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SECOND PHASE OF THE FISCAL YEAR 1977 BUDGET
OVERSIGHT, ENGINEERING AND DEVELOPMENT, FED-
ERAL AVIATION ADMINISTRATION, DEPARTMENT
OF TRANSPORTATION

GOVERNMENT

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HEARINGS
BEFORE THE
SUBCOMMITTEE ON
AVIATION AND TRANSPORTATION R. & D.
OF THE
COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

NINETY-FOURTH CONGRESS
SECOND SESSION

FEBRUARY 17 AND 18, 1976

[No. 73]

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Committee on Science and Technology



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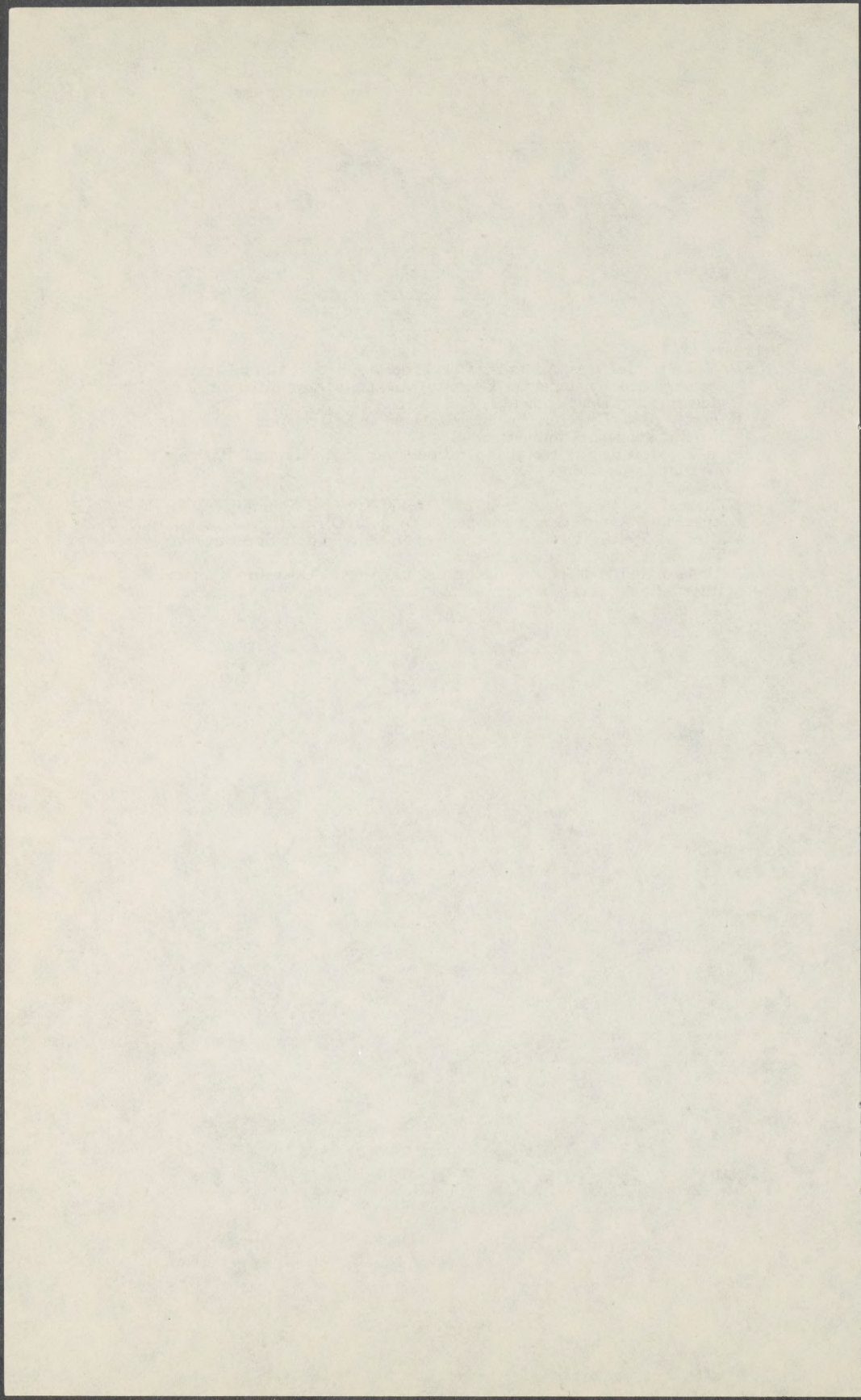
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CONTENTS

WITNESSES

	Page
February 17, 1976:	
Dr. John L. McLucas, Administrator, Federal Aviation Administration accompanied by Jefferson Cochran, Associate Administrator, En- gineering and Development-----	1
Robert Wedan, Director, Systems Research and Development Service, Federal Aviation Administration-----	41
Fred B. McIntosh, director, operational services, National Business Aircraft Association-----	56
February 18, 1976:	
William B. Cotton, chairman, Air Traffic Control Committee, Air Line Pilots Association, accompanied by John O'Brien-----	77
Walter A. Jensen, vice president of operations and engineering, Air Transport Association of America-----	90
J. Donald Reilly, executive vice president, Airport Operators Council International-----	101



SECOND PHASE OF THE FISCAL YEAR 1977 BUDGET OVERSIGHT, ENGINEERING AND DEVELOPMENT, FEDERAL AVIATION ADMINISTRATION, DEPART- MENT OF TRANSPORTATION

TUESDAY, FEBRUARY 17, 1976

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON AVIATION AND TRANSPORTATION R. & D.
Washington, D.C.

The subcommittee met at 9 a.m., pursuant to notice, in room 2325, Rayburn House Office Building, Hon. Dale Milford (chairman) presiding.

Mr. MILFORD. The subcommittee will come to order.

This morning the Subcommittee on Aviation and Transportation R. & D. will begin the second phase of its examination of the FAA R. & D. program. The first phase of this examination consisted of a detailed status review of the FAA's ongoing efforts in research and development. During that phase the subcommittee visited FAA facilities at Atlantic City and Oklahoma City and held hearings here in Washington. Thus we received valuable information not only from FAA headquarters, but from the scientists and engineers in the field. In addition, the subcommittee took testimony from industry and aviation associations.

The second phase of this examination, which is the purpose of the hearings today and tomorrow, will deal with the FAA fiscal year 1977 budgetary request for its R. & D. programs.

This morning, we will first be hearing testimony from the FAA. I think I may speak for the members of the subcommittee in stating that it is with a great deal of enthusiasm that we welcome our first witness. Dr. McLucas brings to the FAA a fine record of accomplishments and a firm grasp of the importance of maintaining a sound R. & D. base. We are looking forward to a fruitful working relationship between this subcommittee and Dr. McLucas.

Welcome on board, sir.

**STATEMENT OF DR. JOHN L. McLUCAS, ADMINISTRATOR, FEDERAL
AVIATION ADMINISTRATION; ACCOMPANIED BY JEFFERSON
COCHRAN, ASSOCIATE ADMINISTRATOR, ENGINEERING AND
DEVELOPMENT; AND ROBERT WEDAN, DIRECTOR, SYSTEMS RE-
SEARCH AND DEVELOPMENT SERVICE**

Dr. McLUCAS. Thank you, Mr. Chairman.

I am very pleased to be here to present our R. & D. program to the subcommittee today. I speak on behalf of our request for what you

recognize is a \$76.7 million request for fiscal year 1977. I have been associated with aeronautical research and development, as you have said, for a long time and I welcome this opportunity to continue my association with aviation in this new role with the FAA.

Since I have been on board at the FAA for something less than 3 months, I am still a novice there, but I have been there long enough to be impressed by the dedicated people that we have and the good job which I think they are doing overall.

We have, by most people's reckoning, the best air traffic control system in the world and the best regulatory procedures and this is testified to by the number of foreign visitors that we continually get seeking advice and help as they go about solving their own air traffic control problems.

While we recognize that we have the best system, we also recognize that there are many unsolved problems and much unfinished business as we go about improving our system to enable it to keep up with traffic growth which we anticipate.

Now, the system has been able to grow in the past and has met the needs of air traffic control and the other functions that the FAA performs over its life history.

During most of that growth, technology has been the key to enable us to achieve the kind of growth and safety which we have achieved.

The reason that we can deal with today's problems is that we have had a good research and development program in the past and we have been able to make improvement and stay ahead of most of our problems.

But the traffic is expected to continue to grow, and for that reason we have to continue an aggressive R. & D. program, because before too long if we don't make further improvements the traffic is going to exceed our capacity to handle it.

So we have problems if we don't look ahead and maintain an aggressive program but if we look ahead, and if we do the things that we think ought to be done, we expect to be able to deal with those problems adequately.

Some people suggest that because of the recent downturn in the rate of growth of aviation maybe our projections of the past have been too optimistic about traffic growth. I think that in the real world we have been a little overoptimistic about what was going to happen, but the fuel problems that we ran into in 1973 and other added costs of aviation, caused a slowing down of that growth, especially as applied to the air carriers.

But looking ahead to a recovery of the economy in general, we think that we are going to get back on a fairly steep curve of overall growth and therefore we have to plan ahead for that type of situation.

As you know, during this recent downturn in air carrier traffic we have not had a similar fall off in general aviation.

So we need a comprehensive and aggressive approach to solving our R. & D. problems in getting ready to handle the traffic of the future. We can add people to our air traffic control system but that is not the only answer and we think it is not the best answer, although we do expect that some numbers of people will have to be added to the air traffic control system as we go along.

We think that technological improvements offer a much better approach if properly integrated into the system. Safety is something we cannot compromise and if we don't allow the system to grow, then as the traffic itself grows inefficiencies will pile up. We already have some delays and we know how expensive those delays can be.

Also, we need a further margin of safety over what we now have. We think that we have a very safe system but the fact we still have accidents indicates there are further things that need to be done to improve safety. One of the areas that we have been concerned with is midair collisions. And I recently expedited the installation of our so-called Conflict Alert System in the Air Route Traffic Control Centers to reduce further the likelihood of midair collisions. The program that we are presenting here today will include adding Conflict Alert in our terminal areas to further reduce the likelihood of midair collisions.

As the traffic grows we know it is going to grow both in the controlled air traffic areas and in the uncontrolled or noncontrolled traffic. Both of these add risk.

Through Conflict Alert, through Airborne Collision Avoidance Systems or beacon-based systems, we expect to reduce the hazards of flying and the probability of midair collisions. I will soon submit to the Congress a plan which describes the different things that we plan to put into effect and to provide information to the pilot as well as to the controllers on the ground, which will further reduce the likelihood of collisions.

Dr. McLUCAS. Midair collision is not the only hazard in flying, of course. We have had a number of instances where aircraft that were under control flew into the ground. This points up the need for further attention to this problem and we have a number of programs underway which will deal with the problem of airplanes under control flying into the ground.

You are familiar with the ground proximity warning system which has been installed. We are installing shortly a minimum safe altitude warning system into our air traffic control software and we are working on the discrete address beacon system. And we are working on wind shear. Through all of these, we expect to make significant reductions in the likelihood of airplanes under control conditions flying into the ground.

I think everyone agrees that although the accidents that we are talking about, either midair collisions or flying into the ground, are very remote types of accidents; that is, they happen very infrequently. Still, we recognize that something has to be done to reduce the probability of this type of accident even further.

Today we operate our air system in such a way as to provide the maximum possible access by aircraft which are properly equipped to all the airspace that exists and that is under control.

But because of various factors, principally the growth of traffic, we do experience delays and these delays are going to get worse unless we make adequate improvements in the air traffic control system.

Now, delays translate into many things. Fuel cost, of course, is one that comes to mind immediately; frayed nerves is one of the other more obvious results; and then it leads to debates about safety and whether we are pressing the system too hard in an attempt to reduce delays and compromise safety.

So it means we must—we need to make further safety reserves in the system and to increase the capacity of the system so that it is not always operated right up on the verge of its maximum capacity so that you will have a safe safety margin there. If we don't do these things we find ourselves establishing regulations and regulations, of course, are a counterproductive way to go and non-cost-effective way to go in dealing with traffic problems.

One of the things we would like to do, of course, to deal with increase in traffic is to improve our airport capacity. That is a very difficult thing to do. As you know, it is very difficult in many areas to get land to build airports and then because of environmental factors in many areas where we do have enough land and would like to add capacity through new runways and whatnot, we have difficulty getting the approval through the necessary review bodies that have to review the development of airports.

So it looks to us like one of the better approaches is to go toward shortening the spacing between airplanes as they come in.

Obviously you cannot do that unless you improve both the air traffic control system itself and also do something about suppressing the wake of these large jets which now demand a rather large separation. In fact, the heavy jets as we call them, have caused us to increase spacing of airplanes rather than decrease them just at the time we would like to decrease them to handle more traffic. So working with NASA we expect to do considerable work in wake-vortex suppression, understanding wake vortices, predicting when they are going to be there and be a problem. When they are not there you do not have to account for them in your spacing.

But I think one of the better approaches is to figure out ways to suppress the wake vortices coming off our large airplanes. This to me is one of the more promising things we could do.

Also, we need to improve the reliability of the air traffic control system. In many ways we have a very reliable system but nonetheless it does break down and every day I look at a status report which shows various components of the system somewhere in the country which have failed during the previous 24 hours and the traffic delays that this causes.

One of the obvious ways to reduce these delays is by putting in redundant systems so that if you do have some kind of a mechanical or electrical failure you fall back on your secondary system and continue to operate at capacity.

Our users are very leery as we go about improving our air traffic control system of what this might mean to them in terms of additional costs. User costs are always a problem. And we recognize a responsibility that as we make improvements we should do this at a minimal cost to ourselves and to the users.

But I think we have to recognize that to get the increased margins of safety and to operate airplanes with less delays that we are going to have to pay a price one way or another.

We would like to have an efficient system overall. Right after safety comes efficiency. Safety always comes first.

I think we also have to accept the responsibility for protecting the environment as we go about making improvements in our system.

Noise is the word that comes up very often in this environmental discussion.

Pollution is another word that we are familiar with and all of these are the responsibility which we along with NASA have to work on and come up with adequate solutions.

Fuel wastage is a term that we are involved with here because of the increase in costs of fuel. The FAA through reduction of delays in the air traffic control system can make significant improvements in reducing fuel wastage. At the same time many of the factors that affect excess fuel use are not under our control and fall more logically under CAB and others having to do with load factors, routes, and so on.

And with NASA, again, they can sponsor research on making more efficient engines to reduce fuel consumption, too.

One of the systems that you will be hearing considerably about from Mr. Cochran is the microwave landing system. This is something which we regard as one of our significant and higher priority programs, particularly if we can continue to work with the military to make sure that we have a standard common system to improve the responsiveness of the overall air traffic control system to give us the flexibility which will be brought about by going to the microwave system.

As you know, we have submitted to ICAO, the international civil aviation organization, the microwave landing system as a candidate for standardization as a world wide system. Although we do not know how that will come out we recognize it could be of considerable benefit to the U.S. industry if that system were adopted as the international standard.

One of the problems I have been concerned with since coming on board is aviation security. I was not on board very long before we had a very serious problem at LaGuardia and we have been dealing with that problem ever since. But looking back to the history of our dealings with hijacking, we were able to come up with a security program which effectively eliminated hijacking as a serious problem.

Some people have suggested we have dealt so well with that problem that we could dismantle the procedures that we have but we feel very strongly that those procedures should be maintained until the threat of hijacking goes away.

Similarly, on the bombing side, we have instituted certain procedures and we are continuing our studies, our research and development, and we will be doing some testing which will lead to new procedures along that line.

We have been working very closely with the airport operators, with the airlines, and others to develop these new procedures.

In conclusion, Mr. Chairman, I would say that our research and development is an investment in the future. It is an investment which is necessary to maintain the viability of our air traffic control system.

We believe that we can face the future with confidence if we carry out the program that you will hear outlined here today. Many of these programs operate over a long period of time. You cannot immediately go from the research and development stage to the operational stage. Therefore, we have to start now and continue to make

investments year by year to bring about the improvements that are necessary in the air traffic control system.

