not be subject to human interpretation and error.

It's time we initiate and expand on a program of accident prevention through the use of the flight recorder, instead of utilizing it exclusively for accident investigation.

Respectfully submitted.

GLENN B. IVERSON,
Vice President, Engineering.

REGULATIONS GOVERNING FOREIGN CARRIERS

In the latter part of November 1960, the FEIA received information that two Mexican airlines were operating flights into the United States without the services of a certificated flight engineer, contrary to the laws of Mexico. The Mexican civil air regulations require the carriage of a flight engineer, properly certificated in accordance with Mexican law.

Part 44.5—Flight Crew Requirements of the U.S. Civil Air Regulations states as follows:

Each member of the flight crew shall be possessed of a currently effective certificate or license issued by the country whose nationality the aircraft possesses, evidencing competency to perform his duties in connection with the operation of such aircraft.

It is thus clear that any foreign carrier operating aircraft into the United States would be required to carry at least the minimum certificated crew in compliance with the regulations of the country in which the aircraft is registered.

We brought the entire matter to the attention of the Mexican Ambassador on December 20, 1960, and again on January 11, 1961, with copies to the FAA and to the White House, and said in part:

> Our position that such illegal operations are prejudicial to life and property in this country cannot be overlook and in any event should never be allowed to expand.

The January 19, 1961, Aeronaves DC–8 jet crash at Idlewild which killed 4 crew members and endangered the lives of 102 passengers, including many Americans, may have been prevented if there had been a properly certificated and trained crew on board.

We have evidence to indicate that no one on the Aeronaves DC–8 flights ever made a preflight inspection or monitored the refueling operation. In fact, this situation became so serious that the refuelers refused to accept the responsibility and complained to Eastern Air Lines, who services Aeronaves at Idlewild. Eastern then issued a directive to their maintenance department delegating the responsibility of suprvising the refueling operation to its mechanics.

Such haphazard and irresponsible operation should be and must be stopped, and immediate action must be taken by the responsible U.S. authorities to see that all foreign carriers comply with their own country's regulations when flying into the United States or her possessions.

RECOMMENDATIONS

Foreign flag carriers

Foreign flag carriers are operating into U.S. territory in violation of international agreements respecting such flights. They are in violation by virtue of noncompliance with the laws of the country in which the aircraft is registered, since these carriers are not carrying a license and certificated flight engineer on such international flights as is required by the laws of those countries concerned.

Since such operations are a violation of U.S. law also, we urge this committee to consider ways of policing this situation when it occurs. This could be done through authority to the FAA to ground such operations if investigation reveals that a violation exists.

Senator MONRONEY. Does this refer in any way to the DC–8 Mexican Airlines crash?

Mr. IVERSON. Yes; it does.

Senator MONRONEY. Was there no engineer aboard?

Mr. IVERSON. No, sir. They had a three-pilot crew and there was no certificated engineer on board. Nobody had the certificated license or had gone to school for that particular operation.

Senator MONRONEY. There was no engineer required then, even an American engineer, on board?

Mr. IVERSON. That is correct.

Senator MONRONEY. And the pilots, the three pilots, none of them had been certificated or schooled in engineering duties, is that correct?

Mr. IVERSON. That is correct. We wrote to the Ambassador of Mexico, with copies to the White House and the FAA, some weeks

before this accident happened, protesting this operation. Since then we took part, incidentally, and had two of our accident investigators at the scene of the accident, and we have documented evidence to indicate that no one ever did a preflight on this airplane before this particular accident, or prior to any other departure of this equipment. The crew would walk out the door, right on to the airplane and depart, and never look at it. The refuelers who refueled the airplane at Idlewild, the Allied Refueling Corp., complained to Eastern Air Lines, which did the maintenance for Aeronaves, that they were not going to accept the responsibility for fueling this airplane if someone on the crew didn't care about it, didn't look at it, and didn't take the time to see what was going on; they were not going to accept the responsibility for fueling.

And they reported to Eastern. Eastern then had to put out a directive saying that the mechanics, when they pulled the airplane up to the gate, would stand by and watch the refueling progress and inspect the airplane prior to departure, encompassing the duties of the flight crew as we know them in this country.

We protested some weeks prior to this incident, saying it was an unsafe operation and should be remedied immediately. We still feel that their laws provide that they must have a certificated flight engineer on board, and we feel that they should comply with at least their own laws, since they operate in and out of our airports and over our residential districts. They should comply at least with their own laws.

Senator MONRONEY. Let me ask you, in the training or conversion from prop to jet on our American airlines, does that transition provide for the engineer's time aloft the same as for the pilot's?

Mr. IVERSON. In-flight training time?

Senator MONRONEY. Yes.

Mr. IVERSON. Yes. You receive in-flight training time. However, up until the first of the year, and it is not clear what is the intent of the regulations now, the flight time that would be accorded to the engineer was subject to interpretation by the individual carrier. One carrier might give the flight engineer say 15 or 20 hours of in-flight training time prior to going into scheduled operation. Another carrier might give 5 hours; and another might give 5 hours in flight and 5 hours on the ground. It is all subject to interpretation.

Senator MONRONEY. Isn't there a regulation now that requires a minimum time in the air for pilots on transition?

Mr. IVERSON. Yes, sir; there is.

Senator MONRONEY. Did that same regulation affect the engineers?

Mr. IVERSON. Yes, sir. I believe it did spell out a minimum training time in flight for flight engineers. However, it said that this could possibly be, or some part of it could possibly be conducted in a synthetic trainer in lieu of in-flight time.

Senator MONRONEY. But there is in-flight time on it. I can see where probably, since you don't have to handle the movement of the aircraft, or its navigation or guidance, that there might be some simulation that could occur in your training that would not be satisfactory for a pilot, for the actual control, landing, takeoff and other problems of flight.

It is your contention that you should have the same amount of airtime that is required of the pilots?

Mr. IVERSON. It is our contention that we should have a reasonable amount of time to adequately train the man for his job while on duty. We are not attempting to tie it in any way to the training of any other person or any other member of the flight crew. This should be evaluated on a realistic and logical basis and should be set with minimums for in-flight and ground training.

Senator MONRONEY. What were you saying to the committee: That the airtime is now insufficient, or adequate?

Mr. IVERSON. Yes, it is our opinion that the regulations covering all phases of flight engineer training are inadequate and are subject to interpretations by individuals and therefore there is no standard or uniformity in the industry in the training of flight engineers.

Senator MONRONEY. You may proceed.

Mr. IVERSON. Accident investigation: The past history of aircraft accident investigations and resultant preventive recommendations and requirements indicate excessive emphasis has been placed on finding the one factor that caused the accident.

All too often it is not possible to find the one factor which resulted in an accident, so the catchall phrase "pilot error" is used.

If we find, as the CAB did, that in two fatal accidents the pilots flew into the ground because of inattention to their flight instruments by virtue of being distracted by the functions of other crewmen, then we must find out why. Why were they inattentive to their instruments; why were they distracted from their duties by others?

These are answers that we must endeavor to obtain if we are to advance in the field of accident investigation. If there are built-in distractions then our cockpits must be changed.

Much has been said and written over the findings of "pilot error," however, there has been insufficient followup analysis made of some of the cause factors for this so-called pilot error.

The public and the entire industry have paid dearly in the past for when the phrase "pilot error" was listed as the cause of an accident, little was done to define and prevent recurrence of the cause of the error.

There appears to be general agreement between the regulatory agencies, and the industry that we can and must develop safeguards against single component failures becoming catastrophic, but that we cannot guard against double failures. This line of reasoning must be reevaluated in the light of current and future equipment. As the air carrier operation relies more heavily on complex equipment and systems, crew members functions, and increased navigational workload our exposure to double failure increases rapidly.

The problem seems to be:

1. From the industry standpoint: At what point to compromise on preventative measures so that expenditures will be more than offset by the savings realized as a result of preventing hazardous situations from developing.

2. From the regulatory agencies standpoint: At what point to compromise on preventive requirements without imposing undue financial or operational burdens on the industry while adequately protecting the public.

The industry has surely developed beyond the stage of counting on a particular set of circumstances not occurring and then when these circumstances do occur, paying the terrific cost that results.

The science of probability is now utilized with success in many industries, and it is past due in implementing this thinking in cockpit design and accident investigation. It is possible that this approach to the problem could prevent minor factors from ever developing into the accident stage.

Far from being a costly approach to the problem, this should be financially rewarding to the industry and certainly to the public.

It appears to us, in addition, that there is in the CAB and FAA the seeds to a more fruitful approach to aviation safety.

Recommendations: We suggest that the following three points will have the effect of increasing aviation safety, speed up accident findings, and provide more value per unit of financial investment in the two regulatory agencies:

1. Prior to the issuance of the CAB accident report, and within a limited period of time following the final hearings, that agency should hold a prereport conference of all interested parties to the accident investigation in question. Final evidence would thus be made available to the CAB, plus any other relative information aimed at assisting the Board in its findings. Discussions would be held also concerning recommendations for prevention of similar accidents in the future.

2. The CAB recommendations as the result of its findings should be made known to all interested parties, as well as the FAA.

Senator MONRONEY. Isn't that true now that all those are published and announced, all their findings?

Mr. IVERSON. It is now. They put out a "probable cause," but that is all.

Senator MONRONEY. To my knowledge all of the recommendations that they have made in the field of air safety have been made public. I don't know whether it is formalized by being printed in the Federal Register but it is generally given wide distribution through publicity.

Mr. IVERSON. It must be made available somewhere. I know that it is to the FAA, but I am not aware that it is made formally.

We would recommend that when the accident findings are put out, that would be the time to list recommendations, publicly, to all parties.

Senator MONRONEY. Sometimes you need them before the final cause is cleared up.

Mr. IVERSON. That is true.

Senator MONRONEY. It depends on the degree of emergency, whether the CAB determines that something should be done on an immediate basis pending the final determination cause.

Mr. IVERSON. No. 3. Such recommendations should carry regulatory obligation on the part of the FAA to initiate followup action in whichever direction is required, with due notice to industry. This would take the form, for example, of a notice of proposed rulemaking, proposed airworthiness directive, et cetera.

At present the regulations do not spell out that anyone is obligated to undertake any form of work in connection with the recommendations by the CAB.

The CAB can recommend to the FAA that they should go into a program of evaluation and determination in one regard, but the FAA is not obligated to do so, nor is any other agency, such as the NASA.

The CAB can go to them and suggest help, or suggest a program that should be dealt with for investigation and analyzed, but there is no obligation on any party's part to undertake this at the suggestion of the CAB.

We feel that this is a very serious stumbling block.

Our comments on accident investigation would not be complete without a word or two concerning the situation within the CAB. The demands on the organization have been so heavy of recent times as to considerably dilute their effectiveness in the many areas in which they are responsible under the Federal Aviation Act.

It was for this reason, among others, that we have suggested the assistance outlined under point 1 of our recommendations, to enable a more complete technical picture be made available to the CAB to assist them in a fuller analysis of an accident/incident.

We believe this committee should lend full consideration toward greater financial assistance of this aspect of the CAB's work.

Regulations: The enclosed recommendations pertain to flight engineer certification and training requirements as proposed by the FEIA to the FAA in June of 1960.

These proposed changes to the regulations are the culmination of many months of study by the FEIA and represent the overwhelming majority thinking of all those actively engaged in the flight engineer profession:

Item 2: Certification requirements for flight engineers.
Item 3: Training requirements for flight engineers.
Item 4: In-flight training of flight engineers.

(The documents are as follows:)

FAA CONFERENCE AGENDA ITEM 2—CERTIFICATION REQUIREMENTS FOR FLIGHT ENGINEERS

In order to provide the answers to the various questions raised under this item, we are presenting the recommendations of our instructor flight engineers check airmen, and air safety and engineering committees. All of these people have been very close to these problems for years and are the best qualified people in the industry to comment on these subjects.

Line flight engineer comments are also presented, being taken from our FAA–FEIA medical survey questionnaire.

We note from the general discussion of this item on the agenda:

"It would appear that the skill and knowledge requirements should be expanded and more specifically identified to insure the competence of a flight engineer in exercising the privileges of his certificate."

We submit the following suggested revisions to parts 35.31, 35.32, and 35.33:

"35.31. EXPERIENCE: An applicant shall—

"(*a*) Have had at least 3 years of diversified practical experience in the maintenance and repair of aircraft and aircraft engines, of which 1 year shall have been in the maintenance and repair of multiengine aircraft having engines rated at least at 800 horsepower each or the equivalent thereof in the case of turbine-powered aircraft, and have had at least 25 hours of training in-flight in the duties of a flight engineer on multiengine aircraft requiring a flight engineer.

"(*b*) Be a graduate of at least a 2-year specialized aeronautical training course in the maintenance, repair, and overhaul of aircraft and aircraft engines of which at least 6 months shall have been in the maintenance and repair of multiengine aircraft having engines rated at least at 800 horse-

power each or the equivalent thereof in the case of turbine-powered aircraft, and have had at least 25 hours of training in-flight in the dutures of a flight engineer on multiengine aircraft requiring a flight engineer.

"(c) Hold a degree in aeronautical, electrical, or mechanical engineering from a recognized college, university, or engineering school and have had 6 months practical experience in the maintenance and repair of multiengine aircraft having engines rated at least at 800 horsepower each or the equivalent thereof in the case of turbine-powered aircraft, and have had at least 25 hours of training in-flight in the duties of a flight engineer on multiengine aircraft requiring a flight engineer.

"(d) Properly rated military flight engineer and have had at least 100 hours of flight experience in the duties of a flight engineer."

Comments: We have deleted the present 35.31(d) entirely, since pilot-in-command time alone does not assure the required mechanical and electrical experience required in this jet age for adequate safety.

The approved school requirements should be compatible and consistent with the experience requirements listed in (a), (b), or (c) above.

"35.32 KNOWLEDGE:

"An applicant shall satisfactorily pass a written examination on the following subjects with respect to aircraft having four or more engines and certificated in the transport category or an aircraft having four or more engines and incorporating a flight engineer station:

"(a) The provisions of the Civil Air Regulations applicable to the duties of a flight engineer;

"(b) Theory of flight and elementary aerodynamics;

"(c) Aircraft performance and aircraft powerplant operation with respect to limitations;

"(d) Mathematical computations of engine operation and fuel consumption;

"(e) Basic meteorology with respect to engine operations;

"(f) Aircraft loading and center-of-gravity computations;

"(g) General aircraft maintenance and operating procedures;

"(h) Emergency procedures; and

"(i) Basic electronics."

Comments: The flight engineer written examination must be revised to show the electronics knowledge level of the applicant. We again reference the flight engineer report forms submitted under Agenda Item 3(a) to sustantiate that the applicant must possess broad mechanical and electronics knowledge.

At the present time, the majority of flight engineers flying on jet aircraft are senior flight engineers. These men were in a good position to digest the mechanical and electronic complexity of the turbine aircraft and advanced state of the art, because progressively through the years they had increased their electronic knowledge. However, we must now consider that applicants for flight engineer certification, who are to deal with these complexities must demonstrate an adequate mechanical and electronic knowledge level.

"35.33 SKILL:"

Comments: It is only natural that an applicant for flight engineer certification be given an oral and a practical examination to determine his competency. This, of course, is the finale of his initial training. It is felt that here again the flight engineer duties as well as the definition of a flight engineer should be spelled out in the regulations. Our previous definition of a flight engineer should aid in amplification of Civil Air Regulation 35.33.

(a) When the Civil Air Regulations providing for flight engineer certificates were first established, there were only three aircraft operating which required the services of the flight engineer. Now, with the airlines operating many different kinds of equipment which utilize radically different means of propulsion, it would be unrealistic to imagine that a single license would automatically qualify a flight engineer to perform his function on all aircraft. General ability, as attested by attaining a flight engineer certificate, is a necessary prerequisite, but specific qualification on particular aircraft is absolutely necessary if an airman is to perform the flight engineer function safely and adequately.

Turbine engine theory and operation is completely different from piston-type engines. The introduction of a.c. electrical systems in wide use on turbine aircraft requires a greater knowledge of electronics and skill in troubleshooting. The complex operating mechanisms of the propeller on turboprop-type aircraft are different than that of piston-driven aircraft. There is a greater stress on

the flight engineer for increased knowledge and skill in aircraft systems, pressurization, and air conditioning due to increased speed and altitude of the jet.

There certainly is enough difference between piston-powered and turbine-powered aircraft to warrant the issuance of type ratings for flight engineers. Further, type ratings should also be issued for the different types of piston aircraft due to the equipment substitution on some airlines and the fact that the junior flight engineers are forced, due to their position on the seniority list, to stay qualified on many types of equipment.

Typical of the above regarding numerous type qualifications is the operation on Eastern Air Lines. New flight engineers are originally trained, certified, and qualified on the Constellation type aircraft. They are then assigned to a base on the bottom of the seniority list at that base. Since all his flying will be reserve, he is then sent to DC–6B, DC–7B, and L–188 school—not necessarily in this order.

Once qualified, he may be assigned to any aircraft and in spite of himself or how well he personally knows he is not qualified, he will wind up with 50 hours in 6 months on every airplane on which he was required to qualify on. He, therefore, remains legally qualified according to the air carrier and the present regulation, although he personally feels he cannot serve the best interests of safety by such operation.

It would be difficult enough for a senior flight engineer, with many years of experience, to operate under such conditions; but, here junior is faced with this problem as soon as he checks out. It has been only with superhuman effort and the fact that the Eastern Air Lines' flight engineer has had a good mechanical background that he is able to operate under these conditions.

However, the cause of safety is not adequately served if this type of operation is not regulated. The value of the flight engineer as a technical specialist is decreased, because he can only know less about, and be less familiar with each type of aircraft.

Further, the FAA–FEIA medical survey questionnaire reveals that one of the major problems of the individual flight engineer which he considered the most difficult part of his work was staying properly qualified on all types of equipment. Properly qualified includes a good working knowledge of aircraft and powerplant systems, engineering modifications, trouble shooting, and emergency procedures.

In view of our experience and all submissions to our office, we strongly urge the adoption of type ratings with the breakdown as shown in item (b) following.

Item 2(b)

(*b*) Based on our experience, the following is considered to be a reasonable breakdown of the type ratings for flight engineers:

(1) Piston aircraft with appropriate specific aircraft manufacturer and model: Douglas, DC–6; Douglas, DC–7; Lockheed, L–759, L–1049; Lockheed, L–1049—C,D,E,G,H; Lockheed, L–1649; Boeing, B–377.

Our reasoning for the above classifications is that the DC–6 and DC–7 should be separate, due basically to the difference in engines. Also, regarding Constellation aircraft, we feel that the L–749 and L–1049 can be classed as one specific aircraft, due to the fact that both incorporate the basic 3350 engine. However, when the 3350 compound enters the picture, then this should be shown as another type aircraft. The L–1649 would further be a different model, due to aircraft and system design changes.

(2) Turbine aircraft with appropriate specific aircraft manufacturer and model: Lockheed, L–188; Boeing, B–707, 720; Douglas, DC–8; Canadair, CL–44; Convair, CV–880; Convair, CV–990; Boeing, B–727; Sud Aviation, Caravelle.

You will note that the L–188 is included with the turbine aircraft even though it is a propjet since the turbine engine is still utilized and complicated AC electrical power systems are installed. The separate jet classifications are naturally based on difference in aircraft basic design, powerplants, and systems.

Item 2(c)

(*c*) Flight engineer proficiency checks should be required every 6 months for a specific aircraft on which the flight engineer is qualified. This proficiency check on each type of aircraft should include the following:

(1) En route check where the check airman shall observe the line flight engineer on his preflight; fuel loading; normal operating procedures; operation and monitoring of all powerplant and aircraft systems related to the mechanical

operation; fuel management and records; intermediate station servicing; and the A. & P. logbook entries. The check engineer shall inform the flight engineer being checked of his deficiencies and the air carrier recurrent training program shall correct such deficiencies.

(2) Emergency procedures.

(3) Troubleshooting.

(4) Oral, open book, examination on the mechanical functioning of powerplants and aircraft systems. It should be noted that the line flight engineer should be adequately trained initially and through recurrent training to satisfactorily pass the above proficiency checks.

Item 2(d)

(*d*) Flight engineer records of flying time, training and check rides, are being kept on anything from looseleaf paper to bound logbooks. Since we feel very strongly about the need for type ratings, adequate recurrent training, and proficiency checks, it is only logical that the individual as well as the air carrier should be responsible for information relative to his qualification for duty on each type aircraft.

Item 2(e)

(*e*) In order to properly specify the privileges and limitations of the flight engineer certificate it is first necessary to define the duties of a flight engineer. It is suggested that this definition appear in part 35.2. By incorporation of a definition in the regulations, it can also be referenced in approved airplane flight manuals in showing the flight engineer duties.

We recommend the following definition for incorporation in part 35.2:

"35.2. A flight engineer is an individual holding a valid flight engineer's certificate with appropriate type rating issued by the Administrator and whose primary duties pertaining to the flight are as follows:

"(*a*) *Preflight.*—Conducts through preflight inspection of aircraft exterior and interior, to ascertain airworthiness and proper functioning of all systems. This check includes a visual check of fuel, oil, hydraulic quantities; A. & P. logbook review of previous malfunctions and corrective action; and coordination with maintenance and servicing departments regarding preflight discrepancies, fuel loading, and previous aircraft and powerplant discrepancies.

"(*b*) *During flight.*—Responsible to the pilot in command for the mechanical operation of the aircraft with respect to proper operation of the powerplants, fuel system, electrical system, pressurization and air conditioning, hydraulices and pneumatics, and related systems within FAA and manufacturers' limitations under both normal and emergency operating conditions; and for in-flight troubleshooting and maintenance as required.

"A flight engineer is further responsible for proper A. & P. logbook entries and supplemental information pertaining to aircraft and powerplant malfunctions. These reports will contain detail entries and in-flight troubleshooting that was accomplished.

"(*c*) *Post flight.*—Coordination with maintenance and serving departments in order that ground crews can be fully informed as to airworthiness, fuel aboard, and malfunctions of subject aircraft."

The foregoing definition is the job which the flight engineer function encompasses; and, the flight engineer has been performing these functions for years. Its inclusion in the regulations is needed for the information and guidance of all segments of the industry.

Airlines can, under the present regulations, assign specific duties to the flight engineer. These duties are assigned under economic and political pressures. Also, in airline operation it is necessary for different crew pairings. Thus, each captain can assign or change the air carrier assigned crew duties. It is necessary that the regulations establish standard flight engineer certificate privileges. As a certified airman, the flight engineer should be required by his licensing to perform the aforementioned functions.

FAA Conference Agenda Item 3—Training Requirements for Flight Engineers

With the loose and broad interpretations of the present regulations, the individual flight engineer, as a certified airman, is not aware of the requirements relative to his job in the scope of all phases of his training and proficiency checks. In order that the individual and all interested parties may be fully

aware of his status and legality at all times, all regulations pertaining to the flight engineer should be clearly and distinctly spelled out in a separate section of the regulations. A flight engineer can then, by reference to this one section, know his requirements for certification, qualification, initial training, recurrent training, and proficiency checks. Knowing his requirements, he can further compare his records with those of the air carrier in maintaining adherence to the appropriate regulations.

Flight engineer requirements for initial training, recurrent training, and proficiency checks should be clearly shown in the regulations. The regulations should reflect and adequately cover the items which will be discussed under this section of the agenda.

If our recommendations for flight engineer certification are followed, this certified airman then possesses the necessary basic experience, knowledge, and skill to proceed further with specific aircraft training. The air carrier shall then adequately train him in: (1) aircraft and powerplant maintenance procedures; (2) aircraft and powerplant troubleshooting procedures; and, (3) aircraft and powerplant normal and emergency flight operating procedures.

Flight engineers certified under sections of the present part 35, which does not require this specific maintenance training as recommended, should be given within a reasonable time such maintenance training to properly analyze and troubleshoot as envisioned in our proposal for expanded part 35 show throughout this conference agenda.

PREVIOUS CORRESPONDENCE SUBMITTED TO THE FAA REGARDING RECURRENT TRAINING

AUGUST 27, 1959.

Subject: Recurrent training for flight engineers.

Mr. OMER WELLING,
Chief, Maintenance Division,
Bureau of Flight Standards,
Federal Aviation Agency,
Washington, D.C.

DEAR MR. WELLING: Some time ago, in a meeting held in your office, I discussed with you the inadequacy of recurrent training for flight engineers which exists throughout the greater part of the industry. Following this meeting I sent out requests to some of our members for information and recommendations on this subject. In addition to a mail inquiry, I had held meetings with different groups of flight engineers where all phases of training were discussed. As a result we have gathered an immense amount of information covering initial, transitional and recurrent flight engineer training. Although the data has not been completely compiled at this time, we are able to put down several ideas on this subject.

First of all, I would like to emphasize the fact that there is a definite need for the FAA to specify in its regulations an expanded recurrent training program for flight engineers. The regulations must spell out in specific language the amount, type, and thoroughness of the training. I mention this because of the past sad experience of our organization in attempting to obtain sufficient recurrent training on many airlines. Some time ago I supplied your office with a rather detailed account of our TWA chapter's experience in attempting to come to an agreement with the company over a recurrent training program. Since that time our office has been supplied with a correspondence file on this subject. I am enclosing a copy of this file with my letter in order to better describe to you the efforts of the TWA flight engineers in trying to establish an adequate recurrent training program on their airline. I want to emphasize that recurrent training on TWA is neither the best in the industry nor the worst, but would seem to strike a mean average. Further, the efforts on the part of the TWA engineers has been duplicated by many other flight engineer groups with equal determination and intensity—and, unfortunately, with the same results.

In addition to the detailed reports which I have presented to you concerning the TWA flight engineers, I would like to quote from several reports submitted to me by flight engineers from other airlines.

"I believe that it is imperative that we make a strong case (before the FAA) for recurrent training insomuch as the company has now had no refresher classes for over a year and actually considers checking out on a new airplane as a substitute for an annual proficiency check" (Eastern Air Lines).

"Regarding your request for information covering flight engineer recurrent training, our company does a good job when business is slow and when pushed does not do anything. * * * they neglect check rides sometimes as long as 1 year or 1½ years. I know of many fellows who have gone over 1 year without training, or check ride, * * *" (Flying Tiger Line).

"In regard to your request for information on recurrent training for flight engineers it is ironic that you should ask for such information from a Continental Airlines flight engineer. To this date I do not know of any single instance when Continental Airlines has given any flight engineer recurrent training. The only training CAL flight engineers get is when some a.c. system or circuit is not fully understood. When such a problem arises, the flight engineers dig into their pockets and hire a professional instructor from another airline and have classes on their legal time off" (Continental Airlines).

Because many airlines are unwilling to provide an adequate recurrent training program for flight engineers it becomes imperative for the FAA, who is responsible for the certification of the airmen concerned, to make certain that the proficiency of the flight engineer is properly maintained. This can best be done by changing the pertinent regulations to spell out in detail (leaving no room for interpretation by company officials) what is required for FAA approval of a flight engineer training program.

SIMULATORS

The perfection of electronic flight simulators in recent years can, when properly used, contribute more toward crew coordination than any other development which has occurred in aviation for some time. Their importance from this standpoint cannot be overemphasized. The proper coordination of an entire crew in performing both normal and emergency procedures is a must if we are to obtain the highest degree of safety. In recent years the Civil Aeronautics Board has issued several accident reports which indicate that the pilot flying the aircraft has let his attention be distracted from the primary job of monitoring the flight instruments, by activities of other members of the crew engaged in executing emergency procedures. FEIA believes that this represents a real hazard on aircraft equipped with three-abreast cockpits, where the pilot flying the airplane can easily become distracted by the actions of the engineer and the other pilot who must carry out these emergency duties (in many instances) directly in front of the pilot. The only means of preventing this natural weakness from occurring at a critical time is constant practice of these procedures. The obvious place to do this is in an electronic simulator. FEIA would recommend that crew coordination training in flight simulators be required on all carriers and would hope that the Federal Aviation Agency would start immediate studies on this subject. The usual argument of economy as expressed by the industry is not valid. The purchase of an electronic simulator will almost invariably reduce the number of aircraft required by a carrier inasmuch as less training will be required in an actual aircraft. Furthermore, the cost of operating a simulator is considerably less than the cost of operating an actual aircraft. Carriers who hesitate to purchase simulators when buying new equipment, complaining that they are financially unable to do so, may well be cutting corners on crew coordination training in other areas, a fact which should, in any event, be corrected.

GROUND SCHOOL AND ORAL INSTRUCTION

We would like to emphasize, however, that FEIA does not consider that simulator training or crew coordination training alone will qualify a flight engineer properly. We feel that the simulator has a limited value in actual flight engineer training and that it is important that such training not be used as a substitute for regular flight engineer recurrent training. While simulator training will make nearly any individual proficient in the pushing of buttons and the pulling of levers upon a given signal from the pilot in command, it will not provide the engineer with the information he must have if he is to understand the operation of the various systems—and understand them he must. It has been advocated by some groups that detailed knowledge of the airplane systems is not required, particularly on the newer turbine aircraft. However, we find as a result of the experience we have gathered in flying this equipment that this is definitely not true. The systems are more complicated than ever before and many of them are more critical, with the penalty for failure being considerably more severe. The flight engineer's responsibility under the pilot in command

concerns the mechanical operation of the airplane. It then becomes axiomatic that he must have, and retain, a thorough knowledge of the airplane's powerplant and systems. The flight engineer must be able to give immediate operational aid and information regarding the electrical, mechanical, and other systems of the aircraft to the pilot in command, which will ease his (the pilot's) workload and aid him in making sound decisions based upon reliable knowledge. In addition, the ability to properly advise maintenance personnel is not a naturally acquired skill, but a specialized function. The day is long gone when a simple report of equipment inoperable will suffice to obtain safe maintenance. The complex nature of today's aircraft, coupled with the often obscure or intermittent nature of malfunctions, demands closer alliance between the maintenance and the operating team. This requires the flight engineer to possess a greater technical knowledge of the mechanical and electrical operation of the aircraft than ever before.

In discussing the amount and methods of obtaining flight engineer recurrent training with our members in the field, we have found that they are all unanimous in the belief that it should consist of at least a minimum of 2 weeks per year on each type of aircraft the flight engineer must operate on. Some engineers feel that this training should be given on a basis of approximately 2 days per month, while others feel that it should be given on a semiannual basis. Pan American World Airways, for instance, calls their flight engineers in every 6 months for a 5-day recurrent training program. During this time, the engineers are given classroom instructions and must pass an oral proficiency check. Much time is devoted to actually walking around the airplane, investigating the location of components, and going over the operation of the systems with the check engineer. I should mention here that Pan American's recurrent training program is far above average.

INSTRUCTORS AND CHECK FLIGHT ENGINEERS

A factor closely relatey to recurrent training for flight engineers involves the qualifications of instructors and check engineers. In many instances these individuals are not properly qualified to administer flight engineer training. Some, for instance, are full-time check pilots who have obtained a flight engineer certificate at the request of their employer. These men are predominantly interested in keeping current with changes in instrument procedures and piloting techniques—leaving the checking of flight engineers as an afterthought. One flight engineer states that "proficiency checks are given by the chief pilot or their assistants, so when a check ride is evident the engineer simply notes these figures—fuel capacity, wing spread, maximum landing and takeoff weights, and all operational speeds * * *." Certainly this cannot be called a proficiency check. The instructing and checking of flight engineers should be a full-time job. Such personnel should be required by the Administrator to possess greater experience as a flight engineer and to demonstrate a more extensive knowledge of flight engineering than that required of regular line engineers. Some of our members have recommended that there be a "senior" flight engineer certificate which would be issued only to those who had demonstrated the above-mentioned qualities. This senior flight engineer certificate would be required of all individuals who instruct, check, or supervise engineers on scheduled air carrier operations.

EQUIPMENT QUALIFICATIONS

Another matter closely related to the recurrent training of flight engineers concerns the fact that it is almost impossible for a flight engineer to remain currently qualified on more than two types of equipment. As we get into the more complex turbine equipment with its many complicated systems, it would seem only more practical that a flight engineer be limited to qualifications on one type of aircraft at a time. As an example of how far a carrier will go in the multiple qualification of flight engineers, one airline has required its engineers to be qualified on Lockheed 049's, 749's, 1049's, 1049C's, and 1049G's. In addition some of these same engineers have had to maintain qualifications on DC–6B's, DC–7B's, and more recently, Lockheed Electras. It can easily be seen that no one can actually be proficient in all of these aircraft at the same time,

even though some of them might be of similar nature. It is questionable in the minds of our flight engineers whether proper qualifications can be maintained in both DC–6 and DC–7 aircraft at one time. Certainly if this is the case, it becomes impossible to do the job required if he is to maintain qualifications in completely different types of aircraft.

Because certain carriers have attempted to keep flight engineers qualified on an unrealistic number of aircraft, FEIA would recommend that flight engineers be required to possess a type certificate for each type of aircraft for which they operate. By this we mean the flight engineer certificate in itself would not permit an engineer to operate as a flight engineer on any air carrier aircraft unless the certificate was accompanied by a type rating for the aircraft which he intended to operate on. Following through, the flight engineer could not keep this type rating valid unless he received the proper recurrent training on the particular aircraft covered by his type rating.

SUMMARY

In summary our flight engineers believe that—

1. A minimum of 12 days per year of recurrent training should be given on the type of aircraft on which the engineer is scheduled to operate on. This training should consist of classroom instruction complemented by oral checks on the airplane systems and powerplants.

2. Simulator training should be required by all carriers with a minimum of approximately 10 hours per year. This training should be taken by the flight engineer as part of the entire crew. It should not be used as a substitute for the technical training and classroom instruction. Some troubleshooting procedures can be practiced in a flight simulator but this must be done only with flight engineer instructors and/or check engineers. Most such training when given in conjunction with regular crew coordination training reduces the overall quality of such training and is unfair to the rest of the crew.

3. The scheduling of training should be left up to the carrier and its flight engineers, providing the total amount of training per each 12 months meets the minimum requirements.

4. Flight engineer instructors and check engineers should be required to possess greater qualifications than those required of regular line flight engineers. FAA should issue a special flight engineer certificate for people holding this responsibility. We suggest a senior flight engineer certificate with minimum qualifications of 2,000 hours of flighttime as a flight engineer on aircraft having a flight engineer's station. In addition, he should be required to demonstrate superior skill and knowledge on the subjects related to flight engineering and on the aircraft which he is concerned with in his checking or instructions of engineers.

5. The minimum amount of recurrent training applies to only one type of aircraft. If a flight engineer is required to be qualified on different types of aircraft he should then receive 12 days' training on each of the types of aircraft on which he is qualified. The number of airplanes which a flight engineer may be qualified on must be restricted. We believe that this can best be controlled by the Administrator's issuance of a type rating which would be required by the engineer for each type of aircraft on which he was scheduled to operate. Type ratings on jet aircraft should certainly not be given until the engineer has demonstrated a substantial knowledge of thermodynamics and electronics. It would be difficult to understand how an individual can completely comprehend the operation of a turbine engine without a good knowledge of thermodynamics. In the case of electronics the trend in modern aircraft is to use high frequency A/C power. Electronics play a large part in the operation of these aircraft. In the interest of safety the engineer should be thoroughly acquainted with the electric circuitry so that he will be able to deactivate any electrical unit necessary if emergency conditions present themselves. To accomplish this efficiently the engineer must possess a basic knowledge in the fundamentals of electronics.

Sincerely yours,

R. A. BROWN,
Executive Vice President.

68755—61——62

PREVIOUS CORRESPONDENCE SUBMITTED TO THE FAA REGARDING DRAFT RELEASE 59–3

SEPTEMBER 21, 1959.

Subject: Draft release 59–3.

FEDERAL AVIATION AGENCY,
Docket Section, Room B–316,
Washington, D.C.

GENTLEMEN: The Flight Engineers' International Association approves in general the principles proposed in draft release 59–3. We feel that the more rigid supervision of airline training program by the Administrator has long been needed in the industry in order to avoid the practice of many airlines of attempting to cut costs by reducing the quality and quantity of flight crew training. While management people in the operating divisions of the airlines may disapprove of the inadequate training they are able to give their flight crews, they are often helpless to correct the situation because they lack a voice in the economic affairs of running the airline. For this reason the standard of airline training must be set by the Administrator. Further, it must be the responsibility of the Administrator to see that the programs, as approved, are properly administrated.

Although the proposals in draft release 59–3 appear to be primarily concerned with the certification and qualification standards of pilots other than pilots-in-command, there are many changes which would in addition affect the training and qualifications of all the other crewmembers, including dispatchers.

While the proposals would appear to rectify many of the shortcomings of the regulations covering the training and qualifications of copilots (pilots other than pilot-in-command) it does very little toward correcting the inadequacies of the regulations covering the recurrent and initial training, checking, and rating of flight engineers.

For example, the reasons advanced in draft release 59–3, that all pilots other than pilots-in-command possess a type rating, apply even more to the flight engineer. The act of flying an aircraft is a skill more common to all types of aircraft than is the responsibility of knowing and understanding the highly complex systems on today's many new air transports. The pilots' basic flight instruments are generally standardized in all makes of aircraft, and the function of the different flight controls is the same on all aircraft. The ground facilities, navigational aids, radio and communication frequencies, etc., do not change from airplane to airplane. This is not to detract from the need for copilots to possess a type rating, rather it is to point out an even greater need for an aircraft type rating for the flight engineer who must cope with electrical systems ranging from 24-volt direct current to 110-volt, 400-cycle alternating current. Powerplants vary from standard reciprocating engines to turbocompound, turboprop (with its complex prop control system), turbojet, and soon, turbofans. The difference between these mechanical and electrical systems can be very great. The flight engineer's responsibility under the civil air regulations concerns the mechanical operation of the aircraft. Certainly, then, the Administrator should require a type rating for specific aircraft as well as the Administrator's approval of recurrent training programs and proficiency checks for the flight engineer.