We have done our best to balance our research and development budget among the various needs that we have but naturally, and I am sure you hear this from everyone, we do not have all the money that we would like and therefore we have had to leave out some of the non-essential or less essential items.

But we think that we have included in here those items related to safety and traffic capacity which should be included in our budget to meet the needs of the future.

Thank you, Mr. Chairman. I would like to call on Mr. Cochran to follow me.

Mr. MILFORD. Thank you, Mr. McLucas, would you like your entire statement inserted in the record? I noticed you were paraphrasing.

Dr. McLUCAS. Yes, sir; if you would, please.

Mr. MILFORD. Without objection, your entire statement will appear in the record at this point and we will withhold questions and go on to Mr. Cochran if that would be all right.

[The prepared statement of Dr. McLucas follows:]

STATEMENT OF DR. JOHN L. McLUCAS, ADMINISTRATOR, THE FEDERAL AVIATION ADMINISTRATION

Mr. Chairman and members of the subcommittee, as this is my first appearance before this Subcommittee as the Administrator of the FAA, I am grateful for the opportunity to speak on behalf of the agency's research, engineering and development program, for which \$76.7 million is requested in FY-77. Being an engineer involved in aeronautical research most of my life, I have tried to keep pace with the present and future aviation concerns of this country. In the time I have been Administrator of the FAA, I have been most gratified to find highly motivated and competent professionals addressing these concerns. It is no wonder that the Air Traffic Control System and regulatory programs of the agency are regarded as the best in the world.

As you gentlemen know, in the past the Air Traffic Control System has grown and changed to accommodate the rapid growth and dynamic nature of aviation. For the most part, technology has been the principal instrument to effect change. As a result our present Air Traffic Control System is able to deal with today's situations. However, air traffic continues to grow and exceed the capabilities of today's system. I foresee serious consequences if we do not pursue an aggressive and comprehensive technology program. We cannot continue to accommodate more and more aircraft into the system without trading off safety and efficiency. Since safety will not be compromised, we are already seeing growing signs of inefficiency evidenced by serious delays on the ground and in the air with commensurate economic and energy wastes. The automation which was recently completed for enroute and terminals is rapidly being loaded to capacity. I am concerned by the recent near mid-air collision over Lake Michigan of a DC-10 and Lockheed L-1011 and other such incidents. In this regard, I have already expedited incorporation of the conflict alert function to provide warning for controllers monitoring en route traffic. The program I am presenting today accelerates the more difficult development of this capability for the terminal areas.

In the same vein, the increasing mix of controlled and non-controlled aircraft in the National Airspace System increases the risk of mid-air collisions. Our current technological development programs in the areas of automated conflict alert and collision avoidance systems are designed to reduce this hazard. I will, in the very near future, submit to Congress a comprehensive plan for collision avoidance which have both near term and long term payoff. This plan will offer protective service in controlled and uncontrolled airspace.

We are also concerned about accidents involving controlled aircraft flying into terrain, especially during the approach and landing phases. The recent crashes during landing at Kennedy Airport and during approach to Dulles Airport a year ago illustrate this unfortunate reality. While the ground proximity warning system will allay this problem to some degree, the present development programs in

automated minimum safe altitude warning, discrete address beacon systems, and wind shear detection will significantly reduce the probability of such situations. I cannot over emphasize the consequences of inaction in these areas of safety and operating efficiency. We know that we can achieve the needed improvements. We also know the consequences of deferring or delaying these improvements. We operate today so that to the maximum degree safely possible, all equipped aircraft have equal access to all airspace. If we do not improve the system to accommodate growth, our options are few. As I said earlier, we are already experiencing serious delays especially at major terminals. If, as we project, air traffic grows, then congestion will increase. As congestion increases, delays will become more severe. As the delays become severe, the system will stagnate, fuel consumption will increase and operating costs escalate. As the system stagnates, more regulations will become necessary to restore operating equilibrium. This would be most unfortunate and could be the least cost beneficial direction.

Recent airport capacity studies and agency forecasts demonstrate the necessity for technology solutions to cope with traffic growth and airport saturation. New developments in air traffic automation, wake vortex avoidance, and airport surface control can mitigate rising-energy prices by minimizing costly delays. Likewise, other programs are aimed at reducing the cost for operating and maintaining the National Airspace System by improving the productivity of our air traffic controllers and the reliability of our equipment.

Not surprisingly, both the commercial and general aviation community have expressed apprehension over additional user costs that new technology might generate. Indeed, no one here would deny that there is a price to pay for progress. However, we assume the burden of demonstrating to the user and to the general public that any added costs will be substantially offset by improved safety and operating efficiency.

Under the heading of operating efficiency, we are, of course, concerned with conserving natural resources and with protecting the environment. I can assure you that any new features of the system which are considered for implementation will have passed the tests of environmental acceptability and energy efficiency.

One of our current major programs is the Microwave Landing System. This program is progressing rapidly toward implementation status although there have been some recent slippages in the military versions. The Microwave Landing System has been submitted to the International Civil Aviation Organization for acceptance as the worldwide standard. If it is chosen, U.S. industry should benefit by the expansion of worldwide markets.

In addition to the programs we have developed to meet long range needs, the agency has responded rapidly to new emergencies. For example, the rash of hijacking attempts that occurred not long ago prompted research and development projects to resolve this menace. Security devices and procedures installed and implemented at most U.S. airports have successfully nullified these criminal outrages. Although essentially isolated incidents, they produce an insidious psychological impact on aviation by undermining the public's faith in air travel. The recent bombing at LaGuardia Airport has precipitated similar reactions and the agency has recently been tasked with developing appropriate countermeasures. We have prepared a comprehensive program to confront this problem and I am confident that we can succeed in reducing this threat.

The overall research, engineering and development program is an investment in the future, an investment now which will produce substantial dividends for aviation. We can effectively address the safety, efficiency, environmental and economic challenges that face us now. We can preclude tomorrow's problems through timely actions today.

Owing to the long lead-time in research and development programs, many of the aforementioned technical solutions will require time to complete and implement. If we proceed, a substantial commitment of our resources will be needed as the programs develop and we reach the prototype demonstration phases.

In assessing our program for FY-77, we have carefully balanced the research, engineering and development program to ensure that we can continue to provide the U.S. public with a secure and safe airport and airway system. Furthermore, we have deferred some of our non-safety and non-capacity related efforts in order to present a lean program that is responsive to the President's desire for economy. Lastly, what we are proposing is not a panacea for all aviation's dilemmas. It is instead a realistic approach to the future that can furnish, through technology, a continued safe and viable system.

At this time, I would like to introduce Mr. Cochran, the Associate Administrator for Engineering and Development, who will describe in some detail the

FAA's research, engineering and development program.
Thank you.

Mr. COCHRAN. Thank you, Mr. Chairman, Dr. McLucas, I appreciate the opportunity to appear here today to discuss with you the FAA research, engineering, and development plan. I would like to do this by using the flip chart that I have before you there and then by going through a series of viewgraphs which I will discuss with you. Looking at the flip chart, we are up here to talk to you today about our research, engineering, and development plan, our \$76.7 million request which we have made to the Congress, and our plan for the future. We have depicted here on the chart our domestic core plan and overlaid on top of that the estimate that we can see for the AEROSAT program, an international program with high future potential. This is an overview of what I will be telling you.

Let me discuss what I will be telling you. First, I would like to start out by saying that the system that we are discussing, the air traffic control system and the airport system in this Nation is the finest in the world and we think that it does a tremendous job both in handling the traffic and in handling that traffic safely.

Today's system is basically semiautomated, but it depends on humans to decide and react. Therefore, as traffic grows the demand for service grows. I will discuss the trends toward the attendant saturation of the system and the attendant rise in cost.

I will show you that there are two paths to follow in dealing with this problem. [See viewgraph No. 1.]

Briefing Overview

today's capability ➡ Semi-Automated Control

TRAFFIC GROWTH < SERVICES DEMAND

Saturating System

HIGH COSTS

TECHNOLOGY

UG3RD

Capability
System Interactions

BUDGET

Core Program
Advanced Projects

**SEVERE
GROWTH
RESTRICTIONS**

VIEWGRAPH 1

One of those is a restriction on growth by the regulation of air traffic to best serve the Nation's needs if we do not have technology. The other is the technology program, a program that we optimistically and practically believe will meet the needs of the future and will handle the traffic requirements of the future. I will be discussing with you today the upgraded third generation air traffic control system. I will talk about its capabilities, its elements, its interactions, and the budget requirements for the upgraded third generation system.

I also will mention briefly the advanced technology needs for later in this century.

First, let us touch on the inherent limitations of the present system; controller capacity, airport capacity, and old technology. [See viewgraph No. 2.]

present system limitation – *Semi-Automated Control*

- CONTROLLER CAPACITY ➡ MORE { CONTROLLERS
SECTORS
- AIRPORT CAPACITY ➡ INCREASED DELAYS
- OLD TECHNOLOGY ➡ { LIMITED
PRODUCTIVITY
INCREASED RISK
LEVELS

Limited Capacity

VIEWGRAPH 2

The controller can safely handle only so much traffic. Then we add more controllers and a lot more sectors to the airspace, growing linearly. There are just so many controllers that can be put into the system.

The airports themselves have capacity limitations imposed by the runways that are poured and by the people and systems that support the runways.

The technology that we are using in the field is up to 10 years old. It puts limitations on productivity of people, and as the density of traffic grows, risk levels and delays grow.

Saturation is already here to some extent.

Today we have 10 airports with peak-hour delays. The four with quotas have a limit on the number of operations and the remaining six have substantial delays. [See viewgraph No. 3.]

Today, TEN Major Airports Have

- QUOTAS {
 - O'Hare
 - Kennedy
 - La Guardia
 - National

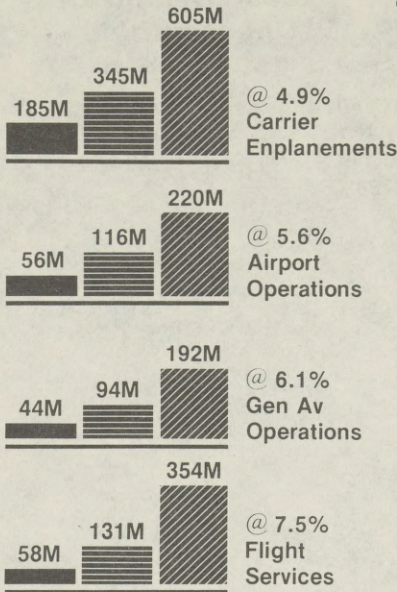
- SUBSTANTIAL DELAYS {
 - Atlanta
 - Los Angeles
 - Philadelphia
 - Denver
 - San Francisco
 - St. Louis

The System Is Saturating

Several of these are threatened with quotas. The problem is on us. Traffic is growing.

The demands of the ATC system will nearly double by 1985, and will have an increase of fourfold by the year 2000. [See viewgraph No. 4.]

Aviation Is **GROWING**



LEGEND



SYSTEM DEMAND

**Nearly DOUBLES
by 1985**

**QUADRUPLES
by 2000**

VIEWGRAPH 4

These four bar graphs that I have shown you and the subsequent charts are conservative growth estimates ranging from 5 to 7.5 percent.

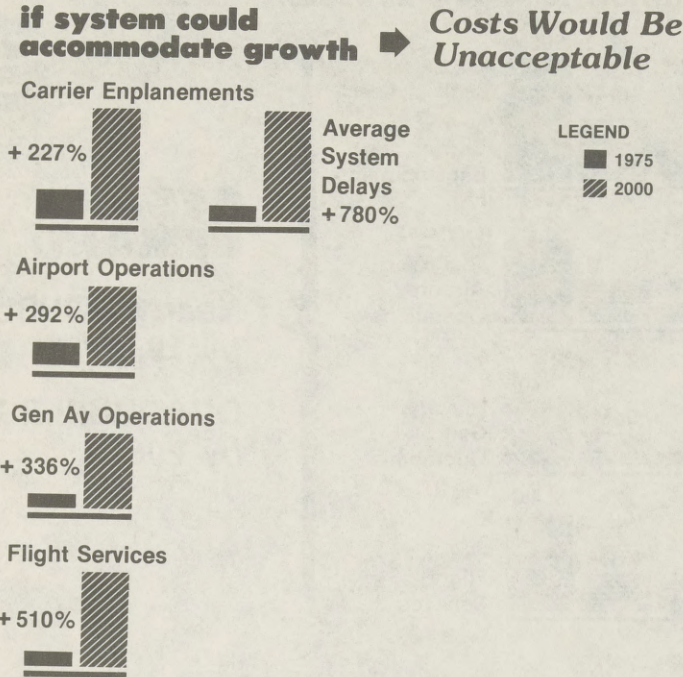
The bars represent a few of the categories of demands on the system in the years 1975, 1985, and the year 2000.

I think we furnished to you some time ago at one of our previous hearings one of our traffic forecast books and it is available to you.

Mr. COCHRAN. We have shown to you here today four categories, air carrier enplanements, airport operations, general aviation operations, and flight services.

You will notice and I will just use one as an example here, in the airport operations, in the year 1975 there are 56 million operations; 1985, we would be looking at 116 million, and in the year 2000, 220 million operations.

Some say we could accomodate the growth without extensive change in the system technology. [See viewgraph No. 5.]



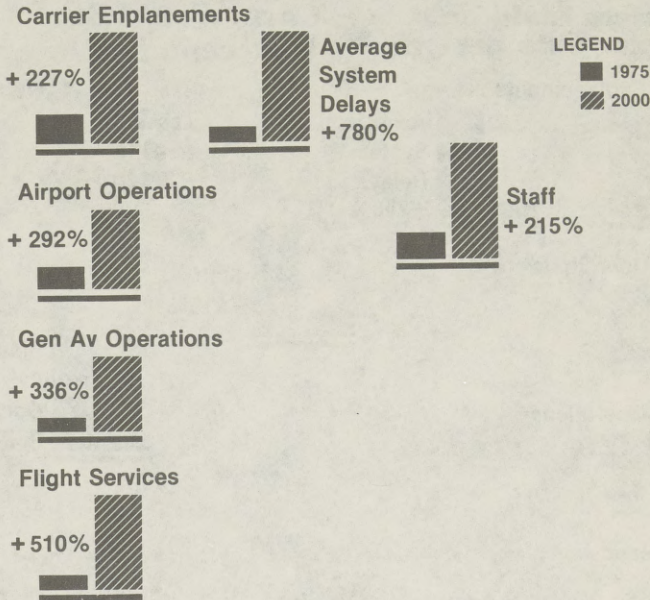
VIEWGRAPH. 5

The next series of graphics will take that view and hypothesize for you the possibility of operating the system with the growth parameters you have just seen for the years 1975 to the year 2000. I will show what would happen if the system could accommodate this growth without new technology. First, looking at the peak delays in minutes, the present delay of about 4 minutes would go in the year 2000 up to 31 minutes.

The cost to users would be unacceptable.

Looking at another factor, our air traffic facilities staff would have to go from 26,000 people to 81,000 people, a threefold increase in staffing. [See viewgraph No. 6.]

if system could accommodate growth ➔ **Costs Would Be Unacceptable**



VIEWGRAPH 6

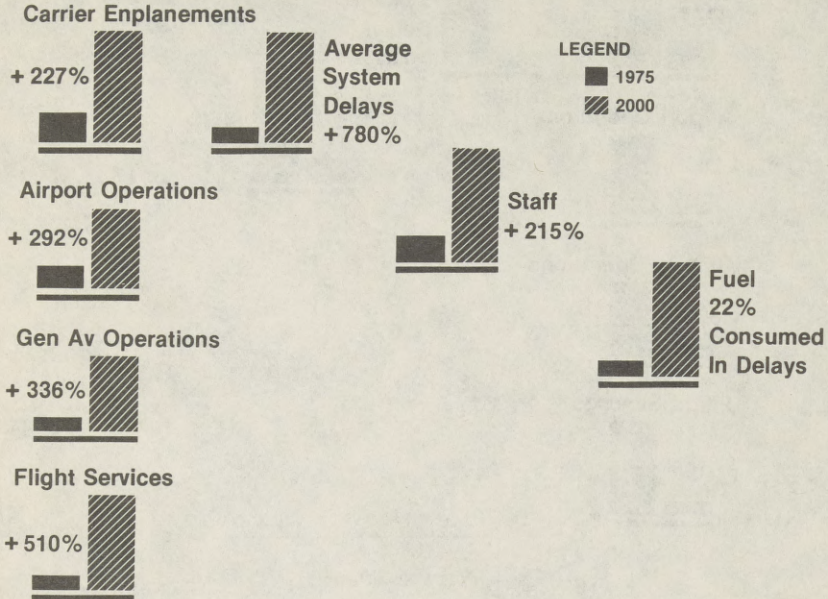
Looking at another indicator [See viewgraph No. 7], the amount of air carrier fuel consumed in unproductive delays would go from about 500 million gallons in 1975, to 4 billion gallons in the year 2000. Almost a quarter of the fuel consumed by aircraft would be wasted in delay.

Today the amount of fuel being wasted in delays is approximately 9 percent.

**if system could
accommodate growth**



**Costs Would Be
Unacceptable**

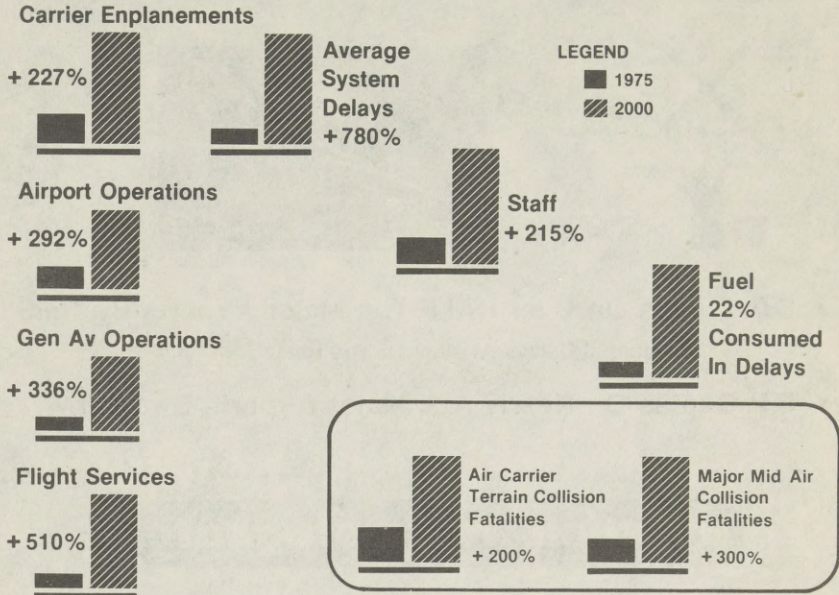


VIEWGRAPH 7

Looking at another factor, hypothesizing a linear growth rate without any change in technology you would be looking at a safety picture that would be grim. [See viewgraph No. 8.] This hypothesis assumes a linear projection of the growth in traffic and passengers in the system with roughly the same number of incidents or accidents happening per million flight hours as are happening today. We could not permit this situation to occur, and would have to act to check growth.

**if system could
accommodate growth**

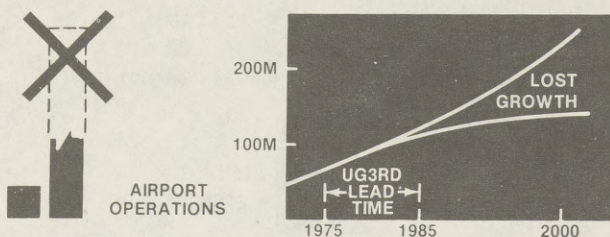
**Costs Would Be
Unacceptable**



VIEWGRAPH 8

Actually, the system would tend by itself to choke off aviation growth through economic and safety costs. These would cause severe restrictions to be put on airport traffic. Around 1985 the hub system would slow down the accommodating of more air traffic. Fixed quotas would probably occur on half of the major airports by 1985 with quotas on all of them by the year 2000. [See viewgraph No. 9.]

atc system saturation ➡ *Checks Growth*



- IFR Quotas On Over HALF The Major Airports By 1985
 - Substantial Delays At Most Of The Rest
- IFR Quotas On Nearly ALL Major Airports By 2000

aviation would stagnate

VIEWGRAPH 9

The present ATC/airport system would stagnate and in fact cause the aviation industry to stagnate to some extent.

Mr. Chairman, one of the things I would like to highlight on that last chart is the leadtime for the development and implementation of the major features of the upgraded third-generation system—10 years. That is a realistic view of the time it would take to implement the major technological improvements. I believe that this would coincide generally with the time when the system would saturate.

If we do not do anything in the way of technological improvements, the profile of stagnation would be greatly increased Government regulation. There would be a fixed total number of aircraft operations in restricted airspace and displacement of general aviation out of the urban airport. There would be higher fees and fares. [See viewgraph No. 10.]

stagnation impacts ➡ By Year 2000

- | | |
|--|--|
| • Fixed Total Operations | } INTENSIVE
GOVERNMENT
REGULATION |
| • Displacement Of General Aviation | |
| • High Delays & Fares
 User Fees | |
| • \$90 Billion Lost Passenger Revenues | |
| • Lost Airframe Sales
 Avionics | |

ONLY SOLUTIONS:

**upgrade ATC technology
-or-
more urban airports**

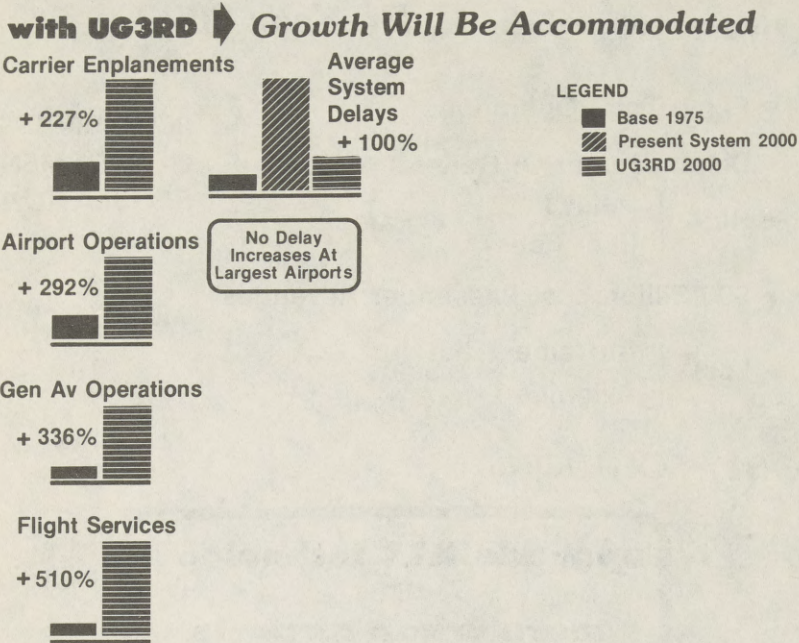
VIEWGRAPH 10

We project that \$90 billion in air carrier revenues will be lost over the period 1985 to the year 2000 by limiting the passengers that can pass through the major airports.

Secondly, we project that this limitation on the system would cause a loss of the airframe and avionics sale, and perhaps could affect our posture in the export market.

We can possibly build more urban airports, but it is very, very difficult. In fact, I doubt that very many of them can be built.

We can, however, accommodate the growth with technological changes in the system. On this graphic I am bringing back the demand growth comparisons I showed you before and comparing the upgraded third-generation air traffic control system costs in the year 2000 with the potential system cost of our present technology in that year and the base year of 1975. [See viewgraph No. 11.]



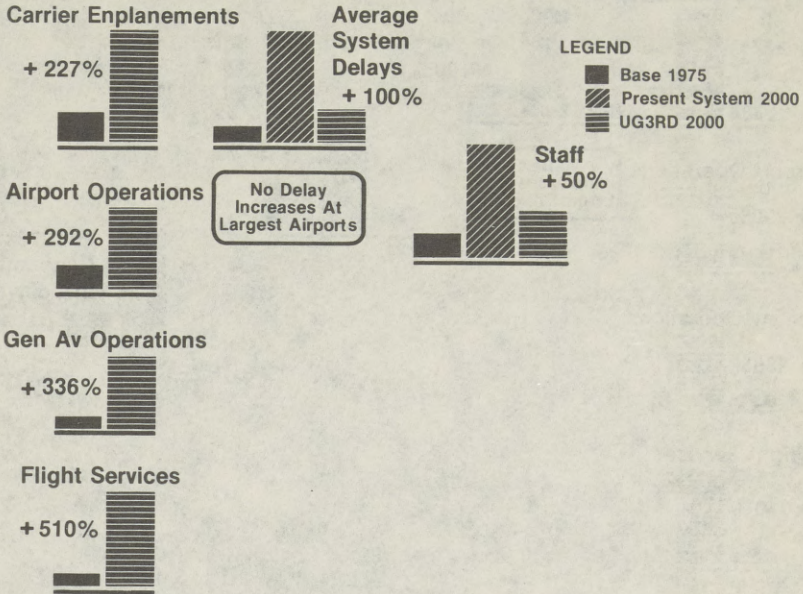
VIEWGRAPH 11

The upgraded third-generation ATC system will accommodate the projected growth. In accommodating the year 2000 traffic, the upgraded third-generation ATC system will show no more than double the average delay of today systemwide even though the system demand would be up fourfold. This is compared to delay increases in the year 2000 of ninefold if the present system were extended.

This spreads the delay out. There will be no greater delays in today's major hubs, but there will be a greater percentage of airports that will move up into the category of major hubs and show some delays.

Looking at another indicator, we see the productivity of the system increasing. Staffing requirements will go up by about 50 percent for our air traffic control staff, who will be handling about three times the activities of today. [See viewgraph No. 12.]

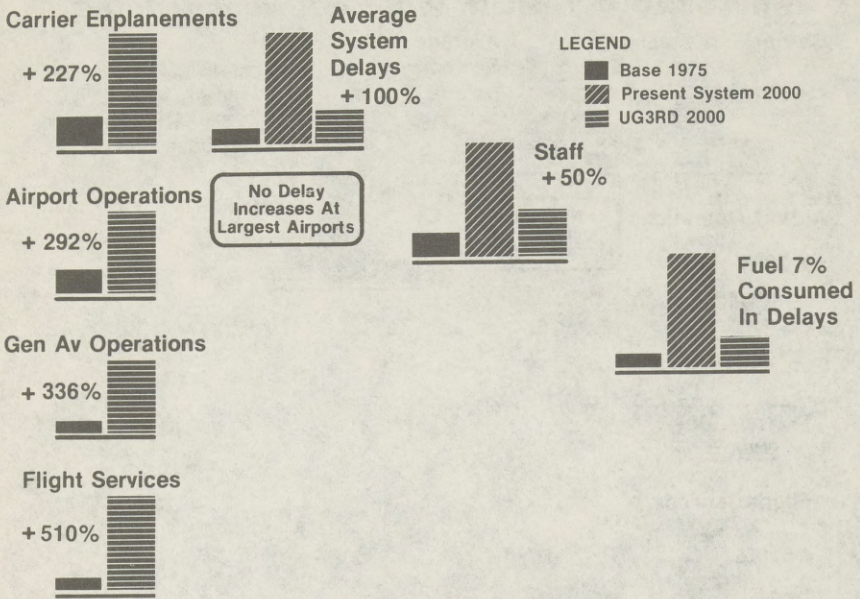
with UG3RD ➔ *Growth Will Be Accommodated*



VIEWGRAPH 12

Looking at the fuel, the 7 percent of fuel consumed in unproductive ATC system delays will be essentially the same as it is today. [See viewgraph No. 13.] The absolute amount will be about 1 billion gallons

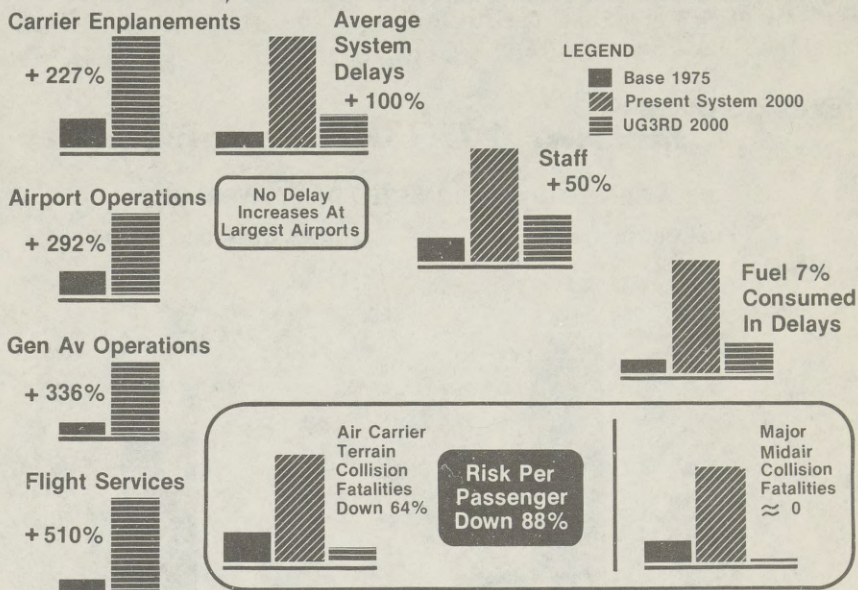
with UG3RD ▸ Growth Will Be Accommodated



VIEWGRAPH 13

compared with today's 500 million. But many more aircraft will be operating in the system and producing many more passenger-miles of air travel. Most significantly, technology can reduce the passenger risk [See viewgraph No. 14.] The chance of terrain collision fatalities would be down 64 percent from today rather than up threefold from today.

with UG3RD Growth Will Be Accommodated



VIEWGRAPH 14

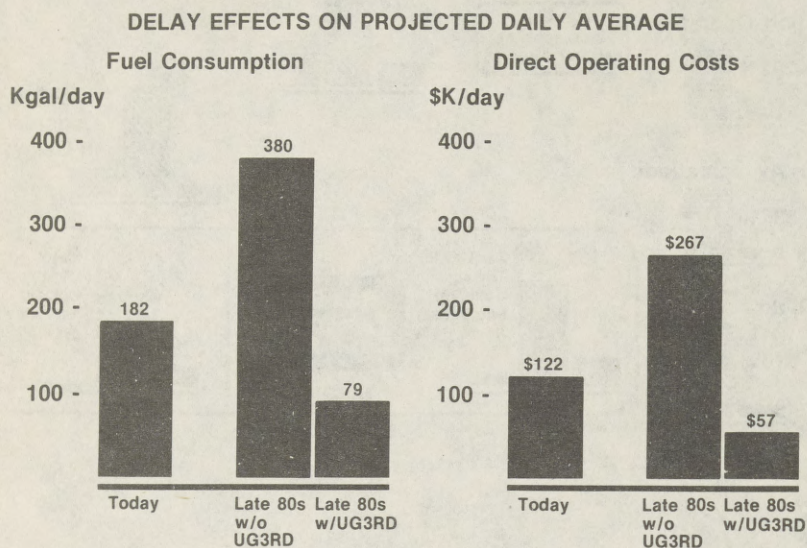
This occurs because the risk per passenger will be down 88 percent rather than up fourfold.

We will have driven the risk of a major midair collision between controlled aircraft to nearly zero.

These performance data are good figures. If general aviation is properly equipped and trained, it will get these same advantages.

Perhaps it would be good for us to look at some real world data as a test of what can be done with the upgraded third-generation air traffic control system. I have an estimate from the report from the O'Hare Task Force that consisted of the airlines, the airport operator, and the FAA. [See viewgraph No. 15.]

chicago o'hare task force ➡ *UG3RD Improvements*

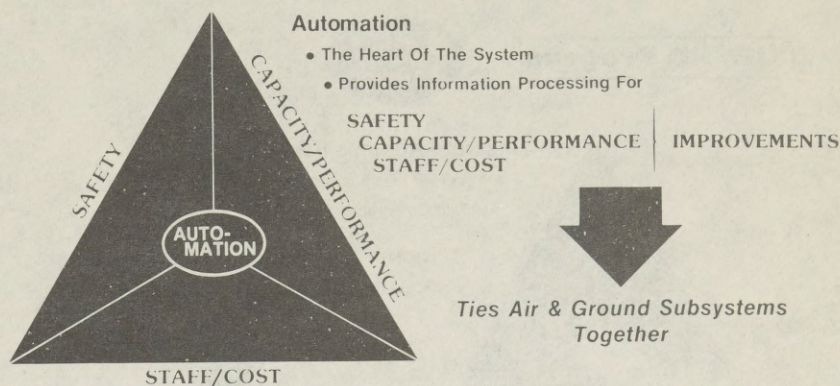


VIEWGRAPH 15

The upgraded third-generation system gives this excellent performance by providing close to a 40-percent increase in overall capacity. By the late 1980's, the fuel consumption and direct operating costs due to unproductive delays can be reduced by nearly 80 percent, compared with an unimproved system, to cost levels even lower than today's.