Part 40.263 of the present Civil Air Regulation states simply and unequivocally that the flight engineer shall be required on all aircraft with a gross takeoff weight in excess of 80,000 pounds. No other airman is allowed to fulfill this function except in the case of flight engineer incapacity. Therefore, the regulations firmly establish the concept of the flight engineer as a specialist crewmember. The intent of 40.263 is that regardless of the original aeronautical background (piloting, engineering, maintenance, etc.) the flight engineer himself through experience and training acquires skills not otherwise required to be present in the operating team. The flight engineer must be able to give immediate operational aid and information regarding the electrical, mechanical, and other systems of the aircraft and its engines to the pilot-in-command, thus easing his workload and aiding him in making sound decisions based upon reliable knowledge.

In addition, it has been proven that the ability to properly advise maintenance is not a naturally acquired skill but a specialized function. The day has long passed when the reporting of equipment inoperative will suffice to obtain safe maintenance. The complex nature of today's aircraft (as described in the preamble of 59–3) coupled with the often obscure or intermittent nature of the

mechanical or electrical malfunctions demands a closer alliance between maintenance and the operating team, than is presently required by regulations.

It would, therefore, seem that part 40.284 as it is presently worded in Civil Air Regulations does not fulfill the intent or purpose of part 40.263 in that flight engineer training is specified as only a portion of pilot training. Certainly the flight engineer will not be properly qualified to aid the pilot-in-command in making reliable decisions concerning mechanical irregularities if he possesses only a portion of the identical training which is required of the pilot. Therefore, we believe that in order for the flight engineer to obtain the training necessary to enable him to fulfill the intent of 40.263 and to insure safe maintenance through proper flight-ground liaison the following changes should be made to part 40, with similar changes to part 41 and part 42.

"40.284. Ground training for all flight engineers shall include instruction in at least the following:

"(*a*) The appropriate provisions of the air carrier operations specifications and appropriate provisions of the regulations of this subchapter with particular emphasis on the operation and dispatching rules and airplane operating limitations;

"(*b*) Dispatch procedures and appropriate contents of the manuals;

"(*c*) The duties and responsibilities of crewmembers;

"(*d*) The principles and methods of determining weight and balance limitations for takeoff and landings;

"(*e*) A detailed study of the aircraft and its engines and all major components and systems related thereto, including performance limitations, standard and emergency operating procedures, and appropriate contents of the approved Airplane Flight Manual;

"(*f*) A study of the recognition and control of en route malfunctions together with instruction on maintenance procedures and proper maintenance advisory information;

"(*g*) Training in meteorology sufficient to insure a practical knowledge of the principles of icing, thunderstorm and frontal systems as they pertain to engine operation, including procedures for operating in turbulent air, icing, and other potentially hazardous meteorological conditions."

To provide for an aircraft type rating for flight engineers we would recommend that 40.300 as proposed in draft release 59–3 read as follows:

"(*a*) No air carrier shall utilize any flight crew member or dispatcher, nor shall any such airman perform the duties authorized by his airman certificate, unless he satisfactorily meets the appropriate requirement of 40.280 or 40.289 and 40.301 through 40.310. Each pilot serving as pilot-in-command shall hold an airline transport pilot certificate and appropriate type ratings for the aircraft in which he serves. All other pilots shall hold at least commercial pilot certificates with instrument ratings, and appropriate type ratings for the aircraft in which they serve. All flight engineers shall hold a valid flight engineer's certificate and an appropritae type rating for the aircraft in which they serve.

"(*b*) Check airmen shall certify as to the proficiency of the airman being examined as required by 40.302, 40.303, 40.305, and 40.307, whenever applicable. Such certification shall be made a part of the airman's record."

The Flight Engineers' International Association also suggests that 40.307 of the Civil Air Regulations be changed to provide for the flight engineer to receive a proficiency check similar to that proposed by the Administrator for the pilot other than second in command. We recommend the following language:

"40.307. Proficiency check flight engineer.

"(*a*) An air carrier shall not utilize a flight engineer until he has satisfactorily demonstrated to a check engineer or a representative of the Administrator his competence in the duies of flight engineer. Thereafter at least twice each 12 months, at intervals of not less than 4 months or more than 8 months, a similar flight engineer proficiency check shall be given each flight engineer. Where such flight engineer serves on more than one type airplane the flight engineer proficiency check shall be given on each type of aircraft on which the flight engineer shall serve.

"(*b*) Irrespective of the provisions of paragraph (*a*) above flight engineers shall not be deemed competent or qualified on the equipment for which the check is specified, unless prior to this check and subsequent to the preceding one, the flight engineer has received a minimum of 6 days refresher training on the type of aircraft on which he is to be qualified."

The institution of this amendment would, of course, necessitate a change in paragraph (*b*) of 40.289; the last sentence would now read "satisfactory completion of the checks required by 40.305 or 40.307 will meet the requirements of this section."

The Flight Engineers' International Association wishes to thank the Federal Aviation Agency for this opportunity to make recommendations regarding changes in the Civil Air Regulations.

Sincerely,

R. A. BROWN, *Executive Vice President.*

ITEM 3—TRAINING REQUIREMENTS FOR FLIGHT ENGINEERS

(*a*) All flight engineers should be trained to perform the same in-flight duties that some flight engineers have been doing for years in regards to anticipating, detecting, and correcting in-flight mechanical and electrical irregularities.

In order for the flight engineer to be in a position to adequately serve the cause of safety in this behalf, it is necessary that he have a thorough knowledge of all systems, accessories, and components. With the advent of a.c. electrical power systems in wide use, it is mandatory that he be thoroughly trained in electronics theory and proper handling of these systems. Adoption of training and certification requirements as set forth in our presentation will provide the scope of training necessary to adequately anticipate, detect, and correct in-flight irregularities.

Note from the following reports submitted as documentary evidence that the flight engineers on Pan American World Airways are doing much more work in electronics in-flight detection and troubleshooting than some other carriers. It is only through years of study and practical experience that a man is in a position to serve the cause of safety, which is shown in these reports. Therefore, we must take a program that is in existence, which has duly served the cause of safety, and established a standard for the industry.

In contrast, compare the philosophy of air carriers which utilize flight engineers who do not have this broad technical experience and training. Particularly note the incident report of Dallas, flight 871, of May 29, 1960. In this case no attempt was made to properly isolate or troubleshoot a hydraulic malfunction. This resulted in a landing attempt without the use of spoilers. Because of marginal lateral control, the aircraft was observed rolling on approach, 30 degrees from side to side, and touched down on the runway at a speed of 178 knots. The outboard engine pod struck the ground. Proper system knowledge and mechanical background of the flight engineer can eliminate incidents of this type.

For a flight engineer to be properly trained in this electronic age, he must have broad mechanical and electronic knowledge and training.

[Copy]

"REPORT OF INCIDENT AND 880 OPERATIONAL STATUS, MAY 28, 29, AND 30, 1960

"Customer service—Department message

"Delta incident: Delta Airlines flight No. 871 (airplane No. 903) New York-Houston with 78 passengers; Sunday, May 29, 1960, approximately 5:30 p.m. (e.d.t.). No injuries.

"Aircraft climbed to 35,000 feet normally. Shortly after cruise altitude was reached, No. 1 system fluid level began to drop. The pumps were put in low-flow position. A characteristic of the system is that in this condition, the level in No. 2 system will drop also until the interconnect level between No. 1 and No. 2 tanks is reached. This drop in level was thought to be a failure of No. 2 system and the pumps for that system were put in low-flow position. Flaps were extended to 20° using auxiliary pump; all that was possible at higher speeds using this pump. Main gear was extended hydraulically; nose gear by free fall.

"The landing was made with no spoiler operation. Touchdown was at approximately 178 knots. Fuel was not dumped because of lack of hydraulic pressure. The crew has stated that No. 2 system was returned to normal before the landing. The pumps and switches were found in the low-flow position (and temperature control valves open) when the airplane was entered after the landing.

"The approach was made with spoilers inoperative and the aircraft was observed to roll slowly from side to side about 30° due to increased inertia re-

sulting from high fuel loads (because of no dumping) and pilot unfamiliarity with the change in lateral control effectiveness.

"During the landing, No. 4 engine contacted the runway. Damage was confined to the engine, suppressor, and pod doors. A high-pressure leak was found at No. 1 pump pressure outlet. A break in a one-half inch T fitting on No. 4 engine was also found and may have occurred during landing impact. Considerable oil was on runway and emitting from the cowl during towing and after arrival at the ramp. No tires were blown. Landing weight was 167,500 pounds. Flight duration: 51 minutes. Landing was made at weight in excess of all allowable landing weight and appropriate inspection was made.

"Inspection disclosed wrinkled fairing in aft portion of pylon and damaged pod doors. No internal primary structure was damaged. The engine and pod doors have been replaced and the airplane will be ferried to Atlanta today (May 31).

"At a hearing in New York the CAB has recommended this be classified as an incident. Convair has issued telegraphic instructions clarifying emergency procedures for spoiler inoperative operation and hydraulic failure emergency procedures for the flight manual.

"Airplane No. 7, Delta's only remaining airplane, is operating on a nonscheduled basis.

"TWA: Airplane No. 10 has accumulated 106:44 hours total time with no major maintenance items that would cause delays. The 5-day training flight average is 10:44 hours/day. Flight time this weekend was: Saturday, May 28, 7:28; Sunday, May 29, 11:16; Monday, May 30, 12:45."

(Prepared by Service Engineering Transport Group, May 31, 1960.)

Item 3(b)

(*b*) The amount of training necessary for a flight engineer to accomplish a thorough preflight inspection should be determined by his background. A flight engineer who has formerly been associated with aircraft maintenance and inspection obviously has a more comprehensive knowledge of aircraft inspection than a flight engineer who has not had the benefit of this type of experience. The ability of the experienced flight engineer to locate mechanical irregularities that would otherwise be unnoticed until in flight, or until trouble of a more serious nature develops, requires experience and training. The flight engineer should be completely familiar with the airplane so that he can observe a section of skin, note a loose rivet, and determine if this is detrimental to the safety of the flight. He should know the appearance of a crack in metal and the probable places for these to occur. Water dripping from an area may be condensation or it could be from waterlines in the area. He should be able to distinguish fluid leaks such as engine oil, kerosene, type of hydraulic fluid, et cetera, to enable him to determine the source and if the leak is of a serious nature. A thorough preflight covers a multitude of items, and complete knowledge of the airplane and component parts is essential. Therefore, a flight engineer who is obtaining his certificate without the benefit of previous aircraft mechanical or inspection experience should be required to have minimum experience requirements as described in agenda item 2.

Preflight training on new equipment should include a minimum of 24 hours on the airplane in becoming familiar with the location of and access to component parts.

In summation, since a proper preflight inspection requires all the senses of sight, smell, taste, and feel, plus full knowledge of aircraft powerplants, all systems, accessories, and components, the flight engineer must possess a broad mechanical and electrical background and knowledge to do a safe and efficient job of this important function. Adoption of training and certification requirements as set forth in our presentation will provide the scope of training necessary to adequately perform the preflight function. Our documented report forms once again verify the above point. One can readily see that the flight engineer is truly the "quality control" on the product being delivered to the public.

It should be readily apparent from the forms submitted and from observations in the field that a broad mechanical and electrical knowledge definitely furthers the cause of safety in this important realm of operations.

One of the biggest problems today in a flight engineer performing an adequate preflight is that the airlines are not assigning sufficient time for this function.

Pan American World Airways is one of the few carriers that has recognized the need for thorough preflight inspections and has carried through into this

turbine age with necessary actions by allowing sufficient time for this function.

For adequate safety, the preflight must be required by regulations and in doing so the flight engineer must have time to perform this safety function.

Item 3(c)

(c) Training programs must be standardized and training requirements should be defined in the regulations, applicable to flight engineers. Training programs cannot be tailored to the experience and background of the individual, because if this condition prevailed, here again it would be necessary for further field, regional, and central interpretation of the regulations applicable to this particular flight crewmember. Standardization for certification and training must be defined in the regulations and maintained. In this manner the quality of the applicant is fully controlled, all parties are fully aware of the requirements firsthand, and the ultimate in safety is achieved.

It is felt that certainly worthy of consideration in the realm of training is a discussion of instructor flight engineers. Even though a good training program is shown on paper and set up by the carrier, the quality of the flight engineers emerging from this training is only as good as the quality of instruction received. This instruction quality can only be controlled by the selection of qualified flight engineer instructors.

Even though some air carriers select their best flight engineer personnel for use as ground school, simulator, and flight instructors, there is no industry standard. We urge adoption of a regulation requiring flight engineer instructor's ratings in order that a standard and a minimum quality of this type personnel is maintained for the training of line flight engineers.

Ground school instructors should be flight engineers qualified on the type aircraft upon which they are instructing.

Flight engineers instructing in the simulator and on the flight line should be rotated so that the trainee can be given the full experience of a man qualified on the airplane and one who also realizes the limits of the simulator. The simulator should be no place for retired flight engineers or other unqualified personnel. A man whose sole job is working in the box—simulator—is not aware of the problems and differences which exist between the aircraft and the simulator.

It follows also that check flight engineers be fully aware of the standardized training program which the individual is receiving and that the proficiencies be standard for the type aircraft involved.

To summarize, in view of our experience and substantiating material in our files, training programs must be standard for all flight engineer personnel involved. Further, all flight engineer instructors and check airmen in these programs must be properly qualified on the type aircraft in order that the high quality of the stipulated program be maintained.

Furthermore, with standardization the problem of interchange operation is alleviated and also the integration of airline crews on airline aircraft into CRAF in case of a national emergency is already standard.

Item 3(d)

(d) Flight engineer instructors and check airmen, as well as line flight engineers state that what the individual needs most is constant recurrent training on all systems, since he deals with all systems, both before flight and in flight. Check airmen state, in particular, that proficiency checks are turning into instruction periods, since the flight engineer has had no recurrent training.

It is the consensus of opinion that the best program to keep a line flight engineer properly qualified in all phases of his job is by progressive recurrent training. Recurrent training only once each 6 months to pass a proficiency check is not adequate.

Under the program as it exists today, a flight engineer is at his highest proficiency level at the completion of his initial training and the day before each proficiency check. What about the other 364 days of the year?

The only sensible and logical solution to the above is progressive recurrent training on: (1) aircraft and powerplant maintenance procedures; (2) aircraft and powerplant troubleshooting procedures; and (3) aircraft and powerplant normal and emergency flight operating procedures.

Item 3(e)

(e) What is a realistic proportion of approved simulator time versus flight time for the following:

(1) Training on new equipment based on programs in existence which have proved satisfactory; simulator time should be twice the number of hours of flight time.

(2) Accomplishment of proficiency checks with proficiency checks required every 6 months, every other proficiency check performance in flight would be adequate. Every other proficiency check in flight is necessary, because flight engineer instructors and check airmen observe that an individual becomes complacent in a simulator. He may not react to the problem at hand as effectively under the pressures of actual flight conditions.

(3) Completion of recurrent training requirements—the simulator recurrent training program should definitely include normal and emergency procedures with crew coordination, plus training of the flight engineer to anticipate, detect, and troubleshoot aircraft and powerplant systems. However, it is impossible for the flight engineer instructor to demonstrate systems troubles and troubleshooting while the pilots are engaged in instrument work. This phase of flight engineer training can best be accomplished, as one major carrier has realized on initial L–188 training, by separate flight engineer periods in the simulator.

As recommended on initial specific aircraft training, the simulator time for recurrent training should also be twice the number of aircraft time.

FAA Conference Agenda Item 4—Inflight Training of Flight Engineers

Flight training of flight engineers for original certification shall be accomplished on flights scheduled for crew training purposes under the supervision of a properly qualified instructor flight engineer.

Flight training of a certificated flight engineer for additional type ratings shall be accomplished on flights scheduled for crew training purposes under the supervision of a properly qualified instructor flight engineer.

Only flights scheduled for crew training purposes shall be used for initial certification and type ratings of flight engineers because: (1) abnormal situations arise from improperly executed normal procedures and (2) emergency procedure demonstrations necessitate various aircraft systems and powerplant deactivation.

Line training of a certificated and type rated flight engineer may be accomplished on air carrier scheduled operation under the supervision of a properly qualified flight engineer. This line training is to familiarize and train the individual with the day-to-day operation.

A program in existence today, which has proved very successful and is utilized by one major air carrier is as follows: Under this initial training program, the student is given 14 to 15 hours of local flying, followed by a certification check ride by a Federal Aviation Agency inspector or an examiner check engineer. At the completion of this local training, the student is then given an oral examination as required by the regulation. Upon satisfactory completion of the above, the trainee is then given approximately 100 hours of line training under the direct supervision of a properly qualified flight engineer. Finally, he is then given another oral examination before being released for line duty on his own.

Programs similar to the above have produced very capable flight engineers. The local training before certification is mandatory to adequately determine the students' adaptability to the job and to further determine his reaction under the pressure of actual flight conditions. Since the flight engineer is under pressures from the start of a preflight until the end of a flight, it is necessary for an instructor to work diligently with him in local training to determine his fitness for the job, and for the check engineer to further verify that ability.

Flight time limitations

The regulations as presently constituted have pushed human endurance to the limit, leaving no reserve for emergencies, yet the crews are expected to have some hidden reserve which keeps them going.

It is unrealistic to suppose that crews operating under part 41 are endowed with more stamina than those under part 40. Allowing 12 hours of flight time, as in present part 41, can lead to a 16- to 20-hour duty time or more. This is obviously an unsafe condition.

Therefore we urge the FAA to take immediate action regarding flight time limitations for flight crews with the objective of bringing these limitations down to a more realistic level.

We specifically propose that part 42 be amended immediately to spell out flight time limits for flight engineers, navigators and radio operators, and that flight time limits be standardized for all operations.

We recommend that the flight time limits be predicated on the hour of departure in an effort to reduce fatigue caused by irregular sleep cycles.

We further recommend that future regulations regarding flight time limits give more consideration to the social aspect involved.

Foreign flag carriers

Foreign flag carriers are operating into U.S. territory in violation of international agreements respecting such flights. They are in violation by virtue of noncompliance with the laws of the country in which the aircraft is registered, since these carriers are not carrying a licensed and certificated flight engineer on such international flights as is required by the laws of those countries concerned.

Since such operations are a violation of U.S. law also, we urge this committee to consider ways of policing this situation when it occurs. This could be done through authority to the FAA to ground such operations if investigation reveals that a violation exists.

That is all that I have, Mr. Chairman. I have finished reading my statement, unless one of my colleagues has something to add here.

Mr. SULLIVAN. Mr. Chairman, just for a practical example of your last question, to go back, in the case of American Airlines, the average flight engineer time, prior to the reworking of the regulations which came out in January, ran approximately in the bumps and grinds along the local area, getting the flight engineer checkout, the average was approximately 20 hours and 30 minutes. In addition to that, at least two line checks were given which amounted to, initially, maintenance to the coast and back, to get all the fundamentals of control under the individual's belt, and on some of the locals, say, Idlewild-Detroit-Chicago and back, to get takeoffs and landing experience.

So our boys did receive between 20 and 30 hours, in many cases, prior to this particular incident.

Senator MONRONEY. You consider that as adequate?

Mr. SULLIVAN. I would say at least 25. I believe a new regulation of the company which I read the other day, in training people—it was the management training them at one time—that they are going to a minimum of 15 hours, and in addition to that they will get much line time prior to check out.

Senator MONRONEY. By line time do you mean they would be riding with another, more experienced engineer?

Mr. SULLIVAN. Yes, sir. At the end of this period of time then he will receive a comprehensive check by a check flight engineer.

This all looks good on paper, and people have lived up to it, but a strange thing happened: approximately 2½ years ago in this new regulation that came out on training, both ground and in-flight, it spells out now that the flight engineer shall have recurrent training. Within our particular organization the company regulations went beyond, at one time, the FAA minimum requirements, and they spelled out on all equipment that the flight engineer would receive recurrent training each year up to four 2-day periods.

During the jet operation, in our opinion, due to the stress of the times in scheduling and so forth, in the case of the 707 I would like to bring this to everybody's attention: there has been one flight engi-

neer refresher in the past 2 years, and in the case of the Electra, there has been none.

The minimum requirements now coming out will still not remedy this company policy that existed at one time of giving thorough training in anticipating, detecting, and correcting in-flight malfunctions; and they are still there.

I would ask if the other fellows at the table have anything to say with respect to their particular companies?

Mr. IVERSON. Mr. Chairman, in closing I would like to add one thing, and that is that these are not simple machines which we were led to believe prior to their introduction. I think the record shows that they are not simple machines.

We have had three commercial crashes, fatal, in jet operations, in all configurations of operation: one in descent, in takeoff, and one in landing. We have had four accidents in jet training: two in flight, one on takeoff, and one on landing. We have had numerous incidents, nonfatal, during jet operations. One, of course, that we are all aware of, was the 29,000 foot dive over the Atlantic, a Pan American airplane that lost an engine over the Atlantic on a ferry flight. And there have been numerous other incidents.

So this equipment that we are flying today is no more simple or less complex than the forerunners that we have seen in the aviation industry for so long where the flight engineer was put on the airplane by regulation.

Senator MONRONEY. You talked a good deal about preflight. You are not saying that the engineer's preflight check and following the checklist for himself should absolve the pilot of doing the same thing.

Mr. IVERSON. The regulation, I believe, at present, the only thing it mentions, is that it should be the responsibility of the captain to either do or see that the preflight is done. However, the flight engineer is the one who does the detailed preflight of the airplane and then reports his findings to the captain.

Senator MONRONEY. When he finally gets the checklist before takeoff, the pilot cannot absolve himself of the responsibility of going through the complete checklist because the engineer may have already performed that?

Mr. IVERSON. No, sir.

Senator MONRONEY. So we have the fail-safe doublecheck before the plane is fired up for takeoff.

Mr. IVERSON. Right.

On preflight the engineer goes through the whole cockpit checklist, checking out and testing all the electrical operations, such as mach trim systems and checks these all out on preflights so that if there is a malfunction he can get them corrected by maintenance prior to flight departure. He goes through the cockpit and preflights and checks all the systems and then when the captain and copilot come aboard they again go through their checklist and set up their instrument panels as they desire for the trip.

Senator MONRONEY. In the light of your testimony, which is quite voluminous, on the responsibilities being greater, and the strain and stress on the crew member, knowing full well sometimes that crew members are stricken with food poisoning or otherwise, in flight, would you say that there is need for two flight engineers so that you

would have a fail-safe man at the panel instead of only one engineer on these jets?

Mr. IVERSON. I think, Mr. Chairman, that there is only space for three people in any airplane: two pilots and a flight engineer. That is what they are designed for. In the event they ever design an airplane, such as they did, for two flight engineers—the B–36—they need two flight engineers on there. But the present-day equipment is designed for only one flight engineer, and rightfully so.

Senator MONRONEY. In that event would it not be a fail-safe provision that someone, even though he was a copilot, have some capabilities to take over in the case of the incapacitation of the engineer?

Mr. IVERSON. Yes, this is covered in regulations.

Senator MONRONEY. They are required to know the fundamental duties?

Mr. IVERSON. Yes. They need not hold the license but they must be knowledgeable enough of the duties to function in the flight engineer's place in the event of incapacitation.

Senator MONRONEY. Thank you very much for your testimony on that matter. We appreciate the time that you have taken to prepare this list of suggestions. I know that they will be helpful in our search for a greater degree of air safety.

The committee will stand in recess until 2:30 this afternoon in this room.

(Whereupon, at 1 p.m., the subcommittee was recessed, to reconvene at 2:30 p.m., this same day.)

AFTERNOON SESSION

Senator MONRONEY. The Subcommittee on Aviation will resume its hearings.

We are honored today to have Mr. J. B. Hartranft, Jr., president of the Aircraft Owners and Pilots Association.

You have appeared many times before this committee in the past. You have made many important contributions, not the least of which has been airport safety and construction features, more airports, and also the 180° procedure which your organization so ably pioneered. We are happy to have you back, Mr. Hartranft. You may proceed in your own way.

STATEMENT OF JOSEPH B. HARTRANFT, JR., PRESIDENT, AIRCRAFT OWNERS AND PILOTS ASSOCIATION, ACCOMPANIED BY CYRIL THOMPSON AND VICTOR KAYNE

Mr. HARTRANFT. Thank you, Mr. Chairman.

I am president of the Aircraft Owners and Pilots Association, a nonprofit service organization for aircraft owners and pilots, and appear here today in their behalf. I also am president of the AOPA Foundation, Inc., a safety organization devoted exclusively to the furtherance of safety in the air.

My further qualifications appear on the third from the last page.

I would like to introduce two of my associates here today. On my right, Mr. Cyril Thompson, who heads our airport division, and on my left, Mr. Victor Kayne, our air traffic control specialist and head of our policy group.

I would call your attention to the last two pages for those members of the committee to whom this testimony may go who are not familiar with our headquarters. I would not expect this to be incorporated into the record, Mr. Chairman, but I thought it might give them some idea as to the physical setup of the Bethesda AOPA office. I regret we do not have similar photographs yet of our Oklahoma City office.

It is our understanding that this committee desires information from the various nongovernment aviation user organizations concerning their role in aviation safety. Accordingly, our statement has been prepared to give the committee a summary description of AOPA and its safety activities.

The Aircraft Owners and Pilots Association, with a current membership of 87,000 pilots and owners, is the world's largest service organization for civil aircraft pilots. It was founded in 1939 and incorporated as a nonprofit organization—

to promote, protect, and represent the interests of the members; to further the art, science, and industry of aeronautics and the pursuit of flying; to promote the economy, safety, and popularity of flight in aircraft and the use of aircraft by members, including the pilotage thereof by members * * *.

An audited survey of AOPA members indicates that approximately 64 percent of the members of our association own one or more aircraft. These aircraft constitute a majority of all aircraft operating in the U.S. airspace today.

The AOPA national headquarters is located in Bethesda, Md., and employs a staff of some 75 people to provide a wide variety of services to members. A branch records office is located at Oklahoma City. A high percentage of the total service rendered to members by the AOPA staff has a direct bearing on safety. A summary of our membership servicing activities is as follows:

1. AERONAUTICAL CHART SERVICE

Our chart service provides AOPA members a plan whereby a pilot automatically will receive the latest revised charts in which he is interested. This is tremendously important to the safe conduct of general aircraft flights since these chart revisions deal primarily with changes in airway locations, navigational aids, radio frequencies, and location of restricted and prohibited areas. This service is provided at cost of the charts, plus postage. It insures that a pilot will always have the latest charts and will not be using an obsolete chart. This department, using IBM techniques, selected and distributed more than 120,000 aeronautical charts to AOPA members last year. I believe that we are the largest nongovernment distributor of these charts in the world.

2. FLIGHT PLANNING

Our flight and travel department offers assistance to members planning flights both domestic and international. We recommend routes to be flown which offer maximum safety with regard to experience of the pilot, type of aircraft, terrain, and facilities. Radio frequencies, survival equipment, and other requirements for safe flight over the route are furnished to the pilot. On foreign flights, AOPA works closely with many foreign governments and obtains the necessary per-

mits for each country and furnishes the pilot with complete information concerning the requirements for flight in that country. This also includes data necessary for safely meeting national defense and military requirements in areas both within and outside of the United States. Numerous publications are prepared for pilots to use on foreign flights with safety information peculiar to each country.

For example, Mr. Chairman, I hold in my hand here one such publication entitled "Latin America and the Caribbean Islands, a General Flight Guide." This is published and revised frequently. It includes all of the necessary information which a pilot should have to take his aircraft into a foreign country. We have similar publications for all points all over the world.

3. TECHNICAL STAFF

AOPA's staff includes well-qualified experts in a number of technical fields, such as aircraft maintenance and operation, pilot training, radio communcations and equipment, air traffic control, airports, airspace utilization and general flight operations. This technical staff answers individual queries from our members concerning their aviation problems at a rate of several thousand letters a month and prepares articles for publication in our magazine.

The knowledge of general aviation operations gained by the technical staff from these comments by our members, supplemented by their own knowledge and observation of actual conditions throughout the country, is the foundation for the many recommendations that have been made by AOPA for improvement in air safety. A majority of the AOPA technical staff are active pilots. Our staff contribute to and are working members of many Government and nongovernment technical groups concerned with safety. These include the many committees of the Radio Technical Commission for Aeronautics and others such as the FAA Collision Prevention Advisory Group. Our staff is supplemented by approximately 40 pilots who serve on the various air traffic control advisory committees established by FAA throughout the country. These individuals serve on a volunteer basis, without pay, and include lawyers, bankers, aviation dealers and even a city council member.

4. THE PILOT MAGAZINE

AOPA provides each of the members with a monthly magazine devoted exclusively to general aviation subjects. This magazine, the AOPA Pilot, is a full-size publication which normally carries feature articles and regular departments on items which pertain to aviation safety, new developments, new facilities, regulations, and other items of interest to those who operate aircraft throughout the country.

For example, regular departments include the Safety Corner, which is devoted entirely to educational matters pertaining to safety; the Accident Report, which gives an analysis of typical accidents in order that members may learn to avoid similar occurrences.

These two, incidentally, by questionnaire have proven to be the most popular of all the articles run in the magazine, evidencing a continuing interest in safety on the part of most pilots.

Also, a What's New Department that summarizes new developments and rules affecting flying operations; and a column which reports on changes in airways facilities, including frequency changes to radio aids, airport changes, announcement of new charts, new or changed telephone numbers for obtaining aviation weather and other such pertinent data. Another educational feature is entitled "Never Again," which relates, for the benefit of all, selected experiences that others have had. A unique "Weathercast" of forecast weather gives every AOPA pilot a month or 6 weeks in advance, the probable area and route weather for planning purposes. This data, prepared under contract with Irving P. Krick, Associates, Inc., is especially helpful to noninstrument pilots and has consistently proven to be remarkably accurate.

Senator MONRONEY. Before you leave the magazine I would like to commend you on two articles that I have seen in the March 1 issue, one, "What About Airports," which is a very stimulating and thought-provoking editorial regarding the diminishing numbers and the vast costs that certain airports, such as Idlewild and Dulles entail, and the need for a great many more private airports, airports for general aviation; along with another article entitled "Our Vanishing Airports." Both of these are very thought-provoking and spotlight the matter that the committee discussed this morning and on several occasions, as to where are we going to get the landing space for the vast number of new aircraft in the general aviation fleet that are constantly being added, and the threat that comes from municipalities ignoring the needs for this type of service for people of the area who will own or do own aircraft today.

Mr. HARTRANFT. Thank you, sir.

5. CONFIDENTIAL NEWSLETTER

This publication is issued monthly to our members and contains a brief summarization of developments of interest to our members. Both the Pilot magazine and the Confidential Newsletter, which are mailed approximately 2 weeks apart each month, are used to solicit opinion and comment from AOPA members on current events.

6. THE AOPA AIRPORT LETTER

This biweekly publication is designed primarily for those concerned with the operation and provision of airports and airport facilities for general aviation aircraft. It contains news of latest developments in this field and provides information designed to encourage the building, improvement, and continued operation of safe landing facilities throughout the country.

7. INSURANCE

When AOPA was founded in 1939, it was impossible for the average pilot to obtain life insurance without paying a sizable additional premium because of his flying activities. AOPA has provided guidance and leadership over the years so that pilots now may obtain insurance at a reasonable cost. The example set by AOPA and companies that it has encouraged in this field has led to the inclusion of

piloting as a normal risk for life insurance purposes by most major insurance companies. Of greatest value perhaps is the vast pool of actuarial data which these plans have produced and the importance of this statistical information when considering the safety aspects of proposed regulations.

8. MISCELLANEOUS SERVICES

AOPA provides a variety of other services to its members, including a list of the lawyer members specializing in aviation law who are available to assist in specific problems, evaluation and certification of airports offering satisfactory service to civil pilots, aircraft title search, notification of impending expiration of airman medical certificates and aircraft radio station licenses, and publication of numerous pilot service bulletins.

I hold in my hand here, Mr. Chairman, a certificate of approval which is issued annually to those airports which meet certain minimum requirements with respect to safety and service. A good part of this information is obtained by a card which we provide to our members, a very simple postal card which requires no postage. Upon landing at any airport the member fills in the date, the airport, and then he has three columns to check: good, average, and poor. The items covered are such things as airport markings, condition of the landing area, neatness of the buildings and hangars, promptness and courtesy of service, and it goes on down the list here to is the field accurately and completely listed in charts, guides, et cetera.

These cards come back in great quantity. They in turn provide our flight routing service with a guide as to the airports to which pilots should more appropriately be sent on their cross-country flights.

I might say that we have found the average pilot like the average person is rather forgetful of dates. A private certificate which runs for 2 years usually requires a reminder so that the man will get his medical and his certificate still current before expiration. The aircraft certification license runs for 5 years. There we find that were it not for this memorandum he gets 30 days prior to expiration, that many of those people would fail to renew their certificates.

These bulletins cover a wide range of subjects dealing with all facets of aircraft operation. Sample titles are: "Terrain Flying," "Your Radio and You," "Key to Aviation Weather Forecasts," "Omnigation," "Overwater Flying," "How To Buy a Used Airplane," "AOPA 180 Degree Rating."

Wherever contemporary subjects come up of a technical nature which are confusing to pilots, we make an immediate effort to reduce it into lay language and put it out, then, to all desiring pilots so that they will be fully informed.

Other bulletins published on a special basis include such items as a joint AOPA-military bulletin warning all pilots of scheduled air defense exercises. Here is such an example. When we have notice from the military of any special operation of that kind, our office immediately goes on a three-shift schedule. The lights never go out until every pilot and aircraft owner has been notified of the pending exercises.

I might add that AOPA is cosponsoring a general aviation fly in this year to Vandenberg Air Force Missile Base and is working with the Navy to sponsor fly ins to various Navy facilities in order to promote better understanding of military operations and requirements. This, in turn, should contribute to safety in areas where these activities are taking place.

AOPA FOUNDATION

The AOPA Foundation, Inc., which is supported by AOPA members plus volunteer contributions, is devoted entirely to aviation safety matters. A grant from the AOPA Foundation to the University of Illinois several years ago sponsored the development of the AOPA 180° turn procedure. This is a lifesaving technique, whereby a pilot who does not have instrument training and who may inadvertently fly into bad weather is enabled to turn around and safely fly back into a good weather area and, if necessary, descend through an overcast. The foundation sponsored the teaching of this technique to instructors throughout the country in order that they could pass it on to other instructors and thence to the flying public. The present instrument training requirements for private pilots recently incorporated in the Civil Air Regulations by the FAA are a direct outgrowth of the AOPA 180° turn procedure.

The AOPA Foundation also sponsored a careful analysis of fatal aircraft accidents. It was discovered that 32.2 percent could be classed as weather accidents. The study also revealed that, although the pilots involved in this group of accidents flew 14 hours during daytime to each hour flown at night, about one out of five of the accidents occurred during darkness. As a result of this finding by the foundation, AOPA gave increased attention, particularly in our magazine, to the hazards to be avoided in nighttime flying. Another contract was to explore the feasibility of sequential strobe light techniques to give a brilliant, continuing floodlighting of the ground from an airborne light fixture in event of forced landings at night—a much needed substitute for the limited benefits from landing flares. That is floodlighting of the ground and that was a project developed by Cornell under a foundation grant.

Senator MONRONEY. Is that in the plane?

Mr. HARTRANFT. Yes, sir.

Senator MONRONEY. You mean it is landing lights, except it is a new type?

Mr. HARTRANFT. It is not landing lights. It is designed to substitute for flares. Instead of giving a beamed light ahead, it is designed to give a flooded area completely around the airplane so that the pilot may make a selection of an emergency landing field.

Senator MONRONEY. How far is that usable?

Mr. HARTRANFT. The foundation took it and completed it through the breadboard stage. I have now been advised that the Navy Department is taking an interest and we are hopeful now that they may make further refinement of the principles which were established.

Senator MONRONEY. At what altitude would you have to be to be able to get a fair sampling of the terrain?

Mr. HARTRANFT. The results of the initial, as we call, breadboard lighting, indicate that at 1,000 feet you would have the equivalent

of the lighting from a very bright moonlight night. Then as you decrease your altitude, the amount of illumination builds up somewhat in greater proportion.

Senator MONRONEY. In other words, at 1,000 feet you could detect wooded ground or very rough terrain, and you could begin to select an area in which you could perhaps come down for a safe landing?

Mr. HARTRANFT. Yes, sir.

Senator MONRONEY. And the closer you get, the more identity of the terrain comes out by the lighting?

Mr. HARTRANFT. Yes, sir.

Senator MONRONEY. This is carried out as a part of the landing lights; is it?

Mr. HARTRANFT. No; this would be a separate flush-mounted type of receptacle on the underneath side of the fuselage inboard of the airplane wing. An interesting part of it is that primary research on that had to do with the rate at which you could flash that light and fool the eyeball. As you know, in simple terms, the watching of a motion picture is actually the watching of separate pictures so merged that your eye is tricked into the illusion of movement.

The problem here was to find the type of light which would give the proper intensity, and then to give the proper sequence so that you would neither have what they call flicker nor flacker. The flacker was the more difficult of the two because it would tend to give a person a loss of the sense of depth perception. So that they were finally able to arrive at a proper sequence flash rate to give the illusion of a steady light, yet using a very low amperage stepped up into a high intensity light such as your strobe light principle gives you.

Senator MONRONEY. This is the first time I ever heard of it. I congratulate you.

Mr. HARTRANFT. The AOPA Foundation has produced several films on the subject of aviation safety. One of these, "To Save a Life" is based on the 180° turn procedure. Prints have been made available to the various State aeronautics commissions on the basis that the foundation would give them one free copy for each one purchased at actual cost. This safety-education film has been viewed by hundreds of pilot groups from coast to coast, and in this country and abroad.

Another film, cosponsored by the AOPA Foundation and the National Association of State Aviation Officials, entitled "Flight Decision," depicts for the novice pilots weather conditions which he should avoid for the safe conduct of his flight. This film was awarded highest honors in the field for nontheatrical films on safety by the National Committee on Films for Safety.

The projection of either of these films is available to this committee or their staff at any time, Mr. Chairman.

The foundation continues to show an active interest in crash injury research. It is a well-known fact that the lives of many passengers who died in aircraft crashes could have been saved had the seats they occupied been securely anchored and the passengers securely fastened to the seats.

We know, for instance, that seat belts alone are not always sufficient to prevent fatal injuries which need not have been incurred. This is particularly true of light planes, where occupants of the front seat face the hazard of the upper part of the body being thrown against

the instrument panel by the impact of the plane striking the earth or other solid objects.

Crop dusters have shown that shoulder harness prevents many accidents from being fatal accidents. One of the problems with shoulder harness is finding a secure anchoring system in the plane. The foundation commissioned a study several years ago in the hope of developing a shoulder harness installation, particularly for the front seat of light planes, which will meet with FAA approval, be low in cost and simple to install. This is a continuing project and we hope to come up with a solution in the not-too-far-distant future.

The foundation also sponsored the development of the Griswold lateralizer, which is a safety device designed to keep the airplane under control in conditions where an untrained pilot may not be able to do so because of weather conditions or other factors. Currently, the AOPA Foundation is about to engage in a survey of all registered aircraft owners in the United States to obtain information concerning the equipment in these aircraft, how and where it is used, utilization of ground facilities and other factors having a vital bearing on aviation safety.

In addition, the foundation has sponsored a number of aviation safety forums designed for the education of pilots and improvement of flying technique. The foundation also is currently working on development of a ground school course that would be made available throughout the country on much the same basis as courses are given for the boating fraternity by the U.S. power squadrons.

AIRPORTS

I should like to briefly discuss airports because they are a major factor for consideration when planning aviation safety.

All intercommunity travel or cargo movement by aircraft involves two airstrips or airports—the one at point of takeoff and the one at point of landing. There are over 17,000 incorporated places in the United States today which contribute to the national economy. But FAA records show only 6,426 civil aircraft landing places and in many cases, two or more of these are located around the same city.

This fact reveals a safety problem. The air traffic volume at many airports today is unnecessarily high because aircraft users are trying to get to the 17,000 small and large centers of economic activity by using an airport system which serves only the larger cities. For example, when a business airplane used by the International Harvester Co. of Chicago transports sales or maintenance personnel to small centers in Kansas, the landing for Holton would probably be made at Topeka and a landing for De Soto would probably have to be made at busy Kansas City Municipal Airport.

As another example, the Food Fair store's airplane from Miami, Fla., would probably have to land at Atlanta's Fulton County Airport on a produce-buying business trip to Douglasville, Ga.

During the 5-year period 1955–60 general aviation operations are reported by FAA to have increased 80 percent while airline operations have increased 28 percent. It is important to remember that the larger airline transports offer service through only 566 airports, while general aviation's light airplanes serve the economy through more than

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6,426 airports. There is no doubt that a national policy for Federal leadership in expanding our system of low-cost airports for general aviation would contribute to aviation safety. As our airlines learn to fly higher and faster, let's not forget that about 75 percent of our incorporated places are still isolated from the air age and have no landing facilities for the flying public.

There is an urgent need for both Government and the aviation industry to join forces in giving the public the complete picture about general aviation and the need for airport planning on the same basis as public ownership of streets, sewers, parking lots, and other similar facilities.

The FAA, CAB, and the Census Bureau all should participate in gathering of pertinent data. Our sampling surveys strengthen the belief that far more than half of today's air travel on business in the United States is being accomplished in general aviation aircraft.

Given an adequate system of small airports, there is little doubt that the growing use of business and taxi aircraft can give a substantial boost to commerce and industry. We believe that general aviation can be a great feeder asset to the airlines. Timesaving private or company and taxi airplanes feed passengers into airline jet terminals for long-distance trips, thus enhancing the national significance of the large jets.

General aviation is the largest segment of civil aviation in the United States today. It includes the largest group of citizens—aircraft owners, manufacturers, base service operators, airport operators, suppliers and pilots—actively working to make aviation safe. By helping to supply Federal policy direction and the matching funds needed to expand the Nation's system of small airports for general aviation, the 87th Congress can make a major contribution to aviation safety. This subject, however, may be more completely covered in other hearings on the future of the Federal-aid-to-airports program which, I understand, the committee will consider within a few weeks.

Progress in safety recommendations: We believe that the previous hearings held by this committee on aviation safety have directly produced some very good results. The FAA now is consulting with industry more than in previous months with regard to obtaining all available information prior to promulgation of rules. There is every indication that the FAA will continue to show improvement in the coordination of proposed rules in order to obtain the benefit of the thinking and experience of all concerned.

Our testimony before this committee in January and June of 1960 contained many specific recommendations for improved safety in the air, which have been developed over the years by the AOPO technical staff. These are still germane and, we believe, worthy of committee consideration. Of these, we wish to comment specifically on some which have received attention since our last appearance before your group.

We have been recommending since March 1957, that all aircraft designed to operate at more than 300 m.p.h. be required to carry flight recorders. Partial implementation of this recommendation was accomplished prior to the New York collision in that recorders were required on certain turbine-powered aircraft. We understand that

the FAA currently is considering an extension of this regulation to include additional aircraft.

We have been recommending that a speed limit of 180 m.p.h. be established for all aircraft operating below 2,000 feet. This recommendation previously was partially implemented by imposing this requirement in high-density traffic zones. The FAA currently is considering a speed limit of 250 m.p.h. for all aircraft below 14,500 feet when within 50 miles of destination.

In addition, they are considering a speed limit of 180 m.p.h. for all aircraft within a 5-miles radius of all airports where a control tower is in operation.

Since March 1957, we also have recommended that a collision warning device be required in all aircraft designed to operate at more than 300 m.p.h. AOPA has been participating with the FAA and other organizations in a search for development of a suitable collision warning device through the FAA Collision Prevention Advisory Group. This search has been fruitless to date, despite a continuing effort on the part of many organizations over the past 4 or 5 years.

REVISION OF FEDERAL AVIATION ACT

Since our last appearance before this committee, we have seen many signs of improvement in various parts of the FAA with regard to increased coordination and a growing tendency to discuss problems with industry prior to initiating action. Nevertheless, the experience of the past 2 years clearly indicates that some safeguard is needed in the Federal Aviation Act to provide for a review of FAA actions.

We note that Senator Engle has introduced a bill for this purpose, S. 446. He also has introduced another bill, S. 447, which would incorporate additional safeguards in the Federal Aviation Act with regard to proceedings against certificate holders. AOPA heartily endorses the concept of these bills.

We believe it to be of utmost importance to safety in the air and the development of civil aviation that harmonious relations and full cooperation exist between the Government and the aviation community. It is only through maximum utilization of the combined efforts of knowledgeable and experienced people in both Government and civilian life that we will achieve the common objective of a safe and healthy national asset in the form of civil aviation.

The Aircraft Owners and Pilots Association is dedicated to this philosophy and will continue to work toward this objective as in the past.

Mr. Chairman, I wish to express my thanks and appreciation on behalf of our 87,000 pilot members for the invitation and the opportunity of appearing before your committee on these matters of vital importance to the flying public.

(Qualifications of J. B. Hartranft, Jr.: President, Aircraft Owners and Pilots Association; membership, 87,000 pilots and owners. President, AOPA (Safety) Foundation, Inc. Publisher, the AOPA Pilot magazine. Licensed commercial and instrument pilot. Aircraft owner (operating from National Airport, Washington, D.C.). Former secretary, Interdepartmental Air Traffic Control Board. Former lieutenant colonel, Army Air Force. Member, executive committee, Radio Technical Committee for Aeronautics. Member, Joint Civil-Air Defense Committee, etc.)

Senator MONRONEY. I notice in the early part of your statement you attribute 32.3 percent of the accidents to weather. I believe that was the figure you used, if I remember correctly.

Are you satisfied that we are getting the maximum distribution of weather information?

By this I mean the average fixed base operator who services the general aviation user on the average field. I have yet to see an undated weather chart that is shown in the lobbies or the places where pilots go through prior to their departure for flight. Many of the men will use the telephone to contact weather and some of them are inclined to be in a hurry, thinking it is a clear day—I am just going 200 miles and it ought to be clear there.

It seems to me that with the weather information at most of the major airports, even while we wait for facsimile weather maps which could be printed and distributed, that there could be a little more done by the Weather Bureau or by the Weather Safety Section of the FAA to portray graphically where a line of thunderstorms is reported, and where there is a possibilty of icing conditions or rain or fog, on a weather map, so that pilots going out to get in their lighter aircraft would visually see at least an area of a State and what trouble they are likely to encounter.

This could be changed almost every 2 or 3 hours, as fast as new information comes in, and could be graphically shown—as MATS often show on their weather maps for their long-range flights for the information of the crew and also for the information of the passengers.

Mr. HARTRANFT. A short answer is "Yes." A short comment would be this: I believe there have been a number of recent steps made cooperatively between the Weather Bureau and the FAA to improve the situation.

The flight-following service of the FAA, in which a pilot in filing a VFR flight plan will automatically, when passing over certain selected stations, get a complete weather briefing, is certainly an improvement. But the fact that the highest single category of aviation fatalities in general aviation is attributable to weather-connected accidents suggests that much more should be done.

In my own opinion I believe the Weather Bureau may have been handicapped a little by a lack of funds. They may have been concentrating on the flights at jet altitudes to the extent that some of the weather facilities for the general aviation may have been neglected.

But basically I believe the problem is one of communications. The emphasis upon forecast weather has been great. The emphasis upon existing weather has possibly suffered the result of lack of communications.

By that I mean this: there is hardly a major route anywhere in the United States that is not at this moment being traversed at not one but many altitudes by some aircraft somewhere.

The idea that we must rely upon forecast weather when actually we can get the exact weather existing at the exact minute at the exact place we want seems ridiculous on the surface. But it is explained by a problem of communications.

Certainly with respect to your earlier approach, Senator, we have radio, we have teletype circuits, and we have facsimile, all of which

can provide to the smaller airport a whole lot more basic weather than we are presently able to get.

I think that improved techniques for PIREP reports, that is, the pilot advising weather in flight, so that those behind him may take advantage of it, also requires additional attention.

I do not think that there can be too much attention put upon this one subject which is the greatest killer in general aviation.

Senator MONRONEY. It seems to me that is true also. I lost two very dear friends in accidents which had a high degree of weather in them. The custom of pilots to take off, to be committed to flight, to get 15 or 30 minutes off of the airport and call ahead for the weather, when they are halfway there, is an invitation to take certain chances that you might get through since you have already traversed 50 percent of the distance. Had the weather conditions been graphically shown on a map, showing your thunderheads, showing your front lines, showing the possibility of squalls, the turbulence by figures that could easily be understood, and that could be quickly standardized and usable, if this were updated every 2 hours or so, it seems to me that it would be of very great help in discouraging takeoffs.

What I am trying to say is that once the pilot has taken off and has been committed to flight there is a mental hazard there that it is hard for him to overcome unless he is a real old and confirmed weatherbird.

Mr. HARTRANFT. I would suggest that you revise your comments only with respect to one thing. Two-hour-old weather in a condition of a squall line or thunderstorm condition is very bad weather. The time element has to be greatly improved upon if it is to be of much use to the pilot.

Again I think the value of the in-flight pilot reports, especially on a rapidly changing condition, is one that should have major stress.

Senator MONRONEY. These squall lines do move awfully fast. That is the trouble. You know the direction of them, even if they are at present in the area. I am trying to be practical on how fast you can disseminate this information. I know that the custom is in a control tower to report weather to put out a weather advisory if there has been a very sudden change that could mean trouble.

I am just using that as an example. Of course the best weather would be 15-minute-old weather. I don't know whether you can disseminate that to a great many of the airports that fast.

Mr. HARTRANFT. I think that the reliance in the case of that kind of weather condition must be one serving primarily the man already in flight, rather than in trying to preflight the man on the ground.

I would like to say, I think that the FAA communications stations on the whole are cooperating beautifully. I just completed a 3,000-mile trip to your fair city and some other middle western stations this last week and I found without exception that in some changing weather conditions that I encountered and reported to ground stations, it was only a matter of minutes but what the communications stations were on the air over the navigational facilities using that voice channel, giving special advisories, so that anybody else who might be in the air and in my vicinity would be sharing the information with me.

That is a matter of educating the pilots as well as the FAA personnel. But there is some problem with respect to priority on ground

lines in a situation of deteriorating weather which is simultaneously a situation in which greater amounts of conversation have to go over the airways for air traffic control functions.

I sometimes run into a situation that the pilot who may be flying weather which has become marginal actually is deprived of weather when he needs it the most because the communications channels which are being used for air traffic control completely usurp the time and the regular weather does not have an opportunity to get on the air.

I don't say this is a thing that happens a great deal, but it does not have to happen very often because the circumstance under which it does happen is inherently a dangerous one.

So that there may be problems of additional ground circuitry and perhaps some further look at frequencies which might be set up, for instance. One or more frequencies for the very special handling of weather situations when a deteriorating weather condition comes into being which might endanger VFR flights along a particular route.

Senator MONRONEY. I notice that in your statement also, on page 7, you reveal that—

> although the pilots involved in this group of acicdents flew 14 hours during daytime to each hour flown at night, about one out of five of the accidents occurred during darkness.

Since they were flying 1 hour at night for every 14 hours in the daytime, yet they have a ratio of 1 out of 5 accidents, would this suggest that perhaps before a pilot would be certified for his private license he should at least have some experience in emergency navigation and emergency landings, control of the plane in flight, for after-dark flying?

Merely to put this in the same context that you put the 180 program in, that one or two night landings by a pilot with an instructor at his elbow might prevent him from getting caught and trying to reach his home airport just before sundown and with headwinds perhaps arriving after dark?

Mr. HARTRANFT. Your analysis I think is an accurate one, Senator. I could happily say that I think the repair work has already been done by inclusion of the requirement for instrument familiarization as a prerequisite to a private ticket.

The major problem in night flying, to state it simply, is that you can come upon bad weather so easily and without notice. You can fly into a condition of restricted visibility almost before you know that you are in it. Hence some knowledge of instrumentation, the ability to fly the gages at least to execute a 180° turn and get out of the situation, is the most probable cure for that.

I believe that step was taken recently by the inclusion of that requirement, which as I said in the testimony is an outgrowth of the 180° turn rating. I believe that particular problem has been dealt with in a manner which should be fairly effective.

Senator MONRONEY. I would think perhaps that the 180° would deal with the instrument phase of it. I am thinking about the psychological phase of never having flown your aircraft, perhaps, as a beginning pilot after dark, and that suddenly circumstances catch the pilot after dark before he gets to an airport at which he wishes to land.

Maybe two or three familiarization landings after dark, by a pilot

with his instructor, might relieve at least the mental hazard of never having been in that particular situation before.

I can remember when the airmail for a short time was flown by quite competent daytime reserve pilots, and yet we piled up an awful lot of aircraft, and lost a great many lives, apparently because they had not been familiarized with night flying.

Mr. HARTRANFT. It is hard to conceive that a person could have very much flight experience without having had night landings, Senator.

I do not know that we have pinpointed the problem of landing at night. It is a problem of getting into weather and getting lost. So that there would be some question in my mind that the practice of landing after dark would be a cure for the type of thing we are talking about. I am inclined to believe that in the majority of cases the pilot would have encountered familiarization on night landings routinely as part of his preparation for his private license.

Senator MONRONEY. You say you think it would be a routine preparation for his private license?

Mr. HARTRANFT. Sir?

Senator MONRONEY. Your understanding is that it is now routine preparation for a private license?

Mr. HARTRANFT. I say it is hard to conceive that a man can pile up 50 hours of flying prerequisite for a private ticket without having included night flying and some night landings. I do not believe the regulation calls for a mandatory requirement.

Senator MONRONEY. I wonder if that is accurate.

Following the training programs a little bit as I do, most of us look for nice clear weather in the daytime. It seems to me that familiarization operations as to how to handle the aircraft after dark with an instructor might be useful.

I did not realize the accident ratio for the hours flown was as extremely high as your statement indicates.

Mr. HARTRANFT. Mr. Kayne has indicated as I think I have already said, that it is not the landing part of the program that seems to be the problem; it is not that it is dark but it is what you cannot see about the weather at night until you are into it.

It is a built-in boobytrap type of thing. Unless a person is flying on a nice moonlight night, if he is flying with an overcast, just when he is going to run into a cloud condition which will put him technically on the gages, is very hard to know and to detect until you are actually into it. That is the type of thing that is causing most of the accidents.

Senator MONRONEY. Is there anything that you wish to add? I know in some of your accident research you found certain things in the construction of the plane. You mentioned the cockpit and the safety belts and features of that kind. Have most all of the other things been debugged as far as gasoline caps and other things which gave you trouble in the past?

Mr. HARTRANFT. I think it is a case of constant vigilance, Mr. Chairman. When one is cured we turn to the next one. Always there seems to be another one coming along when we have dispensed with that one. It is trial and error, and live and learn.

The problem is to get defined action when these things do occur. There is always the problem, when pilot groups are discussing the question of pilot error, as to whether they are trying to in any way avoid proper emphasis upon errors which pilots can and do make.

On the other hand, it has long been my feeling that in the category of pilot error, as we have so often used it, it is a simple expedient to file an accident report some place but that we really ought to start the investigation right at the point where it stops.

The instance you have mentioned is an example. By regulation a pilot is required to be responsible for knowing the condition of his aircraft. And it would take no stretch of the imagination to require him to know that the gasoline cap was properly secured, and in a manner so that the cap was not reversed so that it might siphon out the gasoline, which we found with one particular cap on one particular airplane.

We could very well completely close that accident investigation by saying that the pilot did err in not making that check. But a more realistic approach is to think the thing through and just with minor engineering changes on the cap arrange it so it cannot be put on in the wrong way, and that eliminates the possibility of pilot error.

In crash injury research—and I hope that the FAA will pursue this with great vigor—we know that there are, in our studies, about 29 percent of the general aviation accidents which are probably survivable accidents but in which fatalities occur because of some lack of proper engineering on crash-injury research.

A structure which collapses inwardly instead of outwardly upon impact, knobs and dials which the face goes into, rather than having them recessed; improper safety belt or seat installation which allows the body to go flying through the air when contact is made, and so on.

We would feel that an airplane-by-airplane analysis would be something that if we had the funds to do we would certainly do it. We do not. We feel that safety is a very difficult thing to sell. It is something which the manufacturers naturally shy away from. But it should be somebody's business. It certainly is of great interest to those of us who use the airplanes. And there is a section presently domiciled in Oklahoma City, Mr. Chairman, a very small unit now, starting up some additional work on crash injury research.

I would commend it to the committee's attention. I think they should have what they need to do the job which needs to be done, because it would, in my opinion, if successfully concluded, save many lives in general aviation that are needlessly being sacrificed at present.

Senator MONRONEY. I hate to say I don't know everything that is going on in Oklahoma City, but is this in the interest of general aviation only, or is it coupled with scheduled airline transport as well?

Mr. HARTRANFT. Both. Much of the past history of the crash injury research which was originally under the Cornell University, later under Flight Safety Foundation, which organization is still maintaining a program of crash injury research, dealt with programs jointly sponsored by industry—we contributed some money to it—the Navy, the Army, and the old CAA all put funds into this type of research.

Our problem, as is so often the case, is not in pure research. Our problem is that once the analysis is completed, how do we get the results of the study into the aircraft which is used in its contemporary counterpart?

It is not an easy problem. As I have stated, we have a retrofit program. I believe that most of the aircraft manufacturers in the last 5 years at least have become keenly aware of the need for crash injury research as they develop new models. I know from personal experience that they have engineers sitting at their elbows. But we have a tremendous refit program for all of this almost 80,000 or 90,000 airplanes currently in use, many of which will continue to be in use for a great number of years ahead.

And there are many things that can be done with respect to shoulder harness and other precautions to reduce that.

Senator MONRONEY. Are there such things as foam rubber upholstery on metal parts of the dashboard?

Have you done any of that?

Mr. HARTRANFT. That is all a part of it.

Senator MONRONEY. And there is a retrofit program which can be put on by a fixed base operator to take the plane back to the factory?

Mr. HARTRANFT. One of the things, for instance, that gives us concern: the modern four-place airplane used by so many of our people, which has a stressed skin, presents a problem when you are trying to anchor a shoulder harness.

Where do you anchor it? That is a matter of individual engineering. We estimated, and had bids out to several groups to do this job for us, that it would cost something in the order of $8,000 to $10,000 per airplane to run the necessary stress analysis, to develop the hardware which could be installed in kit form by a fixed base operator, let's say, for putting in a shoulder harness with a retention reel which would allow the man full movement and yet lock on a crash impact.

The question is, who will put up that money?

Senator MONRONEY. Is that $8,000 a copy?

Mr. HARTRANFT. Per airplane model.

Senator MONRONEY. This is not the research to do it; this is the installation after the research has been achieved?

Mr. HARTRANFT. No. This is to do the engineering—for instance, in certain types of airplanes—I am using very loose language here—gusset plates would have to be affixed to a certain point so as not to do anything to the basic structure of the airplane by way of weakening it, and yet which would hold the force load of the person retained by the shoulder harness. It would require detailed blueprints and it would require somebody to come up with the actual hardware so that a man could go to the counter and say "I want a kit for an Avion or a Beechcraft," or whatever it is, and that he might take that kit and have an average A and E mechanic install it at his home base.

To get that end product, the estimates that were made to us—I have no reason to question them—ran something in the order of $8,000 to $10,000 per airplane.

That is for a prototype.

Once that was done, then the procedure would be to go to an aeronautical supply house and persuade them to actually build the hardware and to merchandise it for those airplanes.

Senator MONRONEY. It seems to me as if some interest in this would be evidenced by the manufacturers to perhaps bring out retrofits themselves so that these planes could be made even safer than they are today.

Mr. HARTRANFT. I would think that should be true, too. To date I believe the greatest evidence of their interest has been in trying to improve the current production airplanes. They probably are no different than an automobile manufacturer who rarely takes interest in the model they are no longer manufacturing.

Senator MONRONEY. Are the new airplanes then coming out with structural parts that could add to these various safety features at minimum cost?

Mr. HARTRANFT. To varying degrees, with some manufacturers expressing greater interest than others.

Senator MONRONEY. In regard to the airport, you heard testimony this morning of Mr. McMullen regarding the need for separate airports wherever possible, within easy distance of the metropolitan areas, and the fact that he was recommending the 3,000-foot clear airspace. I think you recommended this also with perhaps a little bit different ceiling limits, did you not?

You have been recommending 180 miles per hour for all aircraft operating below 2,000 feet?

Mr. HARTRANFT. Yes. As I heard the discussion this morning, if I heard it correctly, there was a little confusion, perhaps, between the witness and yourself.

I discussed this briefly with Mr. Kayne, our air traffic control man. I wonder if he would like to make perhaps a clarification statement as we understand it, for the record.

It might be helpful.

Mr. KAYNE. Senator Monroney, to answer first your question about the 3,000 feet, we originally were, you might say, a party to that recommendation, and we later compromised down to 2,500, and then finally the rule which was adopted several weeks ago came out at 1,200.

We share Colonel McMullen's desire to see that higher. However, we did accept the 1,200 feet as, you might say, a step in the right direction.

I think the confusion this morning arose somewhat about the so-called positive control route segments or the altitudes above which you must file IFR. At the present time we do have certain intercontinental routes above 17,000 feet where you cannot fly unless you are on an IFR flight plan, have full instrumentation and an instrument rating, in addition to that there is an area around Indianapolis and Chicago where the FAA is carrying out an evaluation of positive control theory above 24,000 feet.

This, however, is not to be confused with the continental control area floor which was at 24,000 and recently is being lowered to 14,500 feet, because you can fly VFR in the continental control area where the visibility limits are greater.

You must have 5 miles VFR instead of 3 miles. That then is further complicated by the airlines' golden triangle rule wherein they will file IFR for all flights above 10,000 feet, later extended all over

the country, and now I understand they are considering lowering that to 5,000.

So we have a variety of these rules. Each one has its own separate context. I hope I have not confused it, but rather clarified it.

Senator MONRONEY. This comes about through the mention of the 3,000 feet for the slower speed aircraft, to have almost a reserved airspace excepting around airports, does it not?

You say now it has been put at 1,200 feet?

Mr. KAYNE. The way the rule is projected, Mr. Chairman, there is nothing, for example, that would prevent an airline aircraft carrying passengers from operating down in that same airspace under VFR conditions. Under IFR they would have to operate at the minimum instrumentality or above. But VFR I think they can continue to operate in that same airspace.

Senator MONRONEY. All excepting your feeder carriers which are now all filing IFR flight plans?

Mr. KAYNE. No, sir; I don't believe that is quite right. Airlines are filing generally above 10,000. They have projected this to a 5,000-foot program but I do not believe it has been implemented throughout the country.

That is a voluntary program on their part.

Senator MONRONEY. What I was concerned about was the lowering of their IFR down to 5,000, and narrowing the range in which general aviation generally would be out of the way of conflicting scheduled airline traffic.

Mr. KAYNE. They could still continue to operate below 5,000, even under that program VFR just as they operate below 10,000 today in great numbers VFR. Quite frequently. In fact, I went to Boston the other day and the aircraft filed 8,500 to stay below the 10,000-foot mark. He went up VFR, right along with all the rest of us.

Senator MONRONEY. Generally speaking, in the areas in which we fly, we rarely encounter any airline traffic at 5,000 feet or below, unless there are some special weather conditions like icing, and then they come down 2,000 or 3,000 feet to go on through it.

I don't want to get traffic systems that are going to squeeze down on the limited amount of airspace that is generally used by general aviation. This is why I was questioning the effect of the 5,000-foot IFR squeezing further into the space in which the general aviation pilot is using perhaps 90 or 95 percent of the time.

Mr. HARTRANFT. Ultimately, the airlines have in mind the 5,000 feet would be above control only. Then what you say is exactly true. It would be a great hardship.

Senator MONRONEY. I don't think it actually has to be positive control.

In filing flight plans, they now go to 24,000. In order to get clear access for more clearance altitudes they drop down and start clearing them as low as 5,000 feet IFR.

It seems to me that you are going to penetrate more and more the low altitudes which generally have been fairly free of your scheduled airlines, even on a 50- or 75-mile haul from Oklahoma City to Tulsa.

You rarely see a Constellation, DC–6 or a plane of that character below the 5,000 feet.

Mr. HARTRANFT. Excepting the DC–3 perhaps.

Senator MONRONEY. Yes.

Mr. HARTRANFT. I think that our orientation here has been that where you get into the center, your terminal area, where you will have a greater concentration of traffic, that is the point at which you should reduce, and everybody should reduce, speeds. This is an old axion but applies to almost every form of transportation I know of. The *Queen Mary* hits the Hudson River and comes down it to the order of something like 3 or 4 knots maximum.

The Greyhound bus hits the city limits and it may be capable of doing 90 miles on the open highway, but it comes down to the posted limits. And even the railroads, when they hit the terminal yards, it is simply a product of the number of vehicles being moved and the amount of space which requires a reduction of the speed for the safety of all concerned.

Senator MONRONEY. On page 11 you mention that—

FAA is currently considering a speed limit of 250 miles per hour for all aircraft below 14,500 feet when within 50 miles of destination. In addition, they are considering a speed limit of 180 miles per hour for all aircraft within a 5-mile radius of all airports where a control tower is in operation.

Do you support that proposed change in rulemaking?

Mr. KAYNE. Yes, sir. In fact, we have consulted with the FAA on both proposals. The later one, 180 miles an hour around all airports, we think does not quite go far enough. We would like to see it 180 miles an hour flat out across the country below 2,000 feet, because quite frequently a lot of these airports, you can come up on them frankly without knowing they are there.

Below 2,000, if we could slow everyone down, this would contribute to safety in the traffic pattern of many of the airports.

Many of these smaller airports are not shown on charts. That would only be on airports as they propose it, for FAA or other control towers.

Senator MONRONEY. That would be limited by altitude, too?

Mr. HARTRANFT. Yes, sir.

Senator MONRONEY. Below 2,000, the way they have proposed it, you would be out of that.

Mr. HARTRANFT. Except in your control zone.

Senator MONRONEY. If you were at 3,000 or 4,000, you could be going 400 or 500 miles an hour?

Mr. KAYNE. Yes, sir.

Mr. HARTRANFT. This is probably not too much of a hardship on departure because you well know on your 880 series and your Electra series, 2,000 feet altitude is not much more than a wing, timewise.

The other part of your question I think we did not answer as yet, regarding airports in the metropolitan areas.

I think that the statement of Colonel McMullen that I heard this morning is one that we endorse. Our experience has been this: that where an alternate facility is provided, which is useful, there is no problem with respect to the traffic dividing itself.

I can name many examples of that. Meigs Field, in Chicago. Or your own airport in Oklahoma City, for example, and so on.

There is a need for people to get into terminal airports who have legitimate business there. I think if we would concentrate on get-

ting these airports for general aviation in where they properly belong, that you automatically solve the problem and do not have to get into a regulatory approach.

Senator MONRONEY. There was some testimony, however, last week where the traffic had been reduced in numbers of planes being accepted at Newark, Idlewild, and La Guardia, but that the nonscheduled airline traffic had increased more than the reduction in the field of the scheduled airline traffic.

Mr. HARTRANFT. I think that is usually understood. If you would put yourself in the position of any business user of an airplane who wishes to leave Washington, conduct a day's business in New York and return the same night, you must either use La Guardia or Newark or Idlewild. You cannot do it by using Westchester or Zahn's Airport where you take an hour-and-some-odd minutes on the Long Island Railroad after getting from the airport to the station and reverse the procedure.

The answer there again would be if the Port of New York Authority would take some recognition of the need of general aviation in the New York area and put in some close-in airports where there is yet some real estate to be had for that purpose.

These airplanes would automatically, and by preference, do as they have done in other cities where that has been done.

They would go over and use that facility. The problem in New York is that the good city fathers in New York have not shown yet a recognition of the needs for general aviation and provided the facilities required in that area.

A great many people flying general aviation airplanes have a need for getting into New York to conduct their business.

Senator MONRONEY. How far out of New York City, or how far removed, would Mitchel Field be? It is being abandoned, I understand, as a military base?

Mr. HARTRANFT. Mitchel Field has a spur on the Long Island Railroad that is on the Hempstead line, as I remember. The Long Island Railroad runs from the Country Life Press, or Garden City, which is the closest to that spur. It is about a 37- to 40-minute run, as I recall. That would certainly help.

My understanding is that the port authority has no interest in Mitchel Field. I think that is very unfortunate. If they want to solve some of their congestion problems in New York, I think a very realistic attitude would be for them to take an interest. Here is a piece of real estate which is going to go for other purposes. The neighborhood is completely conditioned to having an airport. It is available almost with no required outlay of funds. The hangars are there, the runways are there, it is ready to go. It would be a very simple matter to make a good general aviation use airport out of Mitchel Field.

Senator MONRONEY. Would not be too distant?

Mr. HARTRANFT. I wouldn't say it is the most desirable, but I don't think we have too many choices in New York, either.

Senator MONRONEY. Unfortunately not. Could the traffic coming into Mitchel Field be separated safely from the jet and high performance aircraft using Idlewild or La Guardia?

Mr. KAYNE. I think it could, Senator. At the present time, or at the time military traffic stopped using Mitchel, they have been

doing this. Under instrument conditions, Mitchel traffic came under, as I recall, the Idlewild approach control authority. In other words, under IFR they operated you might say as a single entity. But under other conditions you can operate the two traffic patterns independently, establishing them on separate patterns and operate very safely.

Senator MONRONEY. It wouldn't be the most ideal airport for traffic, but it would be satisfactory?

Mr. KAYNE. Yes, sir; it would, in my opinion. Trafficwise, I know it would.

Senator MONRONEY. Miller Field, over which the collision occured, is that large enough to accommodate general aviation traffic?

Mr. HARTRANFT. Staten Island, you are talking about?

Senator MONRONEY. Yes.

Mr. HARTRANFT. I am not too familiar with that. I think you have a transportation problem from Staten Island.

Senator MONRONEY. You don't know the land area?

Mr. HARTRANFT. It is a very small field. As I remember it has no substantial improvements. It is a dirt field, as I remember.

Senator MONRONEY. Certainly you would put New York No. 1 as needing a general aviation airport; and if they had it, it would relieve a substantial amount of congestion over and above the congestion of scheduled lines that go in there; is that correct?

Mr. HARTRANFT. I think New York probably could use from 6 to 10 general aviation fields at selected radials at various sides of Manhattan.

Senator MONRONEY. This would then relieve some of the necessity for an additional major airport?

Mr. HARTRANFT. Again, human nature being what it is, Senator, a man who is going in, for instance, to La Guardia Field, with anywhere from a $10,000 to $35,000 airplane or up, isn't particularly happy about landing there and leaving his airplane tied out, he hopes, at the mercy of the elements. He would much rather go into a general aviation airport equally accessible that could offer him hangar and storage facilities and the other things that he requires. The only reason then for him to go into La Guardia would be to either pick up or to discharge somebody who was going out on an airline aircraft.

I think you will note from the Chicago pattern very, very few people going into Midway, except those that have business with the airlines. Anybody who can get into Meigs Field, which is just practically within walking distance of Michigan Avenue, will do so. The problem has become the other direction there. They are having trouble trying to limit the size of airplanes now that go into Meigs Field because everybody wants to use it because of its convenience.

Senator MONRONEY. Do you think that would be the pattern if you had good, satisfactory, general aviation airports within reasonable proximity of town, that there would be no question but that general aviation would choose to separate it?

Mr. HARTRANFT. I not only think so, I believe it has been proven, Senator. Mineapolis is an example of it.

Senator MONRONEY. Can you think of any others?

Mr. HARTRANFT. Detroit City Airport, having been turned over to general aviation, I think is another example; Fulton County Airport, Atlanta, Ga.; the Addison Field has already been suggested in Dallas; Tamiami, in Florida.

Senator MONRONEY. How about the North Side Airport? That is rather heavy with general aviation, isn't it, since they have moved most of the schedules?

Mr. HARTRANFT. It is heavy. I haven't been there recently. I couldn't speak for that.

Senator MONRONEY. You have a dual runway situation at Phoenix, one of our busiest airports; do you not?

Mr. HARTRANFT. Yes, sir.

Senator MONRONEY. That traffic is adequately separated in its approaches?

Mr. HARTRANFT. Apparently everything is copasetic in Phoenix.

Senator MONRONEY. How about Los Angeles? I notice in this article there is very amazing evidence of the disappearance of airports, in a State that probably does more flying per capita, or at least a major area, where you say San Jose, Golden Gate, had 17 airports in 1940, today they have 3 and may lease one of these from economic pressures.

Your situation is really very critical in California; is it not?

Mr. HARTRANFT. Extremely so.

Senator MONRONEY. Los Angeles in particular?

Mr. HARTRANFT. Los Angeles in particular, and San Francisco isn't too much better.

Senator MONRONEY. Your proposal in your editorial is that Congress should give some attention to earmarking certain parts of the Federal funds—I think you suggest 35 percent—for your general aviation airports, thus trying to get this program to meet the ever-increasing needs before the various aviation authorities of the municipalities.

Mr. HARTRANFT. Two things: One is the actual isolation of the funds. Second and equally important is that the general aviation airport program be administered under a different set of administrative rules. Without criticizing, but trying to take from the past that which we can learn and be productive, there was a tendency in previous programs, and one of the reasons I believe that communities often did not avail themselves of the Federal funds was the fact that some local person in the community would take an interest in an airport for that community, would take it up through the preliminary stages of his local city council, and they would be talking in terms of a modest budget to put in maybe a single strip, let's say 2,500 to 3,000 feet of pavement plus maybe a thousand-foot overrun, and that is all. Then they would call in the airport specialists from the Federal Government, who were required by their criteria to go out and advise the city fathers, "This is fine, and you can have it close in, but this will never make a feeder airline airport. You are going to have a master plan. You are going to have to put this runway out to 5,000 feet. And then, if you want Federal money, really you should be depending upon a full airline eventual expansion, and you should locate where you can get perhaps 7,000 feet."

The rule of all this would be that, No. 1, the close-in site is thrown in the bucket, and 2, the ante that the city fathers saw they would have to sell in the form of bond issues to the population rose to such a large figure that none of them had the courage to try to compete with that kind of a program against the town's requirements for schools and other things which would normally be more popular among the taxpayers.

At some point I think we have to arrive at what we require from that general aviation, and that is why a couple of years ago we developed what we call the MINI–MAX airport in which we said this airport has to have a certain minimum requirement; it can't be a quagmire; it has to be either paved or stabilized so that it has all year round weather utilization. It has to be close in where it will actually serve the community.

But then we said, on the other end of the line, you shouldn't go overboard. You shouldn't put in more concrete than you really need; you shouldn't put in from Federal funds buildings and structures which really should be up to the community to provide once the landing strip is put in; and this has to be kept down to a budget which will be popular enough so that the average small city needing a business aviation airport will be able to absorb it and not reject it on the basis that they are asking for too much.

Hence we come to the interesting question, and we put it in the form of a proposal. We think that the administration of these general aviation airports ought to be on an entirely different basis than the master plan airport type of approach which has identified previous Federal aid airports. It is too discouraging to the communities and the communities simply end up not asking for the money.

Senator MONRONEY. What we are talking about is a single runway, something like a country farm-to-market, hard-surfaced road, against a four-lane divided superhighway, which is built for trucks?

Mr. HARTRANFT. That is right.

Senator MONRONEY. In other words, we are trying to accommodate a different class of traffic and it need not be begun to finally become an airport that could handle jets.

Mr. HARTRANFT. Yes. I think you had the terminology very well this morning, Senator, when you spoke about three-quarters of a mile of secondary road. That is something that the average county road commissioner can understand. You go in before a local group and talk in terms of something like that, along with the provision that they maintain, with highway equipment, the mowing operations alongside, and pull the snowplows in there in the wintertime, and you have a modest airport, a going facility, which the public will accept and be able to pay for.

Senator MONRONEY. We have already crossed in my State one such feature where the legislature in the last session allowed the county commissioners to use their own graders and their own earthmoving equipment to level off and prepare the grade. Now we are up against this: We have the grades and we have nice rock fill, but they chew up the propellers. Yet for a minimum amount of blacktop, which could be put on to bring it into a very efficient and effective hard-surface runway, we haven't the authority to divert any of the country highway money that the county is entitled to out of the rebate of its gasoline

taxes to take even the three-quarters of a mile length which would serve the whole community for air purposes, against three-quarters of a mile that might reach only two or three or four farm families with a similar extension of the farm to market roads.