Mr. COCHRAN. I want to now turn to a brief description of these advances in the system design. [See viewgraph No. 16.]

UG3RD Program



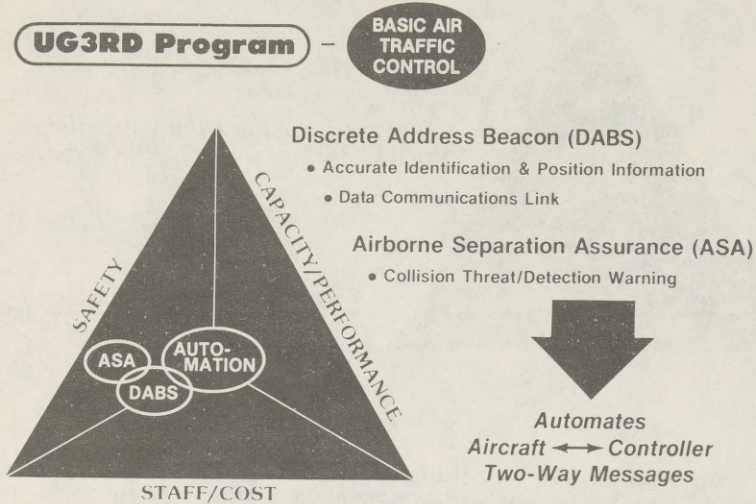
VIEWGRAPH 16

I want to show you two things on this image to the left. First, the primary contribution each system element makes. For instance, automation is the heart of the upgraded third-generation air traffic control system. It permits all the elements to produce the safety, capacity, and cost improvements we will get.

Second, I will show you the important interactions of these core elements. You will see these on the subsequent charts.

Automation, then, ties all these subsystems together.

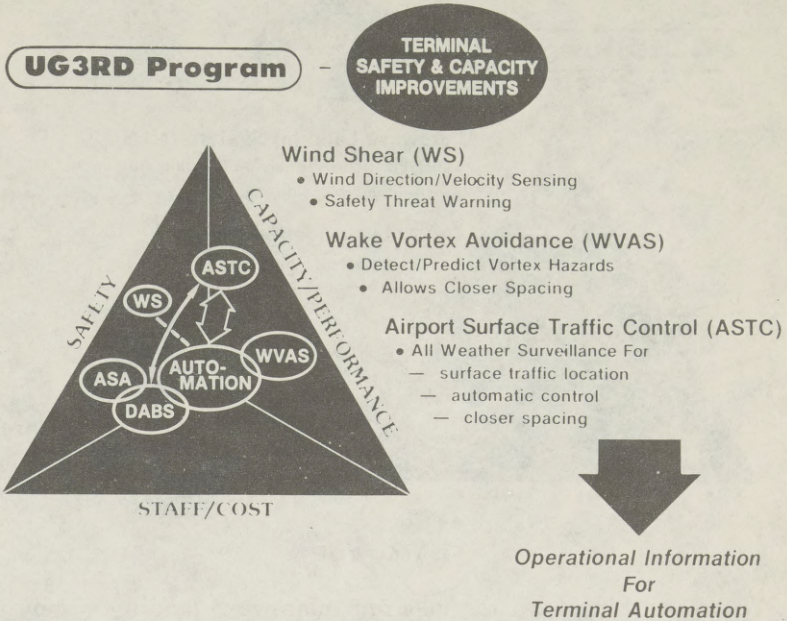
The basic technology improvements to separating air traffic are the discrete address beacon systems and the intermittent positive control system. [See viewgraph No. 17.] Here we see the interaction of these system elements with automation. These improvements provide the positive information, communication link, and collision avoidance warning needed in the future.



VIEWGRAPH 17

The basic capability gained is to eliminate the need for human processing of a number of two-way messages between the aircraft and controller. In addition, they provide a backup to the existing manned air traffic control system in the future.

In the areas of terminal safety and capacity improvement, we have the three programs shown here. [See viewgraph No. 18.]

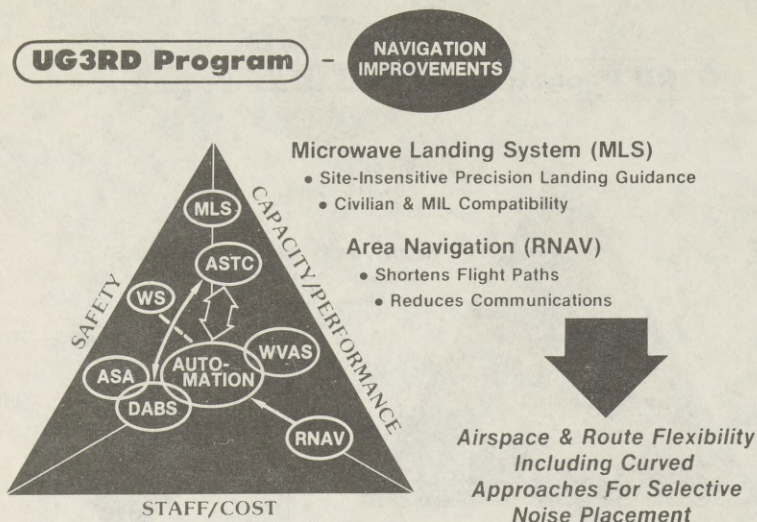


VIEWGRAPH 18

Wind-shear detection should allow for better decisionmaking by pilots in hazardous conditions. Our wake vortex avoidance system will provide a major step forward in regaining capacity by more closely spacing aircraft under safe vortex conditions. This is important, since our larger hubs will have a greater number of wide-body aircraft in the future, approaching about 40 percent, later in this century.

Controlling airport surface traffic through automatic techniques will mean capacity on the ground as well. I think any of you who has been at our real busy airports recognize some of the problems in control of the traffic on the ground.

Navigation improvements, especially the new MLS, will give us a much needed flexibility. [See viewgraph No. 19.]



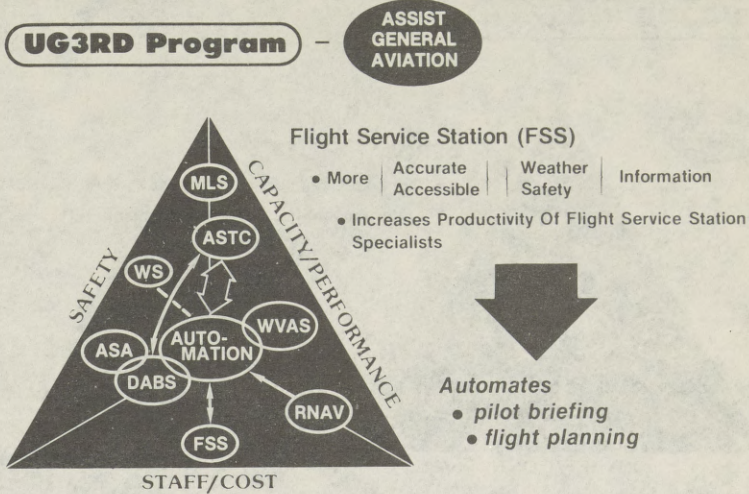
VIEWGRAPH 19

We are working hard to make our microwave landing system the international standard. We are working with the Department of Defense for a compatible military and civil system, as called for in the Federal Aviation Act.

We are pursuing area navigation programs which afford more direct flight paths and attendant fuel savings, as well as some increase in the airspace capacity of some of the major areas of activities.

Some potential noise gains can be seen by the avoidance of heavily populated areas with both of these systems.

To assist the general aviation pilot especially is needed a revamping of our flight service stations. [See viewgraph No. 20.]

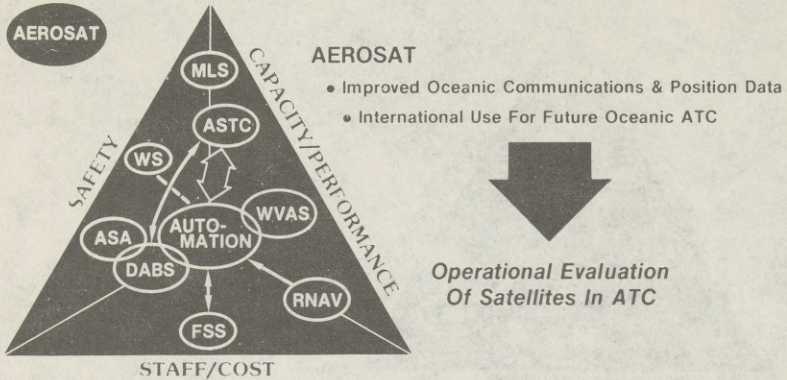


VIEWGRAPH 20

There are some sizable savings to be realized through automation of the flight service station program. Along with that, we would be able to provide much better and more timely information. Hopefully we would get rid of the statement which you can receive so often on the telephone when you call now, "the briefer is busy, please stand by." We would like to see in this automation program the big "S" put back in flight service stations.

The Aerosat is a vital international cooperative program. It brings advanced space technology into use in the oceanic areas. It gives an advanced technological base for future systems beyond the upgraded third generation air traffic control system. [See viewgraph No. 21.]

UG3RD Program

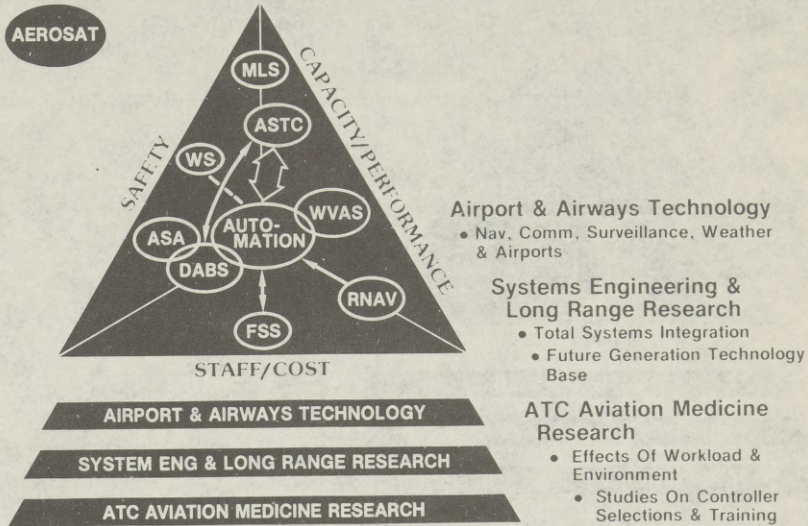


VIEWGRAPH 21

It is a program that we and our European and Canadian friends have entered into with the knowledge of all interested parties in this country.

Besides the basic upgraded third generation air traffic control system and the satellite program we must continue to work in other advanced technology and research programs. [See viewgraph No. 22.]

Total Program



VIEWGRAPH 22

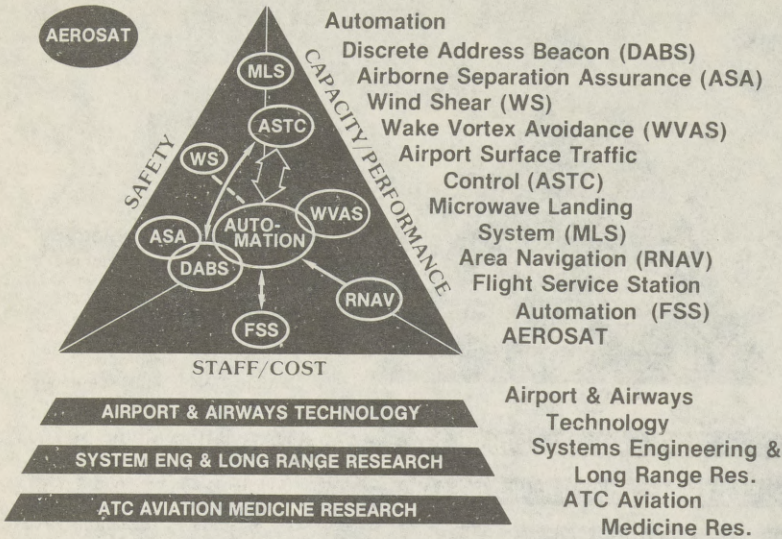
We must maintain basic technology disciplines in areas shown. An example is the integrated communications program which has high potential cost savings. The upgraded third generation ATC system meets the requirements to about the end of the century. By the year 2000 we must be prepared for further upgrading to the fourth generation.

For this reason our total program must include consideration of the next generation of problems. We must prepare the technology for the next generation air traffic control system as we did for the upgraded third generation system years ago.

We cannot forget the human in the system and our aviation program must continue to research man's performance and limitations.

This summarizes our program and the total request for \$76.7 million for fiscal year 1977. It is a balanced program, well designed to meet the system requirements. [See viewgraph No. 23.]

Total Program



\$76.7M

VIEWGRAPH 23

However, as Dr. McLucas said, our fiscal year 1977 program maintains the core program and only that.

We have expanded our efforts in safety—we are going to do more work in wind-shear and airborne-separation alert area, we are going to increase our efforts in the discrete address beacon system, intermittent positive control, and our airborne separation assurance. [See viewgraph No. 24.]

FY77 program ➡ Maintains Core Program

- Slightly Expands Safety Development
 - Wind Shear & Accelerated Conflict Alert & ASA
- Sustains Major

{	Capacity Improvements Cost Reduction	}	Momentum
---	---	---	----------

 - Automation, DABS, WVAS, ASTC (ASDE), Basic MLS, & AERO SAT
- Limits Efforts In:
 - Systems Engineering & Long-Range Research
 - Airport & Airways Technology & Aviation Medicine
 - Nav, Comm, Surveillance, Weather, & Airport Pavement Engineering & Controller Medical Studies
 - Wide Coverage

{	Civilian Military	}	& Shipboard MLS
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lean year ➡ Valuable Technology Projects Deferred

VIEWGRAPH 24

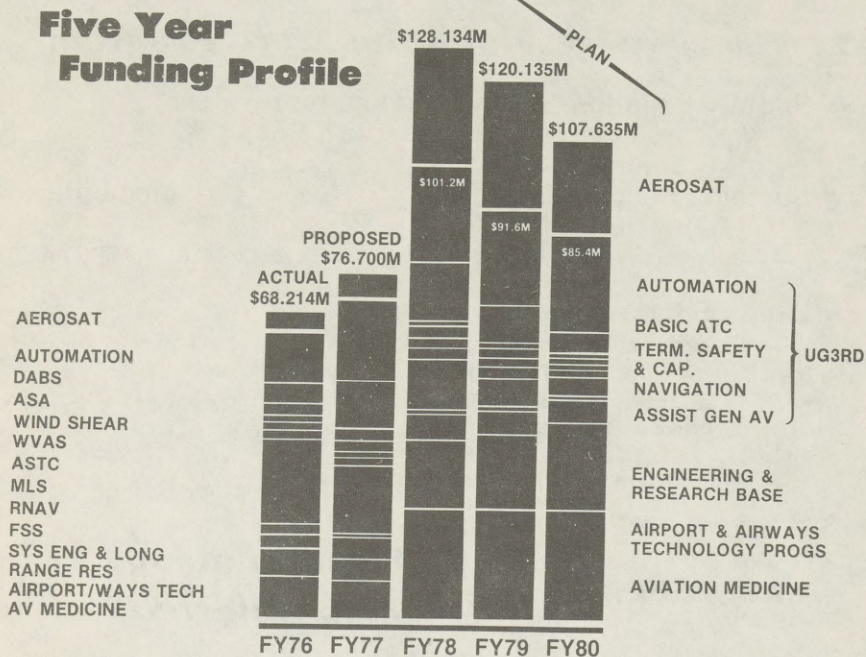
We will sustain momentum in the capacity improvements and cost reduction areas, and sacrifice some supporting efforts.

We will do limited systems engineering and long-range research in response to the needs for the next increment of improvement.

The airport and airways technology and aviation medicine programs are curtailed in this lean year. Nationwide problem-solving projects such as individual airport capacity studies and so forth will be held at a minimum this year.

We will do less in the way of some of the other efforts than we would if we had all of the funds. But I can say to you sincerely that all of the programs that relate to safety and everything that we know in the way of safety is covered by this program and by this plan.

Let me show you just basically a funding profile as we would see it from the research, engineering, and development point of view. This is not the agency's budget. This is the way we see some of our funding going over a 5-year period. [See viewgraph No. 25.]

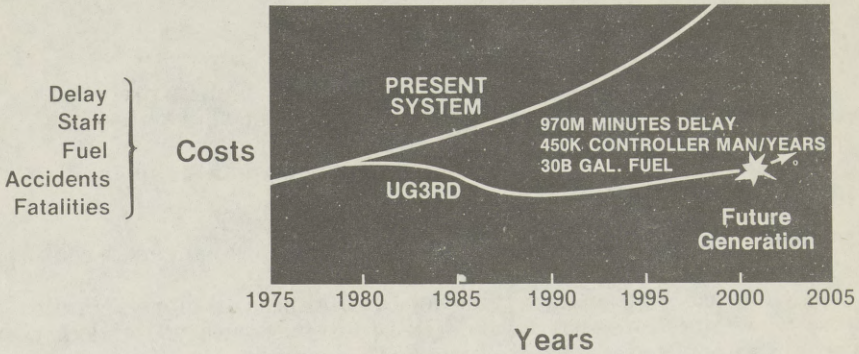


VIEWGRAPH 25

I am showing you what we received in fiscal year 1976, propose for fiscal year 1977, and then plan through fiscal year 1980. On the left, we list the same program elements that you saw before. On the right we show the packages of the basic contributions they represent. Apart from the Aerosat program, the major growth would be in the system in the fiscal years 1978, 1979, and 1980, would be in the system engineering and research base and the airport, airways, and technology programs with some growth also in aviation medicine.

In summary, we can project for you the characteristic cost of not moving ahead in technology. [See viewgraph No. 26.]

Benefits Of The UG3RD



UG3RD Technology

Changes
Cost
Performance
Of System

VIEWGRAPH 26

This is in effect a characteristics curve of cost for the present ATC system and the upgraded third generation ATC system and indicates how that upgraded third generation system alters the cost performance of the present system. This cost characteristic works well in all the cost categories as shown.

Over the 20 years shown, we expect the upgraded third generation technology to produce cost reductions of 970 million minutes in delay saved, 450,000 controller man-years in staffing, and 30 billion gallons in fuel.

Note that by 2000 we will need to do some of this again for a fourth generation system because the upgraded third generation system will have begun to outlive its usefulness at that time.

We believe we have a sound program, and we hope you will agree. We are continuing with our efforts to coordinate and make the best use of the information and the programs that are available to us in the Department of Defense and NASA. We rely on these agencies for assistance in all of the programs that we undertake where we have common interest so that we can bring the best talents to bear on the problems as we see them.

Thank you, Mr. Chairman.

Mr. MILFORD. Thank you, Mr. Cochran.

Mr. COCHRAN. Mr. Chairman, we have at your request prepared a status briefing on five programs that you asked in your letter to us.

Mr. MILFORD. OK.

Mr. COCHRAN. Mr. Wedan is prepared to give you a status briefing on those at any time you would care to have it.

Mr. MILFORD. All right, fine.

Mr. COCHRAN. If you would like to do that now, we can, or we could wait for the questions.

Mr. MILFORD. Rather than tying up Dr. McLucas all morning I did have a few questions that I would like to discuss with you and then perhaps we could proceed with the rest of the agenda.

Dr. McLUCAS. Fine.

Mr. MILFORD. Dr. McLucas, as you stated, you are now in a very important position, that being the FAA Administrator, and realizing your own newness, perhaps, has not allowed you to fully lay out what you would like to do or how you would like to do it. There are many that are wondering, I being one of them, for example, if you have yet established, or do you know now, what sort of a role you envision for R. & D. in the FAA? Are you looking toward more basic research, greater funding, consolidation of facilities, or, for example, have you thought how FAA R. & D. might help the airlines overcome their very important economic dilemma they are facing now?

In short, Dr. McLucas, what would be your basic philosophy concerning R. & D. and especially FAA R. & D.?

Dr. McLUCAS. Well, Mr. Chairman, it seems to me there are certain areas where the FAA mandate, if that is the right word, is pretty clear. This has to do with navigation and air traffic control. We should do anything that we can do that would improve the ability of the system to handle traffic and to minimize delays while maintaining safety. It seems to me that we have a clear charter to do those things and it is just a question of us having the vision and projecting the kinds of things that need to be done and getting the right support over here in the Congress for the funds that would be required to do that.

I believe that we operate under various conflicting pressures such that not everyone welcomes us expanding our R. & D. to the maximum because they see that most of the things that come out of R. & D. are devices that have to be bought by someone and that these will lead to increased user charges.

Nonetheless, I think that there is a consensus that there ought to be a good, sound R. & D. program which would enable us to handle the traffic growth of the future.

Now, when you start to go beyond those things it seems to me you get into further controversy but that does not mean I do not think we should do other things.

For example, we need to do considerable work to come up with more efficient engines. We have a fuel shortage situation, the problem of the high price of fuel to deal with. It is not apparent to me that the FAA charter includes developing these new engines, but working with NASA which does have a better charter in this area, we expect to continue to work cooperatively and encourage them to do these things which, because of our role in the whole picture, we can see the need for.

So we would like to support them in whatever way is necessary, joint studies, common development programs, carefully integrated programs, so that the work that we do will be complemented by what they can do and through that combination we will get these improvements in efficiency.

I mentioned engines but there are other things having to do with aerodynamics that relate to efficiency.

Noise is another area where it seems to me that our charter is not unlimited. But again by working with NASA we can, together, do significant work to reduce noise.

Pollution is another area.

Mr. MILFORD. Do you feel that your liaison and work with NASA is productive? Have you had any difficulties in liaison with NASA and these programs?

Dr. McLUCAS. Well, Mr. Chairman, as you point out I have not been there that long but I have had four or five meetings with our friends over at NASA. I knew quite a few of their people because of my Air Force associations. I found in meetings that we have had so far and I have taken a number of these gentlemen here at the table with me to some of these meetings, that the atmosphere seems to be excellent.

The atmosphere is such as to bring about cooperation. I cannot point to specific things that we have agreed to do but we have all said the right kinds of things to each other about the desire to do cooperative programs, to exchange information, to make sure our activities are dovetailed properly and all the rest. We were over there as recently as last Friday talking with them about having a better long-range plan which would lead to improvements in the future that we think are necessary for continued aviation progress.

I mentioned in my conversation earlier with you, in my statement earlier, about the interest in wake vortices and that is one area in which I think NASA now recognizes that we are very seriously concerned and they will give more attention to it than they were giving before.

Mr. MILFORD. Let me proceed a little further, mostly on the philosophical level because until one has his philosophy straight it is difficult to really understand the outcome of it.

Dr. McLUCAS. Right.

Mr. MILFORD. Secretary Coleman has often pleaded in speeches and in appearances before the Congress for this Government to establish a national transportation policy using all segments of transportation.

I am one to think very highly of the Secretary. I think he is one of the greatest that we have seen in this area in a long time.

Dr. McLUCAS. Yes, sir.

Mr. MILFORD. And I think his idea is a good one, it has merit. Unfortunately, the makeup of Congress being as it is now, with split jurisdictions, that national transportation plan I am afraid is going to remain somewhat elusive.

But nonetheless, I feel that if at all possible we should work towards the day when we can come together with a national transportation plan and in that particular light, aviation is a segment of transportation.

I am wondering if it is not time for us to sit down and identify if in no other field, the research and development area of establishing a national aeronautical R. & D. program where we would look ahead, say, take the year 2000 or take any figure, and try to identify where the Nation is going to go, what role Government is going to play, what role industry is going to play, and establish a program looking to the attainment of that goal.

I wonder if it is not time that we stop and tried to do something like that as opposed to having Mr. Cochran come in and try to bite off 3 or 4 years at a whack here, or 10 years?

I would appreciate your comments, if you have any, on that.

Dr. McLUCAS. Mr. Chairman, I would be glad to comment on that.

I would agree with you that aviation is one of the transportation fields that it seems to me lends itself to this kind of coordinated planning for the long-term view.

Aviation as we all know has been a big contributor to gold flow and our foreign exchange problems and we would like to see that continued.

At the same time, most of the people that are in key roles in this aviation industry see trends that they do not like, leading out into the future which would tend to jeopardize the American predominance. Maybe we have had so much predominance that we cannot expect to continue at that level of predominance but still we would like to make sure that the industry does remain healthy, that the manufacturing companies continue to get business and that the airlines prosper.

In order to do that, we have got to continue the kind of technological progress that we have had in the past. I mentioned some of these things that we hoped to work with NASA on. I think that if you were talking with the airplane manufacturers they would be even more vehement in saying these things need to be done. Things leading to better engines, more efficient wing shapes, reduced drag, reduced noise and pollution. All those things.

At the same time they must be done at a price that people can afford. I think perhaps we can—we are getting some help there in the sense that people are beginning to be willing to pay the price to make the environmental improvements and we are talking about, retrofit and one thing and another that has to do with noise factors which would not even have been considered a few years ago because people would say it does not make economic sense. But if you are willing to pay the price in the environmental area there are many things that you can do, as you know.

Getting to the more fundamental things and improvements in efficiency and doing this at a price, I think we do need an overall national plan and it is going to take a cooperative research and development program partly funded by the Government and partly by private industry. It seems to me that is sort of the American way.

And we do not have as good a handle on this as we need. I would welcome initiatives from the Congress. I think Secretary Coleman is on the right track. He is trying to do the right thing. But as you suggest that is not easy.

Part of it is that we do not have a history of having projected these plans into the future and specifying what the role of NASA, FAA, and all the rest will be on the Government side; and what then the private sector has to do on its own.

So I think it is a good area for initiatives and we would welcome such initiatives on your part or other appropriate congressional committees. Secretary Coleman is anxious to see this done. He has asked me to do everything I can to see that such plans are brought to being. I have been in touch with, for example, John Robson at the CAB to try to get better ties there.

I think there are areas of overlapping interests, areas not too clearly specified as to where one agency stops and another one begins but if we understand each other's problems and work together better I am sure there are some things that can be done. There is economic impact for the things we want to do which the CAB needs to take account of. Similarly it works in the opposite direction.

So there is certainly a need to work on this together and I think the Congress is maybe the key element to bring all this about.

Mr. MILFORD. I would hope that we will be able to do that. We are going to give it a try on this subcommittee at least in the R. & D. field.

I could not help but think of an often-heard complaint particularly from the general aviation area when you in your testimony were talking about the collision-avoidance-airborne system, transponders, discrete beacons, ground-proximity warning systems, that often there is one segment of the aviation industry that begins to shudder when they hear talk of that nature out of Washington because the small-business pilot, the sports pilot, or owner, has horrors of having to go out and purchase rather expensive equipment in order to remain in the air.

I happen to be one of these sports flyers and I am wondering what your comments would be there. They come to me and they say, well, you know, back in the old two-way radio days, we were told we would not have to have them; then we had to put in radios. Then we had to put in transponders; and now what will happen to us in the way of all this exotic equipment that we keep hearing about?

Dr. McLUCAS. I think the reason we have sponsored a number of different approaches to this collision-avoidance problem, to take one case here, is that there is a difference of opinion about what is the right way to go technologically and there is a difference of opinion, also, about how much different types of pilots can afford to pay and how much is enough.

There have been pressures to have systems that could be deployed tomorrow if there were congressional mandate that such systems were to go in. From our standpoint we have not felt that collision-avoidance systems had reached the stage of development and at the price where we wanted to mandate their installation.

But we recognize that we are not completely in control. We may get told to have such systems put in. Therefore, we want to be ready. We have sponsored as you know the work on so-called ACAS, airborne collision-avoidance system.

That work has led us to believe that technically we are to the point where feasible systems exist that could be put in, but that economically we do not think we have gone as far as we need to go.

We think there are other systems that could be deployed at lower cost and just as effective.

But even the other system that we have in mind at the moment, the so-called beacon-based collision-avoidance system is not ideal in that it calls for maneuvers that are not part of the normal air traffic control procedures. The pilot might find himself in a position of being told by air traffic control to maintain altitude and be told by the collision-avoidance system to change altitude. So we would like to go on to other systems which would lead to maneuvers other than changing altitude. You mentioned the discrete-address beacon system. That is the evolution of the existing beacon system which would give us more ability to handle individual situations properly and we would like to continue to do the research and development on that leading toward an eventual system available for installation.

If you ask will these systems be added costs to the average general aviation pilot, I think the answer is "Yes." And for that reason we need to spend more money on the research and development so that in the implementation phase, we can reduce the cost to the individual pilot. I think we are always going to be in the position where the airlines and large aircraft are going to want to install increased items for safety purposes which the average pilot will not want to install. I would expect there would always be this duality then with the large aircraft heavily instrumented and the small aircraft which has minimum instrumentation. We hope we can keep the cost of these black boxes, which the small airplane would need in order to operate in a given traffic environment, down to a point where most people would be willing to pay for them.

Mr. MILFORD. I have gone over my 5 minutes.

Mr. Lloyd?

Mr. LLOYD. Thank you, Mr. Chairman.

It is nice to see you again, Dr. McLucas.

Dr. McLUCAS. Good morning.

Mr. LLOYD. I, too, share our chairman's concern for general aviation. As a very natural situation both you and I know, having worked with the military and of course obviously with your indepth understanding of aviation through the Air Force, that the emphasis for the military is very easy. Whatever they need in any avionic equipment which is adjusted to safety to military aircraft is very easy, because in the dollar range the aircraft costs are so extremely high that this is a very small portion of it.

These costs then start to grow when you get into commercial areas although there is a heavy emphasis on certain types of equipment, automation of the aircraft approaches, hands-off approaches, et cetera. But when you get down to the small pilot where he is going to pay \$10,000 for a used aircraft, and then specialized equipment is going to cost in the neighborhood of \$3,000, maybe even \$5,000 and certainly not automation, but just warning devices, transponders and coding altimeters, we then get into a situation where really he is very hard pressed.

Of course, the people of the airlines whether it is the Pilot's Association or the owners, the people of the large manufacturers who manufacture the heavier equipment, these are the 1011's, DC-10's, et cetera, maybe even a Concorde or two, and certainly the military have very little empathy for this type of a pilot and have expressed openly almost an antagonism.

I think that antagonism is reflected in your Agency—I do not mean you individually but I am referring to the Agency. Let me give you a for instance. In my district there is a small airport called Bracket Field and the FAA has indicated a great desire to put in an ILS system in Bracket Field.

I have shot instrument approaches in that area and while I am not certainly in the *n*th degree a person automatically willing to go out and fly instrument approaches I would no more than the man in the moon fly instrument approach into Bracket. I do not care what kind of equipment you have, there happens to be two small hills on each side and yet FAA is adamant about the fact, at least I am told by the county aviation people, that this is really necessary. And what I am doing is telling a story which in essence says that in our bureaucracy in Washington which by the way are a little offensive to me at times, I am sure they are to you, too, we all get caught in this bureaucratic morass, and in our desire to respond to the cries of the people who say they are badly put upon because of noises or the impacts of pollution, that we overreact. Do you think there is a possibility that maybe we ought be put more emphasis within your Agency to a holding down of that and trying to address ourselves from the total spectrum with a greater balance? I think this is really what Mr. Milford was talking about.

Certainly it is what I am talking about. I think that you are out of balance is what I am saying. Do you think that is true?