This was for the type of airport you mentioned which puzzled the city fathers of the small towns. By the time they get through listening to all the engineering that has to be done, the planning and cost estimates and the competitive bid contracts and other things, they find the preparation of the planning for the airport has consumed just about what they thought they could afford to put into the airport itself.

Mr. HARTRANFT. One of the heartbreakers is seeing the amounts which some of these cities seem to feel they have to spend in getting an airport survey to establish the need for an airport, which if they had spent the money they had spent on the elaborate surveys in some cases they would have had enough to acquire the land and come near to putting in a hardtop runway. Yet I think again this is education, and I believe that the pilot groups and the aviation fraternity have to be pretty honest in this, too, and not ask for more than they really need.

I am afraid that in the past there has been too much leeway left there, because operating people will always ask for as much as they think they can get, and sometimes, under the guise of safety which may or may not be there. But if we are talking about establishing a basic network of airports then we have to pare down to essentials, and that is how we arrive at the concept of mini-max types airports.

Senator MONRONEY. Your conception of mini-max is that we consider this type of airport different from planning and from the specifications that go into the normal Federal-aided airports, and that maybe some small branch within the Federal Aviation Agency in the airport section might be helpful to search out and to promote, even, the cooperation in this type of airport construction.

Mr. HARTRANFT. Yes. I think we need to standardize on a particular type of field now. If the community wants to go further than that, that is the community's business.

You can certainly decide the length of the runway, have it corrected to altitude in the case of those communities at higher altitudes. But basically it is one type of thing, a general aviation airport, and the pattern would be pretty much the same wherever it was put in.

Senator MONRONEY. In other words, you would have a standard package in which an average-sized town could then say, "We have the land, it is flat, and this would be about a thumbnail estimate of what the grading and drainage and hard surfacing would cost." And they would know then what they had to put up, and what the Federal Government might possibly match in the event that they went forward with the project.

Mr. HARTRANFT. That is essentially and exactly what we are talking about. You start out not confusing the community between a multiple-choice question on what kind of an airport, and you are able to say, "We want a field the same as Zanesville or the same as Podunk," and so on. You know exactly what you are buying and what your costs will be.

Senator MONRONEY. An off-the-shelf general aviation airport.

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Mr. HARTRANFT. We tried the other way and it hasn't worked. I think this package concept is worthy of some study.

Senator MONRONEY. I know from my own experience that three-fourths of the time lost is in the decisionmaking of how long the runway should be, or what the type of surfacing should be, and how much grading there should be. The Federal-aid-to-airport man could arrive with a do-it-yourself kit, almost, to show what the mini-max is, as you rightly call it, off-the-shelf design. They could then talk to their local people about what this work would cost and shortcut months upon months of estimates, designs, drawings, and things of that kind. Is that correct?

Mr. HARTRANFT. Yes, sir. And we will be prepared, when this committee is seriously considering the airport matter, to have some interesting exhibits to illustrate the kind of thing we have in mind.

Senator MONRONEY. Fine. Do you have anything else?

Mr. HARTRANFT. No, sir.

Senator MONRONEY. Thank you and your associates for your very helpful testimony.

The committee will meet Wednesday, March 8, in room 5110, that is Interstate and Foreign Commerce, at 1:30, at which time we will hear the Weather Bureau, the National Airport Operations Council, and Mr. Link.

We expect to conclude the testimony at this session of the current series of safety hearings. We would like to adjourn the hearings at that time. Anyone who has not testified may have the privilege of submitting statements for the committee's information, some of which may be incorporated in the committee record.

The committee will stand in recess until 1:30 Wednesday afternoon.

(Thereupon, at 4:15 p.m., the subcommittee was adjourned, to reconvene at 1:30 p.m., Wednesday, March 8, 1961, in room 5110, New Senate Office Building.)

AIR SAFETY

WEDNESDAY, MARCH 8, 1961

U.S. SENATE,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
SUBCOMMITTEE ON AVIATION,
Washington, D.C.

The subcommittee met, pursuant to adjournment, at 2:30 p.m., in room 5110, New Senate Office Building, Hon. A. S. Mike Monroney, chairman of the subcommittee, presiding.

Senator MONRONEY. The Subcommittee on Aviation will resume its hearings.

We are again honored by Mr. F. W. Reichelderfer, Chief of the U.S. Weather Bureau, Department of Commerce, who has so often appeared before this committee and who is so helpful regarding the activities of his agency and its services to aviation.

I believe Mr. Reichelderfer holds one of the very lowest numbered pilot's licenses issued in this country, having been a Navy pilot during World War I.

STATEMENT OF F. W. REICHELDERFER, CHIEF, U.S. WEATHER BUREAU, DEPARTMENT OF COMMERCE, WASHINGTON, D.C.; ACCOMPANIED BY NEWTON A. LIEURANCE

Mr. REICHELDERFER. That is correct, though there are a number lower. Mine was 2422.

Senator MONRONEY. That is pretty early.

We are glad to have you back. You may proceed in your own way. If you wish to brief your statement, that will be fine, and it will be printed in full in the record.

Mr. REICHELDERFER. Thank you, Mr. Chairman.

I am happy to appear before the committee. I have a general statement, some 21 pages, which I would like to submit for the record.

There are a few points that I would like to highlight that I think are important, and I will try to do that in a minimum of time.

(The statement follows:)

PREPARED STATEMENT OF F. W. REICHELDERFER, CHIEF, U.S. WEATHER BUREAU

Mr. Chairman and members of the committee, the long list of weather factors affecting aviation was discussed fully in my statement before this committee last year.

Analysis of aircraft delays and accidents caused by weather shows that there are several major problems. Projects directed toward solving them are given in summary in the appendix to this statement. The conclusions that we have drawn from our study of aircraft accidents that occurred in 1960 and early 1961 are given on page 10.

Real progress toward solution of some of the major problems on which we have been working can be reported. In large measure the progress has come from recent advances in technology—improved storm detection radar, high-speed electronic computers for quick numerical processing of weather data, better upper air soundings, speedup in aviation weather communications, and increase in the number of outlets for weather information through automatic telephone briefings, continuous radio range weather broadcasts, and the flight service stations of the Federal Aviation Agency.

Also, in early prospect, are the new possibilities of getting pictures of "nature's own weather map" through telemetering from meteorological satellites in orbit around the earth.

The plans and studies of the Weather Bureau also include examination of the possibilities of weather modifications or control but present indications are that significant success in this field will be much more difficult to attain than is sometimes supposed.

Most important among the present weather problems in aviation are:

Sudden and severe local storms, often developing beyond the scope of available detecting or measuring equipment (see Weather Bureau Report on Sparse Data Areas);

Clear air turbulence, of which the locations and causes have yet to be related to movements and developments in the atmosphere;

Further development of forecasts of wind, ceiling, and visibility at terminals;

Forecasting precise visibility values for approaches and landings in low-visibility conditions; and

Preparation to meet supersonic aircraft operational requirements for weather information and forecasts relating to very high altitudes—60,000 to 80,000 feet.

In following paragraphs some of the progress in aviation weather services and in research and development are summarized. More comprehensive coverage can be found in other reports and papers published by the Bureau during the year. Among the most important of these are the "Research Progress and Plans of the U.S. Weather Bureau," fiscal year 1960; "Plan for Meeting Meteorological Observation Requirements Over Sparse Data Regions," Weather Bureau Technical Planning Study No. 1; and Forecast Development Report No. 1 on "Depiction of Satellite Cloud Observations for Facsimile Transmission." The Bureau has also completed a plan for a common system of meteorological observation satellites which is now under interdepartmental study. It would give observations of great value to aircraft operations as well as to general public meteorological services.

SERVICE IMPROVEMENTS IN 1960 AND EARLY 1961

Last year it was reported to this committee that many improvements in the Weather Bureau's Aviation Weather Service were in progress. Some of the accomplishments in 1960 and early 1961 are summarized here and a few particulars are given on the great volume of weather information that is being furnished for aviation.

RADAR NETWORK

Greater radar coverage is being attained by the progressive installation of the powerful new WSR–57 weather radars developed by the Weather Bureau. These radars can detect oncoming weather conditions at altitudes of 40,000 feet or higher at distances out to 250 miles and, in addition, make possible continuous surveillance of conditions at lower altitudes in areas nearer to the radar site. Twenty sets are in operation and more are to be installed. They are operated by specially trained staffs. This "weather eye" system continuously surveys the atmosphere and reaches blind areas between ground observing stations to detect the development and movement of squall lines, thunderstorms, tornadoes, and other conditions of concern to aviation. Flight advisory weather service (FAWS) centers receive radar reports by teletypewriter and weather facsimile to assist in their continuous weather watch. Other, less powerful, radar equipment is used at a number of Weather Bureau airport stations to detect short-period weather changes around terminals.

UPPER AIR SOUNDINGS

Installation of improved equipment for upper air soundings at some of the Weather Bureau's aerological stations has brought increased height and accuracy of upper wind reports. This is particularly important for high-level turbine-powered aircraft flights. A special high-altitude forecast service is also maintained for such flights.

COMMUNICATIONS

Communications improvements in 1960 included the expansion of the Weather Bureau's national weather facsimile network to several more Weather Bureau stations. Also the transmission speed was increased to 120 scans per minute. By this means, the current and prognostic guidance charts prepared by the National Meteorological Center at Suitland, Md., have been almost doubled in number. Among new charts which are now being transmitted are weather-depiction charts, every 3 hours, showing the broad-scale distribution of significant weather, including operationally important aviation weather conditions. These charts are readily understandable to pilots. Another new chart being transmitted every 3 hours is a composite chart of weather information obtained from surveillance by the network of weather radars.

Weather transmission was also improved by the increase in speed of the teletypewriter circuits carrying operational and synoptic weather information, aviation weather forecasts, and upper wind information. An express weather teletypewriter circuit was established between some of the major forecast centers for rapid relay of aviation weather reports, forecasts, and warnings.

AUTOMATIC TELEPHONES

Weather briefing by unlisted telephone was improved in 32 communities with busy airports. Automatic telephone weather answering systems now permit pilots at home, office, hotel or hangar to dial a number for the latest preflight weather information for routine flights in surrounding areas.

RADIO RANGE WEATHER BROADCASTS

Many pilots were served by the continuous transcribed aviation weather broadcasts on FAA low-medium frequency, L/MF, radionavigation facilities at 38 radio range locations, as of February 17, 1961, each serving an area of about 125 miles radius. Twenty-seven of the broadcasts were started since January 1, 1960. The forecasts and weather reports used in these broadcasts are furnished by the Weather Bureau. By the end of 1961, the program of such broadcasts is expected to be in operation at 87 locations, providing countrywide coverage. With the purchase of an inexpensive radio receiver, all public airports can have access to preflight weather information after this program is complete. In addition, pilots in the air with minimum radio equipment can be kept continuously apprised of weather on their routes.

FAA WEATHER BRIEFINGS

Two years ago a program was planned in collaboration with the FAA to furnish weather briefings to pilots by the FAA's flight service stations (FSS). The Weather Bureau established a meteorological course and conducted training of flight service specialists. After suitable tests, they will be granted Weather Bureau certificates of authority for pilot weather briefing duties. This program in effect adds 410 additional outlets to the Weather Bureau's aviation weather briefing outlets. Flight service specialists will brief many pilots, both on the ground and in the air, on routine weather information. They will also furnish to pilots the Weather Bureau's warnings and advice concerning hazardous weather conditions. The expanded pilot weather briefing program is one of the most important aviation weather service improvements of recent years. Many more pilots will be able to receive personalized weather briefings to assist in planning their flights, and many others will be able to receive more complete weather information while in flight by communicating with flight service stations.

PILOT WEATHER REPORTS

An expanded pilots' in-flight weather reporting program was initiated in 1960 to enable pilots to trade weather information quickly through the Weather Bureau "clearinghouse." The weather as seen and reported from the cockpit is rapidly summarized by the Weather Bureau and disseminated to other aircraft in flight and to flight planning locations on the ground.

FLIGHT ADVISORY WEATHER WATCH

The pilot weather reports also supplement the continuous watch by professional meteorologists on changing weather conditions reported by other means. An unceasing weather watch results in the issuance of advisory messages by the Weather Bureau's flight advisory weather service (FAWS) centers whenever they detect weather potentially hazardous to aircraft in flight or about to depart. The advisories are given immediate wide distribution by teletypewriter and aeronautical radio facilities. This service was brought into full implementation during 1960 by staff increases at the FAWS centers.

AIRPORT WEATHER MEASURING EQUIPMENT

Semiautomatic weather-measuring equipment was installed at 10 additional airports. It reports continuously the values of cloud height, visibility, temperature, and winds. This program, as funded through fiscal year 1961, will equip 148 terminals. In addition, a computer to process data and report runway visual range (RVR) has been developed and is under procurement. This RVR factor represents the horizontal distance a pilot will see down the runway from the approach end. Nineteen major airports now report RVR, using manual and semiautomatic computation.

WEATHER SATELLITES

In an area of more general interest to aviation, the success of the first weather satellite, TIROS I, drew wide attention. During the 3 months from its launching on April 1, 1960, to the termination of picture transmission on June 30, TIROS I provided almost 24,000 photographs, from 400 miles up, of broad-scale weather situations. An operational program has provided forecast offices on a current basis with facsimile depiction based on photographic weather surveillance by the second weather satellite, TIROS II, which was launched November 23, 1960. Plans are in the making to derive additional day-by-day operational benefit from the third weather satellite, which will be launched some time in 1961.

VOLUME OF ACTIVITY

To furnish Weather Bureau's services for aviation in 1960 the atmosphere was kept under closer surveillance than ever before. Approximately 3,600,000 surface observations and 80,000 radiosonde and rawinsonde probes of the upper atmosphere were made. There were 400,000 radar observations, and a large increase in the number of pilots' inflight weather reports.

Weather briefings were furnished by Weather Bureau airport stations for 210,000 international flights and for over 6,500,000 domestic flights.

Approximately 1,400,000 aviation forecasts were prepared by 28 flight advisory weather service (FAWS) centers for areas and terminals in the 50 States. The areas served by these centers were adjusted during 1960 to approximately equal size, coincident with the realinement of the Public Weather Forecast Service of the Weather Bureau. The aviation and public forecast centers are now colocated, and have been strengthened by increased staff.

WEATHER BUREAU INVESTIGATIONS FOR AIRCRAFT ACCIDENT AND SAFETY ENFORCEMENT PROCEEDINGS IN 1960 AND 1961 (TO DATE)

The Weather Bureau performs investigations of weather conditions relating to aircraft accidents and safety enforcement proceedings. It furnishes certified records and its experts often participate in hearings on major accidents, if weather appears to be a significant factor.

The Civil Aeronautics Board analyzed all 101 U.S. air carrier accidents that occurred in 1959 and to date has analyzed only 37 of the total number of 1960 accident cases. Those with weather as a causal factor included 13 in 1959 (13

percent) and 11 of the 37 analyzed cases of accidents that occurred in 1960 (30 percent).

In the general aviation field, the CAB reports 4,539 accidents in 1959; 3,763 in 1960. Of the 1959 accidents, weather was a causal factor in 509 (11 percent). The CAB has analyzed only 1,317 of the 3,763 accident cases in 1960. Of these 1,317, 210 involved weather as a causal factor (16 percent).

Weather Bureau investigations are tabulated as follows:

Cases	Cases investigated	
	1960	1961 (to Feb. 14)
Air carrier	35	2
General aviation	62	2
FAA (including safety enforcement)	19	5
CAB compliance	16	2
Civil litigations	18	5
Total	150	16

Conclusions that we have drawn from our investigation of weather factors associated with these aircraft accidents and from our participation in accident hearings are:

1. Clear air turbulence is a potential source of trouble to high-speed, high-altitude aircraft, and the extent of the hazard to aircraft in flight is still unknown.

2. There appears to have been a sharp increase in the type of general aviation accident where the pilot encounters weather conditions beyond the capabilities of himself or of his aircraft, or both, although he may have adequate weather information.

3. It seems that in a number of general aviation cases, pilots who get into trouble in bad weather have not obtained, for one reason or another, the weather reports and forecasts that are available to them.

With reference to conclusions 2 and 3, the committee is reminded of last year's testimony by the Chairman of the Civil Aeronautics Board, supported by the concurrence of an industry association representative, that the most important single factor encountered in general aviation accidents involved flight into adverse weather conditions with which the pilot was unable to cope. In many such accidents, the weather conditions are not especially severe. Since the State of the weather is of special importance to a pilot who must operate only under visual flight rules conditions, it would enhance aviation safety if student pilots, or those planning to obtain private pilot licenses, were encouraged or required to learn more about the weather and to gain a greater appreciation for its hazards. Just as important, they should be encouraged or required to learn more thoroughly how to obtain appropriate weather information prior to and during flight. They should also be able to apply weather information to their particular operations.

There is a great amount of weather information available. It is widely distributed. Unless it is used, it will not help to increase flight safety. The pilot with minimum qualifications should become especially weather conscious.

WEATHER RESEARCH AND DEVELOPMENT

Earlier in the statement, five major problems were pointed out. Their solution will require research and development effort. In addition, there are other problems of a lesser nature. All of the problems together constitute a part of the overall research and development package of the Weather Bureau as the National Meteorological Service. Some of the problems are interrelated with nonaviation problems. The benefits of their solution will apply to improvement of all types of weather service, since the understanding of the atmosphere and its behavior is the basis for all types of forecasts for the various activities of the public.

The following brief report on the status of the five major problems is furnished:

SUDDEN AND SEVERE LOCAL STORMS

In the spring of 1960, the Weather Bureau organized and is managing a large national severe storms project in the Middle West. With special observing networks, specially equipped aircraft, and high-quality research staff, a massive attack is being made on the causes and development of tornadoes and other severe local storms which affect all human activities. The project is a cooperative effort of the Weather Bureau, the Federal Aviation Agency, the National Aeronautics and Space Administration, the Air Force, and the Navy.

Included in the first phase of the multiagency, 3-year study of the atmospheric factors and relationships in these storms was a series of systematic factfinding and data-collecting missions flown by the project's squadron of specially equipped research aircraft based at Oklahoma City, Okla.

The planes have flown into incipient and active storm systems through the Nation's tornado belt. Analysis of the 4-month coordinated storm investigation has begun at the national severe storm project center at Kansas City.

Included in future plans is the use of high-altitude, camera-carrying rockets to view storm systems from altitudes as high as 35 miles.

A closely spaced network of specialized research observatories will be woven into the pattern of regular Weather Bureau observing stations to provide basic knowledge of severe local storms over a 300,000-square-mile area in the Central Plains.

CLEAR AIR TURBULENCE

A project is planned to gain more knowledge of the mechanisms producing clear air turbulence. The aim of the project will be to develop successful methods of identifying and forecasting weather situations that coincide with instances of severe and extreme clear air turbulence. Meanwhile, a modest research program is underway to collect data and to analyze it in relation to synoptic weather conditions and aircraft weather reports.

Additionally, a clear air turbulence detection effort, using a WSR–57 weather radar, is being carried on at Evansville, Ind.

TERMINAL FORECASTS

In early 1961, a program for intensive study of development of short-period terminal forecast techniques was started. A dense network of reporting stations is being installed in the Washington National Airport area. The reports, over a period of time, will be analyzed by computer methods to find the clues for forecasting the correct values of ceiling, visibility, surface winds, et cetera, for the proper times during the approach and passage of different weather situations.

FORECASTS OF PRECISE VISIBILITY FOR APPROACHES AND LANDINGS

As improved equipment for weather measurements at airports becomes operational, air transport operations avail themselves of lower operating minimums for takeoff and landing under low visibility conditions. The recent development of runway visual range computation and acceptance of RVR as an operational value of visibility by amendment of the Civil Air Regulations, give rise to imminent requirements for precise forecasts of this value. Highly dependable forecasts of RVR would enable pilots, particularly those of jet aircraft, to plan to remain at altitude until certain that their aircraft could be committed to a successful approach and landing . The RVR forecast would assure the pilot of sufficient down-runway visibility upon touchdown to maneuver his aircraft successfully and safely along the runway and turnoff. Research on possible techniques must be pursued for a considerable time, before this very complex problem can be solved.

SUPERSONIC AIRCRAFT OPERATIONAL REQUIREMENTS

Action was initiated during 1960 to study the weather problems that will arise by 1970 in connection with supersonic civil air transport aircraft. The relation of the sonic boom to atmospheric conditions, the winds and turbulence at the 60,000–80,000 cruising levels, and the need to avoid hail and other hazards during high-speed climb and descent must be studied.

OTHER R. & D. PROJECTS

In addition to the projects listed above, the Weather Bureau has been active on other research and development matters of value to aviation. Among these, the most important are:

APPROACH LIGHT CONTACT HEIGHT COMPUTER

The problem of measuring slant range visibility, to determine the height at which a pilot on final approach in cloud will be able to change from his instruments to visual flight, is under attack with work on development of an approach light contact height (ALCH) computer. The goal is to compute the value of ALCH, with reference to the standard high-intensity approach light system, from the values measured by the ceilometer (for cloud base height) and the transmissometer (visibility sensor). The value would be automatically adjusted for day or night values and the current intensity setting of the approach lights. The intensity of the approach lights is varied according to weather conditions.

Automatic electronic ALCH computers are under test and evaluation at Newark and at the National Aviation Facilities Experimental Center (FAA) at Atlantic City, the latter in conjunction with the possible use of the ALCH computer as an integral part of the automatic meteorological observing system (AMOS).

Following evaluation, determination will be made of the applicability of the ALCH computer to support flight operations at airports with high-intensity approach lights.

If it is determined to be a standard requirement, the ALCH computer will need to be installed at airports equipped with high-intensity approach lights, a ceilometer, and a transmissiometer.

AUTOMATIC METEOROLOGICAL OBSERVING SYSTEM (AMOS)

The onset of the jet age created demands for accurate and continuous measurements of weather elements directly in the runway complex and the airport approach zone, in direct support of takeoff and landing operations during bad weather. The Weather Bureau began work several years ago, with collaboration of the National Bureau of Standards, to develop an automatic telemetering system for airport observations. Success was achieved.

As now constituted, AMOS is a computer and a system of "sensors," or individual automatic pieces of equipment that can measure the height of cloud bases, the wind direction and speed, temperature, dewpoint, pressure, pressure changes, visibility, and amount of precipitation.

By electronic connections, these measurements of weather elements are fed into the computer. The condition of other elements, such as amount of cloud cover, operational ceiling, types of precipitation and obstructions to vision, is punched into the computer by a weather observer. AMOS can then automatically prepare a coded weather report, display it, transmit it by teletypewriter upon interrogation, and maintain a printed record of reports so that weather briefers and pilots can check for trends. AMOS can also provide a cumulative record on magnetic and punched paper tape that can be used to create a punchcard file of the reports. The punchcards can be used for climatological purposes, response to legal inquiries, forecast research, and accident investigations.

The Weather Bureau is working on development of additional sensors. The objective is to provide the system with sensors to make all determinations that must now be made by an observer.

Still to be developed are sensors to determine the amount of cloud cover, the operational ceiling value, types of precipitation, prevailing visibility, and other conditions.

SUMMATION

Recent advances in the technology of radar, electronic computers, meteorological satellites, et cetera, have opened the way to great developments in the atmospheric sciences and their applications to weather reporting and forecasting. Weather science and particularly aviation meteorology has always suffered from attempts to generalize too much. There has been oversimplification in the search for a simple key to the multitude of different combinations and variations of weather that affect aircraft operations. The fact is that aviation has reached

the point where the sum total of pilot needs everywhere amounts to observing, reporting, and if possible predicting what is going on in the atmosphere practically everywhere, continuously. This means that meteorological services must have much more numerous reports of significant atmospheric conditions than are now available and these reports must be communicated more quickly, processed automatically, and the summaries and forecasts disseminated more promptly and universally than is possible with present facilities. Large additions to facilities have been made in recent years but further increases are necessary if weather reports and forecasts are to be satisfactory and meet adequately the requirements for "safety and efficiency in air commerce."

Years ago many aviation authorities and meteorologists believed that improvements in aircraft design, perfection of powerplants, automatic air traffic control, and so on would produce all weather flying and decrease the importance of weather reports and forecasts. While the highly reliable modern aircraft has been made independent of some of the weather conditions which bothered early airplanes, each major advance in aircraft has brought new meteorological problems. For example, early aircraft never encountered the severe clear air turbulence at high altitudes which is so difficult for meteorologists to measure and even more difficult to predict. Again, indications are that mach-3 aircraft may be affected by corrosive effects of ozone at high altitudes and this may place upon the meteorologist the necessity to measure daily variations in ozone concentration at flight levels. There are many other new demands, such as the greater importance of forecasts of cloud ceiling and visibility at airport terminals for jet aircraft with critical fuel limitations.

Present and prospective future aviation developments call for a larger and more closely spaced network of stations or other facilities with sensors to measure atmospheric conditions and telemetering devices for transmitting them promptly to processing and analysis centers. The output must then be tied in with the air traffic control system and disseminated through this and other channels for immediate use of pilots in the air and on the ground. As stated earlier, much has been accomplished during 1960 to increase the number and convenience of outlets for getting weather reports and forecasts into the hands of pilots everywhere, but there is still much to be done.

Fortunately, basic research in the atmospheric sciences directed toward advancement of knowledge for the general welfare has direct applications to improvements in aviation weather services. Although there are different approaches to solution of meteorological problems, and although progress doubtless is possible through empirical methods, there can be no doubt that the most complete and powerful solutions are to be found through basic research and increase in our fundamental knowledge of the atmosphere. Quick cures or panaceas have been proven to be ineffective in dealing with atmospheric problems. We are dealing with an atmosphere that envelopes the earth and extends to great altitudes above. Its movements and physical changes are almost ceaseless and their ultimate causes and the mechanisms through which they work are imperfectly understood, in some cases completely unknown.

Meteorological conditions at one point may be quite different—very significantly different—from those at a point only a few hundred feet away, for instance in clear air turbulence or in the winds and pressures around a passing tornado. More data, new and advanced computers for processing and analysis of data, and more research are the avenues to progress in meteorological services.

Certainly, the most phenomenal single advance in meteorology during 1960 was demonstration of how successful meteorological satellites can be in adding to the data on cloud formations, distribution and movements and indirectly other features of the atmosphere. Their future significance can only be estimated at present but we can be sure they will have a major part in the universal system for collection of weather information required by aviation. They will not fill all of the void now left in the gaps between radiosonde stations and other facilities for measuring component elements that make up the weather, but they will go far in obtaining what cannot be measured by local sampling in the station networks on the ground.

Through the plans and programs referenced in this statement and with cooperation of other agencies—DOD, FAA, NASA, and many others whose field organizations provide essential weather reports not otherwise obtainable, all contributing to the common pool of information for the Weather Bureau's national meteorological service, the Bureau feels certain of much progress ahead in weather service for aviation.

APPENDIX

Project No. 1: Complete the aviation weather reporting network.
Phase I: Install semiautomatic AMOS IV.
Phase II: Add new sensors, when developed, to all AMOS installations, to provide fully automatic weather measuring.
Project No. 2: Increase the frequency of upper wind soundings to four per day at all land-based upper air stations.
Project No. 3: Extend radar detection of local storms to safeguard aviation operations.
Project No. 4: Forecasts for more airport terminals where needed to safeguard operations at high-activity airports.
Project No. 5: Direct weather reporting and advisory service to air traffic service units.
Project No. 6: Extend the service A express weather teletypewriter circuit to all Weather Bureau centers where required.
Project No. 7: Extend weather facsimile to meet requirements.
Project No. 8: For pilot briefing:
(a) Install automatic telephone answering systems for routine flight planning wherever telephone briefing loads warrant; and
(b) Establish closed-circuit television briefing at international terminals and high-activity domestic terminals.
Project No. 9: Finish development of a fully automatic meteorological observing system (AMOS).
Project No. 10: Further development of terminal and en route forecasts and of clear air turbulence forecasts.
Project No. 11: Develop methods of forecasting runway visibility values.
Project No. 12: Automate data processing.
Project No. 13: Develop an automated weather dissemination system for optimum satisfaction of future needs.
Project No. 14: Develop an automated weather briefing display.
Project No. 15: Develop an automated aircraft sensing system for weather reports from aircraft in flight.
NOTE.—The foregoing projects are from the Weather Bureau's plan for modernization of the Aviation Weather Service. This plan was originally published in 1958. It was revised in 1959, and another revision to bring it up to date is in progress.

Mr. REICHELDERFER. This committee has heard a good bit in recent weeks from many agencies, and I believe on the whole there has been relatively little about weather this year. We hope that that is because both the weather and the weather service have improved. We are conscious, however, that there are many weather problems and that the weather factors involved in air traffic control and safety in aviation are becoming more and more important as the volume of traffic increases and the techniques involved become more complex.

Our Aviation Branch is dedicated to the aim and the principle of providing the very best possible weather service input in the air traffic control system. We know from analysis of accidents that by far the largest percentage of aircraft accidents occur in the area around terminals, and we are therefore concentrating on improvement in terminal weather forecasts.

We have a number of projects in progress and we have every belief that important improvements will develop in the coming year.

En route, one of the major weather problems is clear air turbulence. We have heard a great deal about that. There is still much that is unknown about the causes of clear air turbulence, but we know much more than we knew a year ago, and there are research projects directed toward determining the causes and finding the best ways to predict clear air turbulence. We know that in many cases clear air turbulence comes from effects of the jetstream, and of course the jetstream then becomes the key to forecasts of clear air turbulence.

At the close of my brief remarks, I would like to show you the relationship of the very revolutionary advance in meteorlogy as a result of meteorological satellites, the relationship of this to location of the jetstream over areas where the data from upper air soundings are too sparse to give us an accurate location.

Meteorology in general and weather service in particular have always suffered from the natural tendency to overgeneralize. There are so many hundreds of details in the weather each day, differing from level to level and from point to point, that there is a tremendous volume of significant weather data to report and predict. The tendency, therefore, has been to overgeneralize.

We are giving more attention to ways and means of getting the local peculiarities, the local differences in weather reported, and this information disseminated as promptly as possible. A great advance in that respect has been made in the past year by increasing the number of outlets to pilots through the cooperation of the FAA and the flight stations of the FAA. They are working very closely with us and we with them in developing these hundreds of additional outlets to the pilot to the fullest extent possible.

Another very important aspect in our program is the improvement in severe storm warnings, severe thunderstorms, tornadoes, and so on.

This coming Saturday we have here at the airport two of the aircraft, flying laboratories, a B–57 and a DC–6, that have been specially equipped for an extensive program of research in the Kansas City and Oklahoma area this coming spring. They will go into operation very shortly.

I think it is of interest to know that they are the most extensively, most completely equipped meteorological flying laboratories that have ever been put into operation. There are, too, 10 planes that are being put into the air for this purpose through the cooperation of FAA, DOD, NASA, and so on. It is quite an extensive, cooperative interdepartmental project.

Those studies will get into the causes of formation and better means of detection, not only of severe local storms, but when the hurricane season arrives they will get into the hurricane research program at the end.

Senator MONRONEY. Before you leave that: You mentioned various planes. Isn't it true that the U–2 will fly again, and that it will fly over America instead of elsewhere in search of weather data?

Mr. REICHELDERFER. This is quite true.

Senator MONRONEY. I thought that was true. And it will be for high-altitude research.

At what altitude do you plan to use this plane for your weather research data?

Mr. REICHELDERFER. It depends on just what the condition is, but altitudes in the neighborhood of 55,000 to 65,000 feet for the most part.

Senator MONRONEY. Which no other plane can attain?

Mr. REICHELDERFER. This is true.

Senator MONRONEY. We have had nothing other than our balloon sampling of this upper altitude weather until we put these U–2's into service.

Mr. REICHELDERFER. The U–2, and more recently the satellites. We are getting some excellent pictures from the meteorological satellites in orbit.

You referred to the U–2, Mr. Chairman. A number of years ago we obtained photographs from very high altitude of storms, typhoons over the Pacific. The plane was not identified at the time, but it turns out that the photographs came from the U–2-type plane.

Senator MONRONEY. By photography, you can cover how many miles' area?

Mr. REICHELDERFER. From 60,000 feet, I think, with the usual lens—I might have to correct this for the record—it is hundreds of thousands of square miles. It is a very broad area. It covers a whole typhoon area.

Another aspect that we think ought to have a great deal more attention is the training and the keeping in training of pilots, particularly the general aviation pilots, with respect to knowing what meteorological information is available, how the information is provided, and just what it means.

An analysis of some of the accidents has indicated that at times the standard terms used in reporting and forecasting are not completely understood. Of course, it is fundamental that this should be corrected, and with the support and cooperation of the FAA a great deal has been done in the past year to extend the training in meteorology.

Senator MONRONEY. Could I ask you a question right there. A private pilot, perhaps with his new plane in a strange airport, many miles from his home, if he calls the Weather Bureau for information, is there any interrogation as to the number of hours that he has flown? It seems to me if these men can be advised at the time they are asking for weather information, and if there is bad turbulence or extremely low ceiling or adverse weather between the two points that they are asking about, that it would be proper under today's procedure for the Weather Bureau to say there is extreme turbulence or extremely low ceiling, blind-flying conditions or instrument-flight conditions in the area that is being inquired about. However, if you go by way of another route, the forecast on this route would be visual.

Mr. REICHELDERFER. Your inquiry goes to the heart of the difficulty in some cases. I think the majority of pilots would not be offended by an inquiry. Usually our people try to be tactful and avoid any implication of inexperiene. There are a few who react violently and inquire as to what business it is of the forecaster.

The information as to the background, qualifications, and capability of the pilot is very pertinent and we are trying to find better ways of obtaining that information. Certainly the forecaster, the Weather Bureau representative, does the best he can to tailor the information to the particular needs of the individual.

In honesty, I must add that in bad weather, when the calls are frequent, it is not always possible to give all the time we would like to each indiivdual case. It is one of the old problems, that when you need it most, it is hardest to get.

Senator MONRONEY. It would seem to me, though, that many pilots would fail to say "I can fly only VFR," but if a routine question was asked, "Are you asking for instrument weather or for VFR," or even the inquiry, "Do you hold an instrument license or noninstru-

ment license," that perhaps it would alert the man giving the information that there should be perhaps suggested tactfully an alternate route if one were open, where the weather conditions were such that he could handle the situation—not being an instrument pilot.

Mr. REICHELDERFER. I would think that very probably we would work out a more formal procedure, a standard procedure, for this sort of thing in cooperation with the FAA. We would want to work it out together. I think that this is a good suggestion.

Senator MONRONEY. I don't want to belabor the point, but could you perhaps arrive at it by saying, "In order to be sure we are giving information only to pilots and not from casual inquiries, could you give us the type of license you hold and the number?" Sometimes this would help in tracing planes that don't show up if they make a call and the weather advisory has been for a certain routing. Many times these men do not file flight plans. But if you say, "In order to give maximum service to pilots, can you tell us your rating and your number," they might do that.

Mr. REICHELDERFER. I think this might be done. This, again, we would want to work out in cooperation with the FAA so that there would be uniform practices, and we would take into account the experience and advice which they could give us. The training program, or the general familiarization program that we plan to develop with FAA is to impress on pilots how to read and understand the meaning of the forecast warnings and the advisories, how to get the weather information during preflight planning, and during the inflight operation, something on the effects of unusual weather in connection with their individual flight operations, and alternative actions in case they run into difficult weather conditions.

I believe the committee is acquainted with the emphasis we have placed in recent years on pilot reports, in-flight reports, and debriefed reports after landing. This has been coming along well. We still have communications problems to solve but there are improvements there.

I want to emphasize that pilot reports are a very important and necessary source of information about inflight conditions and that we are pushing this as one of the best ways to get complete information.

Senator MONRONEY. This is especially valuable in getting conditions from on-top reports.

Mr. REICHELDERFER. This is about the only way that we can do it over the area as a whole.

Senator MONRONEY. Have the problems of feeding it into the weather network been solved so that it will be current information and reach the weather network at a time close enough to be valuable.

Mr. REICHELDERFER. There is much more to be done; partly a matter of increased channels, physical channels, communications channels, partly a matter of coordination, because it is difficult to handle these things promptly. The weather information gets stale very quickly, and unless it gets through to the user promptly, they are no good. This is not completely solved yet. This we must give more attention to.

Senator MONRONEY. Does the jet plane flying nonstop from Friendship to Los Angeles, as he contacts his regular check points, the area

control, does he report the weather—any unusual weather that he thinks might be of interest to the network area controller?

Mr. REICHELDERFER. This is not a standard uniform practice. There are many factors involved. Jet pilots are awfully busy with other things. We think more can be done, and we are trying to develop this source to the fullest extent we can.

Senator MONRONEY. What I am after is information regarding the mechanism of this in-flight weather reporting. Does it go from the pilot, when he has something to report to the area controller and from the area controller to you or to your people?

Mr. REICHELDERFER. Yes; to some extent.

Mr. Chairman, if you would permit me, I would like to ask Mr. Lieurance, who is the Chief of our Aviation Branch, and who has been working directly on these, to give you some further information on it.

Senator MONRONEY. Mr. Lieurance, would you state your full name for the record?

Mr. LIEURANCE. I am N. A. Lieurance, Associate Chief of the Weather Bureau, Aviation.

Mr. Chairman, in connection with your question concerning the jet—say, from Friendship to San Francisco—you would undoubtedly be on an IFR flight plan, and by virtue of that in direct contact with the centers. Any transmission that he would make concerning weather would be handled by the center itself, the ARTC. Many times, because of the workload in the centers, some of the reports that he would give in connection with weather would not get much further. This is a bottleneck in the system of PYREP collection, particularly from the commercial airlines which are operating almost routinely on IFR clearances now. This is being worked on by the FAA and Weather Bureau, and we hope to be able to eliminate this bottleneck very shortly.

Senator MONRONEY. Does it require more or less standard reporting as to terminology and things of that kind? Have efforts been made to transmit in a standard terminology for various weather phenomona that the airline pilot, for example, should be familiar with?

Mr. LIEURANCE. Most all of the airlines have standard operating practices within their operating manuals, a pilot weather reporting program which has been coordinated with us and with the industry. It is required, I think, by all of the major airlines to report all phenomena in the severe category, such as turbulence, icing, or unusual situations which have a bearing on safety. These are, I think without exception, reported very well, and I think without exception these get through the channels and into the system where they are supposed to go.