Dr. McLucas. Well, Mr. Lloyd, if you are saying we tend to put more emphasis on those problems that relate to the airlines and less on general aviation—

Mr. Lloyd. That is part of the question; yes. Really what I am addressing is the total philosophy, Dr. McLucas, of the little guy really does not count that much. I am trying to impart to you that I think he does count that much.

Dr. McLucas. I would certainly agree with that viewpoint. I do not claim to know everything that the agency has done with respect thereto, so I cannot comment in specifics. But I certainly have heard over the years the same type of comment that you have made that we tend to focus in some areas and ignore others. At the same time, some of the pressures that we get from the people who say they represent the little man, are that they want to be left alone.

Mr. Lloyd. They do not want anything which is unrealistic also, I understand that, Doctor.

Dr. McLucas. So I can see there are two sides to that controversy. I guess what I should say is I will try to school myself in the needs of all these various users to the point where I can make rational judgments. As of today, I do not have any big program that I want to come in and force down the throats of my associates. I feel that I am still in the phases of absorbing information and getting ready to take positions on issues as they come up.

I welcome that opportunity but I do not start out with the strong feelings that we are way out of kilter. I certainly recognize what you say about giving adequate attention to general aviation and the need not to mandate systems that will drive some people up the wall.

At the same time, I think I have to say that as we move into more congested airspace there is going to be a demand for things like every airplane that operates in that space having a beacon with altitude encoding in order to enter certain controlled areas. It may be that is sort of the minimum price of admission but I am an optimist on the question of what you can do with microminiaturization technology and driving down the costs of these black boxes.

I think what has happened to the hand computer is a good case in point and we should see that same type of cost reduction in other fields.

Mr. LLOYD. In other words, what you are saying is we really can have our cake and eat it, too, and that the cost of aviation to the small general aviation operator will be within his scope to continue on in operation and commensurate with the needs of the specific area, and of course I always think of Los Angeles and by the way Dr. McLucas, I think there has to be a traffic separation in Los Angeles. I recognize the great geographical squeeze that occurs with the numbers of aircraft which are operating in that basin and the potential of really great danger.

So I really do appreciate the problem. But I also want to, as I am sure our chairman was trying to point out, want to communicate to you the great need for conscientious efforts on your part and your agency's part to recognize that the small aviation guy is probably the base of where many of our transport pilots, even military pilots first started flying. And I think that it deserves our encouragement.

Let us address ourselves to another area which I happen to be very interested in. That is support of our aircraft manufacturing people in the overseas sales situations.

Do you see yourself as administrator, as having some responsibility to aid and abet our commercial effort on the part of our people—even though it is much in the press like a Lockheed or Northrop or McDonnell Douglas, or better yet Cessna, Piper, or Beechcraft—in overseas sales?

Do you see yourself in your role as administrator of putting pressure on say the State Department to have a greater level of interest in furthering these commercial interests of our Nation?

Dr. McLUCAS. Well, Mr. Lloyd, I have not recognized that need up to this point. As I indicated earlier, Secretary Coleman has asked me to spend more time thinking about this type of issue. He thinks that in my role as principal aviation adviser to him that I should come forth with some initiatives that would tend to improve the viability of the American aviation industry. I look forward to getting into those things. I have not done that much about it so far but I do recognize it is something that we should do. I do think that this is the typical case in bureaucratic Washington where no one agency has the ball but we all need to address the problem, and I would appreciate any help you gentlemen can give me.

Mr. LLOYD. I think my 5 minutes is up.

Mr. MILFORD. I would like to get back to one area that I think is extremely important. It perhaps doesn't directly apply to this subcommittee as the Aviation Subcommittee, but there is a cross pollenization of the membership, and this is this business of user cost. I happen to feel it is a very important area and that the bona fide user should pay his proportionate share of the cost. There has been a difference of opinion as to what that particular share of cost might be. The Department of Transportation did a study which I looked at and, which I disagreed with most violently because I did not feel it was a fair representation and many others felt that it was not a fair apportionment of user cost. Particularly it came home to me a few years ago when, like hundreds of other hobbyists, I decided to build my own airplane and was able to keep track of the costs that were involved. I noticed that I had to spend a considerable amount of money going to FAA engineering to simply prove that the design I had was safe. I had to spend a considerable amount of money in building up the various components by having inspectors come and simply look at them and say, "Yes, that's the way it should be," or "Yes, it is safe."

I had to go through a flight test program which again was simply to prove that aspect of the plane.

None of these steps made that airplane a bit better, did not make it any better, and then, of course, you can carry it on further, if you wanted to, that the pilot has to be examined, he has to prove his competence, and so on. This, again, doesn't make the pilot any better.

So, these are the factors that I feel have not yet been properly identified in establishing a user charge for aviation services.

Do you, or does Secretary Coleman, have any way of going back and making a true study so we can properly identify what is for public safety as opposed to what is making the airplane fly better, or what does the airplane or its crew actually use in its work?

Are any plans underway on that?

Dr. McLUCAS. Yes, sir, Mr. Chairman. There are plans to redo the study which was done—I forget just how long ago—which came up with these user cost allocations. It is recognized that this cut at the problem was not adequate and it ought to be redone and I am having a meeting with Mr. Bender and some of our own planners next week to go into this matter.

I think everyone—at least the people I have talked to—said, "Yes, we believe in user charges." What we are really arguing about is whether they are properly allocated. Certainly, we are never going to come up with a user charge allocation system that pleases everyone, but certainly we can do better at it than we have done and we do intend to have another go at this.

Mr. MILFORD. OK.

Finally, in your remarks concerning the research and development underway to counteract the bombings and this sort of thing, are you running into any problems or conflicts with such things as the Freedom of Information Act, or recent trends in this country to cut back on domestic intelligence on the part of the FBI, and law enforcement officers? Are these a factor in trying to adequately protect passengers from these bombing-type incidents?

Dr. McLUCAS. Well, as you know, we have special provisions in FAA's legislation that allows us to hold close certain material related to techniques as to how we are going to add additional security to airports and in the aviation field in general.

We are not bothered by the Freedom of Information Act in that sense.

Now, I have heard—and this is secondhand—some of my friends in the FBI and others say that the fact we have gotten so conscious of keeping adequate records on people which were judged, in some cases, to be more than adequate, that with that new consciousness, it is complicating our problems of law enforcement. But since we at FAA are not normally in the law enforcement business, I don't have firsthand knowledge of that.

Mr. MILFORD. OK.

Dr. McLUCAS, we sincerely appreciate you appearing before the committee this morning and participating in our hearing. We wish you the best and would offer the cooperation of this subcommittee in any way that we can to work with you toward a goal that we apparently are both trying to attain.

Dr. McLUCAS. Thank you very much, Mr. Chairman. It is a pleasure to be here. We look forward to working with you as we foster this mutual goal of continued aviation progress.

Mr. MILFORD. Thank you, sir.

The Chair would now recognize Mr. Robert Wedan, Director of Systems Research and Development Service, Federal Aviation Administration.

STATEMENT OF ROBERT WEDAN, DIRECTOR, SYSTEMS RESEARCH AND DEVELOPMENT SERVICE, FEDERAL AVIATION ADMINISTRATION

Mr. WEDAN. Thank you, Mr. Chairman. I will be speaking about five major development programs. The programs were requested by you in a letter to the FAA, four of which are supported by the research, engineering and development appropriation and one supported by the facilities, engineering and development appropriation.

For each of these programs, I will review briefly its requirements, expected benefits, history, and the expected results of our fiscal year 1977 activities.

I would like to submit for the record technical papers on each of these programs.

Mr. MILFORD. Without objection, your entire statement and attachments will be printed in the record at this point.

Mr. WEDAN. Thank you.

First, we have an aeronautical satellite program. Currently, the air traffic control over the North Atlantic, Pacific and Indian Oceans is accomplished by unreliable high frequency radio. This will not support continued growth of international aviation especially the requirements of the late 1980's and 1990's. [See viewgraph No. 27.]

Aeronautical Satellite

PROGRAM BACKGROUND

- ICAO REPORT - PREDICTED HF SATURATION 1968
- OTP ASSIGNS LEAD TO DOT/FAA 1971
- ICAO RECOMMENDED EXPERIMENTATION 1972
- MEMORANDUM OF UNDERSTANDING 1974
 - USA/FAA
 - EUROPEAN SPACE AGENCY
 - CANADA

STATUS

- CO-OWNERS AGREEMENT ON FUNDING JANUARY 1976
- SYSTEM SPECIFIED
 - SPACECRAFT RFP MARCH 1976
 - AVIONICS CONTRACTS
 - VHF JUNE 1975
 - L-BAND APRIL 1976
 - AERONAUTICAL SATELLITE COMMUNICATION CENTER (ASCC) APRIL 1976

VIEWGRAPH 27

Satellite communications and surveillance technology will accomplish approximately five things: one will be a reduction of aircraft separation which currently over the ocean at altitudes is 120 miles apart between aircraft tracks.

This will result in improved efficiencies including fuel consumption enhanced search-and-rescue operations, and the reduction of the number of flight information regions. Additionally, studies conducted by the Department in cooperation with the FAA have indicated that satellites have a potential advantage for operations over the continental United States and Aerosat will give us the opportunity to experiment with that capability.

Now, so far as background is concerned, in 1968 the International Civil Aviation Organization made projections of future international aviation travel indicating that the current system would not support the demands to be put on it in the late seventies and early eighties. In 1971 the Office of Telecommunications Policy assigned the United States leadership for the program to DOT/FAA. In April of 1972 ICAO recommended the member states proceed with experiments with Aerosat and in 1974 a memorandum of understanding was signed by the participating members of the program.

Current status is that the funding agreement by the co-owners has been reached and with each participant's contribution shared proportionately with the United States sharing 47 percent; European Space Agency, 47 percent, and that is with nine participating countries; and Canada, 6 percent. This is of the space segment.

The Space Segment Space Program Office established in the Netherlands is preparing the specifications for the equipment for the space segment. The request for proposal is expected to be released in March of this year.

Contracts for VHF avionics in the commercial airlines have been let as well as request for proposals for the L band avionics and the ground-based Aeronautical Satellite Communications Center. The contracts for the avionics and the Communications Center will be negotiated this year.

So far as 1977 objectives are concerned, we estimate that the contract for the space segment will be awarded by December of this year. This contract is a significant part of the program and until we have the information on the costs of the space segment we will not be able to have a definitive picture of what the total program costs are. [See viewgraph No. 28.]

Aeronautical Satellite

FY-77 OBJECTIVES

- AWARD SPACECRAFT CONTRACT
- DRAFT OF TEST & EVALUATION PLAN
- ISSUE RFP FOR U. S. PORTION OF AERONAUTICAL SERVICES EARTH TERMINAL (ASET)
- DELIVERY PROTOTYPE VHF AVIONICS
- SYSTEM DESIGN COMPLETED

VIEWGRAPH 28

Also, in 1977, we expect to issue for international coordination a draft of the test and evaluation plan which will indicate the data which will be collected during the experiment. This data will be the basis for decisions on technical, operational, and financial aspects of any follow-on operational system that will be established.

The request for contractual proposals for the Earth terminal will be issued in Fiscal Year 1977—and construction of the U.S. Earth Terminal should start in April 1977.

And the development of aircraft receivers and transmitters will continue with prototype hardware delivery expected in the second quarter of the year with installation in FAA and airline transport aircraft to follow shortly thereafter.

The system design itself is expected to be completed by the end of fiscal year 1977.

Now I would like to speak to the flight service station program. I would remind you at the outset that this is a program which has both developmental and operational aspects. The program does involve many parts of the FAA and I will speak to the total program, as well as the R. & D. portion. [See viewgraph No. 29.]

Flight Service System Modernization

PROGRAM BACKGROUND

- DOT/FAA STUDY AUGUST 1973
- THREE PHASE PROGRAM
 - NEAR TERM IMPROVEMENTS
 - BASELINE AUTOMATION
 - ENHANCEMENTS

STATUS

- COLLOCATION DEMONSTRATION INITIATED FEBRUARY 1976
 - WASHINGTON ARTCC/FC
- ATLANTA AERONAUTICAL WEATHER AND NOTAM SYSTEM (AWANS) OPERATIONAL EVALUATION JULY 1976
- BASELINE SYSTEM PROCUREMENT SPECIFICATION AUGUST 1976

VIEWGRAPH 29

The current flight service system is very labor intensive, which means, as Mr. Cochran had indicated, that as the demands go up over future years, so will operational staff requirement to maintain the services unless something is done.

The application for future demands for a service such as pilot briefings are forecasted to triple during the years 1974 to 1980, if we were to maintain the present services.

To prevent the continued escalation of the number of personnel—and as a reference point the present staffing is approximately 4,500 people—major revisions to the present system are needed. Alternatively, we must pay the price for additional people or drastically reduced services.

With the new system, and the improvements under development, we project an annual savings by 1990 of approximately \$175 million. This new system will satisfy user demands and will enhance safety by improvement of the service.

The joint DOT-FAA study completed in 1973 recommended a new automated flight service station concept to replace the existing system. The program was then divided into three phases shown on the chart.

First, the near term improvements being introduced, such as limited automation, providing closed-circuit TV for facsimile data, and improved operator consoles.

The next step is the baseline automation program. The start of this activity will be the investigation of the feasibility of collocation of the flight service station at an air route traffic control center and a consolidation of several flight service stations. This effort is now under the Washington Area Air Traffic Control Center located in Leesburg, Va.

The next phase is the enhancement program which will add such techniques as automated computer voice response for those people who wish to extract information directly from the computer. This will include direct access devices by which the pilot or the user can access the system not only at self-briefing terminals, but through his own telephone with devices currently being developed.

We have installed the Atlanta A-1 system. The viewgraph depicts the consoles available to the operators at the Atlanta Flight Service Station for beginning of experiments. This has been in operation since July 1975. I might add that this system has received enthusiastic acceptance by both the operational personnel and the users.

One such device is a hand terminal which can be used with the telephone system. With it you can enter your request to the computer directly for weather information and receive the information over the telephone through a computerized voice response system. The request for information can be edited with the display. One can also file a flight plan directly into the computer with a device of this sort.

In 1977, the tests on the automatic telephone answering service and the transcribed weather broadcast system in New York will be completed and the design for the national system will be finalized. In the latter part of the fiscal year contracts will be awarded, based on the proviso of satisfactory completion at Leesburg, for the baseline system and for expansion of the baseline system to improve the user accessibility and interface with future ATC systems including these enhancement products. [See viewgraph No. 30.]

Flight Service System Modernization

FY-77 OBJECTIVES

- COMPLETE NATIONAL PILOT AUTOMATIC TELEPHONE ANSWERING SERVICE/ TRANSCRIBED WEATHER BROADCAST (PATWAS/TWEB) DESIGN
- AWARD CONTRACT FOR BASELINE PRODUCTION
- AWARD CONTRACT FOR ENHANCEMENT DEVELOPMENT
- WASHINGTON ARTCC/FSS CONSOLIDATION COMPLETED

VIEWGRAPH 30

Much has been said about the aircraft separation assurance program. I have a few added remarks to be made here.

With the general growth in the population of aircraft, particularly general aviation, and the size of the commercial fleet, there is increased concern over the possibility of midair collisions. In 1974, Congress directed that study be made to evaluate the technical alternatives open to us. This work is continuing and I will indicate the status as we go along.

Any solution to this problem will have to be based upon a combination of procedural, regulatory, and hardware options.

The process of improvement of the quality of this protection is basically evolutionary and, of course, is deeply rooted in the beacon concept for aircraft identity and position including altitude which is available to the air traffic controller. [See viewgraph No. 31.]

Aircraft Separation Assurance

PROGRAM BACKGROUND

- CONFLICT ALERT (CA)
- NEW AND IMPROVED SURVEILLANCE
- EXTENDED USE OF TRANSPONDERS AND ALTITUDE ENCODERS
- BEACON COLLISION AVOIDANCE SYSTEM (BCAS)
- INTERMITTENT POSITIVE CONTROL (IPC)

STATUS

- | | |
|--|---------------|
| • HIGH ALTITUDE CONFLICT ALERT | DECEMBER 1975 |
| • AIRBORNE COLLISION AVOIDANCE SYSTEM (ACAS) TESTS | DECEMBER 1975 |
| • BCAS FEASIBILITY TESTS | MID 1976 |
| • IPC SYSTEM DEMONSTRATIONS | UNDERWAY |
| • DISCRETE ADDRESS BEACON SYSTEM (DABS) | |
| CONTRACT AWARD | FEBRUARY 1976 |

VIEWGRAPH 31

The enhancement to this system begins with the technique of conflict alert. This is implemented through the software program in the ground base computer facility. It evaluates possible conflicts and if one does exist the controller is alerted automatically and serves as a backup to the controller's assessment of any given situation.