Senator MONRONEY. This is a major thing you are looking for?

Mr. LIEURANCE. This is a major thing we are looking for. The routine things, such as the tops and layers and the wind speeds and things of this nature, these are the ones that we don't get routinely. But I would say that the severe categories are handled very well. This could be speeded up to great advantage, but by and large these are getting through when they are reported.

Senator MONRONEY. Thank you very much.

Mr. REICHELDERFER. Mr. Chairman, the remarks that I have made cover the points I wanted to emphasize in particular, with the exception that I would refer to the summation of my general statement and one or two sentences there which I think are key sentences in the present status of weather reports and forecasts for aviation. The summation says:

> Recent advances in the technology of radar, electronic computers, meteorological satellites, et cetera, in particular, have opened the way to great new developments in the atmospheric sciences and their applications to weather reporting and forecasting. Weather sciences and particularly aviation meteorology has always suffered from attempts to generalize too much.

These new developments in technology—radar, satellites, and other things—now enable us to give more attention to the local variations that I emphasized.

If I may, I would like to refer to a chart, or rather a photograph, taken from the first meteorological satellite, Tiros I, which was launched April 1, 1960. At first glance it might appear to the observer that satellites are much too far away and have much too broad a picture to be of much interest or application to aviation weather service. But this would very much underestimate the possibilities, the applications of meteorological satellites directly to aviation services. I think this is seen rather easily when we point out that the Tiros satellite could take pictures that would identify such things as a fairly good sized thunderstorm. That gets it down pretty small. Moreover, one of the striking things from the Tiros I pictures was a square cloud observed over the Southwest, over Oklahoma, in fact, which turned out to be a precursor—we don't know whether it was the cause or not but at least it preceded the development of tornadoes.

One of our great problems in tornado forecasting is to find out where they are going to generate. If we can tell from a bird's-eye view, from nature's own weather map which the satellite picture gives, where the affected areas are likely to be, then we can spot them and track them right from the beginning. I think this will turn out in the future to be one of the greatest advances in meteorology of all time.

The bottom of this large photograph is made up of a mosaic of some 20 or 30 separate photographs transmitted by the satellite Tiros I. They have been fitted together. They have to be rectified because the view in some cases from the camera was a slant view and not a direct vertical view. But after rectification so that you have a planed view throughout, those clouds were superimposed on what we had from a very sketchy weather map of the North Pacific.

In the upper part of the photograph you see on the east of continental North America, with Hudson Bay in the extreme upper right corner. On the extreme left the map approaches Japan, although it doesn't encompass all of the North Pacific. But the essential features, very briefly, are these: The position of the front shown by the line with the beads on it, extending east-west over mid-Pacific, was corrected and made much more accurate after the clouds were located. I think it is fair to say that this is the most complete weather map of the North Pacific ever available as a general view. It, of course, does not give all of the local details of wind and weather

that we would like, but for forecasting it gives enough to be much more accurate than we could have been without the Tiros cloud photographs.

This shows other things that meteorologists did not know before and could not derive from the scarce data given by ship reports. For example, in the rear of the front, to the west of the low in the upper center of photograph, the circular isobar marked "L", you see detached clouds. Those are arrayed, we found from satellite studies, in a systematic form, in an orderly form, much more systematic than we had supposed. If you have system in a natural phenomenon, then you have a base for forecasting. If it is random, if there is no system, you can't forecast. This is an important thing to note.

With respect to the jetstream, we do not have enough ocean vessel stations in the Pacific nor enough soundings from merchant vessels to locate the jetstream accurately. But with the Tiros photographs and the location and orientation of the front we can know with reasonable certainty that the jetstream starts from a point somewhat east of the front in the low, in the upper left-hand portion, dips southeastward toward the high-pressure area, goes on eastward and then curves again northeastward.

This is important not only for air navigation in locating the best levels for transatlantic flight, but this also tells the forecaster a great deal about the speed of motion of the highs and lows and the fronts, and when the jetstream is over the United States, it tells the forecaster about conditions that result in what we call explosive development—very rapid development of lows in the Southwest that bring some of our most severe snow storms, or the very rapid acceleration of hurricanes along the east coast, such as we had in an instance a few years ago when a hurricane, after coming up the Florida coast and along the Georgia and Carolina coast at a speed of roughly 15 to 18 miles an hour, overnight accelerated to 30 or 35 miles an hour and effected New England and the Middle Atlantic coast much sooner than there was any reason to believe before we knew the causes. This is just an indication of the importance of these developments.

I think we can look forward with a great deal of confidence to improvements in meteorological services as a result of these developments.

Thank you, Mr. Chairman.

Senator MONRONEY. Thank you, Dr. Reichelderfer.

How much money is being spent on weather control research?

Mr. REICHELDERFER. The direct responsibility for weather control research is now under the National Science Foundation, although the Weather Bureau does conduct limited weather control research in connection with its responsibility for weather forecasting. I will have to supply that figure. I will have to consult with the National Science Foundation.

Senator MONRONEY. Most of it is being spent by them?

Mr. REICHELDERFER. In weather modification, yes, under contract.

Senator MONRONEY. This is regarding precipitation and——

Mr. REICHELDERFER. Rainmaking. They are not doing anything at the moment in storm modification or storm deflection. We did a little in connection with hurricane studies a few years ago, 2 or 3 years ago. We had planned more last season, but there weren't enough hurricanes in the right places to carry on the experiments.

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We do plan more this coming season. This, of course, ties right in with forecasting.

Senator MONRONEY. You don't think anybody is monkeying with our weather, do you, and causing so much snow being dumped on us at times such as the inauguration?

Mr. REICHELDERFER. I would like to find a Jonah to blame it on. Actually if you go back a few years you will find that these misplaced snowstorms or the effects that are unusual for one region do occur every 10 or 15 or 20 years. So that there is no justification for believing that man is meddling with Jupiter Pluvius, yet, though this may come about eventually.

Senator MONRONEY. We know today that whatever meddling is being done, we are seeding clouds in certain places, and it is becoming prevalent practice in some of the dry areas of Oklahoma to put up the money and to be satisfied with the results that they get. But would there be any general effect on the pattern of weather?

Mr. REICHELDERFER. There is no evidence of any general effect on weather. Even in the local seeding experiments they need to be examined very carefully because it is difficult to separate the increase due to the artificial causes from what would occur naturally.

There was quite an independent statistical study of this by people who had no axes to grind whatever a year or so ago called the Skyline Conference. It was held up here in the Alleghenies. This was sponsored, financed, I believe, by a contract with one of the foundations, one of the private foundations. They came up with the conclusion that while in a few cases there was some evidence of modest increase, there were no cases where it was entirely conclusive, and there were many cases where what had been thought to be the results of artificial effects were simply natural causes.

Senator MONRONEY. Are you satisfied with the flash advisory service? Does it work to your satisfaction?

Mr. REICHELDERFER. Services of that kind can never be said to have reached a satisfactory stage. There are always improvements that can be made because there are so many communications problems involved.

Certainly it represents an excellent service, but we fully expect to continue to improve it. I think one can say that there is no real reason for dissatisfaction with the progress we are making. We are making progress.

Senator MONRONEY. In estimating the percentage of the accuracies of your forecasts, do the flash advisories that are given after the weather change has been apparent appear in your accuracies record?

Mr. REICHELDERFER. They are not formally included in the accuracies records.

Senator MONRONEY. In other words, it is a longer-range forecast that you rely on, and the advisory is an emergency activity to give the very latest weather information?

Mr. REICHELDERFER. This is true. And also in trying to verify something, or to test the accuracies of something like a flash advisory or severe storm warning, meteorologists never have complete reports covering what did happen. They have scattered reports here and there. So that an accurate verification system is rather unattainable. But, of course, we do check up on what was said to see whether

it was justified or whether it can be improved. We post mortem all cases of that kind to see if there was anything wrong.

Those do not appear in the figures of forecast verification because of the indeterminate factors that I just referred to.

Senator MONRONEY. Will we have more weather stations this year than we had last year?

Mr. REICHELDERFER. In sum total we expect more. There will not be many more Weather Bureau stations. They are not provided in our appropriations, but through the extension of cooperative arrangements we do expect to have a few more stations.

Senator MONRONEY. These come from what source?

Mr. REICHELDERFER. Some of them are new facilities of the FAA, some of them are new places opened up by the military.

Senator MONRONEY. And all the route facilities, that is, FAA weather reporting facilities, funnel into your network do they not?

Mr. REICHELDERFER. All of them, yes. It is essentially a very highly cooperative program. Sometimes we are asked if we wouldn't have a more efficient service if everything were organized into one integrated system. This is impossible in meteorology because in the first place our weather service here depends upon reports from Canada, and certainly the U.S. Weather Bureau can't install weather reporting stations in Canada.

The same is true of reports from ships at sea. So that the best service, the best national meteorological service, is that which takes the reports from all available remote stations—lighthouses, airports—and puts them all into the common system for analysis and processing and distribution. This is what we are doing.

The National Meteorological Center of the Weather Bureau at Suitland I think I may say fairly is the largest center of that kind in the world. If the number of visitors from other lands is any indication, who come and say that they are surprised to see how extensively it is organized and what it does, then I think we can conclude that it is the best in the world, if I may be a bit modest.

Senator MONRONEY. Thank you very much, Dr. Reichelderfer, for your very helpful information on the subject of aviation safety. We appreciate your appearance here.

Mr. REICHELDERFER. Thank you, sir.

Senator MONRONEY. Our next witness is Mr. Samuel Freeman, vice president, airspace, National Aviation Trades Association, Washington, D.C.

Mr. Freeman, we are happy to have you before our committee. We will welcome any information that you have. I believe you are accompanied by Mr. Robert Monroe, your executive director.

STATEMENT OF SAMUEL FREEMAN, VICE PRESIDENT, AIRSPACE, NATIONAL AVIATION TRADES ASSOCIATION, WASHINGTON, D.C., ACCOMPANIED BY ROBERT MONROE, EXECUTIVE DIRECTOR

Mr. FREEMAN. That is right, sir.

Senator MONRONEY. You may proceed. You may brief your statement and it will appear in full in the record, or you may read it.

Mr. FREEMAN. I will read it.

My name is Samuel Freeman. I own and operate a commercial airport at Bedminster, N.J. I am a past president of the National Aviation Trades Association and currently serve as its vice president for airspace. I appear here in behalf of its more than 330 members who are businessmen providing aviation goods and services to the general public.

Our members own or operate airports; provide air taxi services, train pilots and mechanics; provide maintenance, repair, and overhaul services for aircraft and equipment; sell aircraft and accessories; and provide aerial applicating services to agriculture and forestry.

NATA'S ROLE IN AVIATION SAFETY

NATA appreciates the opportunity to present its views on aviation safety. Our association has a long record of interest in the subject and has conducted safety promotion programs since its founding 21 years ago. Substantial portions of each annual convention have been devoted to the study of accidents, their causes and methods of accident prevention. Literally thousands of operators have benefited from these workshop sessions. The fact that the number of general aviation accidents has not grown in parallel with the growth in numbers of aircraft, airmen or volume of usage, we believe, attests to the value of this program of safety promotion through the education of the businessmen who have the greatest opportunity to require and instill safe operating habits in employees, student airmen, and pilot customers.

I will go over some of the programs we have developed, and Mr. Monroe has samples of these.

In 1948 NATA produced a "Code for Safe and Sane Operations" to help guide aviation businessmen in their efforts to operate more safely. A copy is submitted for your inspection. Though small and unpretentious, you will note that it is quite comprehensive. This year, NATA started a program to revise and expand this publication into a detailed aviation business management handbook for the guidance of operators in conducting safe, efficient, and profitable operations. This book should be in use at the year's end.

Over a dozen years ago the members felt so strongly about safety promotion that they added to NATA's executive committee a vice president whose principal responsibility is the conduct of the association's safety program. This led to greater concentration of effort on the areas where maximum gains in safety were possible: pilot training and aerial applicator operations.

Considerable space in our Newsletter is devoted to the reportage of CAB statistics on accidents and their causative factors, so that as the year progresses, operators may know how well or poorly they are doing. We have produced a press kit which operators may use to help minimize the adverse public relations which normally follow an aircraft accident.

Whenever CAB or FAA have proposed regulations which we believed held reasonable promise of significant improvement in aviation safety, NATA has supported the adoption of those proposals. Thus, we fully supported the addition of requirements for instrument training for private and commercial pilots. We even have cause to think that we were instrumental in getting this proposal adopted. The results of a study we conducted in 1958 supported

such a requirement and were frequently used in conferences on the subject. NATA was, I think, one of the foremost organizations in promoting or advocating the present rule which we do consider a very real contribution to safety requiring some instrument training for private pilots. We think that this is working out. There was some opposition to it among some of the school operators at first, but on the whole we think this is one of the better rules that FAA passed and is a real contribution to safety.

This year we also propose to sponsor or cooperate in an industry conference to undertake a complete review of the pilot training problem. We believe it is now time to look anew at the aircraft we are using, the environment in which they operate and to redetermine what knowledge and skill requirements are necessary for pilots to gain 90 percent utility from their aircraft. We also believe that in the light of these requirements it is time to redetermine what combination of curriculum, training aids and teaching techniques will do the most efficient job of developing safe and competent pilots.

One of our basic problems is that flight instruction is still married to the tutorial system. As a consequence, the flight instructor has increased his productivity very little over what it was 30 years ago. Mass teaching techniques for aviation must be developed and used so that instructors can become more productive and earn a livelihood appropriate to their profession and in keeping with their responsibilities.

ROLE OF RELATED ORGANIZATIONS

Promotion of aviation safety by aviation businessmen is not confined to their activities under the aegis of NATA. Our members are also active in State and other associations of operators. Through these associations they pursue other and noteworthy safety programs. Almost all State operators' associations conduct meetings in which the discussion of safety problems takes a large part. Many applicator associations, either on their own or in cooperation with their State colleges, sponsor short courses for aerial applicators, and again, safety matters form a part of the program.

In several instances State associations have obtained State legislation which exercises reasonable control over their operations and establishes standards to promote safety. Several years ago the Arizona Aviation Trades Association, as a result of some difficulties with the application of agricultural chemicals, brought about the establishment of the Arizona State Board of Pest Control Applicators which regulates the safe application of these chemicals.

The Texas Aerial Applicators Association is engaged in a similar effort this year in their State.

Many years ago the Montana Aviation Trades Association achieved suitable regulatory requirements for application operations from their State Aeronautics Commission.

The California Agricultural Aircraft Association has been instrumental in getting reasonable requirements in their State.

The California association has gone even further. We present a safety pamphlet which it developed for instruction of ground crews in safe application operations. Qualified members have assisted in the investigation of aerial application accidents and they regularly publish

safety bulletins which keep the safty problem before their members constantly.

Probably one of the most promising and far-reaching State association efforts is the Idaho safe pilot program sponsored by the Idaho Aviation Trades Association in cooperation with their State aeronautics department. It is a program of awards to pilots based on consecutive years of safe operation. It gives credit for refresher training and withdraws the award if the pilot has an accident. It imposes penalties if violation of either Federal or State flight rules draws official action. The program is open to all pilots in the State, not just association members. Though the program has been in operation for only 1 year it has already produced a significant reduction in aviation accidents in Idaho. If this safe pilot program continues to be successful NATA will consider turning it into a national program. We submit a copy of the rules and applications for this outstanding program.

In 1950 NATA promoted and established the National Air Taxi Conference, an affiliate organization, to promote high standards and safe operating practices in the air taxi business. In the 7 years during which the conference has kept records on accidents of its members, only six fatal accidents have occurred, or an average of less than 1 per year, for this group of approximately 150 operators who do a high percentage of the air taxi business.

Last year, just to give you some indication, we carried 81,000 passengers a total of 30 million passenger miles. I believe you occasionally ride in some of these. We think that our accident record on the whole, with the National Air Taxi Conference, we have run 3 years without any accidents at all. Last year, unfortunately, we had I believe two or three fatal accidents.

Senator MONRONEY. Do you advocate that all air taxi service be conducted by pilots who have instrument ratings?

Mr. FREEMAN. I would not myself oppose that, sir. I think that there might be areas of the country where this would really not be necessary. In other words, I think this might well be a fairly stringent requirement. I think that all night flying should be accomplished by a man who has an instrument rating. But I think that many of our air taxi flights in my own operation, for instance, we have flight instructors. Some of these flight instructors are very good instructors, but they do not all have instrument ratings. On a clear sunny day, for instance, if somebody wanted to go to Idlewild, if I were not able to use these people on a VFR flight it would be somewhat of a harship. As I say, I think for VFR flying today it should not be required.

Senator MONRONEY. The reason I mention this is that as a frequent user of air taxi service I believe I would feel easier if I knew that the standard requirement for an air taxi pilot would be one who could get through weather in case we happened to hit it. I think it would be conducive to greater use, perhaps, of air taxis if the standards of whatever pilot you happened to draw as a charter plane in some distant city would be at least known to be able to meet instrument standards.

Mr. FREEMAN. Of course, there is another angle there, too, and that is whether it was a single-engine or a twin-engine aircraft. I believe

that most of our operators who are using twin-engine equipment you will find for the most part do use instrument-rated pilots simply because these aircraft do lend themselves to instrument flight. At the present time we are operating under part 42 of the Civil Air Regulations, which specifically forbid instrument flight in single-engine aircraft for hire. So on that basis if you hit bad weather it might be necessary to know the fellow can get down through it on an emergency basis. But you actually couldn't at that point file an IFR plan legally.

Senator MONRONEY. I don't mean that. This is a matter of bringing more business to the man even in a single-engine plane, who would like to know that if you run into severe clouds, something of that kind, that he has the capacity and has been certificated to fly through it.

Mr. FREEMAN. We also, of course, from a purely emergency or safety standpoint, have the current requirement for commercial pilots, which does include the ability to fly basic instruments at least. In other words, he has to demonstrate his ability to make a GCA approach. On that basis, if you should get caught on top of a solid overcast and want to get down, at least in theory he knows how.

Senator MONRONEY. You may proceed.

Mr. FREEMAN. These many examples demonstrate that industry has, and will continue, a strong program in aviation safety. Government is not the sole—or even for that matter, the preeminent—guardian of safety.

FAA RULEMAKING

Aviation businessmen are directly or indirectly affected by several kinds of regulations which the FAA adopts. For practical purposes we were affected by 19 of the 27 amendments made to Civil Air Regulations which concerns us, three of the five special regulations and an indeterminate number of changes to regulations of the Administrator. NATA, with its limited staff, has simply not been able to cope with the great number of regulatory changes concerning airways, navigation aids, and airspace under the current system of handling.

Attached to this testimony is a list of the amendments to Civil Air and Special Regulations referred to. Beside each is our evaluation of its effect as a requirement and its probable effect on safety. You will note that, in our opinion, 6 of these amendments provided relief from more stringent requirements, 14 made little or no change, and 2 increased requirements. Of these 22 actions we think 18 will have no measurable effect on safety, 1 will increase safety and 3—which were in reality all the same matter—were adverse to safety.

The three amendments which we feel were adverse to safety all had to do with raising the floor of the airway—two actions postponed raising the floor of the airways to 1,500 feet from its present 700 feet and the other rescinded the rule under which this could be done. It is only fair to say that just recently FAA did replace this rule with another which allows raising the floor to 1,200 feet or higher. We believe this will increase safety, though to a lesser extent than the previous provision would have.

Incidentally, that is being implemented through airspace actions at the present time.

To us, the large amount of rulemaking activity which makes little difference in requirements and no measurable difference in safety indicates that something is wrong with the concept of the proper purpose of rulemaking and/or the body of rules themselves. We suspect that what is wrong is that the regulations have become far too detailed and, as a result, the objective of safety has been lost in a welter of administrative considerations.

Of the 19 draft releases affecting Civil Air Regulations issued last year, 10 are of concern to general aviation business. Of these, six have been adopted. Among the 10, we expect that 8 would have little or no effect on safety; 1—redefining controlled airspace—would give some improvement, though not as much as the rule it would replace; and the other—lowering the floor of the continental control area—would also improve safety. Here again, we are struck by the high proportion of proposals which appear to us to have little to do with safety improvement, however desirable they may be for other reasons.

In the area of airspace and air-traffic management, general aviation business has benefited by reductions in restricted airspace and appears not to have suffered to any great degree from changes in navigational aids and airway routings. The limitation of class III medical examinations to FAA-designated examiners still brings NATA many complaints from its members—and the effect of this requirement on safety is still moot.

In my hometown, for instance, the price of a private physical has gone from $6 to $15. It takes up to 2 weeks to get an appointment, and we have had some students seriously inconvenienced. The difficulty, as I see it personally, is that I can't see any improvement in overall safety resulting from that rule. However, we have gone around and around on this before.

Similarly, many other changes to the regulations of the Administrator have, will, or may affect our procedural methods of doing business but have little or no effect upon the safety of our operations.

THE PROBLEM

Basically, what we seek is sound growth and development of aviation, a high percentage of utility from our aircraft, and a reasonable level of safety in their use.

Regulations affect the manufacture of our aircraft, the training and qualification of our pilots, the qualification of our mechanics, the maintenance of our aircraft, and our aircraft operations on the ground and in the air.

Last fiscal year FAA appropriations totaled $690,494,000. The FAA's employment now approximates 40,000 people. Thus, we expend in public money an average of about $6,000 per airplane to control the certification and operation of 108,000 aircraft, of which only about 72,000 are in active operation. And we publicly employ about one-third of a man for each airplane.

The FAA is now the second largest independent agency of Government. Only the Veterans' Administration is larger. The FAA has more employees than four Cabinet-level departments: Commerce, Justice, Labor, and State. We spend more effort on keeping 100,000 airplanes safe than on improving our foreign relations—which everybody says is so important.

Now, if these ratios seem high to you, gentlemen, they seem fantastic to us. No other industry bears such a weight of supervision. No facet of the aviation business is free of some regulatory requirement.

The quality of the Agency's past rulemaking activity leaves much to be desired. The Agency presents little or no statistical or other evidence in presenting its proposals. Rules are rationalized from opinions or selected specific instances—not from a statistically valid body of knowledge. In our view the Agency should bend every effort to collect the statistical data which are essential to intelligent and responsive rulemaking. The facts and the evidence should be developed before rulemaking takes place—not afterward, as in the case of the medical regulations which have been the source of so much disagreement.

It must be admitted that we do not have unlimited funds for Government operations. We cannot do everything. It, therefore, becomes necessary to discriminate between the essential and the desirable. We must recognize that some problems are significant and merit attack by the tax-supported aviation arm of the Government and that some problems are not significant and do not merit such attention.

The Agency has generally done a poor job of discriminating where effort and money should or should not be expended—with the possible exception of airport aid. It has failed to ask—and answer—such questions as: What is the evidence a problem exists? Does this problem merit attention from the public agency? What is the evidence our solution will solve it? What do we need to know? What do we know? How can we learn what we need to know, but do not know? Where are the greatest opportunities for improvement in aviation safety? Is a significant gain possible in this area? What are the real and significant obstacles to improvement? What programs will produce rewarding gains in overcoming these obstacles? How can we get these programs going?

In our opinion the Agency needs further guidance from Congress. Just how much safety is in the public interest? What is an acceptable level of safety? What is the minimum threshold below which the expenditure of public funds and effort is not warranted?

Absolute aviation safety is an impossible goal—unless we stop flying—but stopping flying is not in the public interest either. What accident rate then is acceptable?

We must know what is acceptable so as to establish priorities for attention. Since the public agency for aviation regulation does not have unlimited funds, it must learn, as business has long since, that successful administration is the judicious practice of selective neglect. It cannot attack and solve all safety problems regardless of magnitude. It should instead concentrate on those areas where significant gains can be achieved.

Thus, we believe it needs to be recognized that there are practical limits to safety regulation and that some matters, at least for the time being, might well be left to the industry, which, as we have pointed out, also has a safety program.

It also appears that perhaps the time is ripe for a reevaluation of the function of aviation regulation. We agree with the objective of safety but we think the regulatory method by which it is sought

needs to be comprehensible, objective in nature and enforceable. Certainly the regulations have become far too massive and complicated to be comprehensible, and some simplification is long overdue. The degree to which many present regulations spell out methods of accomplishment rather than objectives or goals to be met provides a mass of details which are almost impossible to encompass, frequently contradictory, confusing, and often difficult or beyond the capability of the Agency to enforce. This plethora of details gives rise to the mass of editorial, clarifying or procedural rulemaking actions which have little or no effect on safety but consume much of the Agency's rulemaking resources.

RECOMMENDED ACTION

Two basic things should be done. First, whatever effort and money are needed to produce reasonably accurate statistics about the nature and operations of general aviation should be expended for this purpose. Until we know what operational areas and causative factors are producing accidents and have the exposure data to compute an accident rate for these areas and factors we cannot rationally propose preventive solutions. We are merely shooting in the dark. The Civil Aeronautics Board should be provided the resources it needs to do the job it is supposed to do in this regard.

Second, the criteria in part 320 of the CAB's Accident Investigation Regulations which specify that damage to aircraft exceeding $100 shall be reported as an accident should be amended to $500. The cost of replacement parts for minor damage items has risen to such an extent that the current figure is no longer valid. Such an amendment would remove from the accident statistics a number of minor damage incidents which were not intended to be included in the accident record because they are the aeronautical equivalent of getting the fender of your car scraped.

In the nature of specifics for safety we have several suggestions. While the development of a proximately warning device has a fairly high priority in the research and development program, we believe it should be No. 1 and that no effort should be spared to make it a reality.

I note in a recent FAA release that they have apparently, or are now testing an outfit, a Sperry collision avoidance system. We hope that when this is developed that the difference between the collision-avoidance system, which actually turns the airplane out of the way of the collision automatically, that this would normally not be compatible with the needs of general aviation in the sense that it would probably be so complicated I doubt if we could afford it, either weight- or cost-wise. So that we hope and would still like to underline this, that what we want is a proximity warning indicator which might be compatible with this more complicated device which, perhaps, airlines would carry.

Some such device is essential to augument the "see and be seen" technique which we are presently using and probably will be for many years to come, in the airspace used by the majority of general aviation.

Along the same line, we have previously suggested along with AOPA and other groups, that more be done toward improving cockpit visibility. Also we have always advocated speed limits of some

reasonable nature in the congested areas. This, again, the latter, the speed limit proposal, I believe is recently being discussed with a proposal of 250 knots within I think 50 knots of the landing area. This may be as low as can be done, but it is still on the high side. We would hope that this 250 knots could be cut down some as we get closer in to the actual control zone.

Senator MONRONEY. Of course this applies generally to jets. There would be probably less than 100 airports that would be accepting and receiving them. This brings about testimony we heard the day before yesterday from the AOPA and others who are very anxious that general aviation airports be provided to allow the general aviation traffic to separate itself from the high-performance aircraft.

The committee and the FAA and others are working in some of these areas to see what can be done to provide such additional general aviation fields so that this slow speed of 250 knots for a jet will not be nearly a supersonic speed for a man with a Piper Cub, or someone else coming in for a landing at the same airport.

Mr. FREEMAN. A year ago we asked that priority for weather forecasts by flight stations be raised to the preeminence it has formerly enjoyed. It has not been done and we think it should be. That is the quarter of and quarter after sequence report.

Considerable expansion has been made in weather bureau forecasting centers. We believe this should be a secondary concern to the establishment of more weather reportage stations in the many locations which need them due to the peculiar effects created by local geographic conditions. In any case, the Weather Bureau should be provided with the resources to fill in the gaps in its weather data collection system.

I would like to add that dissemination is of great importance to our people, and the current program of the continuous broadcasts, which I believe the Weather Bureau representative here today told me they now had at 40 locations is a very good program. I think we all appreciate it. I know I use it continually in the New York area. It has been a great help.

We regret——

Senator MONRONEY. Before you leave the weather problem, I have often wondered why, since almost all general aviation begin and end their flight at a fixed base operator's hangar and office, if it would be possible to show some pictorial weather display of current weather, either drawn up every hour or every 2 hours by the weather bureau of the area in which traffic in general aviation is then flying, to indicate the approach of fronts, their locality at that particular hour, where there are low ceilings. It would all be done very graphically.

To my knowledge, I have never seen even so much as a typewritten weather report hanging on a bulletin board of a fixed base operator's establishment.

Mr. FREEMAN. I have in quite a few places seen the weather map, the type that they mail out, on bulletin boards. But they are usually a day or 2 late.

Senator MONRONEY. Most of the weather bureaus are located on major airports now. In those where the Weather Bureau does not have such a place, I wonder whether they could supply certain maps of the area to the fixed base operators who could, over their unicom

or other facilities, tune in on the current weather, and with a few graphic signs showing thunderstorms or severe turbulence or fog or rain or snow, make it very clear to a private pilot who is starting across the State to just look at the weather before he goes.

I know that the military have very definite figures, graphically, to show exactly what the different important parts of the weather are at various sections of map segments.

Mr. FREEMAN. Bob Monroe suggests closed circuit TV as used at some Air Force bases. I think, too, some of the television programs, that is, the actual television—Tex Antoine, for example, in the New York area, is excellent. Most pilots who may be planning a trip tomorrow would normally watch one of the programs.

Senator MONRONEY. Those are not official Weather Bureau——

Mr. FREEMAN. That is where he gets his information from.

Senator MONRONEY. Many of them are independent advertising announcers who look at the weather map and don't necessarily have to be meteorologists. And some of the information in the forecast sometimes differs very greatly.

In my part of the country we have good meteorologists doing it, but they have a little more tendency, because of building up their listener circulation, to view each little weather phenomena as sure to be a major disturbance of some kind, so that people will look on tomorrow night to find out what happened to the snowstorm that they predicted.

Mr. FREEMAN. I think Mr. Antoine does an excellent job. I agree that most of the so-called weather gals that they have are utterly useless.

Senator MONRONEY. I wouldn't want to discriminate.

But I do think, in addition, it is interesting, and very helpful. But this is for the general public, not 1 in 10,000 who will be flying the next day, and not 1 in 100,000 who will be running his own airplane.

The fact that we still have a Weather Bureau, while we wait for facsimile maps to be published everywhere at the punch of a button, it seems to me a good old-fashioned hand-sketched map on a form that could be picked up by people who are concerned with aviation weather, such as a fixed base operator—and most of those are oldtime pilots, extremely weatherwise, and they know how to interpret the information that they would get off of a weather radio to update this very simple area map that they could have with whatever severe weather might be in their neighborhood, would be helpful.

Mr. FREEMAN. I think it is something that certainly could be done. Actually, your weather maps are published in the daily paper, and interpreted by the fixed base operator, they could be of help to many of the pilots.

Senator MONRONEY. Particularly in the winter where over several parts of the State you may have icing and yet the rest of the State may be perfectly clear. Or there may be a line of thunderstorms laying across a certain section of the State that general aviation should stay out of or detour around.

It seems to me that there is much that we can still do to bring the same type of weather information without the corresponding cost by a better distribution method such as the airline pilots have when they start out on a flight.

Mr. FREEMAN. If you are lucky enough to be on a field that has a weather bureau, you can get that. The problem is that the smaller fields don't. There, again, this continuous broadcast does do quite a bit of good, because they give the synopsis and say, for instance, there is a cold front located at the Allentown-Pittsburgh area, moving at such and such, and they give the forecast. It really is quite useful, although I think it could be in some cases interpreted for student pilots in a better way.

Senator MONRONEY. Many times when you are 75 to 100 miles away from a weather station you have to get up in the air to get what the weather is. After that you are committed to the flight and you are anxious to get on. And sometimes it misleads the pilot to try and go on through, even though he might have stayed on the ground had he known how bad it was when he took off, or before he left the center of town to come to the airport.

You may proceed.

Mr. FREEMAN. We regret that Government research on basic aeronautical design problems has almost ceased in this dawn of the space age. Much is yet to be learned in this field and we suggest that research should continue on means to improve spiral stability, stall characteristics, crashworthiness, and cockpit visibility.

Impetus should be given to the establishment of terminal omnis at airports—not only at those which are publicly owned but at those which are privately owned as well—which meet the criteria for such aids.

Filling out the Nation's system of airports is also an essential element of a realistic safety program. We shall deal with this in detail when the airport aid program comes up for consideration.

Senator MONRONEY. In this regard, one comment: We have long advocated the use of parallel short runways, or separate short runways at certain terminal airports where you actually can establish a separate traffic pattern and keep the little airplanes out of the way of the big ones. It is one thing to say that we should separate into two airports. This is sometimes feasible. But you get a situation, for instance, at Idlewild in New York, where there is about 10 percent of the traffic going in there that is general aviation. And it is going in there primarily for one reason, and that is to connect with scheduled airline flights. In other words, either actual air taxi flight and corporate or private aircraft will go in almost 100 percent into Idlewild to pick up passengers or to deliver them to the international or domestic carriers.

I think it would be definitely a blow, let's say, to say that they could no longer do this, and that they would have to go to Teterboro or some place else, which would be a couple of hours in a taxi to get across.

At least on a VFR basis we believe that a setup of parallel strips and separate traffic patterns could logically solve this problem and increase safety. Certainly there is no safety in landing a Tri-Pacer on the same runway that a Boeing 707 uses, and often getting involved in the prop wash or jet wash of the big plane.

We have advocated this now for some years.

There are quite a few fields that already have this. No cost would be needed. The concrete desert is already there. In other words,

Idlewild has two or three runways which in at least two cases are never used; but they are there. They are adequate for light aircraft. There are taxiways there which are better than the runways at many fields, which, if they were designated as a landing area under tower control, could be used.

We have the promise of Mr. Anast, of the Research and Development Section of the FAA, that they are looking into this and will have some recommendations. I hope it amounts to something.

Mr. FREEMAN. Recognizing that accidents will occur, despite our best efforts to prevent them, we believe that the loss of life could be materially reduced, when they do occur and occupants of the plane have survived, if all aircraft were equipped with a crash-proof distress transmitter suitable for homing purposes by rescue aircraft. While some such radio units have been developed, more research and development are needed to make them economically and operationally practical for the majority of aircraft. All too often we have expended great sums in fruitless search for lost aircraft while survivors waited for rescue and died for lack of aid in time.

In Mr. Gan's recent book, "Fate Is the Hunter," when he describes the loss of Mr. O'Connor—actually not a loss, but a forced landing—without radio they would never have found that aircraft. I believe John Wayne made a movie of it at one time. But it is an interesting story. They literally had flown right over his position several times. And until he got on the air with a little emergency set, which luckily worked, they were unable to find him.

With respect to general principles, we recommend two things. First, the Federal Aviation Act should be amended as requested last year in our testimony presented by W. R. Laudenslager on January 14. This is essential if equity is to be preserved and the great power now reposed in the Administrator is to have a reasonable check upon its possible misuse.

Second, our opportunities for greatest progress in aviation safety lie in the areas of the human will. Aviation needs research on the problems of pilot training so that we may develop and utilize the most efficient combination of curriculum, training aids, and teaching techniques. With this combination we should then be more successful in producing pilots who have the skill, knowledge, judgment, and will to operate more safely. We suggest you consider recommending to the Administrator that he undertake such a research program.

This actually is the crux. We would like to stress this point.

From my own personal knowledge of many of the accidents which have happened, if not most of them, regulations don't solve this. It is teaching the man judgment and educating him to know weather.

When we consider the overall accident record and the element in which we fly, and all of its vagaries and the nature of the aircraft that we use, we really don't have such a bad accident record. Much could be done, though.

I believe Mr. Requarth the other day said something like 80 percent of the accidents are preventable. I heartily agree. Over and over we see these unnecessary accidents, simply as a result of somebody just determined to get to a business appointment, regardless of the weather and his ability.

It is this type of accident where the human will is involved that we think the greatest progress could be made in greatly improving our accident record.

Senator MONRONEY. Don't you meet yourself coming back, then, on your earlier testimony, that you want less regulation and more individual reliance? It seems to me that your association—which comprises the great pioneers of aviation and some very dedicated men, and comprises perhaps 90 percent of the teachers of aviation, the men who train the pilots of the future—should take it on itself, as they were once trained, to wash out of the minds of a lot of new flyers the idea that flying the airplane is as simple as driving your car. These things are simply not true. Certainly in perfect weather, with a perfectly functioning machine and well serviced, that could be true. But the weather won't hold still that long. And these hazards you old birds know have to be passed on to these men so that after 25, 40, or 50 hours they won't think they are red-hot pilots who can go through anything. You are the men who reach these people.

We can have all the rules and regulations in the world, but unless they are passed on as the men first begin to handle aircraft and on through the time that they receive their licenses, if it is drilled into them every hour on the hour that it takes a lot of flying and a lot of experience to get to be a weatherwise pilot, they are still not going to be safe pilots until they do understand these hazards.

Mr. FREEMAN. I couldn't agree with you more.

I am afraid that some of the sales managers occasionally let themselves get carried away, and some of the slogans that have been used in attempting to sell new aircraft I think have been misleading, and have actually gotten people in trouble.

It is our responsibility as instructors, airport operators, and managers, to do a better job in instructing and teaching these fellows the limitations of their aircraft and their own limitations, and then trying to pound some sense into them in getting them to stay out of these conditions where they get themselves killed.

Certainly it is never a good advertisement for your air service or your town or your airport when you have some prominent man go charging out in a Bonanza and clobbers himself and kills some of his friends with him quite often.

I couldn't agree with you more, sir, on that.

The point I think that I am trying to make is that we realize that more should be done and can be done in this education. But the regulations, per se, or tough enforcement doesn't necessarily stop accidents. I have the figures here for 10 years of the fatal accident rate. Despite tough enforcement, lax enforcement, at times almost no enforcement under the old CAA under a variety of Administrators, the accident rate and fatalities per year is almost a straight line.

I am merely making the point that again neither regulations nor enforcement will markedly cut down our accident rate. It must come through a policy of better education and instruction.

I think we are making progress because although the numbers have stayed steady in the 10 years, the volume of flying has gone up very decidedly. I haven't actual figures on this, but certainly our accident rate has gone down through the years, which would indicate that at least some of our safety programs are bearing fruit.

Senator MONRONEY. That is commendable, but I also attribute a certain amount of that to greater reliability of the aircraft and the more simple flying techniques that they require: slower landing speeds and squawks that go off to remind you that your wheels are not down, that you are receiving a stall and other things.