Another step though not part of the R. & D. program is to increase the number of surveillance systems throughout the country to provide a more complete coverage of the air space.

A parallel but equally important improvement to the quality of the service depends upon more complete equippage of aircraft with altitude-encoded transponders which will provide the air traffic controllers with more and better data. This is a requirement for the air traffic control system today and in future years.

Looking ahead to advanced hardware techniques, the R. & D. program includes the evaluation of air-to-air conflict determination and resolution. One version of this is based on operating in the beacon frequencies and is referred to as the Beacon-based Collision Avoidance System (BCAS).

Intermittent Positive Control (IPC) is a long-term solution to the midair collision problem and is intended to be used with the basic discrete address beacon system.

This facet of the system provides an automated three dimensional warning and collision avoidance display in the cockpit. This type of display is being experimented with in live tests at the Lincoln Laboratories in Cambridge, Mass. The display directs the pilot to make horizontal maneuvers, directing him not to maneuver toward the threat. This capability is unique to the IPC system. The system also indicates by the row of lights around the periphery of the display the direction from which the offending aircraft is coming. This provides a unique capability in providing separation assurance for uncontrolled or VFR aircraft. For the short period that aircraft must be maneuvered to resolve a conflict, a command is transmitted to appropriate panel display, via a data link which is part of the discrete address beacon system program or DABS. This command provides for positive control for this very brief period to resolve the conflict.

Regarding our current status, the conflict alert has been implemented within the automated ATC en route structure for aircraft flying above 18,000 feet. This is currently being expanded to include altitudes above 12,500 feet. [See viewgraph No. 32.]

Aircraft Separation Assurance

FY-77 OBJECTIVES

- COMPLETE ENROUTE CONFLICT ALERT
- COMPLETE DESIGN OF TERMINAL CONFLICT ALERT
- COMPLETE DESIGN - SINGLE SITE DABS AND IPC
- ISSUE NATIONAL STANDARD FOR DABS TRANSPONDER
- AWARD BCAS PROTOTYPE CONTACT
- DRAFT BCAS NATIONAL STANDARD
- ISSUE TRANSPONDER RULE

VIEWGRAPH 32

This portion of the work is to be completed this month, February 1976.

Work is continuing to extend this capability for all en route altitudes and for ARTS III-equipped terminal areas.

Tests of three air-to-air collision avoidance systems, called ACAS, have been completed and I have a report that has just been published on the results of that test.

The feasibility tests of BCAS will be completed this year. As I indicated before, the demonstration of the intermittent positive control concept is currently underway, based on experimental air and ground equipment. We will award a contract this month, February 1976, for the prototype development of the discrete address beacon system which is necessary to implement this function.

Regarding objectives for fiscal year 1977, the en route conflict alert system will be implemented and the design for the terminal air system will be completed.

Additionally, we will complete evaluation and system design of the IPC concept based on single site operation and the design of a multi-site system is included as a task for the DABS development contractor.

Based upon the completed evaluation of the experimental IPC system, a national study will be issued for a DABS transponder. This will permit early development of these transponders. Because of the compatibility for the present transponders and the DABS transponders, the buyer will have the choice of buying either one for the future.

Also, during 1977, a contract for the development of the BCAS prototype system will be awarded and a draft national standard for BCAS will be issued.

Finally, during this period, we expect to engage in the rulemaking process to provide for complete equippage of aircraft with transponders as a prerequisite for flying in controlled air space.

Now, a word about the airport security program.

Mr. MILFORD. Before we leave that, could I interrupt you here for a second?

Mr. WEDAN. Surely.

Mr. MILFORD. I can see that I had had some misconceptions on the difference in BCAS and DABS.

Technically, what are we talking about in discrete airborne beacon system?

Mr. WEDAN. Well, the BCAS system would require that aircraft, other aircraft, the general aviation, for example, be equipped with either today's transponder with altitude reporting or a future DABS transponder with altitude reporting.

Interrogator equipment would be aboard the large aircraft, the jet aircraft, which would look for those aircraft which would present to him a potential threat. This would be an air-to-air resolution detection and resolution of the problem.

Mr. MILFORD. You are carrying a detection device on each airplane?

Mr. WEDAN. Yes; and it is a transponder.

Mr. MILFORD. And you may or may not be carrying a receiving device or interrogator; is that correct, or would this be the same unit?

Mr. WEDAN. The concept would require that the aircraft carrying the equipment that is interrogating would be the resolving of the conflicts. He would be able to detect those other aircraft that are not equipped with anything except the transponder, that it is there; and if a threat exists, then the interrogator equipped aircraft would maneuver out of the way. This would be a vertical maneuver only, very similar to the present air-to-air collision avoidance systems known as ACAS.

Now, the DABS—

Mr. MILFORD. Just a moment, I am still not clear.

On the BCAS, if I put a unit in my airplane, it will first transmit and it will also interrogate others that are transmitting? In other words, it is one box? Am I correct there, so far?

Mr. WEDAN. That is right. You have to keep in mind that there is an interrogator which would be the device which requests information from other aircraft.

Mr. MILFORD. Right.

Mr. WEDAN. Those other aircraft would be responding with their transponder in exactly the same way that they would be responding to the ground system.

Mr. MILFORD. But I have just bought one box to go in my airplane here.

Mr. WEDAN. Yes; that is right.

Mr. MILFORD. Roughly, what are we talking about in the way of cost of that box? Do we have any idea yet?

Mr. WEDAN. Yes; we do.

May I start with general aviation, those that do not carry the interrogators; the cost to him would be the cost of a transponder and an encoding altimeter. We know what those costs are, the devices are in production today. For those who do not have any equipment, it represents an investment of \$1,000, a little over \$1,000. Our estimate is \$1,020 based on catalog prices without installation.

Mr. MILFORD. Is this going to be compatible with present transponders in any way?

Mr. WEDAN. It is the present transponder. I am speaking of the general aviation aircraft.

Mr. MILFORD. That is where he can't—it doesn't tell him where the other airplane is, he is simply transmitting?

Mr. WEDAN. He is simply radiating information like "here I am and everybody else get out of the way."

Mr. MILFORD. Now, if he wants to find the other guy, what does the box cost?

Mr. WEDAN. We envision that the only aircraft to carry that equipment would be large air carriers, military and general aviation aircraft. Our present estimates are \$14,000.

Mr. MILFORD. OK.

Now, what are we talking about in the discrete or DABS, discrete airborne beacon system?

Mr. WEDAN. If a pilot who is not equipped, the aircraft owner is not equipped with anything and chooses to go the route of DABS IPC, he would pay approximately the same price for the transponder which would be about \$500 to \$600. He would pay exactly the same price for an altitude encoder which is about \$420 on today's price basis, plus a display. Now, the display, our best estimates at this time indicate that they would cost about \$500 so his investment for the separation assurance equipment would be about \$1,500.

Mr. MILFORD. In the case of DABS, everything is located on the ground; is that correct? Am I correct there, and it is transmitting to the indicator in the airplane?

Mr. WEDAN. That is correct.

Mr. MILFORD. In other words, the ground unit is reading mine in the air, reading the transponders in the air and transmitting to the individual receiver which would display for that particular airplane?

Mr. WEDAN. That is correct.

Mr. MILFORD. OK, I appreciate that. I was confused as to what we were talking about.

Mr. WEDAN. Airport security: The daily operations in United States average about 15,000 flights into 500 airports. The personal baggage proximates 400 million items. Now, since 1972, 152 people have been killed as a result of 17 explosions and that is either on aircraft or at an airport itself. Six of these have occurred in lockers and in other areas of the airport, around the terminal area. [See viewgraph No. 33.]

Airport Security

PROGRAM BACKGROUND

- RECENT LA GUARDIA INCIDENT
- SUPPLEMENTAL/AMENDED FY-76/77 REQUESTS
- FOR RESOURCES IN PREPARATION

STATUS

- | | |
|---|---------------|
| • EXPANDED TECHNICAL DEVELOPMENT PROGRAM PLAN | JANUARY 1976 |
| • LABORATORY TEST DATA - VARIETY OF DETECTORS | AVAILABLE |
| • MULTI-AGENCY APPROACH | FEBRUARY 1976 |

VIEWGRAPH 33

So, it is necessary to seek ways that we can deter saboteurs in order to permit civil aviation to function safely. The recent LaGuardia bombing has caused us to accentuate our task of detecting concealed explosives before they are introduced into either the terminal or the aircraft environment.

In order to carry out a viable program, one that deals with detection device technologies in addition to the other deterrent techniques, we are working with the Office of the Secretary, OMB and developing an effective program to build on past experiences that were referred to by Mr. Cochran.

An expanded plan for the program execution is now being finalized. Laboratory test data on various technologies that could be applied is available to us and in coordination with other agencies a follow-on program is being conducted.

So, in fiscal 1977 [see viewgraph No. 34]—first, I would like to indicate one of the devices which is available and at hand. It is this X-ray device located at Washington National Terminal. This is not the imaging device, it is an X-ray device, but not the imaging device that we are familiar with as we carry baggage aboard an aircraft. This device uses X-rays, but detectors and logic devices within the system, actually it is a small microprocessor computer, will determine whether or not a bomb or a gun is being carried. It uses an X-ray absorption technique for detection. I witnessed a case last week where two hand carried baggages were first shown on a standard imaging device and all one could see in there was shaving material, and so forth, but when it went through this particular device, the bell went off indicating there was something inside. Opening it up—this was a planted piece of baggage, of course—when it was opened a pistol was in one and in the other was a plastic tube which approximately is the characteristic of dynamite. That, too, was picked up on this X-ray absorption device.

So, this is the kind of thing that we are starting with, plus other laboratory devices on detection devices.

Airport Security

FY-77 OBJECTIVES

- COMPLETE EVALUATION OF NON IMAGING X-RAY CHECKED BAGGAGE PROTOTYPE
- COMPLETE EVALUATION OF PROPOSED LOCKER DESIGN MODIFICATION
- COMPLETE EVALUATION OF AVAILABLE EXPLOSIVE VAPOR DETECTORS
- COMPLETE OPERATIONAL ANALYSIS FOR A SECURE AIRPORT MODEL
- COMPLETE FEASIBILITY STUDY OF THE X-RAY FLUORESCENCE EXPLOSIVE DETECTION CONCEPT
- COMPLETE FEASIBILITY STUDY OF AN AIRPORT OPERATIONAL NUCLEAR MAGNETIC RESONANCE SYSTEM

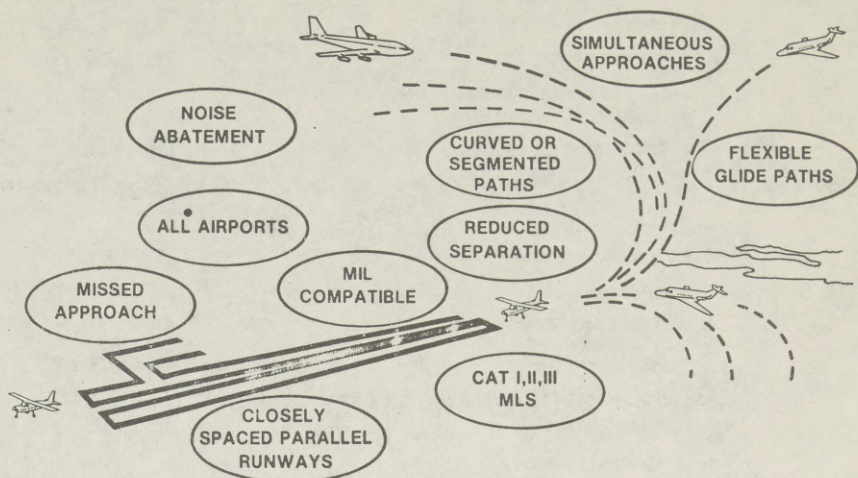
VIEWGRAPH 34

Our goals in 1977 include the checking of baggage, hand carried baggage, and checked baggage with devices of this nature.

Now, so far as lockers are concerned, we are planning to conduct a design and evaluation program of new locker designs so that if a bomb is planted within the locker, the danger will be minimized to persons standing nearby. We expect to have some of these detection devices and locker designs completed and put into use by the end of 1977.

We expect to work with a typical airport and we have, of course, available to us Washington National, or Dulles, that will enable us to evaluate these within an airport environment.

MLS Operational Capabilities



VIEWGRAPH 35

My last program is the microwave landing program. [See viewgraph No. 35.] The current generation of civil ILS or instrument landing systems, and there are approximately 500 in service today provide basically a single approach path to the runway at VHF frequencies. And its performance as we know is characteristically dependent upon the weather, terrain, airport structures, other aircraft, and is often not suitable for installation in some of the small airports used by general aviation.

Military aircraft operating in tactical situations find ILS not the desirable solution either, nor is it a desirable or best solution for helicopter operations and future VTOL aircraft which can use steeper approach paths to the runways. Because of all of these things, a common military-civil system is required to replace the ILS.

The microwave landing system or the MLS, will have some of the benefits or all of these benefits indicated on the chart and will provide a high integrity precise signal in space which is insensitive to dense airport environment. It will provide a low-cost civil-military air version. It is capable of generating curve approaches which will permit less longitudinal separations between aircraft.

It is expected to be internationally accepted as the ICAO replacement standard.

Microwave Landing System

PROGRAM BACKGROUND

- THREE PHASE PROGRAM
 - I TECHNIQUE ANALYSIS FEBRUARY 1973
 - II FEASIBILITY DEMONSTRATION AND TECHNIQUE SELECTION FEBRUARY 1975
 - III PROTOTYPE DEVELOPMENT UNDERWAY

STATUS

- PHASE III CONTRACTS
 - TEXAS INSTRUMENTS AND BENDIX FEBRUARY 1976
- EQUIPMENT DELIVERY
 - BASIC SYSTEMS APRIL 1976
 - SMALL COMMUNITY SYSTEMS MAY 1976
- U. S. INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO) SUBMISSION DECEMBER 1975
- PROGRAM REALIGNMENT
 - REDUCE MILITARY CONFIGURATIONS
 - DEFER CATEGORY III SYSTEM

VIEWGRAPH 36

This program is divided into three phases. [See viewgraph No. 36.] Phase 1, included a program to study and validate the microwave concept which was completed in February 1973 by the six contractors engaged in the effort.

During phase 2, feasibility demonstrations were completed and the technique was selected by the United States in early 1975.

Prototype development contracts are currently underway in phase 3 with Bendix Aviation and Texas Instruments being the two surviving contracts. This phase will provide tangible evidence that the common civil-military MLS is a reality and ready for implementation. So far as the status is concerned, as mentioned, the phase 3 contracts have been awarded with equipment delivery of the basic system expected in April 1976.

A small community system is also included as part of this contract and we expect delivery of one of each of these from each of the two contractors in May.

The small community system provides service equivalent to today's ILS whereas the basic system which I indicated previously, provides the added capabilities of guidance through the wide coverage sector, multiple guidepaths, DME and will have auxiliary data uplink to the aircraft with the signal format.

In December 1975, the United States presented its recommendations to ICAO in support of the time reference scanning beam technique.

International evaluation of the proposals, that is the United States plus other country proposals, are currently underway and completion of this evaluation is scheduled for October 1976.

We expect formal adoption by ICAO of the selected system as early as January 1977.

However, due to the fiscal year 1976 funding constraints, the program had to be realigned with the basic system and the small community system being designed as indicated this year, but not the complete category III system.

In fiscal year 1977 the ICAO decision is expected on which the technical method will become the international standard for the microwave landing system. [See viewgraph No. 37.]