Mr. FREEMAN. They are a lot safer.

Senator MONRONEY. These things the early planes didn't have, or the war surplus planes. I think the decline is also due to the very fine maintenance that you receive from most fixed base operators, with their careful checking of the plane before it is rolled out on the line before the private flyer comes down. It is awfully hard to make any mistakes when the base operator has the plane in shipshape condition before letting it go out of the hangar. All of these have added up to the additional safety. But there is still a human element that we are some way not getting through to, and I think it is the lack of maybe that space between the 50 hours and 200 or 300 hours that finally convinces the pilot that there are certain things that he ought to stay out of.

Mr. FREEMAN. I think there again that some such program, a research program which could perhaps help us in how to reach this area, which is what we are suggesting here, could very well be a good thing for aviation safety.

I have just one or two other comments here. With respect to general principles, we recommend two things. First, the Federal Aviation Act should be amended as requested last year in our testimony presented by W. R. Laudenslager on January 14. This is essential if equity is to be preserved and the great power now reposed in the Administrator is to have a reasonable check upon its possible misuse.

Second, our opportunities for greatest progress in aviation safety lie in the areas of the human will. Aviation needs research on the problems of pilot training so that we may develop and utilize the most efficient combination of curriculum, training aids and teaching techniques. With this combination we should then be more successful in producing pilots who have the skill, knowledge, judgment and will to operate more safely. We suggest you consider recommending to the Administrator that he undertake such a research program.

Certainly there have been comments made in the past that various pressure groups were general safety. We certainly hope that this is a false conception. Certainly the men who ride in the airplanes, it is their necks, too.

I hope we have made the point that, at least so far as NATA is concerned, we realize that safety is vital to our business, and we are not in any way against it. We have been concerned with some of the regulatory philosophy of the FAA. The law says regulate, so we are going to regulate.

I think the situation has improved, particularly in the last few months in communications between industry and FAA. Certainly it has over the early months of the FAA.

Finally, we are concerned because it vitally concerns our whole industry, with the attitude taken quite often by the press and by various experts who seem to hold general aviation and private flying in some way to blame for many of our accidents. Thus we find proposals

right now being made to ban private flying from certain high density airports as an apparent direct result of the recent New York collision which general aviation by no stretch of the imagination had anything to do with.

An analogy would be to ban all highways from public automobiles in order to solve the highway traffic problem. This might make sense in a general emergency, as Mayor Wagner did recently in New York following the last snowstorm, but this approach must be strictly temporary. Any effort to solve our aerial traffic problems by eliminating traffic seems to us completely unrealistic and shortsighted and could well spell ruin for our industry. Despite all the propaganda about the crowded skies and vanishing airspace there is still a lot of room up there, and really what we need to do is work out ways to utilize it more efficiently. We think there will be more than enough room for everybody. This must involve the see and be seen concept for quite a long time to come, as we see it. At least until we can get a much simpler traffic control system than we have had today.

Finally, we can't close without thanking you for your concern and your efforts in this field of aviation. The past 2 years have demonstrated very few flaws in a law so comprehensive as the Federal Aviation Act. It is a tribute to your ability that there were not more. We also appreciate the guidance you gave to the Agency last year which did so much to open the doors to informal consultation on rulemaking matters. The situation which gave us such concern last year, as I just said, has greatly improved.

Thank you again for the opportunity to present these views.

Senator MONRONEY. Thank you, Mr. Freeman, and also for your kind remarks about the committee. I happen to have attended briefly a meeting at Atlantic City yesterday where on such a simple matter as rulemaking on carrying flight recorders, both crash recorders and conversation recorders, there must have been 150 people from industry up there talking it over before any rulemaking process was begun. I think this is rather symptomatic of the maturing, your might say, of the rulemaking process and getting the facts before you act rather than acting and then hearing the protests after the rule has been accomplished.

The new Administrator also advises that, in many cases where emergency action may be indicated, it will be taken more in the nature of a temporary injunction to correct what might be a dangerous immediate condition but still not impose it on the industry as permanent regulation until the industry can be consulted and all sides of the problem studied.

Does Mr. Monroe have anything to add?

Mr. MONROE. No, I don't.

Senator MONRONEY. Thank you very much for your help. It will take everybody working together to achieve safety, and certainly the fixed basis operators have a great opportunity in their important connection with all general aviation to be one of the principal leaders in this field.

Mr. FREEMAN. Thank you again, sir.

("Regulatory amendments affecting civil air regulation parts applicable to general aviation business in 1960," submitted by Mr. Freeman, follow:)

68755—61——66

Regulatory amendments affecting civil air regulation parts applicable to general aviation business in 1960

Subject	Effect on general aviation business		Amendment No.
	Requirements	Safety	
Airworthiness certification requirement of aircraft not newly manufactured (effective Dec. 8, 1959).	dec	n/c	1-3
Location and size of registration marks	n/c	n/c	1-4
Instrument training for private and commercial (effective)	inc	inc	20-12
Special issuance of pilot certificate	dec	n/c	20-13
Revised requirements for flight instructor certificate	dec	n/c	20-14
Revised medical standards for eyes	dec	n/c	29-3
Air carrier training programs (effective Jan. 1, 1961)			42-23
Maximum age limits			42-24
Extended compliance for oxygen on turbine aircraft			42-25
Prohibits alcoholic beverages			42-26
Oxygen on turbine aircraft			42-27
Emergency coverage for flight engineers			42-28
Recorders on turbine aircraft			42-29
Recent experience for crew members (air taxi)	n/c	n/c	42-30
Aircraft limitations for student pilots (effective Dec. 29, 1959)	n/c	n/c	43-12
Postpone effective date (small aircraft)	n/c	n/c	45-5
Postpone effective date (air taxi)	n/c	n/c	47-2
Do	n/c	n/c	47-3
Flying school curriculums and examining authority	dec	n/c	50-2
Definition of control areas (effective Jan. 1, 1960, but aborted)	n/c	dec	60-14
Absence of flight crews from stations	n/c	n/c	60-15
Extends effective date—definition of control areas	n/c	dec	60-14A
Right-o-fway—aerial refueling operations			60-16
Modification of basic VFR minimums chart	n/c	n/c	60-17
Rescission of 60-14 and 60-14A	n/c	dec	60-18
Interpretation of VFR and IFR cruising altitudes	n/c	n/c	60-19
Definition of prohibited and restricted areas	n/c	n/c	60-20
Provisional weights for Alaskan aircraft	n/c	n/c	SR 399C
Airborne weather radar—air carriers			SR 436
Cuban flight plans (effective Nov. 4, 1959)	inc	n/c	SR 437
Authority to carry 55-gallon fuel and oil drums	dec	n/c	SR 443
Jet advisory areas			SR 444

NOTE.—inc.=increase; n/c=little or no change or effect; dec=decrease.

Car draft releases issued in 1960

Subject	Effect on general aviation business		Draft release
	Requirements	Safety	
Distinction between clearances and instructions	n/c	n/c	60-1
Radar transponders and jet advisory areas			60-2
Washington Airport traffic rules	inc	n/c	60-3
Lateral obstacle clearances for turbine aircraft			60-4
Aircraft identification marks	n/c	n/c	60-5
Flight recorders in turbine aircraft			60-6
Eliminate waiver of IFR landing minimums for air carrier pilots			60-7
Redefine controlled airspace—void 60-14	dec	inc	60-8
High-altitude positive-control area in Ohio-Illinois			60-9
New York International Airport traffic pattern	inc	n/c	60-10
Loosen medical vision requirements	dec	n/c	60-11
Lower floor of continental control area to 14,500 feet	inc	inc	60-12
Part 47—air taxi	inc	n/c	60-13
Crosswind and tailwind takeoff and landing limits			60-14
Relax oxygen mask rule			60-15
Replace "beneath the ceiling"	n/c	n/c	60-16
General airport traffic rules	inc	n/c	60-17
Flight recorders in training, ferry and test			60-18
Scheduled operations outside the United States (rewrite pt. 41)			60-19

NOTE.—inc.=increase; n/c=little or no change or effect; dec.=decrease.

Senator MONRONEY. Our next witness is Mr. E. Thomas Burnard, executive vice president of the Airport Operators Council.

Mr. Burnard, we are glad to have you back again and appreciate what you and your organization have contributed not only to aviation safety but to the facilitation of air traffic control, and above all, the keen and abiding interest which you share with this committee in an adequate Federal aid to airport program.

STATEMENT OF E. THOMAS BURNARD, EXECUTIVE VICE PRESIDENT, AIRPORT OPERATORS COUNCIL, ACCOMPANIED BY ROSS A. KNIGHT, DIRECTOR OF AIRPORT OPERATORS COUNCIL TECHNICAL SERVICES

Mr. BURNARD. Thank you very much, Senator. It is always a pleasure to appear before you and this committee because we know that there is both a technical understanding and a sympathetic understanding of airports' problems and aviation's problems.

We hope that we can contribute to some of the solutions of them in our statement today.

My name is E. T. Burnard. I am executive vice president of the Airport Operators Council which is a nonprofit national organization comprised of the organizations and agencies which own and/or operate public airports. Included in our membership are those large, medium and small airport traffic hubs, as well as some of the "nonhubs," served by air carriers, which together handle more than 75 percent of the domestic enplaned scheduled air passengers and about 95 percent of the international and oversea scheduled air passengers. Our members also operate many supplementary or "general aviation" airports to serve their communities. Only two of our members are not public bodies.

The council has three non-U.S. members, but, in accordance with the council's bylaws, only the U.S. members' views have been used in the preparation of this statement.

Appearing with me today is Mr. Ross A. Knight, director of AOC's technical services. He is a man with about 2,800 hours of flying behind him, and has been with our organization for about 2 years.

We are grateful for the opportunity to appear before the subcommittee so that we may present for your consideration our views on the role of the airport in aviation safety. We will carefully examine (1) some of the fundamental concepts in aviation safety, (2) some of the problems of aviation safety in the "terminal area," and (3) make some suggestions for long-range solutions to the problems of safety, growth and development of civil aviation.

These are as follows:

AIRPORTS AND AVIATION SAFETY

I. FUNDAMENTALS OF SAFETY

A. Role of the airport in the air transport system.
B. Safety record of civil aviation.
C. The basic safeguards in aviation safety:
    Aircraft operating safeguards.
    Ground environment safeguards.

II. THE TERMINAL AREA PROBLEM

A. Accidents in the terminal area.
B. Terminal area facilities:
Terminal area defined.
Responsibility for terminal facilities.
Financing terminal facilities.

Support of Terminal Area Facilities

C. Problems in the terminal area and what's being done about them.
Landing—
1. Midair collisions in the terminal area.
2. Outer marker to middle marker.
3. Middle marker to runway landing threshold.
4. Runway landing threshold to taxiway.
Takeoffs—
1. Weather conditions.
2. Birds.
Other—
1. Aircraft fire and rescue protection.

III. LONG-RANGE SOLUTIONS

1. Better systems planning.
2. Greater airport capacity.
3. Additional approach and landing aids.
4. Integrated planning for the supersonic age.

I would like to briefly highlight what we have to say about the fundamentals of safety because sometimes I think those of us engaged in daily activities in this business get so close to the problems that we overlook some of the more fundamental things that do govern our activities.

In particular with respect to the airport, which is an integral part of the air transport system, we have different types of ownership in the different elements of aviation, which might be worth mentioning briefly now.

I. FUNDAMENTALS OF SAFETY

A. Role of the airport in the air transport system

The airport is an integral elements of the air transportation system, being the place from which and to which all flights operate.

The equipment used in the air transportation system and the facilities that make it possible, however, have different types of ownership.

The aircraft operators, whether operators of private, business or airline aircraft, are either private citizens or private enterprise corporations operating for profit.

The public airports serving air commerce in the United States are almost 100 percent local, State, or National Government owned and operated. Each airport operator is therefore a form of public agency rendering a public service on a local basis as part of a national and international system.

Likewise, the airways system and the air traffic control system in which the aircraft operates are provided by a Federal public agency as part of a national and international public service.

To this extent, air service in the United States is similar to highway service. The private enterprise truckers and bus lines as well as private motorists operate over highways provided by public agencies.

There are very modern airports just as there are very modern high-

ways. There are also older, less well-developed airports, just as there are older, less streamlined highways. But whether the airport is new or old, large or small, its existence and condition is a known factor by those who use it, just as the motorist, buslines, the trucklines, and the private motorists know the conditions of the highways they use.

The reliability and efficiency of air service, as well as highway service, is greatly dependent upon the existence and condition of the facilities that are available. Running time between two cities on a highway, for instance, is dependent upon whether or not the road is narrow, curving, hilly and crowded, or whether it is level, straight, smooth and capable of handling all those who want to use it.

Safety of air service, as well as safety of highway service, is dependent to a very high degree on the operating rules for the use of the airports and highways, and upon the adherence to operating rules by the individual pilots and the individual motorists.

On highways, a congested, curving highway usually has restrictive speed limits so that traffic is delayed; but it moves safely. If an individual motorist, bus driver or truck driver foolishly violates the operating rules or uses bad judgment and is reckless, he not only jeopardizes the safety of himself and others, but he also risks injury and punishment himself. The same is true in the air.

At airports which do not have complete instrument landing systems and have insufficient runways and terminal building facilities to handle all the aircraft and people wishing to use it at the same time, the aircraft are delayed by air traffic control but the safety of operations is assured by restrictive operating minimums by certificating into these airports only those aircraft which can operate from the available runway lengths and by ensuring an adequate airspace separation between aircraft.

Thus, with the increase in capacity of airports, just as with the increase of capacity in highways, reliability and efficiency are automatically improved and the level of safety is enhanced.

We strongly and urgently recommend increasing the capability of our national system of airports to adequately handle the needs of civil aviation today and in the future, and we know that safety, reliability and efficiency in air service will result.

Because of the tremendous amounts of money needed to build a national airways system, a national system of airports or a national system of highways, everything that is desirable to do cannot be done all at once.

Airport operators in the United States—that is, the local and State governments which own and operate most of the public airports—have done a tremendous job of trying to provide the facilities necessary to the safe, reliable and efficient flow of air transportation. It is a monumental task, however, which, during the explosive growth years of civil aviation cannot be done by local governments alone.

Technical guidance, research and financial assistance from the Federal Government has been sporadic and inadequate, however, during the past decade of aviation's growth.

We hopefully look forward in the decade of the sixties to a more realistic and comprehensive recognition by the Congress and the executive branch of the importance of the role of airports in our modern air transportation system.

B. Safety record of civil aviation

The only completely safe airplane is in the hangar—if the hangar does not burn up or blow down. The dynamic forces brought into play by the flight of an aircraft automatically produce an element of risk. This is no different than an automobile, a ship, a train, a bicycle or a kiddie car.

Without repeating here the excellent safety record of aviation based upon the total exposure, the wonder of the airplane—which operates in three dimensions instead of the usual two, and at speeds from 2 to 10 times as fast as automobiles—is that it is built, operated and used in such volume as to cause as few deaths, injuries and property damage as has resulted.

The philosophy was concisely put by the report of the President's Airport Commission in 1952 as follows:

> The American public accepts the calculated risk of transportation accidents as an inescapable condition to the enjoyment of life in a mechanical age * * *. However—

it continued—

> the public expects and cooperates to obtain a continuing diminution of avoidable accidents so as to narrow the gap between relative and absolute safety.

The spectacular aviation accidents in the last year or two tend to overshadow temporarily the basically good safety record aviation has developed.

As pointed out by the airlines' spokesman, Mr. S. G. Tipton, president of the Air Transport Association, however, "safety is an accumulative process; it does not start or stop on signal."

It is a goal all of us engaged in aviation strive for every minute of every day—it is only our human limitations of ingenuity and our financial limitations on doing all we would like to do that retard an even better safety record.

C. The basic safeguards in aviation safety

The build-in safeguards of safety in aviation are almost too comprehensive and complex to even attempt in a summary such as this. Broadly speaking, however, they can be classified as follows:

1. Safeguards of the aircraft—its design, construction, and maintenance.
2. Safeguards of the aircraft operation—the conditions under which aircraft operations are permitted; the rules of the road, and the limitations placed on those who transport passengers and cargo for hire.
3. Safeguards of the people directly related to the operation and maintenance of aircraft—the pilots, flight engineers, dispatchers, mechanics, and air traffic controllers, among others.
4. Safeguards of the air environment—the air traffic control procedures, navigational aids, communications services, and weather services.
5. Safegaurds of the ground environment—the airport and its environs.

A brief examination of these safeguards should indicate how a high level of safety of the total air transport service is assured by an intricate, almost exhaustive interlocking of checks, doublechecks, crosschecks and fail-safe devices and procedures. For example:

The aircraft safeguards are embodied in parts 1 through 18 of the Civil Air Regulations, the related civil aeronautics manuals, the FAA technical standards, policy letters, and airworthiness directives. These are supplemented by certification tests of airworthiness and manufacturer's aircraft manuals.

The aircraft operating safeguards are grouped in parts 40 through 49 of the Civil Air Regulations, together with the numerous manuals, standards, letters, specifications, and so forth. These are supplemented by air carrier operating manuals, flight information manuals, and other directives.

The safeguards on people are contained in parts 20 to 35 and 50 to 54 of the Civil Air Regulations and related documents. They are also supplemented by company qualifications and manuals.

The air environment safeguards are contained in the "Federal Airway Plan" and the internal specifications and procedures of the Federal Aviation Agency by which it develops, procures, installs, operates, and maintains and continuously checks the facilities needed to produce a safe environment in the air.

The ground environment safeguards are embodied in parts 550 to 580 of the Regulations of the Administrator; in the 27 technical standard orders currently applicable to airports; in the numerous FAA airport planning documents; in the FAA engineering data sheets; in the FAA standard specifications for construction of airports; in the national airport plan; in the approval of individual airport master plans; in the FAA airport policy and procedures letters; in the inspections and FAA approval of every increment of an airport construction project; in the FAA records of airport facilities, and the periodic inspections by which these records are kept up to date, among others.

In the interest of time, we will not discuss in detail the safeguards of aircraft, people and air environment, but will concentrate on the aircraft operating and ground environment safeguards.

Aircraft operating safeguards. The aircraft operating regulations promulgated by the FAA under the authority of the Federal Aviation Act are comprehensive in scope and thorough in detail. Domestic airline operations are conducted under part 40 of the Civil Air Regulations with respect to basic operating rules, and under part 60 of the Civil Air Regulations for air traffic rules.

The operating regulations specify the many variables that must be taken into account for operation in and out of civil airports. They also include a reasonable margin of safety for such eventualities as mechanical failure and/or human failure. Operations conducted in conformance with all applicable FAA operating regulations must therefore be considered safe.

The regulations provide, for instance, that the air carriers' FAA-approved "Operating Specifications" must specify in detail each aircraft which is authorized into each airport, and the limitations of gross weight, ceiling and visibility, and any other limitations which are applicable.

Other variables must be taken into account such as altitude, runway gradient, temperature, wind and performance of the aircraft.

The regulations provide further that:

Airports.—The air carrier shall show that each route has sufficient airports found by the Administrator to be properly equipped and adequate for the type of operations to be conducted. Consideration shall be given to items such as size, surface, obstructions, facilities, public protection, lighting, navigational and communications aids, and traffic control.

The carriers are also required by regulation (CAR 40.50) to provide an "Operations Manual" for use by flight and ground operations personnel which includes, among other things (CAR 40.51):

(7) Appropriate information from the airport operations specifications, including for each airport its location, its designation (i.e., regular, alternate, provisional, etc.), types of airplanes authorized, instrument approach procedures, landing and takeoff minimums, and other pertinent information,

(8) Takeoff, en route, and landing weight limitations,

* * * * * * *

(12) Procedures for determining the usability of landing and takeoff areas and for dissemination of pertinent information to operations personnel,

* * * * * * *

(14) Airman training programs, including appropriate ground, flight, and emergency phases,

* * * * * * *

(20) Pilot and dispatcher route and airport qualification procedures,

* * * * * * *

(22) Other data or instructions related to safety.

CAR's 40.70, 40.71, 40.72, and 40.77 deal with aircraft weights and ability to take off and land safely.

"CAR 40.77: Landing distance limitations; airport of destination" provides that:

No airplane shall be taken off at a weight in excess of that which, under the conditions stated in this part would permit the airplane to be brought to rest at the field of intended destination within 60 percent of the effective length of the runway from a point 50 feet directly above the intersection of the obstruction clearance plane and the runway * * *.

(*a*) It shall be assumed that the airplane is landed on the most favorable runway and direction in still air.

"CAR 40.91: Takeoff limitations" provides that:

No takeoff shall be made at a weight in excess of that which will permit the airplane to be brought to a safe stop within the effective length of the runway from any point during the takeoff up to the time of attaining 105 percent of minimum control speed or 115 percent of the power-off stalling speed in the takeoff configuration, whichever is the greater.

Of the many other operating safeguards there are those relating to "Pilot route and airport qualifications" (CAR 40.303), "Maintenance and reestablishment of pilot route and airport qualifications for particular trips" (CAR 40.304).

Others include the air carrier's responsibility for "Operational control" (CAR 40.351) and the "Responsibility of pilot in command" (CAR 40.351(c)).

Adherence to "the instrument approach procedures and weather minimums authorized in the operations specifications" are required by CAR 40.364.

The stringent weather requirements of taking off and landing are detailed in:

"CAR 40.405: Takeoff and Landing Weather Minimums—VFR," and "CAR 40.406: Takeoff and Landing Minimums—IFR."

The regulations (CAR 4b.740 and 4b.743) also require the manufacturer to produce an FAA-approved airplane flight manual for each type of aircraft which shows the runway length and all pertinent performance data for the application of the air carrier's operating rules.

If air carrier operations are conducted in accordance with these, and the other appropriate regulations, then the FAA considers that an adequate level of safety is achieved to permit such carriers to transport people and things in air transportation.

I have just discussed specifically the regulations which are applicable to air carrier operations into and out of civil airports, which are detailed, comprehensive, and, when completely followed, are intended to assure the level of safety which the FAA has set forth.

The ground environment safeguards, the built-in safeguards of airport location, design, construction, operation, and maintenance are about as voluminous as those of aircraft operations. They are contained in the basic statutes, regulations, standards, policies, procedures, specifications, inspections, and "guide" which pertain to airports.

The Federal Airport Act requires that the Administrator prepare a national airport plan specifying the projects considered to be necessary to provide a system of public airports adequate to anticipate and meet the needs of civil aeronautics.

Airports not included in the national airport plan cannot receive financial assistance from the Federal Government under this law.

Since there is Federal Airport Act money invested in practically every airport in the United States which is used by the airlines and by much of general aviation, the following is therefore applicable to most airports.

The airports of this country, which are used by civil air carriers, particularly, have practically all received some form of Federal aid in various amounts. So that all of the many safeguards and inspection procedures and approvals which are built into the total Federal airport program are applicable to practically all of these airports.

The act requires that, as one of the conditions precedent to obtaining Federal funds, the airport sponsor must assure in writing that "such airport and all facilities thereon or connected therewith will be suitably operated and maintained". This is further elaborated in part 550 of the Administrator's regulations and in the contractual arrangement between the Federal Government and the airport sponsor known as the grant agreement.

In the agreement, the sponsor agrees—

> to operate and maintain in a safe and serviceable condition the airport and all facilities thereon and connected therewith which are necessary to serve the aeronautical users of the airport.

The regulations as well as the grant agreement also require that the FAA approve an airport master plan as a condition precedent to approval of expenditure of Federal funds on any projects at these airports.

Further, every project must be FAA-approved in detail, in advance of an allocation of Federal funds, and each step must be inspected and approved many times during construction, and then a final inspection and approval is made before the contractor can get paid.

Thus, every airport in which Federal funds are expended is approved by the FAA in every step of design, engineering, and construction. Federal funds are withheld if it doesn't comply with every applicable regulation, technical standard order, policy or procedure; and in addition the airports are subject to routine daily and weekly inspections by airport operators and regular inspections by FAA district airport engineers and FAA flight safety inspectors.

And, just to doublecheck, each airline has its own staff of people who check the airports regularly for compliance with company rules and procedures. And, of course, the pilots who fly into the airports are not a bit bashful about saying what they think can be done to improve them. FAA tower operators are also in a position to make constant surveillance of airport conditions.

The sum total of this approval, inspection, check, and doublecheck adds up to one of the most complete systems of safeguards of aviation facilities imaginable.

We doubt if there are more people and agencies looking at any other single facility in aviation than approve, inspect, check, and report on the airports.

There have been some suggestions that airports now be certificated. We think this is both unnecessary and undesirable. Everything that might be achieved by certification is now being accomplished by the safeguards on airport construction and operation combined with the other safeguards on aircraft operations, aircraft, people, and air environment.

The expressed intent of the Congress is one of Federal encouragement to local governmental units to build and operate airports necessary to the promotion and development of civil aeronautics.

We believe that all of our efforts should be devoted to the encouragement of airport development, not to ensnare it in fruitless bureaucracy.

We now come to the area as such.

We have found this just a little confusing in trying to analyze some of the testimony with respect to what is the terminal area.

II. THE "TERMINAL AREA" PROBLEM

A. Accidents in the "terminal area"

The "terminal area" to an airline passenger means the building at an airport where he checks in and boards an aircraft for a flight, or, conversely, the place where he debarks, picks up his baggage, and gets his ground transportation.

The terminal area to the captain of a jetliner flying a transcontinental or intercontinental run means a point anywhere from 50 to 150 miles from his destination airport when he and the rest of the crew take another notch in the seat belt, loosen their ties a little, and start running through the check lists and procedures for letting down, check points, holding points, approach procedures, missed approach

procedures, altimeter settings, weather reports, and in general get ready for the precision flying to the airport.

To other airline pilots and to business and private pilots as well as others in aviation, the terminal area is somewhere between these extremes.

So we have had many seemingly inconsistent figures quoted about accidents in the so-called terminal area.

Thus, it is not surprising to hear one segment of aviation testify that "80 percent of all accidents occur in the terminal area," while others say that "46 percent of the air carrier accidents occurred during landing"; or that "30 to 35 percent of airline accidents in 1960 occurred in the terminal area"; or even that "12 percent of the accidents occurred on approach."

Until more definitive areas and terms are established for this purpose by the appropriate Government agency or agencies, it is a little futile trying to analyze the various claims and counterclaims that have been made on where accidents happen.

Evidence that is more readily understandable takes account of some of the basic facts of aviation, however.

The first of these basic facts is that as air traffic funnels into and out of airports there is a higher concentration of aircraft in a relatively smaller amount of air space.

The second basic fact was emphasized by FAA Acting Administrator Pyle when he said that, "It is obvious that takeoff and landing are probably that part of the operation that requires the greatest precision. Naturally, your exposure is greater there. I do not think anyone will deny this, so, therefore, you are going to have more accidents in the terminal area. It is just a matter of logic."

Looking at the problem from a functional rather than geographic standpoint, the Civil Aeronautics Board testified that the accidents in 1959 were attributable as follows: 47 percent to operational errors; 35 percent to faulty maintenance, and 18 percent to other causes.

FAA Administrator Quesada testified in 1960 that approximately 50 percent of the air carrier accidents in 1959 were attributable to error or failure on the part of the flight crew; slightly less than 25 percent attributable to faulty maintenance; approximately 18 percent resulted from failure of some part of the aircraft itself; and 8 percent resulted from encountering heavy turbulence.

As to 1960 accidents, the Civil Aeronautics Board has testified that there are no trends as to serious deficiencies in particular areas. According to their views, each of the accidents in 1960 seems to have little or nothing in common with the others.

The testimony this year has indicated that the pattern is not a great deal different from that of the preceding year which had been analyzed.

ATA's President Tipton also testified to the effect that, "It does not appear to us that the accidents which occurred in 1960 fall into a pattern. In the absence of any such pattern the industry cannot pick out any one area for corrective action. The program must cover the entire operation."

This conclusion is consistent with that reached by an aviation magazine editor after the Senate air safety hearings in 1960 when he said of the 1959 accidents:

> Was there a pattern to last year's air carrier accidents? The committee got a different story from each witness. ATA president, S. G. Tipton, said there was no pattern. C. N. Sayen, president of ALPA, conceded there was "no single cause or trend" but sought to show most accidents were connected with approaches to airports. ALPA pressed strongly for correcting the "inadequacy of terminal airport facilities."—W. G. Osmun, editor, Business/Commercial Aviation, March 1960.

In its second annual report to the Congress this year, the Federal Aviation Agency has again stated that human errors and limitations continue as the single greatest cause of aircraft accidents.

We do not mean to imply that accidents do not occur in the area known by pilots as the terminal area, but we think it's important to clearly distinguish between—

(*a*) airports and other ground facilities which remain relatively stable; and

(*b*) airplanes and the people who control them, which, if misguided, move quickly to destruction.

We also believe that a much more scientific analysis of the causes of accidents by the responsible Federal agencies will aid the cause of safety not only to detect true causes, but also to dispel much confusion and misinformation about causes.

The most comprehensive and scientific analysis of the approach and landing accidents of which we are aware has been prepared by the Flight Safety Foundation. They have carefully studied each of the accidents and incidents involving aircraft from the outer marker to the runway—about 5 miles—during the period 1946 to 1958.

They report 437 air carrier accidents which occurred throughout the world during this 12-year period, or about 1 fatal accident per 2.7 million lands per year. The Flight Safety Foundation reports causes of accidents in this 5-mile area as follows, in order of number of accidents:

Landing gear malfunction	153
Errors in IFR operations before reaching middle marker	79
Overshoots	79
Stalls and upsets on runway	71
Undershoots	41
Inflight collisions on approach	11

The study also determined that an average of about 25 percent of the U.S. air-carrier incidents and accidents during the 1946–58 period occurred in the area from the outer marker to the runway.

The study also shows that during the period 1946 through 1958, of the 39 incidents involving passenger-carrying aircraft which struck ground objects because of being below the ILS glide path or at an elevation below procedure limits, 21 happens from 1 to 18 miles from the runway threshold, 18 happened within 1 mile.

It was also found that at the relatively few large airports which handle 50 percent of the air-carrier business there were only half as many accidents as at the rest of the airports, which led to the observation that this "cannot help to establish the lack of approach aids as partially contributing to the incident/accident history."

The 1959, 1960, and 1961 terminal area accidents do not appear to vary significantly from the previous record.

B. TERMINAL AREA FACILITIES

What are they? Who is responsible for them?

A discussion of terminal area facilities necessitates first a definition of "terminal area."

As I said, the phrase "terminal area" seems to mean different things to different people. To give some idea for the record of the area that we seem to be talking about: When an aircraft leaves even route control on a flight, it enters approach control at a point which is usually a navigational fix somewhere in the neighborhood of 20 to 50 miles away from any large metropolitan area, and then continues on to the outer marker or at least the last point of holding under approach control, at which time it is turned over to the FAA airport control.

Incidentally, all of these controls are part of the FAA's air traffic service.

The so-called airport control, which begins at about the outer marker, continues down to the point of touching the runway, and then the FAA's ground controller takes over and guides the aircraft to the ramp.

So that we seem to be talking about the area from the outer marker into the ramp so far as we have been able to discern in most of the conversations.

Terminal area defined: From an air traffic control viewpoint, which is the one usually used also by the pilots, the terminal area varies in size in accordance with the complexity of the air traffic situation at a particular airport or complex of airports.

In large metropolitan areas served by one or more airports, the terminal area may extend 20 to 50 miles out from the airports.

Some idea of the area and the problem may be gotten from a hypothetical flight from Airport A to Airport B.

From Airport A, the point of departure, out to a point as much as 20 miles away, the airport will be under FAA air traffic service departure control.

For the major distance of the flight after leaving departure control, the aircraft will be under FAA air traffic enroute control.

Enroute control responsibility continues until it turns the aircraft over to FAA air traffic service approach control at a prearranged point, varying in distance from 20 to 50 miles from Airport B, depending upon the size and complexity of the local air traffic terminal area.

Approach control continues its responsibility for guiding the aircraft from the point where it picked it up from enroute control to the point where it authorizes the aircraft to descend from the lowest instrument altitude for final descent to the runway. This is usually at the outer marker which is about 5 miles from touchdown. The aircraft is then turned over to FAA air traffic service airport control.

Airport Control of the FAA has the responsibility for guiding the aircraft to the runway and on to a taxiway turnoff at which time the aircraft is turned over to FAA Ground Control for guidance to the ramp.

During all of the flight operations from the time the aircraft leaves the runway at Airport A on takeoff until it touches down again on the runway at Airport B, it is using Federal navigational aids, Fed-

eral communications services, Federal air traffic control procedures, Federal radar service, Federal instrument landing systems, Federal approach lights, and in the near future, Federal visual glide path indicators.

For purposes of defining terminal area in its relationship to airports, we will confine our attentions to that area from approximately the outer marker to the terminal building—a distance of 5 to 6 miles in most cases. We have shown this pictorially in figure 1, "Approach Area Facilities," and figure 2, "Airport Facilities" attached.

We have here what is not a commercial draftsman's drawing but what presents in quite the proper scale the various facilities and devices and boundaries and areas that might be included in the so-called terminal area.

(The map follows:)

Mr. FREEMAN. This starts, as you will notice, from the last holding fix or other navigational aid coming in en route, processing through the outer marker, the middle marker, down the approach light lane, and on to runway and up to the parking area.

In other words, we define the terminal area as that geographical area extending from the point at which the aircraft is cleared to descend from its lowest en route altitude or to leave the holding fix until it comes to a stop at the airport terminal building.

That portion of the terminal area which is outside of the airport boundary we call the approach area. This is trapezoidal in shape and is about 4 miles wide at a distance 10 miles from the airport, narrowing laterally to about 1,000 feet at the approach end of the runway. It is set forth in detail in FAA Technical Standard Order N18.

The airport boundary and the approach area may overlap to the extent that the airport has purchased the land in the clear zone, which is a smaller trapezoid at the runway end of the approach area extending about one-half mile outward from the end of the runway. The land for approach lights is also in this clear zone area and in the case of a 3,000-foot light lane will even protrude out a little farther than one-half mile from the runway threshold.

Responsibility for terminal facilities: It is within this terminal area that there are currently responsibilities for facilities which are (1) exclusively those of the Federal Government, (2) a joint responsibility between the Federal Government and the airport operator, and some are (3) undetermined but under discussion.

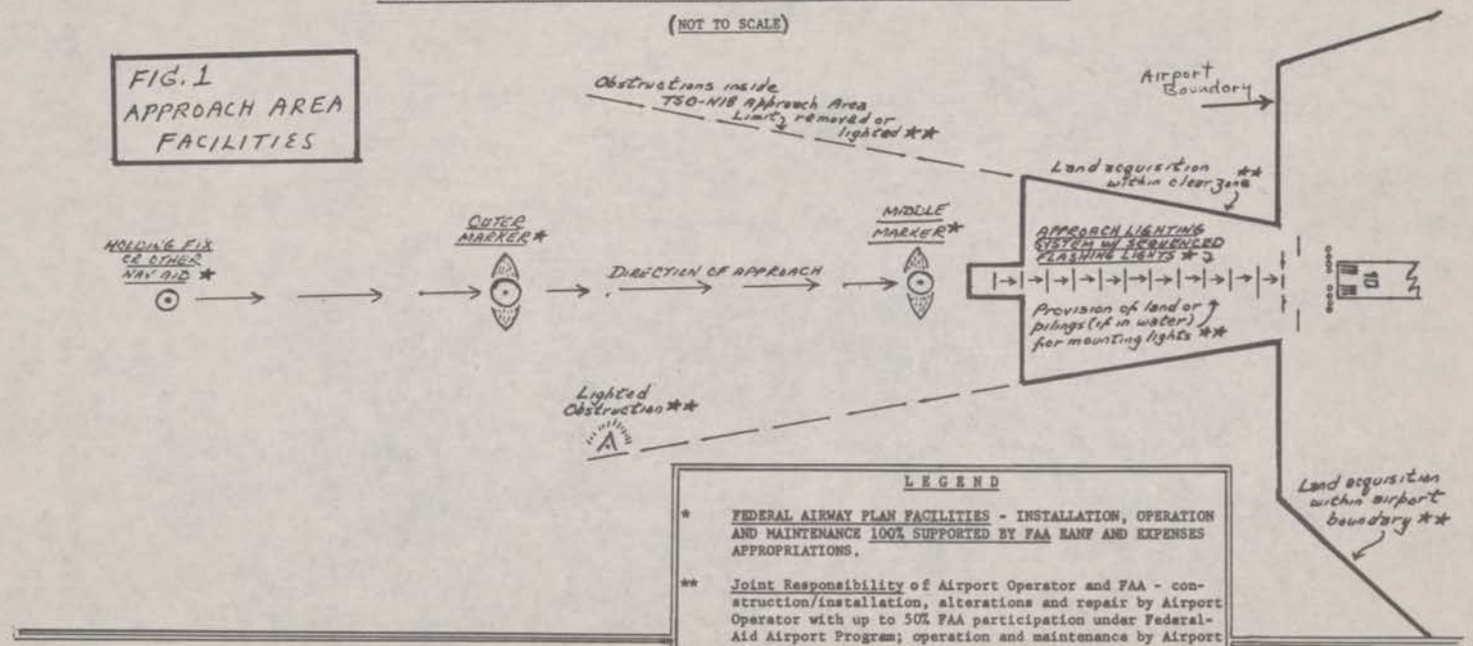
1. The facilities in the terminal area which are exclusive Federal responsibility include:

(*a*) Air traffic control service.
(*b*) Air navigation facilities (e.g., holding fix or last en route aid).
(*c*) Airport surveillance radar.
(*d*) Instrument landing system.
(*e*) Precision approach radar.
(*f*) Approach lighting systems—fixtures.
(*g*) Visual glide path indicators.
(*h*) Runway threshhold lights.
(*i*) Runway end identification lights.
(*j*) Runway visual range measuring equipment.

DIAGRAM OF TERMINAL AREA FACILITIES AND RESPONSIBILITIES IN CONNECTION THEREWITH

(NOT TO SCALE)

FIG. 1
APPROACH AREA FACILITIES



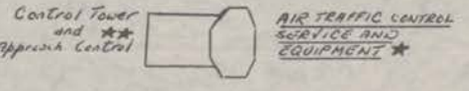
LEGEND

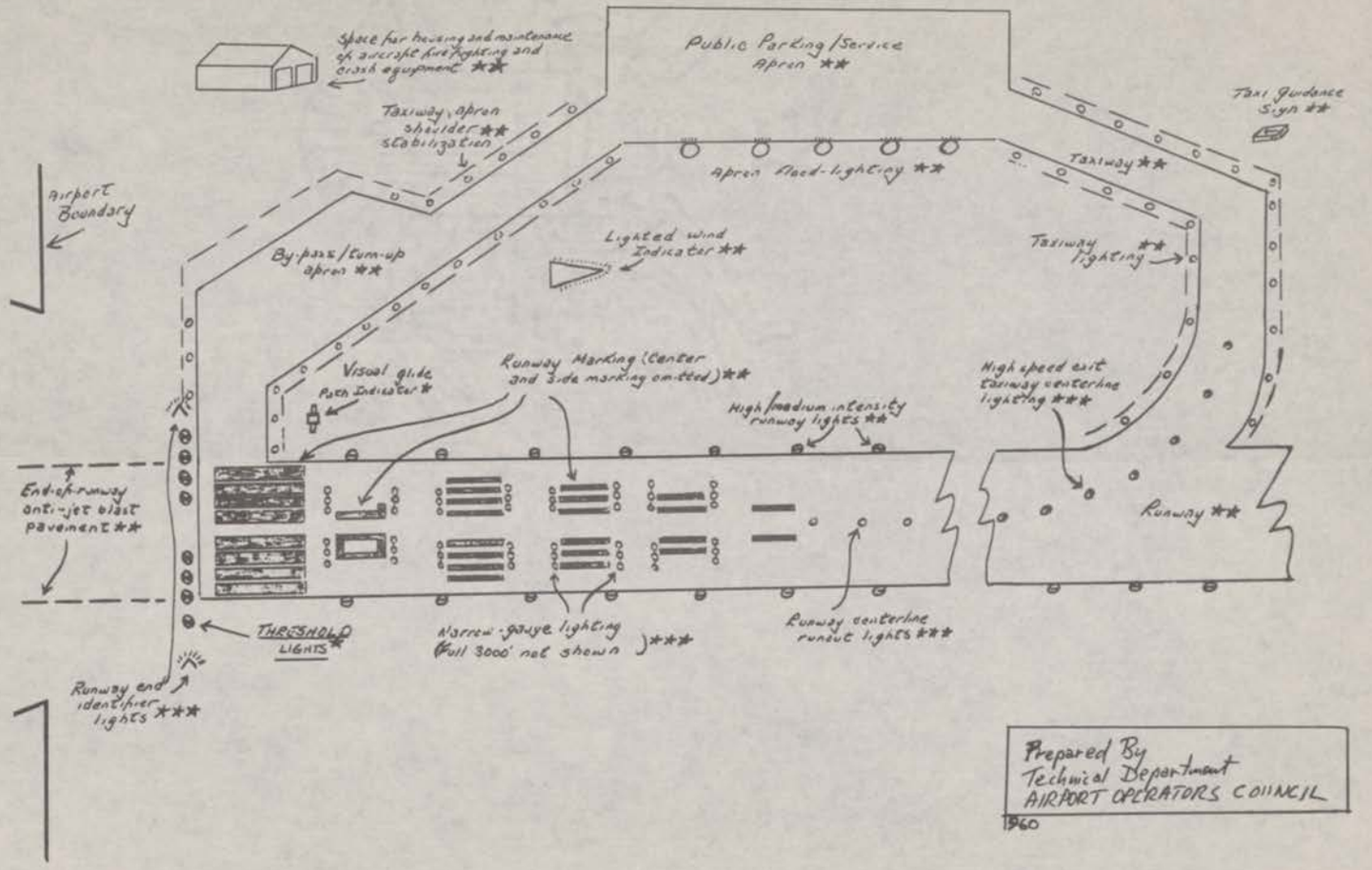
* FEDERAL AIRWAY PLAN FACILITIES - INSTALLATION, OPERATION AND MAINTENANCE 100% SUPPORTED BY FAA RANF AND EXPENSES APPROPRIATIONS.

** Joint Responsibility of Airport Operator and FAA - construction/installation, alterations and repair by Airport Operator with up to 50% FAA participation under Federal-Aid Airport Program; operation and maintenance by Airport Operator.

*** Responsibility overlapping or not yet established.

FIG. 2
AIRPORT FACILITIES





Prepared By
Technical Department
AIRPORT OPERATORS COUNCIL

1960

2. The facilities which are the joint responsibility of the Federal Government and the airport operator include, at the present time, the buildings in which the air traffic communications and weather services are conducted, and the land on which the radars, the ILS components, the approach lights, threshold lights, visual glide path indicators and other landing aids are normally installed.

More specifically, control towers are usually constructed to Federal specifications by local airport management with financial particpation up to 50 percent by the Federal Government and the airport operator include, at the present time, the buildings in which the air traffic communications and weather services are conducted, and the land on which the radars, the ILS components, the approach lights, threshold lights, visual glide path indicators and other landing aids are normally installed.

More specifically, control towers are usually constructed to Federal specifications by local airport management with financial participation up to 50 percent by the Federal Government under the Federal Airport Act when funds are available.

Land acquisition for landing aids is provided by the airport management with Federal financial participation under the Federal Airport Act when funds are available. Most land acquisition is eligible for up to 50 percent of cost.

It is the Federal Aviation Agency, however, which determines under their standards and policies: (a) what airports will get, (b) which terminal aids, (c) at what time. This is carefully blueprinted in the Federal airway plan prepared by the FAA on a 5-year basis and revised annually.

3. Facilities for use in the terminal area still in the category of undetermined so far as need and financial responsibility are concerned include the following which are being evaluated by the FAA as to their practicability, usefulness, or relative merits of similar types of equipment:

(*a*) Narrow gage lighting;
(*b*) Runway centerline lighting;
(*c*) High-speed exit taxiway centerline lighting;
(*d*) Approach light cantact height (ALCH) measuring devices; rotating beam ceilometer and illuminometer;
(*e*) Aircraft arresting or decelerating devices.

The Airport Operators Council has monitored closely the progress of the FAA's research and development on these subjects and expects that decisions will be made when FAA evaluation is complete.

Financing terminal facilities: Federal responsibilities, administered by the Federal Aviation Agency with funds as appropriated by the Congress, are carried out under the two programs listed below:

1. The Federal airway plan is the planning guide for the establishment, operation, and maintenance of all elements of the Federal airway system. Within the terminal area thereof are included all navigational facilities and air traffic control services used by the aircraft from the time it enters the terminal area until it crosses the runway landing threshold, as well as the electronic and communication ground traffic control facilities utilized in directing the aircraft to the ramp. These facilities are 100-percent federally sponsored; initial establishment is sponsored by the FAA's "Establishment of air navigation

facilities" (EANF) appropriation, and subsequent operation and maintenance under the FAA's "Expenses" appropriation. Thus, the amount of facilities provided under the Federal airway plan is completely dependent upon congressional appropriations.

2. The Federal-aid airport program provides a vehicle by which the airport operator and the FAA, on a one-way matching basis—the Federal Government will match local funds for isolated individual construction projects but it almost never matches 50 percent of the total cost of airport development—jointly assume responsibility for the acquisition/construction, or improvements of physical facilities within the boundaries of the airport. Thereafter, the airport operator is solely responsible for operation and maintenance, including incidental or minor repairs. The facilities participated in by the Government under the Federal-aid airport program are affected by congressional action, but to a lesser degree than Federal airway plan facilities because the public agencies which operate the airport contribute substantially to Federal-aid airport program projects, have historically borne the lion's share of the cost.

The way these plans and programs are administered by the FAA is that one bureau of the FAA, the Air Traffic Management Bureau, will develop most of the requirements for the Federal airway plan; another bureau, the Bureau of Facilities and Materiel, has the responsibilities for the budgeting and installation of that.

The Bureau of Facilities and Materiel also has within it an Airports Division in which most of the details of administering the Federal-aid airport program are handled. Both of these programs have suffered in the past from a lack of funds to do all that the FAA would like to do, and certainly a lack of funds to do all that pilots, airlines, and airport operators would like to see done. The effect of this inadequacy, I might detail as follows:

Effect of inadequate Federal funds in support of terminal area facilities.

1. Federal airway plan: Recognizing that budgetary levels will always determine the amount of facilities provided, the FAA provides criteria for facilities so financed; these criteria are based upon providing the most service for the greatest number of people. As a result, those terminals with the most heavy air traffic are usually the first to receive the most advanced terminal navigation aids. These criteria are contained in airway planning standard No. 1 and are in terms of airport traffic volume, with numerical limitations on specific components so as not to, for instance, expend the whole EANF funds on costly $800,000 airport surveillance radar sets and have no money left for less expensive omni installations.

2. Federal-aid airport program: The amounts of money available under this program have been historically inadequate to meet the needs. Additionally, these funds have vacillated from a low of zero in one year to the present high of $63 million for distribution to 50 States, Puerto Rico, and the Virgin Islands.

Although the cost of acquisition of certain land, construction of runways, taxiways, et cetera, are eligible under the law for Federal participation, actual expenditure is based upon the priority rating of a particular project and the existence or adequacy of Federal funds available. It is almost impossible for airport operators to know in

advance, however, whether the Federal Government is in fact going to share in this cost since, even when Federal-aid airport program funds exist, each project at each airport must compete for priorities and money with every other project at every other airport in the United States. Both financial and technical planning by airport operators is therefore handicapped and must be done on the basis that there may be no Federal participation in a particular project.

3. Airport support of improved facilities: Airport operators are strong advocates of increased appropriations for terminal navigation aids. One evidence of this is contained in the comments of the Airport Operators Council to the FAA on the recent revision of the airway planning standard No. 1 when we said:

> In general, members of AOC commenting on this proposal have expressed the view that FAA budgetary considerations appear to inhibit criteria which otherwise would more accurately reflect the need for reliable and adequate navigational aids in the terminal areas near airports.
>
> We believe that these draft criteria should be relaxed so far as eligibility is concerned although we recognize that priorities have to be established for the expenditure of the available funds (which are historically less than needed to do a complete job). A more liberal approach to the airway planning standards would have the added feature of making it apparent that one of the limitations on reliability of air travel is that placed by the Congress itself, through budgetary restrictions.

Airport Operators Council representatives have repeatedly testified before the Congress with reference to the need for more funds for Federal participation in the Federal-aid airport program.

Airport operators also have, conditions permitting, gone ahead with increased reliability projects without Federal support. Examples are the runway end identifier lights at Chicago-Midway and Los Angeles International Airport, and narrow-gage, runway centerline and high-speed exit taxiway centerline lighting on runway 4R–22L at New York International Airport. Few airports are capable of doing such things because they are facilities on which the FAA has not yet developed a standard and because they are expensive.

We now get to the problems in the terminal area, and what is being done about them.

The Federal Aviation Agency has testified at length about the various research and development programs, and their current operating programs relating to air traffic control, ground facilities, and flight standards designed to improve safety of operations both in and out of the terminal area.

The Air Transport Association has outlined the steps being taken by the airlines to improve safety in the operation of the aircraft.

The Air Line Pilots Association, which has been the most critical of terminal area facilities, recognized, however, that most of the facilities necessary—

> to move aircraft safely and efficiently from the ramp of a departure airport to the ramp of a destination airport * * * are the responsibility of the Federal Government.

They add—

> there is not much logic in building an efficient air traffic system between two airports and leaving a bottleneck at both ends.

Based on its own survey of so-called terminal area "inadequacies," ALPA has also concluded that "financial requirements are the major stumbling block to improvement."

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Incidentally, Mr. Chairman, the ALPA survey was the subject of considerable discussion in this hearing. We have prepared a little analysis of some of the results of that survey. If you would like to have it for the committee's use we would be glad to provide it to you.

Senator MONRONEY. We would welcome it.

Mr. BURNARD. Thank you, sir.

With this we agree, and wish to emphasize again the great need for developing an adequate airport system compatible with the capacity of the airways system in order to assure not only the safety, but also the reliability and efficiency of air transportation. This system begins at the terminal building at the departure airport and ends at the terminal building of the destination airport.

What are some of the greatest problems in the terminal area and what is being done about them?

For this purpose we will divide the problem areas into those relating to the landing operation, the takeoff operation, and others.

(The analysis survey follows:)

ANALYSIS OF ALPA AIRPORT SURVEY

The survey was started in November 1959, with an original deadline for completion of May 31, 1960. Cooperation of the Airport Operators' Council and the American Association of Airport Executives was solicited in December 1959. AOC members were advised that the survey was being conducted, and we also asked our members for copies of the completed survey forms for individual airports.

The May 1960 deadline is now 10 months past and the ALPA survey is, roughly, 50 percent completed, according to ALPA President C. L. Sayen. Whether this delay is due to indifference on the part of ALPA members or due to lack of time for individuals to complete the survey conscientiously, particularly for the larger airports, is not known. What is known is that of the 45 large- and medium-hub airports which are OAC members, only 2 have reported being surveyed by ALPA representatives. Since Mr. Sayen reported that the results given the subcommittee in these hearings represented 257 of the 569 airline airports, we must conclude that the vast majority of the airports surveyed to date are of the non-hub- or small-hub type. This is significant because (1) these smaller airports do not, in most cases, have the financial resources to do everything that might be desirable, and (2) the volume of traffic at these airports does not permit them a high enough place on the FAA priority list to qualify for certain terminal area navigation aids.

Therefore, our first conclusion concerning the ALPA airport survey to date is that it does not equitably represent the status of the overall national airport system because it fails to consider a significant number of medium- and large-hub airports, at which the greatest percentage of air traffic exists, and at which the greatest efforts have been made by airport operators and the FAA to provide terminal facilities.

Our second concern with the ALPA airport survey is that the criteria by which it judges airports are, in most cases, pilot yardsticks, not Federal yardsticks. Because, as was stated earlier, the airport operator depends upon the Federal Aviation Agency for both technical guidance and usually financial participation, he must accept the Agency's judgment as to what is or is not required for safety in the way of airport facilities. The following examples are given to compare the pilots' desires, as indicated in the ALPA airport survey data presented to the committee, with applicable Federal policies regarding specific items:

1. Approach lighting installed; instrument landing facilities available; tower facilities available, commissioned; communications procedures available; weather facilities available; surveillance radar available; navigation facilities installed at terminal areas.

Comment: These facilities are all 100 percent federally installed, operated, and maintained on schedules which depend upon the amount of FAA and budget appropriations. The airport operator has little or no control over provision of such facilities except to acquire land, when necessary, on which to erect approach lighting systems.

2. Runway, taxiway, loading ramp condition, obstruction lighting and marking available.

Comment: Airport operators are required by grant agreement provisions to maintain their airports in good condition and to light and mark obstructions in accordance with FAA Technical Standard Order N–18 "Criteria for Determining Obstructions to Air Navigation." In addition to daily inspection and corrective action by airport personnel and when specific deficiencies are reported by the users, the airports are inspected periodically by the FAA to insure that grant agreement provisions are being carried out.

3. Runway marking installed; taxiway lighting and marking; ramp lighting and marking.

Comment: Runways and taxiways are marked in accordance with FAA Technical Standard Order N–10b, "Marking of Serviceable Runways and Taxiways,' which provides for a minimum of runway marking on runways intended for VFR operations, with additional marking for instrument and all-weather runways. Although only the first painting is eligible for Federal-aid airport program participation, the maintenance of runway and taxiway marking is part of the FAA periodic airport inspection.

Taxiway lighting is governed by FAA Technical Standard Order N–3a, "Taxiway Lighting" and is not required for airports at which the longest runway is 3,500 feet or less.

There are no FAA criteria for ramp lighting and marking, except that tops of lighting fixtures should be shielded so as not to produce a glare to aircraft flying over the field. This lack of criteria exists because each airport has its own ramp lighting problem, depending upon the size of the ramp, height of buildings and proximity of buildings and ramps to runways. If a ramp lighting situation is or becomes unsafe, in the opinion of the carrier safety agents, and the FAA concurs, the FAA takes action to see that it is remedied. There is no requirement for ramp marking except as aids to pilots and taxi directors in maneuvering aircraft into and out of gate positions, thus varying with specific types of aircraft.

4. Runway lights installed—ALPA survey: High intensity, 38 percent; medium intensity, 44 percent; low intensity, 18 percent.

Comment: FAA Technical Standard Order N1c, "Runway and Landing Strip Lighting" specifies that high intensity runway lighting be installed on instrument runways served by an approach lighting system or precision electronic approach facilities. Low intensity lights are permitted at secondary airports (landing surface up to 3,500 feet long). Medium intensity lights are installed on other runways. Unless ALPA feels that all runways should have high intensity lights, no reason for concern is apparent in this survey result.

5. Runway length available—ALPA survey: Adequate, 21 percent; marginal, 75 percent; deficient, 4 percent.

Comment: Required runway lengths for the various classifications of U.S. civil airports are set forth in FAA Technical Standard Order N6b, "Runway Strength and Dimensional Standards for Air Carrier Operations." Additionally, FAA-recommended runway lengths for specific airports, based on forecasts of stage lengths and characteristics of aircraft types which would utilize the airports, are contained in the FAA's national airport plan. As stated by Mr. Oscar Bakke, Director, FAA Bureau of Flight Standards, before this subcommittee—"regulations concerning aircraft certification * * * require no unusual skills or unusual use of braking."

Therefore, when the pilots state that 79 percent of civil airport runways are either "marginal" or "deficient" they are either stating that the average pilot is not as skillful as the FAA feels he should be, or, as Acting Administrator James T. Pyle stated before this subcommittee, "They don't believe in the manner in which we arrive at the length of runway."

The Airport Operators Council would suggest that in view of the small number of overrun/underrun incidents, in comparison with the number of normal takeoffs and landings, the proper corrective action would be to improve the visual and nonvisual aids to landing and improve the proficiency of the few pilots involved in these overrun/underrun incidents.

An example of such corrective action took place following the Electra accident in September, where a pilot who should have been 70 feet high (according to FAA testimony before this subcommittee) struck an 8-foot-high dike. The pilot was given a 90-day ATR suspension so he could undergo Electra retraining and proficiency check before resuming left-hand seat duties.

6. Runway overrun available—ALPA survey: Good, 16 percent; fair, 24 percent; none, 60 percent.

Comment: Mr. Bakke spoke to this point very lucidly when he explained to the subcommitee the built-in overrun/underrun features inherent in certification of U.S. civil transport aircraft.

On takeoff the aircraft must be able to start the takeoff, experience a loss of one engine at the most critical part of the takeoff sequence, and still be able to stop on the full-strength runway pavement. This distance in which the aircraft stops after an aborted takeoff is overrun, but instead of being merely a compacted area, it is full-strength pavement.

On landing the aircraft must be able to pass over the approach end of the runway at 50 feet, then touch down and stop within 60 percent of the effective runway length. The length of runway between the landing threshold and the touchdown point is underrun area, and the remaining 40 percent of runway after the aircraft stops is overrun area. Again, this is not merely compacted area, as the pilots recommend, but full-strength runway pavement.

Referring again to Mr. Bakke's testimony, he does not recommend "applying margins on top of margins." To construct at every civil airport which handles commercial air traffic an overrun area beyond an overrun area, to take care of the occasional pilot who cannot land on a runway, simply is not as economically feasible as it is to increase the proficiency of that pilot.

7. Available fire and rescue facilities—ALPA survey: Good protection, 8 percent; some protection, 35 percent; no protection, 57 percent.

Comment: This is a subject of many ramifications, not the least of which are the respective responsibilities of the Federal Government and the air carriers. FAA's active interest in this area was described in testimony before this subcommittee, included in which was detailed an FAA inspection of facilities at civil airports now being conducted by an individual with considerably more knowledge and experience in this field than the average pilot who furnished the data for the ALPA survey.

8. Snow removal available—ALPA survey: Good and not applicable, 10 percent; marginal, 35 percent; deficient, 15 percent.

Comment: Any person can make as valid an assessment of highway snow-removal procedures as a pilot can of airport snow removal, and opinions as to good, marginal, and deficient will vary between users.

Obviously the degree of snow removal at airports will depend upon the severity of the particular winter, as well as upon availability of equipment and personnel. Airport authorities, realizing the impossibility of maintaining flight operations on a runway on which snow removal is in process, lean heavily upon the users for advice on when and where to start clearing. Therefore, snow committees, composed of representatives from airport and airlines, are functioning at many civil airports, for the purpose of making maximum utilization of the airport under snow conditions.

9. High-speed turnoffs available—ALPA survey: Now, 3 percent; planned, 6 percent; none, 97 percent.

Comment: The FAA has yet to provide technical guidance as to where high-speed turnoffs should be located, although this information is anticipated shortly. However, an FAA Bureau of Research and Development project on the subject of runway/taxiway design has disclosed that an airport with an aircraft mix of 20 percent jet, 80 percent conventional, could handle up to 36 movements per hour without high-speed turnoffs.

It appears, therefore, that very few of the smaller airports which comprise the majority of those surveyed by ALPA will ever reach a capacity which would require high-speed turnoffs. The inclusion by ALPA of an item such as this in a survey, implying the lack of a facility, the value of which is questionable at most airports, serves little useful purpose in our minds. Of course, in case a DC–3 pilot lands and folds a landing gear turning off the runway at the first available right angle turnoff, instead of going 1,500 feet farther down the runway to the next turnoff, the ALPA analysis could say "high-speed turnoff would have prevented this accident."

10. Runway distance markers available—ALPA survey: Now, 13 percent; planned, 1 percent; none, 87 percent.

Comment: No civilian need for runway distance markers has been shown, so the FAA has not promulgated a technical standard order on the subject.

AGA–NS9: "National Interim Standard for Runway Distance Markers" was published August 6, 1958, by the Air Coordinating Committee to satisfy a military requirement; the introduction thereto states, "Through joint action of its members and industry, the Air Coordinating Committee has formulated the following interim requirements for runway distance markers to satisfy a military need for standardization. However, since no civil need for visual runway distance markers has been demonstrated, definite requirements as to form and associated characteristics are minimal."

It is our understanding that U.S. civil jet transport pilots utilize airspeed versus elapsed time from brake release check on takeoff and that this check is considerably more precise than using runway distance markers.

II. RUNWAY VISUAL RANGE AVAILABLE

ALPA survey: Now, 4 percent; planned, 8 percent; none, 87 percent.

Comment: For an airport to qualify for runway visual range minimums, six facilities must be provided, four of which are exclusively Federal-funded, and two of which are Federal-aid airport program items. These are: High intensity runway lights, FAAP; Configuration A approach lights with condenser discharge flashers, 100 percent FAA; instrument landing system or precision approach radar, 100 percent FAA; transmissometer and control tower indicator dial, Weather Bureau; TSO–N10a runway marking, FAAP; compass locators at outer and middle markers, 100 percent FAA.

Because an airport must already have high intensity runway lights and TSO–N10a runway marking to qualify for an ILS and approach lighting system, the basic responsibility for provision of the remaining RVR facilities lies with the FAA and the Department of Commerce (U.S. Weather Bureau).

These installations are being provided at localities and in numbers determined by the respective FAA and Weather Bureau budget appropriations.

Mr. BURNARD. The first area of concern to the public and to us is mid-air collisions in the terminal area. This is an area in which airport operators have a great interest but it is generally the province of those other than the airport operator to do something about.

To improve safety in this area the Airport Operators Council has long supported the principles of the so-called high density zones, or, as they are now called, airport traffic areas, around airports wherein two-way air/ground communication and slower speeds of high performance aircraft are required.

We believe that improved radar service, improved air traffic control procedures, and improved aircraft operating procedures will do much to avoid mid-air collisions and to improve safety in this area.

Outer marker to middle marker: Aircraft accidents occurring in the area prior to reaching the middle marker appear to be the result of lack of adequate instrument guidance, lack of adherence to minimums, insufficient experience or training, or a combination thereof, compounded in many cases by inexact weather measurement and reporting capability.

Strict adherence to the built-in safeguards of ceiling and visibility should do much to eliminate these accidents. For instance, airline piston engine aircraft, equipped with the most modern devices, flying into airports with the most elaborate landing aids, are not supposed to go below 200 feet altitude on the glidepath without being able to complete the approach solely by visual reference to the ground. The 200-foot altitude on a normal approach is reached about a half mile from touchdown point and is considered adequate by the FAA for a

"missed approach" and "go-around" if the landing cannot be completed visually from that point.

Jet transport "minimums" are even higher—300-foot ceiling and ¾-mile visibility—which point is reached on the glidepath nearly a mile before the runway threshold and prior to reaching the middle marker and the beginning of the approach light lane. Thus, even with the higher speed of the aircraft and its greater weight, this area is considered by the FAA adequate for the pilot to decide whether to land or start a missed approach procedure.

Individual airlines are free to establish higher "limits" for their own pilots, of course, and many do.

More instrument landing systems on more airports, complete with radar coverage and full approach lighting systems will, of course, improve not only the safety but also the reliability and efficiency of operations at these airports.

Middle marker to runway landing threshold: This is the area of the missed approach and the undershoot. It is the area in which the Federal Aviation Agency is concentrating much of its efforts.

For bad weather conditions, the addition of more approach light systems will no doubt be of considerable guidance to the pilots, improve the reliability of schedules, and reduce the number of missed approaches. It thereby improves reliability of air service to the community and increases the capacity of the airport.

In all kinds of weather, the new visual glidepath indicator should also provide useful guidance to the pilot to touch down at the right place on the runway instead of short or long. This device has only recently been standardized by the FAA and its installation at U.S. airports by the FAA is eagerly awaited by airport operators.

When aircraft land short of a runway they usually tear up the prepared land off the ends of runways even if they don't damage the aircraft. Airport operators are constantly replacing the macadam and other stabilizing non-load-bearing materials at the ends of runways. This adds up to a considerable maintenance cost figure.

Precision approach radar and runway end identifier lights will also be useful at airports not now equipped with other FAA furnished aids.

Over and above the additional aids which may be helpful, however, are the improvements in training and experience of the crews, particularly with new aircraft. The difference in "sink rate" of the new aircraft, for instance, with which a pilot may not be fully experienced, appears to be an important factor in some of the undershoots with the new turboprop and pure jet aircraft of the last 2 years.

Runway landing threshold to taxiway: Once the aircraft safely crosses the runway landing threshold, the problem is one of a controlled landing on the runway, rather than stalling out high or flying into the runway and bouncing. Next, the aircraft must stop soon enough so that it doesn't overshoot.

Both of these problems are primarily a matter of the speed and attitude of the aircraft when it crosses the runway threshold. If normal landing procedures are being followed, then both speed and attitude of the aircraft assure touchdown soon after crossing the threshold and a roll to a complete stop within 60 percent of the effective runway length. With reverse thrust, this landing roll can be reduced even more.

The length of the runway itself is a known factor upon which are based the operating variables taken into account in flight planning and certification of aircraft. With rare exceptions the length of the runway is far less critical in landing operations than on takeoff. This is for several reasons:

First, the aircraft maximum certificated landing weight is considerably less than maximum certificated takeoff weight.

Second, the operating rules require that the aircraft be loaded and operated to be capable of stopping within 60 percent of the effective runway length without the use of reverse thrust.

Third, the takeoff runway length requirements for most of the newer aircraft exceed landing length requirements by a significant amount. A jet that requires 10,000 feet for takeoff, for instance, needs only 6,000 to 7,000 feet for landing. As higher thrust engines are installed, aircraft takeoff distances decrease, so this margin will become less.

The careful implementation of operating procedures and approach and landing aids discussed above for the approach to the runway should do much to eliminate the uncontrolled landing and overrun problem.

The uncontrolled or semicontrolled landing problem is often attributed to the "black hole," uprunway from the landing threshold, which reputedly results from the quick contrast between high intensity approach and landing threshold lights and the relative darkness of the runway touchdown surface beyond. This problem has received a great deal of attention by the pilots, the airlines, and governments over a period of many years. No standards have yet been finalized in the United States on how to solve the "black hole" lighting problem, but the FAA is probably closer to a solution now than it has ever been before. This is an area in which the FAA is currently engaged, and has been for some time, as a matter of fact, trying to figure out just what kind of devices, such as narrow gage runway, lights, centerline lights, et cetera, will in fact improve this depth perception and eliminate the so-called "black hole."

The AOC brought to the attention of the Civil Aeronautics Administrator in 1957 the need for determining whether or not an operational requirement exists for such a lighting system, and if it does, who should bear the financial responsibility.

To the best of our knowledge, the operational requirement has not yet been clearly defined and we have advised the Administrator that if such lighting is determined to be essential, then we believe it is an integral part of the Federal airway system which should be 100 percent Federal responsibility.

With respect to those aircraft which land too fast to stop within the prescribed capability of the aircraft and within the physical limits of the runway length, some consideration has been given to arresting gear or other deceleration devices. FAA research and development projects on pop-up arresters and tailhook-arresting cable types and NASA scaled-down tests on the plastic "covered swimming pool" are being followed very closely by airport authorities but none of these projects is proven as yet.

Weather conditions: There have been tragic accidents, and near tragic incidents, involved in takeoffs from airports under very marginal weather conditions. The most recent accident highlighting this

wiped out a football team. This has resulted in suggestions to close the airports under bad weather conditions such as those which existed in Toledo when the aircraft tried to take off with a football team aboard and didn't make it is the kind of thing which concerns all of us and is particularly not understandable by the public.

It is fundamental under the U.S. system of regulating air safety that rules laid down by the Federal Government detail the circumstances of weather conditions under which aircraft operations may be legally conducted by the pilot and the aircraft operator. If these rules are willfully violated, then, as with the willful violation of other laws governing human behavior on the highways and elsewhere, innocent people may die or suffer, and the violator may also go to his own death or be punished if he survives.

The Federal Government, through the Federal Aviation Agency has assumed control over the safety of these operations both through its civil air regulations and through its air traffic control service.

In an effort to eliminate this kind of accident, the FAA has issued a new order which is now effective which denies takeoff to passenger or cargo airliners or other commercial aircraft when the visibility of the runway is less than a quarter of a mile. This order is to be implemented through the FAA air traffic control service at each airport.

Birds: Ingestion of birds into the air intake of turbine engines on takeoff has been widely reported as a contributing factor if not the cause of a fatal accident in 1960. This accident occurred in a relatively new airplane with engines of a type never previously used in civil transport service. To the best of our knowledge, it is also the first and only fatal accident of its type reported in civil aviation although birds striking planes in flight have occurred since the early days of aviation: Damage in the past has usually been to the airplane surfaces, to the windshields, and to the occupants sitting behind the windshields when the bird came through.

Official reaction to all previous bird strikes in all parts of the world at all altitudes has been one of seeking to build better windshields and better surfaces to withstand this kind of impact. No one previously suggested that the birds be exterminated or diverted from the path of aircraft or routed from their normal habitat.

Is this accident any different, and, if so, what can be done about it?

The Electra accident appears to differ from most bird strike incidents primarily in the fact that control of the aircraft was lost at low altitude after it hit the birds.

If the birds had been ingested at a little higher altitude momentary loss of power and control might have been merely an incident and not an accident. Yet if just one bird had come through the windshield at a critical point of landing or of takeoff the same tragic result might have occurred.

We believe the basic question, therefore, is, not how to eliminate birds, but how to make aircraft that will survive encounters with birds. Condors over the Andes, or ducks over Michigan could have the same results as starlings in Massachusetts or sea gulls in Maine. Aircraft weighing hundred and thousands of tons must be built to withstand birds of a few pounds since it is futile to think of eliminating the birds near airports and elsewhere.

The futility of the exercise is evidenced by the many uncontrollable factors.

At one airport a helicopter was used to frighten gulls away but with no success. At another airport where a "scareaway" carbide gun was used the birds became used to the timing cycle and the airport manager reports that birds actually rested on the gun between firings to warm their feet.

Right here in Washington, a Federal bird sanctuary exists off the end of a runway of federally owned Washington National Airport. The FAA has also recently announced that they are planting an 1,800 acre belt of trees 1,000 feet wide to surround Dulles International Airport as a noise buffer. It is also an obvious haven for birds.

FAA airport planning documents regarding use of land off runways near airports also encourage their use for agriculture and other nonhuman habitation uses as an antinoise complaint measure. This is another obvious invitation to birds to take over. Yet the same FAA has strongly advocated to airport operators that action be taken by them to eliminate the birds on and near airports.

I might inject that many efforts have been made at many airports to try to eliminate them. We are still hoping that somebody will come up with an answer on how to do it.

Senator MONRONEY. The Supreme Court hasn't found a way to get them off the Supreme Court building.

Mr. BURNARD. That is right.

We believe the Civil Aeronautics Board hit the nail on the head when it recommended to the Federal Aviation Agency that it expedite a research program to improve the tolerance of all turbine engines to bird ingestion.

The Board Chairman also recommended that the FAA also give consideration in the certification testing of aircraft to the "operational problems that face a crew when it's flying the airplane and birds are ingested."

We would go the Board one step further and suggest the Federal Aviation Agency include as a certification requirement for new aircraft, and as an operating requirement for existing aircraft, that the engines and the windshields, as well as the operating surfaces, be made imprevious to bird strikes and ingestion. If they aren't, aircraft accidents caused by birds will not be eliminated.

Senator MONRONEY. In other words, the birds have already outwitted the airplane, and the airport managers, and now we have to go back to design the airplane so that they can get the top hand over the birds.

Mr. BURNARD. The airplane is a little heavier than the birds, and we think that somehow they might be enabled to get through them without falling out of the sky.

Another area that has been mentioned in these hearings is that of aircraft rescue and fire protection.

Aircraft Rescue and Fire Protection

This is another subject in which there are mixed responsibilities, some confused thinking, and some serious misunderstandings.

First, let's look at the problem we are trying to solve, then let's examine the methods of solving it.

Fundamentally, we all seek the highest level of safety in aviation which is feasible. Feasibility, however, means that which is attain-

able within the limits of the technical state of the art, the safety and/or economic justification for the development, and the financial ability of those who must pay the bill.

The first practical step in safety is, of course, assuring that the aircraft itself is constructed as safely as faesible. The next is assuring that the aircraft operating procedures and environment are as safe as feasible. And the third is assuring that the flight crew is provided with as many aids to safe operations as is feasible.

It is only when there is a failure of one or more of these safeguards that aircraft rescue and fire protection becomes a subject for discussion.

Fortunately, the air transport industry has enjoyed an enviable record of safety considering the problems it has had to surmount. But accidents do occur so we must all be very vigilant to prevent them. And when a crippled plane tries to land at an airport, the principal concern of the crew and passengers is that of fire.

So, let's look first at the causes of fire on impact and how to eliminate them.

The old NACA, predecessor of the National Aeronautics and Space Agency, staged full-scale crashes of World War II surplus planes to study the causes of fires. More important, they discovered how to stop them: spray water on the "hot spots"—cylinder heads and exhaust stacks. They have found that on jet and turboprop engines it is even easier: spray water into the air intakes.

When asked why this wasn't designed into the hundreds of jetliners now going into service, the manufacturers are reported ("There's a Way To Prevent Fatal Plane Crash Fires," by Gene Methvin, Washington Daily News, Jan. 22, 1960) as having said, "If the customer wants it, we'll give it to them."

The airlines are reported to have said, "Show it to us in a production model and we'll buy it." And also, "In the large majority of cases we will fly this thing around until the plane is junked and never use it, so why go to the expense?"

ALPA is reported to have said:

> The only reason it's not on these new planes is because it's not a requirement for Federal certification, and that goes right back to the Government.

This seems to us like a fair analysis of this aspect of the problem. Technically, it is known what to do and how to do it. If aircraft fires—whether in flight or on impact—are really a serious threat to aviation safety, then the Federal Aviation Agency is long overdue in doing something about preventing them at the source.

Another potentially fruitful area of fire prevention at its source includes that of low combustible fuels. Kerosene fueled aircraft, for instance, have been reported to be a less frequent source of fire on impact than those fueled with JP–4 and high octane gasoline. If this is proved out then regulations on the use of acceptable fuels may be in order.

The "crash worthiness" of aircraft, i.e., the ability of passengers to survive crashes by better design and construction of the aircraft, is also a fruitful area of exploration for prevention of fire on impact. It assumes an irreducible number of crashes and concentrates on survival in those crashes.

If potential fire is eliminated from the crash scene, then a major element of danger is removed—and with it is removed the potential need for millions of gallons of fire extinguishants on the ground, millions of man-hours of waiting for a fire, and millions of dollars worth of costly equipment, which is hard to justify.

But, let's assume that everything will be done to prevent aircraft fires at the source. Still, something may go wrong and create a fire either in flight or on impact when a plane is crippled from some other cause. This enters into the realm of operating procedures and operating environment.

In the event any pilot for any reason thinks he either has a fire or may have one on impact, and if he has any choice about landing, it would seem logical that his commonsense, his company operating procedures, and the Federal operating regulations would dictate that he land at the nearest place best able to handle the situation.

This country is dotted with military bases which have the finest aircraft rescue and firefighting equipment available in the world. In other countries throughout the world, the national governments, either through their defense establishments or otherwise, have assumed responsibility for providing aircraft rescue and firefighting facilities. In the North Atlantic, rescue facilities have been provided at "ocean station" vessels as well as on land for years by the United States and other nations as part of their recognized national responsibility for assuring the safety of air transportation.

But what use is civil aviation making of these facilities in the United States? Can you find them in the Flight Information Manual or the Airmen's Guide? Can you find them in Jeppesens or in the airline operating manuals? Can you find them on aeronautical charts? Can you land at a military base even if you know they have equipment?

The lack of greater use of these facilities by civil aviation is, in our opinion, a waste of a national asset dearly paid for by the American taxpayer. How many flights with incidents occurring en route could have been normal emergencies—and not tragedies or near tragedies—if pilots had automatically headed for the nearest military base instead of limping back to a civil field not able to cope with the emergency? And even if civil facilities were available to handle the aircraft, why endanger or tie up the other users of the airport when the relative isolation of a military field may provide a haven from danger and the curious?

We believe that airlines and airline pilots should be among the first to seek wide open use of military facilities in a potential emergency. We don't know of any proposals from them along this line. We know there may be problems, but if it takes an act of Congress to make better use of them we recommend such an act.

For purposes of discussion, assume that all feasible measures have been taken to prevent aircraft fires at the source; that all feasible measures have been taken to take advantage of the vast rescue and firefighting facilities that presently exist; and that a possibility exists that there will be additional need for aircraft firefighting equipment at other locations.

Just how remote this possibility becomes even today is reflected to some extent in the absence of credits on insurance premiums paid

by either the aircraft owner or the airport owner as a direct result of the existence of aircraft rescue and firefighting equipment at a particular airport.

We believe that if, after thorough study of the problem, the Federal Aviation Agency reaches the conclusion that additional facilities are needed, over and above those now existing at military and civil fields, then the Federal Government should supply them.

We view this protection service much in the same way as we do the air traffic control and instrument landing aid services and facilities provided at airports. It is federally determined to be needed according to their own criteria; it is federally procured, operated, maintained, and serviced—and it is available on an equal basis to all aviation users—from a private Piper Cub to the scheduled airliner or the itinerant military plane.

For the Federal Government to provide fire and rescue facilities and services domestically is completely consistent with the obligation and responsibility the Federal Government assumes for rescue services for flight over the high seas, and with the obligation and responsibility of other governments to provide a similar service.

I might add also that the Coast Guard has existed for many decades as a rescue service for our maritime mode of transportation.

We hope you will agree with our reasoning and we urge your support of such a program to solve this very troublesome problem.

Senator MONRONEY. I am a little lost on your analogy. Isn't it a fact that all ports provide their own fire protection for ships?

Mr. BURNARD. The facilities provided by the Government through the Coast Guard and through the military facilities——

Senator MONRONEY. As rescue operations?

Mr. BURNARD. Sir?

Senator MONRONEY. That is rescue in transit or in flight, in the event of a wreck. But isn't it a fact that firefighting equipment of the ports would be a nearer analogy to the firefighting responsibilities of the airport.

Mr. BURNARD. I think there is some analogy, but on the other hand I think that we do have a job in civil aviation where it is almost impossible for any one civil airport operator to, first of all, know what kind of equipment to try to have on hand, and secondly, to have the trained people and the actual equipment necessary to handle whatever kind of aircraft might drop into his airport. It is the kind of thing where we could never achieve absolute safety, and we hope that we can achieve a greater degree of safety than now exists but it is a very difficult problem with many facets to it that have given us all, all elements of aviation, trouble in the past.

We have tried to show how the basic safeguards in aviation safety comprehensively cover all aspects of aviation activities. We believe the overall safety record in aviation is good, but we will not be satisfied until it is better.

We have outlined some of the problems in the terminal area and what is being done about them, and given some additional suggestions for what further steps should be considered.

We believe that it is clearly the responsibility of the Federal Government to: (a) define the need, and (b) make possible the procurement and installation of such additional terminal area facilities as may be needed to raise the level of safety a little higher.

We urge that this be done not only for the improvements which they will bring to safety, but also because of the tremendous benefits that will result to our national economy from the greater reliability and efficiency that will be made possible in air transportation.

Recommendations: As long-range solutions to the problems of safety, as well as the growth and development of civil aviation in the United States, we recommend the following:

1. That aviation be recognized by the Congress and the executive branch as a very complex and highly technical transportation system, no one element of which can be neglected lest the system become unsafe, unreliable, and inefficient.

In this connection we believe the excellent work of Presidential Adviser E. P. Curtis in his 1957 report to the President is a landmark of official understanding of this fundamental concept. We believe that the new White House national aviation study of aviation goals for 1961–70, headed by Fred M. Glass, should update and refocus attention on the direction in which U.S. civil aviation should be going. We believe, however, that the Federal Aviation Agency has much to accomplish but it can be done with the help, understanding, and support of both the aviation community and of the Congress.

I might add at this point, from our preliminary indications in conversations with the new Administrator, we think that perhaps a closer ability between the aviation community and the FAA to work out some of their problems can be achieved.

2. That additional congressional and executive branch emphasis be placed on an expedited program of developing airport capacity both at existing airports and at new airports. This will require greater emphasis on airport research as well as a larger share of financial participation by the Federal Government in the construction and improvements of airports if airport capacity is not to become the bottleneck in the air transportation system.

3. That additional congressional and executive branch emphasis be placed on an expedited program of approach and landing aid installations. In this, as I said before, we will be happy to insist, as far as we are able.

4. That urgent congressional and executive branch attention be given to the problems inherent in the construction and operation of supersonic aircraft. This country cannot afford to go through the same kind of inefficient and haphazard planning for the supersonic age that has spawned many of today's problems in the subsonic jet age.

We respectfully suggest that the Congress can greatly assist in this program by encouraging the Federal Aviation Agency and the Civil Aeronautics Board to work closely and jointly with the aviation community in the formulation of the principal legislative proposals that may be necessary to implement such a program.

Let me add here that the statements of Mr. Halaby and Mr. Boyd, the Chairman of the Civil Aeronautics Board, have both indicated that they have a desire to try to work out some of our long-range problems on a cooperative basis, and we would be happy to cooperate.

Thank you very much, Senator.

Senator MONRONEY. Thank you very much, Mr. Burnard.

Do you feel that as near as it can be achieved that we should have a national airport system and not a hodgepodge of many, many airports that happen to be listed on a Federal airport map?

Mr. BURNARD. Yes, Senator, we believe that the development of airports in the United States should be in general conformance with a national airport plan; that a broad-scale planning to get the right airports in the right places is a national problem which can be best planned for the guidance of the local people on a Federal level.

Senator MONRONEY. Getting to that, then, if it is necessary, it seems to me that standards, at least for those handling high-performance aircraft, should be made to meet national standards as far as ground facilities are possible. In other words, to adjust—and I note that you mention that strongly as you have before this committee many times before—on the approach and landing aid installations. This committee was very much concerned with that in the past. We have a standard set of other landing aids on practically all of our trunk-line airports. This will require, of course, a considerable increase of Federal expenditures and a considerable amount of energy on the part of the local airport operator.

Mr. BURNARD. Senator, I know the very detailed standards for installation of such facilities now exist in the so-called Federal airways plan. As I pointed out in my testimony, the installation of these various facilities is governed by the FAA's own criteria, which is based upon volume and need. They must and do budget for the installation of as many each year as apparently they think they either achieve physically or get done financially. Most airports would prefer many more of these aids being installed at their airports, and yet the FAA is either incapable of doing it or unwilling to do it under their present criteria. The standards are very detailed and completely within the hands of the FAA. They laid them down.

Senator MONRONEY. But some of these are unaware of the fact that they have not until very recently been completely tested and approved for standard use. Now that they are, is it your feeling that these should be programed by the FAA and ordered installed on the local airports, or must the FAA wait until they are programed by the local airport commission and then fill the needs of their requests?

Mr. BURNARD. I think the bottleneck on this, Senator, is right within the FAA. Every airport in the United States that handles civil air carrier aircraft—and many general aviation airports, for that matter—would like to have a visual glidepath indicator on their airports right now. To the best of my knowledge none exists, not because the airport operators don't want them and haven't the land to put them on, but because the FAA just recently decided on which fixture they will procure and install. And it is exclusively a Federal Aviation Agency province and problem of procuring and installing.

Senator MONRONEY. I understand it is not quite that complete; that it is the duty of the airport operators to put the current in and the wiring, and that the FAA will put the instrumentation in, but that then the airport operator must reach that instrumentation with the power and to supply the power. Is that correct?

Mr. BURNARD. I am not sure that I can answer that definitively.

Senator MONRONEY. I would like to see what all these bottlenecks are so that we won't be here next year with only 5 or 10 more

lights on approaches still wondering where the responsibility rests. We would like to get it pinpointed.

Mr. BURNARD. Let me say that I don't know of any civil airport operator who does not have visual glidepath indicators or ILS, or most of the other aids we are talking about on its airport because of any controversy over wires. The controversy is over whether or not the airport meets the criteria in terms of volume of operations to get a control tower, to get an ILS system, to get an ILS system on both ends of a runway, to get an ILS system on parallel runways, to get a visual glidepath indicator, and to get practically anything else we have been discussing in the way of hardware.

Senator MONRONEY. Let's discuss the centerline approach lighting, too, which always seems to be a stumbling block.

Mr. BURNARD. There is no standard on it, Senator.

Senator MONRONEY. I understand it has recently been standardized.

Mr. BURNARD. To the best of my knowledge, it has not yet been standardized. I beg your pardon; let me check it. I am sorry; I thought you were talking about narrow-gage glide.

Senator MONRONEY. No. I am talking about centerline approach lighting.

Mr. BURNARD. Where that is installed and when it is installed is usually a decision of the FAA.

Senator MONRONEY. The FAA can't go out and install it unless the land is provided?

Mr. BURNARD. That is correct.

Senator MONRONEY. And the easements. And this rests with the local airports. So unless you have a place to put them, you can't install them.

Mr. BURNARD. That is correct.

Senator MONRONEY. This seems to be one of the bottlenecks that we suffered at Midway and many other places.

Mr. BURNARD. But the FAA must first tell the airport that it now meets the criteria for this particular installation, and say we want to install so and so at the airport.

I don't know of any airports that aren't anxious to get most of the aids that are available. There may be some local problems which cause delays in getting the installations in simply because of the legal procedures that must be gone through in the acquisition of people's property. But the installation of most of these aids, as I pointed out in our prior testimony, actually increases the capability of the use of the airport, which means more business, more service to the local community as well as to the traveling public which is in transit. Although there are no doubt isolated cases where difficulties have been encountered, I think as a general principle the airport operators seek the aids rather than repel them.

Senator MONRONEY. Of course, the operators are one group which has to get traffic in and out. Most of those have as their board of governors or their directors politically appointed persons who sometimes apparently drag their feet where a large number of constituents might be inconvenienced.

Mr. BURNARD. Senator, I agree with you completely that to get things done through governmental channels sometimes is a little slower than to do them otherwise. But we think there is a normal

amount of procedure that must be gone through as constitutional safeguards. As a matter of fact, if you try to circumvent them you will wind up spending more time trying to get the property than you would if you follow them.

Senator MONRONEY. But there are certain safety features that have been long neglected that are very simple. Sometimes it has been the FAA. Before that the CAA, which had been slow in getting them standardized. Now that standardizing is available, and even though it might inconvenience some of the people around the airport, I think these things must be moved with the greatest speed and as near as possible standardize lighting at least on our trunkline airways and standardize approach lighting which is an absolute must. I hope before the next year rolls around we will have a little more progress in this field than we have had in the past. Approach lighting on one end of the runway is not enough, particularly when the wind is half the time in the other direction. A simple ILS approach is good, but of course it helps a little bit to have that pattern of light down in front of you even after you come in on the ILS.

Mr. BURNARD. Senator, may I add that the approach light system is usually installed in the so-called clear zone, which is an area which has been acquired by practically all major airports and most of the others, or a great many of the others, particularly for the instrument approach runways. This extends out about a half mile from the end of the runway. Unless there are very unusual terrain problems—and there are a couple of cases that do exist—the land acquisition problem as such I think is pretty much solved at most of the airports that we are talking about that do the highest percentage of the business at least.

Senator MONRONEY. We still have large numbers of airports, some major ones, where the cities have built up on all sides, practically, and the clear zones cannot be obtained on certain very busy runways. For that reason it seems to me that if they can't obtain the clear zones they must obtain easements or something to provide the necessary navigational landing aids that have to go with it, or to instruct the closing of that runway.

Mr. BURNARD. I think most of them have. I think that perhaps the way we can handle this best is to perhaps discuss with the FAA those places where they feel that the airport operators and the FAA can focus greater attention than now is focused on getting the problem solved.

Senator MONRONEY. Do you have any comments to make about the regulations of the flow of traffic? I mean the maximum point of saturation that can and sometimes does occur particularly during peak hours?

Do the airport operators want the responsibility? I know some of them refuse to permit more scheduled flights during the hours when they know it is crowded. I know they have at Washington National. I wondered if that is the general practice of the operators?

Mr. BURNARD. This matter of peak hour traffic is the thing, of course, which gives highway planners, bridge planners, parking-lot planners, airport planners, and many other types of planners their worst headaches.

You try to plan a facility, whether it's Shirley Highway, Memorial Bridge, or Washington National Airport, to accept and handle on a reasonably expeditious basis what you might call the average peak hours that you can anticipate.

The landing areas and the terminal building at all airports in the United States have taken these factors into account during the planning stages. Of course, time has overtaken the actual facilities in some cases, and traffic growth has overtaken the existing facilities; so you have problems there.

The scheduling, actual scheduling by the air carriers is something which they have always felt, to the best of my knowledge—and I worked with the Air Terminal Association for 9 years—to be a province of airline management. The practical way that bunching and peaking of schedules is handled is actually in the air traffic delays which are imposed by the FAA air traffic service on takeoffs and landings. In other words, if a dozen airlines want to schedule their "blue ribbon" flights out of the airport at 5 o'clock in the afternoon, there will be a dozen airplanes lined up waiting to get off the runway.

So they haven't achieved very much. They are simply sitting in the airplane on the holding pad or taxiway, instead of sitting in the terminal building waiting to get into the airplane.

On landing, the practical solution at the moment is about the same thing. If everybody is scheduled to arrive in Washington at 5 p.m., everybody isn't going to get into Washington at 5 p.m. They will find themselves in holding stacks out one side or the other of Washington.

They haven't really achieved what they are trying to do on a scheduled basis.

Frankly, it boils down to unrealistic scheduling in many respects.

Senator MONRONEY. That is true. But it is the public that is inconvenienced. It is an irregular way of rationing the input or the output of traffic from the airport. I don't think the airport operator is responsible for it, although he could say no, that you can't have any more flights, I guess, out of my airport at a certain hour because the people can't get off them. Why make them come out and be on hand?

But the impossibility of throwing it back to industry was demonstrated to me in a conference I had with the president of one of the airlines, stating that he had attempted to schedule honestly, that they had moved some of their best equipment up to a 3 o'clock and 4 o'clock departure to try to encourage people to leave at that hour—or departures at 6:30 or 7:30—but that other competing airlines stayed with their 5 and 6 o'clock departures, and consequently he was running empty at 3 and 4, and at 6:30 and 7:30, while the other airline was running full.

So all he did was just insure capacity loads for his competition. And this being a good, free, competitive enterprise system, competition can sometimes obstruct the rationalization of how you are going to bring about an orderly takeoff and landing acceptance at some of our busiest airports.

This is what we are reaching for as a part of these hearings, because we all know and realize that you can reach a point of saturation in these tremendously busy airports, and the only way that it can be avoided, or is avoided now, is by irregular rationing, which means

that the air traffic control system just says no more takeoffs. All the customers get mad at that and say—

That's what you can expect from these bungling bureaucrats. They get me out here at 6 or 5 and I don't get off until 6:30, and I miss getting to the theater, and missed a dinner engagement.

Yet in reality I imagine if you check the schedules on some of these places, during those hours, there is this almost now customary delay of about an hour.

Mr. BURNARD. I don't think there is any question about the fact that the real seriousness of this is in the delay and inconvenience. I think safety is pretty well assured by air traffic control not permiting the aircraft to take off or land until there is adequate airspace or runway between the airplanes. The CAB has, to the best of my knowledge, the legal authority to do something about realistic scheduling, and as a matter of fact, as I recall, they have already had an investigation of so-called realistic scheduling within the last year or two. I am not familiar with the details, but it is something within their province, to the best of my knowledge, and I do think that this scheduling of everything at a peak hour or at a particular hour turns out to be more of an unrealistic scheduling problem and a form of misleading, I guess, of the public as to when they are actually going to take off or when they actually are going to arrive.

The CAB may have some further thoughts on that problem. I know they have looked into it.

Senator MONRONEY. I am familiar with the unrealistic scheduling which the CAB attempted to stop. This was more or less putting an unrealistic time of arrival on flights that could not normally make it, unless they had a terrific tailwind, in order to beat their competition on the advertised times between two places. This, I think, can be fairly well corrected.

But we are faced now with another problem of unrealistic scheduling. You see 8 or 10 airlines advertising simultaneous departures at 5 o'clock, when they know that under any kind of a system some of those will not be off until 6, because your peak hours generally at these trunkline airports is both takeoff and landing. So the airport not only has to accommodate its takeoff, but has to hold those people on the ground until they distribute the traffic which is incoming. You can't hold them aloft without additional dangers. And it is safer to keep these planes on the ground. It would be safer if you would let the people stay in the terminals, even, instead of putting them out at the end of the runway.

Mr. BURNARD. It is a matter of economics, too, it seems to me. And I am not sure that has been examined carefully enough.

Frankly, it is a lot cheaper for the airlines to have their passengers sitting in the terminal waiting to take off than it is to have the airplane out on the taxiway burning its fuel. And this is especially true with the jet airplanes with the very high fuel consumption rate at sea level or on the ground.

I think there is a real question, in my mind at least, on the economics of building in delays by scheduling.

Senator MONRONEY. This is a problem, I know, that is beyond the airport operators. We will appreciate any thoughts that you can contribute to it.

Thank you again for a very complete and very thought-provoking discussion. You have certainly demonstrated thought again on this statement.

Mr. BURNARD. Thank you very much, Senator.

Senator MONRONEY. Has Mr. Link arrived?

(No response.)

Senator MONRONEY. Mr. Link, the inventor of the Link trainer, from New York, was to testify. We had word that he was grounded in New York, not by air-traffic delays but because of weather.

We will hold the record open for Mr. Link, and we will accept his written testimony as testimony before the committee and incorporate it in these hearings.

(The following statement was submitted for the record:)

STATEMENT BY EDWIN A. LINK, BINGHAMTON, N.Y.

The December 16 New York crash certainly illustrates the weakness of our present air traffic control and air navigation systems.

We could argue that the cause of that disaster was pilot error, since at least one of the pilots appears to have overrun his assigned position. Or, we could argue that the controllers were responsible, on grounds that they should have been able to track both planes continuously on their radars, and to coordinate their movements. We might conclude that distance measuring equipment (DME) could have prevented the collision, or that anticollision devices might have, or 3-D radar, or three VOR receivers instead of two, etc.

Everyone agrees, at least, that our systems for handling air traffic are today inadequate. Air safety in the United States is not what it should be, and from the testimony you have heard here it sounds as though the problem is similar to the old country road established during horse and buggy days—we are trying to patch it up to accommodate our modern traffic when we should be building a new superhighway to take its place.

If we are going to prevent collisions today, and in the even more crowded skies of the future, we must make it possible for each aircraft to be navigated so that it can stay precisely in the airspace assigned to it—and only to it. When we talk about air traffic safety, we are talking about precise navigation.

Significantly, all present navigation system concepts and equipment in use today are more than 10 years old, and were conceived when far fewer aircraft were operating at speeds of only about 200 miles per hour.

Now we have many more aircraft, traveling at far greater speeds, with closure times between them so fast that there is insufficient time to read and interpret a multiplicity of instruments and to accurately calculate positions—present or future. Because so many more aircraft are occupying the air space, an inordinate amount of skill is now required to cope with the ever-present possibility of making a fatal error. I submit that a transportation system that requires such a high degree of personal skill in order to protect the lives of passengers is basically unsound.

The airborne navigation equipment necessary to meet today's requirements is not presently available and its development has lagged far behind. I see no adequate program for bringing it rapidly up to date.

It has been stated that one of the reasons so much fumbling has occurred in attempting to solve the traffic problem in the past has been that the problem has never been clearly defined. With this I agree.

If we keep in mind the simple fact that a collision is impossible unless two or more aircraft arrive at the same place at the same time, then I believe the problem can be defined.

It then breaks down into three basic elements, i.e.: (1) position, (2) time, (3) control.

Defining these more specifically:

(1) Position: Accurate knowledge of present position and ability to accurately reach assigned future position by knowing precise position on a continuous basis. Not estimating from one "fix" to another.

(2) Time: Ability to know, on a continuous basis, time at present position and ability to forecast time of arrival at any and all future positions precisely.

(3) Control: "Fail-safe" data-processing equipment enabling easy and rapid dispatching and automatic prediction of possible conflicts. This equipment has been built and is now being tested by the FAA. It should be pointed out that if No. 1 and No. 2 are attained, control becomes greatly simplified.

If all requirements are met, then it is possible for the controller to assign air space in relatively small blocks with assurance that the aircraft involved can keep to their assigned air space and there can be no collision.

I want to restate that adding to the already overly complex array of instruments in an aircraft, even though to do so might import more needed information, is not the solution. The pilot is already overburdened by the number of instruments he must watch and interpret. These systems must necessarily be dual installations for safety's sake—now, even triple is being considered.

Also, such a large amount of equipment cannot help but increase the chances of electronic failure in the air or before takeoff, thereby causing more delayed and canceled flights. The additional cost to our already heavily subsidized and ailing aircraft industry is also a factor to be considered.

A single display with reliable lightweight, transistorized equipment must be developed that does not involve interpretation difficulties and time-consuming computations.

Offhand, it might appear that the improved equipment I advocate would be of value only if all or a majority of aircraft were so equipped. This is not true. As one experienced controller stated to me, "Even if only one aircraft could be depended upon to know and keep an accurate, dependable flight plan, it would be helpful." Naturally, as each additional aircraft is properly equipped, the system will become more and more effective. In other words, the transition can be evolutionary rather than revolutionary, an obviously desirable situation.

The technological know-how is available today to provide such equipment. No new inventions are needed. There are several means by which the desired facility can be provided.

The following presentation is an attempt to further define the problem and point out one theoretical approach to the solution of the problem of providing the necessary airborne equipment. There are many other and probably better ways it can be done once the problem is recognized.

Diagram (1) shows one theoretical type of position indicator display which could be used in an aircraft cockpit to show the pilot where the aircraft is as compared to where it should be according to the flight plan which has previously been set into the airborne computer.

One virtue of this possible design is that it is a positive reading single instrument with which the pilot can compare his immediate position instantaneously with the approved flight plan. At present he must read and interpret a multitude of instruments—with increasing chances of making a mistake. Easy-to-read instruments are needed to ease pilot strain and error.

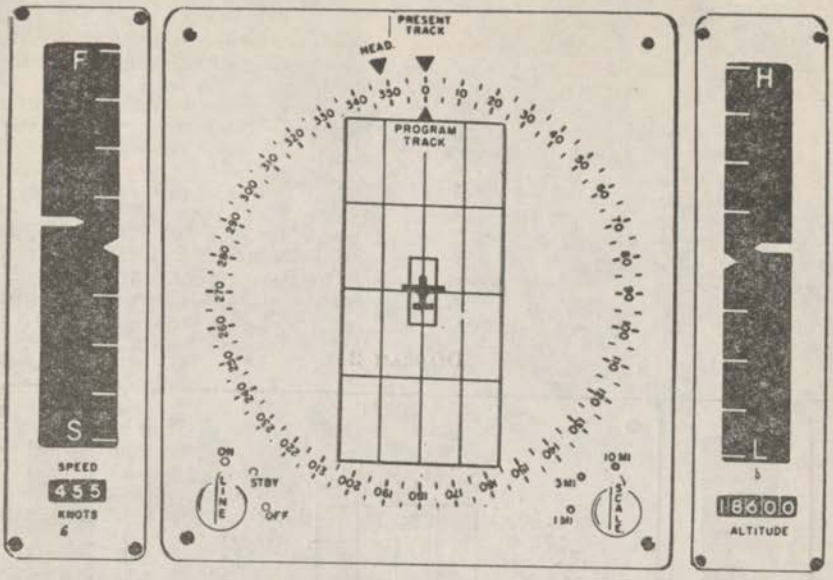
Here speed and altitude are indicated on the left and right respectively while the center portion of the instrument defines actual track, drift angle, heading, and position.

The airplane shown in the center moves over the grid and indicates to scale any divergence of the aircraft from its programed or predicted flight plan position along its route.

The speed indicator at left shows any deviations from predicted or programed ground speed. In this example, the aircraft is traveling above predicted speed.

During a flight program calling for a fixed altitude, the altitude indicator at right will show any divergence above or below that altitude. When a sustained climb or descent is called for, the indicator will remain at zero as long as that rate is being maintained. In this example, the aircraft is traveling above predicted speed and altitude.

DIAGRAM 1



In diagram (2), assume the original wind data have changed. This is reflected by a ground speed of less than the originally estimated 450 knots and a larger required drift angle than expected. The airplane indicator has moved off course and fallen behind schedule. In order to get back on flight plan, the pilot must increase power and change course momentarily.

When changes in wind or weather conditions are too great, he must refile a flight plan and select a new ground speed within the aircraft's capabilities. When he is making an appreciably higher ground speed, he also refiles. The new data is then inserted into the computer.

In either case, any difference between planned performance and actual performace becomes evident immediately to the pilot—not sometime later, after divergences have already occurred.

If an aircraft must deviate from its original course—perhaps for the purpose of dodging a thunderstorm—and the deviation is not of serious extent, the pilot could probably return to his original course and make up the lost time through use of reserve power.

For greater deviations, however, it would probably be necessary for him to refile the flight plan with the traffic control system, get a clearance, and reset to a new way-point that will clear the storm area.

Another example, diagram (3), shows an aircraft on IFR clearance "off airways." If this procedure was approved, you can see the flight plans calls for crossing five airways. Here are five distinct opportunities for midair collisions if precision navigation, with strict altitude control, is not employed. But the pilot using precise reading navigation equipment can predict time of interception of each airway he crosses with complete accuracy and, when coordinated with the controller, no danger of collision can occur.

DIAGRAM 2

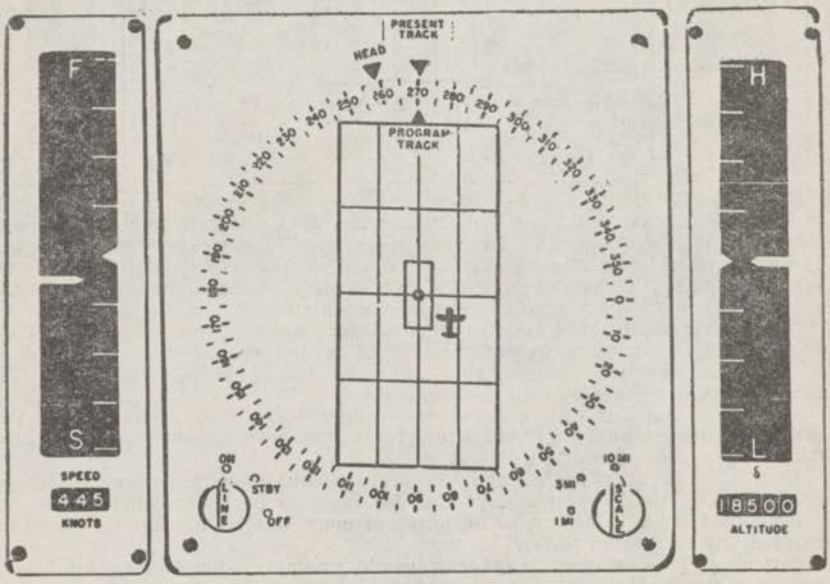

F
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DIAGRAM 3

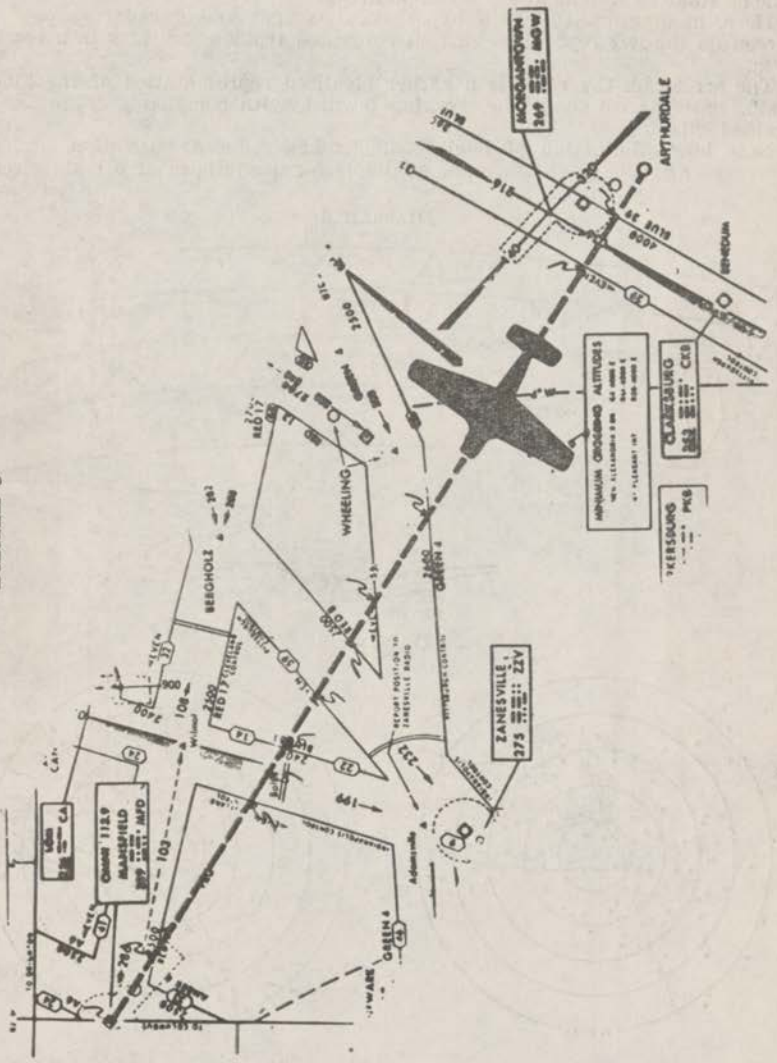

MORGANTOWN
ARTHURDALE
CLARKSBURG
WHEELING
ZANESVILLE
CAMBRIDGE

Diagram (4) illustrates how it is possible to get a more efficient use of airspace as a result of increased accuracy of navigation. Under the present system, as shown on the left in the diagram, a 600-knot aircraft requires 100 miles of reserved airspace in order to provide minimum safety.

At the right of the sketch, the precisely navigated aircraft can adhere so closely to flight plans that airspace envelopes now required for each airplane can be enormously reduced. Then, traffic along major airlanes can be increased and large areas for nonscheduled general aviation aircraft will be made available en route as well as at the terminal areas.

Here, in diagram (5), is a hypothetical comparison of radar scopes. The screen on the left represents current congested traffic conditions in a terminal area.

The screen on the right is a rather idealized representation of the kind of traffic patterns we should be working toward, with completely organized programed flight.

Note how elimination of holding stacks has reduced saturation, and how increased airspace has been made available for unequipped or private aircraft.

DIAGRAM 4

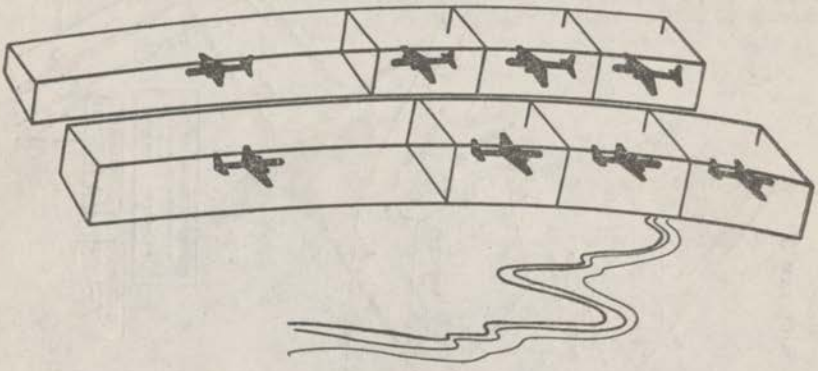
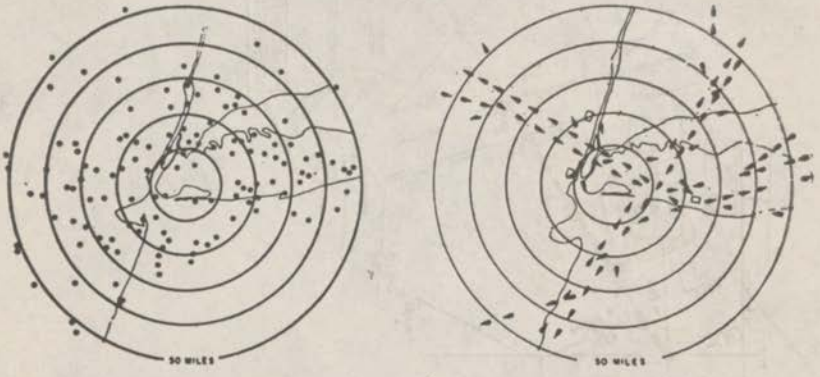


DIAGRAM 5



If ground control centers were working with more accurate information, landing rates at major terminals could be increased, eventually, perhaps even to runway capacity. Arrivals would then be spaced to insure minimum time intervals between touchdowns of various aircraft with different landing requirements.

If all aircraft were equipped and operating within the system, the effect would be like a conveyor belt extending outward from touchdown point, with partitions of equal size holding each aircraft (see diagram 6). Feeding this conveyor belt

would be additional belts representing each airway leading to the terminal area.

With the belts properly synchronized, aircraft would reach the touchdown point at regular intervals and at whatever rate selected by the belt operator.

To translate this back into aviation terms, aircraft would be assigned runway touchdown times based on their flight plan schedules—while still some distance away. If each aircraft were equipped as proposed, it would be possible for each to arrive at safely spaced intervals. "Stacking" and "holding", a procedure necessary today due to the impossibility of controlling and properly integrating terminal arrival schedules, would be nearly eliminated.

To give some idea of the economic effect of this kind of flight coordination, look at diagram (7). This is a graph showing one airline's experience with 1 weekday schedule in an average month. The black area represents scheduled flying time, the shaded area represents extra flying time caused by circuitous routing, and the unshaded area represents holding time.

All told, 23 percent of the total flying time was unscheduled due to circuitous routing and holding.

Needless to say, this extra flying time, is adding proportionately to operating costs. Precise navigation methods could ultimately eliminate holding and make possible more straight-line airway flight—thus reducing the number and the expense of unscheduled flight hours.

DIAGRAM 6

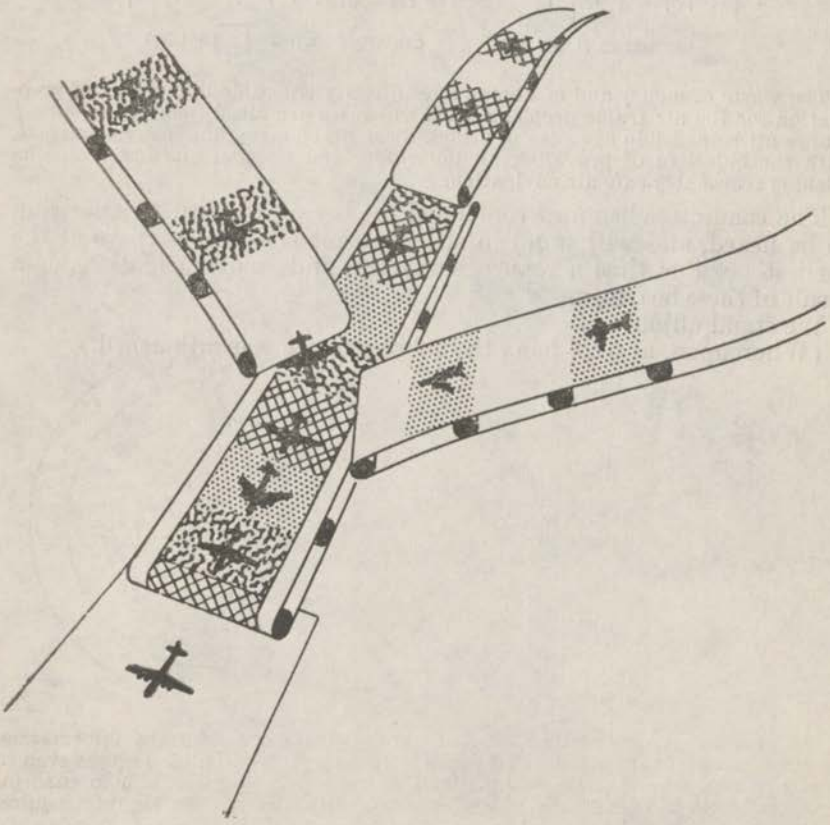
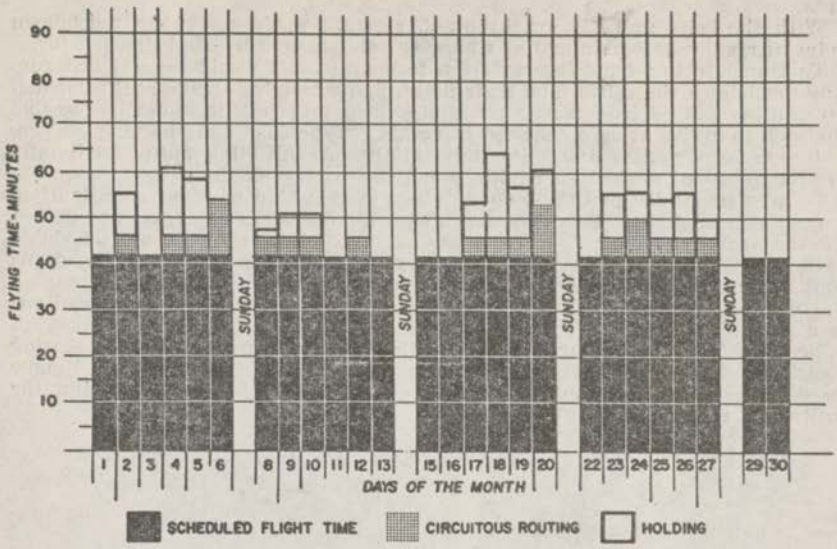


DIAGRAM 7



The waste of money and of human lives directly traceable to our lack of preparation for the air traffic problems with which we are faced today is appalling. I urge all responsible agencies to attack these problems on an emergency basis, with the objective of providing an immediate and adequate means of accomplishing reasonably safe air navigation.

The committee has now concluded the list of all witnesses desiring to be heard, and will stand in adjournment and will prepare at the earliest possible time a report, summary, and recommendations as a result of these hearings.

We stand adjourned.

(Whereupon, at 5:23 p.m., the subcommittee was adjourned.)

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