Microwave Landing System

FY-77 OBJECTIVES

- ALL WEATHER OPERATIONS PANEL/INTERNATIONAL CIVIL AVIATION ORGANIZATION (AWOP/ICAO) DECISION
- CONTINUE TEST AND DEMONSTRATION OF CIVIL SYSTEMS
- CONTRACT AWARD - COMMON/TACTICAL CONFIGURATIONS

VIEWGRAPH 37

Meanwhile, we are continuing the evaluation of a civil system produced under phase 3 and will develop during fiscal year 1977 the common tactical system for the military.

Thank you.

Mr. MILFORD. Thank you very much.

I would go back just a moment to your baggage problem that you spoke of. I keep reading in the newspaper about 2- and 3-hour delays while clearing through baggage. Is that a fact or is it not?

Mr. WEDAN. I believe that the number that we are currently being presented in the newspapers refers to the state of the art of today's technology if it were employed, such as the X-ray absorption system indicated here. If it were employed for checking baggage, plus the expected relatively high rate of opening of bags to insure that the buzzer when it did go off, that there was nothing of danger within the baggage, would cause delays of that sort.

Our goal, however, is not that. It is—we hope to develop equipment in this period of time that would incur no additional delays over what we presently experience.

Mr. MILFORD. As we discussed here, there is a serious problem on windshear, particularly during final approach of an aircraft. What is the status of technology in this particular area of being able to reliably detect these windshears? I understand there are experiments going on at one or two airports. Can you give us an update on the status of that?

Mr. WEDAN. Yes, sir.

Thanks to the equipment developments under the wake vortex avoidance program we do have available to us acoustic techniques which are currently being evaluated to determine their ability to detect windshear and we have experiments that have been performed at some operational airports, specifically New York-Kennedy and Boston-

Logan and at Table Mountain, Colo., to provide a precise measure of the performance of these systems in detecting windshear at various altitudes.

We also have had some experience with laser systems, systems that have been used in the wake vortex avoidance program and they, too, have indicated that they are able to detect windshear. We are currently working toward evaluating performance of these devices under controlled conditions at Table Mountain, Colo.

Mr. MILFORD. One question that comes to my mind is why Boston and New York when the windshear is most common in thunderstorms. Why not install them in the thunderstorm belts where you would have a good frequency of the type of windshear that would really cause a problem?

Boston and New York are not known for numerous thunderstorms.

Mr. WEDAN. Yes, sir, you are correct there.

The reason that those tests were performed at those airports was because the equipment happened to be located at those points in connection with the wake vortex program. Our question immediately came up, "Can we detect windshear with this equipment?" So we ran tests to show that it could. Now, that is not the place where we are apt to find the shear associated with thunderstorms to the extent we would in the Midwest but there is a fairly high incidence of windshear connected with frontal conditions that are more prevalent on the east coast than in other parts of the country.

So far as the windshear associated with thunderstorms, we do intend to perform tests using this equipment in locations where they are more prevalent and in addition, Mr. Chairman, we have determined that an indirect measurement of windshear is possible by measuring the gust front that precedes a thunderstorm and this equipment to detect the pressure changes associated with a gust front is being currently installed at O'Hare. This, too, is an indirect measurement of the windshear phenomena associated with the thunderstorm activity. That is part of our program.

Mr. COCHRAN. We have another part of that same program that involves instrumentation and experimentation in the aircraft itself, so that it could give the pilot a direct readout.

Mr. MILFORD. OK. Well, thank you very much. We appreciate your taking the time to come in this morning for a briefing.

The Chair would now recognize Mr. Fred McIntosh, director, operational services, National Business Aircraft Association.

STATEMENT OF FRED B. McINTOSH, DIRECTOR, OPERATIONAL SERVICES, NATIONAL BUSINESS AIRCRAFT ASSOCIATION

Mr. MILFORD. I notice you have submitted a formal statement which, without objection, will be printed in the record.

If you would like you can summarize or skip around or whatever you care to do.

[The prepared statement of Mr. McIntosh is as follows:]

STATEMENT OF NATIONAL BUSINESS AIRCRAFT ASSOCIATION, INC.

SUMMARY

The National Business Aircraft Association (NBAA) recommends:

A. Airport security.—Cannot comment on adequacy of FAA program but recommends that airports be required to provide gates for General Aviation access to terminal secure areas.

B. Flight service station modernization program.—Funding for continued development of intricate pilot self-briefing terminals be curtailed and adequate funding be placed on the co-location of '800' system FSS with ARTC for effective use of manpower and facilities.

C. Collision avoidance.—CAS not believed necessary but, if ordered, it should be independent of the FAA-operated ATC system and ground environment. It should be a so-called ACAS. If one required, an acceptable one has been evaluated by the FAA/DOD and is available. Requirement to install 'full' CAS should be limited to aircraft operating in areas of FAA Positive Control. Smaller aircraft to carry 'emitter' equipment only on a voluntary basis. Justification for a DABS/IPC system on the basis of a BCAS requirement not valid.

D. Microwave landing system (MLS).—Existing development program should be reoriented to recognize its moderate priority. A program that requires international agreement for completion, the future expenditure levels should be minimized until international agreement is reached. The Committee should encourage the FAA to utilize the existing (and available) ISMLS as a 'provisional' system to provide the benefits of microwave technology.

E. Aerosat.—General aviation (nor we believe, all of aviation) cannot justify either communications/navigation satellite for aviation needs only. Any expenditures for such a system must be on the basis of other national or international needs.

The National Business Aircraft Association (NBAA) appreciates this opportunity to make constructive comments on certain portions of the Federal Aviation Administration's proposed engineering and development program. The NBAA is a Washington based association representing the common aviation interests of over 1,300 American companies and corporations who have found the daily utilization of their own aircraft a vital part of successful business operations.

A brief review of the composition of the American business aircraft fleet would be in order to fully appreciate the impact of the proposed FAA programs and the reasoning behind NBAA's recommendations.

An analysis by Price Waterhouse & Company (for NBAA) of FAA's Aircraft Registry and modified by P-W's own survey, reveals the following breakout:

Type of aircraft	Total aircraft	Estimated business executive
Jet.....	1,771	1,250
Turboprop (H).....	352	250
Turboprop.....	1,793	1,300
Piston multiengine (H).....	1,546	550
Piston multiengine (M).....	6,350	3,900
Piston Multiengine (L).....	13,341	8,200
Piston single engine.....	152,878	29,100
Helicopter.....	5,440	800
Total.....	183,471	45,350

It can be seen from this inventory that fully two-thirds of this fleet operate below the areas of FAA positive control and any unnecessary requirement for electronic equipment can place a sizeable financial burden on the owner/operators. The safety record of the business fleet is second only to the commercial carriers when measured against any baseline.

NBAA's testimony is addressed primarily to the five areas indicated by the Subcommittee's staff as being of prime concern. No attempt has been made to put dollar values on program changes as these amounts are best left to the expertise of the Committee staff working with the FAA.

NBAA offers the following comments (in the same order as the Summary sheet) and considers them constructive in nature. Acceptance of these recommendations, we believe, will create a better cost/benefit ratio and more accurately reflect the needs of the users.

AIRPORT SECURITY

On the matter of airport security research and development, not much can be said by NBAA as to the technical approach. It is an unfortunate sign of our times that such actions must be guarded against. The worse part of it is that many of these crimes are planned and instigated by fellow American "citizens". Most of the techniques developed for use in public terminals for air carriers could be applicable to general aviation areas, if and when, the need should ever arise.

The very nature of general aviation operations tends to place primary emphasis on such critical areas as ramp and parking spaces. We are pleased to note that increasing numbers of fixed-base-operators are conscious of this need and have taken noticeable steps in this direction. For NBAA's part, we have and continue to emphasize to the owner/operator of the aircraft the need for constant security awareness and alertness in regard to both passengers and his aircraft.

There is one critical area that NBAA does solicit the assistance of this Committee and it relates directly to one of the unfortunate "side effects" of the necessary security in commercial terminal areas. For practical purposes, there is no way that a general aviation airplane can drop (or pickup) passengers in the airline terminal area at most airports. There are exceptions, of course.

Passengers who arrive at the airport in a general aviation aircraft to pickup an air carrier flight must leave their plane at the GA terminal which is usually considerable distance from the main terminal. The future airline passengers must then be transported by surface transport to the main terminal and there enter the secure area to board their flight.

Before security precautions became necessary, it was a simple matter to drop the passengers at a convenient airline gate within a short walk of his flight. Most airports served by air carriers have such a door marked from the flight line side to expedite such passengers.

Considering that industry and FAA accepted surveys show that over one-third of the passengers hauled in business and executive aircraft are destined for airline connections or debarkation, the degradation of the old system provides an unnecessary hardship and inconvenience.

NBAA respectfully asks the Committee to indicate in some proper fashion that a legitimate need exists for such general aviation egress when security measures are undertaken at airports benefiting from the use of Federal monies. Your distinguished colleagues in the Senate have included such phraseology in forthcoming recommended legislation on ADAP funding.

FLIGHT SERVICE STATION MODERNIZATION

Less than one week from this date, a major milestone in FAA services to aviation will be marked by the commissioning of the "new breed" of Flight Service Station (FSS) at the Washington Air Route Traffic Center (ARTC) near Leesburg. This consolidated facility will be available to pilots by a network of "800" telephone lines. Some telephone lines will be connected to tape recorders providing weather data, others for filing flight plans and, of course, direct access to a weather briefer.

This station is the direct result of FAA/industry cooperative effort which developed after FAA's proposed system of "pilot self-briefing" terminals was evaluated.

The FSS has always been highly labor intensive and the joint-search for methods to provide better services at reduced cost lead initially to an FAA concept of using computer terminals. The pilot would then do his own briefing by questioning the computer through a typewriter type keyboard. Technology could also provide a printed copy of the answers to the pilot. This proposal required a sizeable amount of engineering and development funding while not substantially reducing the labor cost at FSS.

A considerable amount of E&D monies has already been expended in developing this equipment, but the results will be usable only in special applications. Funding for this concept need not be continued except at a low level to insure the necessary compatibility with the ATC system.

A self-briefing system envisaged by FAA suffered from three major drawbacks: (1) it is too complicated for the average pilot to utilize involving computer inputs from a keyboard in a form of programming; (2) between new equipment costs and a relatively minor drop in labor costs, the system is not sufficiently cost-effective; and (3) and probably the greatest weakness—only 10 to 15 percent of the FSS service is provided to a pilot who is physically there!

A survey showed that the telephone provided up to 90 percent of the information pilots needed! So a system of "800" numbers was born and the service test project begins at Leesburg on February 21st.

The advantages of such consolidation on both a short and long range evaluation are enormous. More efficient use of personnel together with almost direct access to the ARTC computer for flight plan filing, for example. The Transportation Center in Cambridge is investigating various remote devices that will permit transient pilots to contact the system without needing the assistance of a government employee. The common "touch-tone" technique of the Bell system appears to be a likely candidate.

In conclusion, NBAA fully supports the consolidation system that will shortly go into service as the preferred modernization system for the FSS. The monies already expended for development of self-briefing terminals, etc. has not been wasted but further intensive expenditures on this concept should be minimized to only that needed to accomplish the service engineering necessary to assure the equipment compatibility with the FAA communication and computer net. The self-briefing terminals will undoubtedly find use (and a market) in FBO's and larger aviation organizations in the same manner as teletype circuitry now does.

The Committee should indicate in their report the desirability of continuing at a reasonable rate the conversion to the "800" system and the physical consolidation of FSS functions together with the ARTC's to realize the savings in land, buildings and personnel.

COLLISION AVOIDANCE

The FAA's program on collision avoidance can best be described as part holding action and part indecision. On one hand, the FAA is fearful that either another series of apparent 'near miss' situations involving an airliner will result in a Congressional mandate to install not only equipment but will mandate the type and kind of CAS to be utilized.

The FAA has finished evaluating the three existing designs and would probably make a recommendation if pressed to do so. On the other hand, FAA engineers have devised a scheme in which collision avoidance could be a by-product of a new, long range program known as DABS/IPC, an acronym for Discrete Address Beacon System and Intermittent Positive Control. Although the DABS/IPC concept will be discussed later, it is important to note that mandatory carriage of a so-called 'beacon CAS' or BCAS is a cornerstone of the DABS/IPC concept.

NBAA, after participating in the now defunct Collision Prevention and Avoidance Advisory Group (COPAG) for almost 10 years, fails to see the need for mandatory carriage of any CAS, at least at this time.

If we review the individual circumstances of the much-publicized incidents, we find that (1) the only ones that were publicized were under FAA positive control, (2) and they were air carrier aircraft. If it had not been for the resulting publicity and the congressional interest the other incidents would probably never have come to light.

There is a lesson to be learned from this, we believe. If it is deemed necessary to provide aircraft with cockpit anti-collision devices, the system must be independent of the system whose failure it must monitor and guard against. This means an independent or air-derived collision avoidance system or ACAS to use FAA's acronym.

FAA, to their credit, has expedited the installation of separation warning indicators at their control centers and it is realistic to expect this capability to reduce or hopefully eliminate these situations. As we stated earlier, there are air-derived systems that could be used for this function if the need be. Two are truly independent of the ground environment and one must utilize ground based accurate timing devices for calibration.

The FAA has an active program investigating the BCAS. The reasoning for preference of the beacon/ground environment is simply that it fits better into a long-range program of extending positive control over all the airspace in the United States. The reasons given for the BCAS system lean heavily towards the availability of transponders in many general aviation airplanes, but not mentioned would be the need for an encoding altimeter. Further reasoning goes that general aviation could come and go as they wished without the formality of contacting FAA more than a minimum. Yet FAA would be able to track each and every aircraft, if they wished, literally from the ground up!

The other payoff would be the ability to pass instructions to suitably equipped aircraft (about 5,000 by 1980) of flight plan, clearance information etc. through a data link. The data link system or DABS would also permit ground based collision avoidance computation and alert.

Unfortunately, the facts do not justify the reasoning. Everytime FAA raises the spector of 'congestion' or alleged increase in traffic, the proposed solution is some means of increasing positive control from the ground. Past efforts to lower the floor of the controlled air space have been successfully resisted. In one case the reasoning was that 'we now have the capability'.

NBAA submits that Mother Nature has provided a sure and proper limit to the area of positive control, at least for another 10 years. When a pilot climbs above the physiological level that requires oxygen augmentation (approximately 12,500 feet) the environment undergoes a complete change for everything and everybody. The pilot needs oxygen usually through cabin pressurization, the aircraft must fly faster to stay aloft, the engines must be assisted in a manner similar to the pilot and passengers and the price of the airplane and its operational costs also go up. It is a logical place to be a dividing line!

Admittedly, this would not be valid if all of the airspace above 12,500 was being utilized and traffic demanded more. NBAA believes that no further increases in FAA ground control, either through equipment or personnel, should be permitted until more effective use is made of the airspace already available. With Terminal Control Areas (TCA) providing positive ground control from runway to runway for the vast majority of public carriage flights as well as those airplanes capable of operating in the area of positive control, NBAA cannot justify additional expenditures either by FAA or our members for such equipment.

Increased use of 'area navigation' routes should be used. This would include any technique that can navigate the pilot from point to point such as inertial, doppler or VOR-RNAV as examples. There are several hundred RNAV routes published but being published and utilized are two very different things. Accepted studies show that almost 30 percent of flights by business aircraft are between two points, neither of which are serviced by public air carriage thus lessening the need for collision exposure on the well traveled main airways between the air carrier hubs.

NBAA must be excused for its apparent 'doubting Thomas' attitude. FAA's concern over collision avoidance at this time, when viewed through the transparency of history, leaves room for honest doubt. The much-heralded time-frequency CAS was pushed hard by the FAA in years past to the total exclusion and refusal to consider other alternatives. Designed, as properly it should be, to protect two jet airliners in a head-on encounter, the system required, at one time, an expensive number (at taxpayer investment) of ground stations to synchronize the precise 'atomic' clocks utilized by the CAS.

It suffered from practical as well as cost-effective drawbacks but it was only through the combined efforts of the Department of Defense and general aviation that the imposition of a 'national standard' and mandatory carriage was stopped. It is a good system and probably as precise as any available, but not deemed practical by the users.

The FAA, unfortunately refused to give consideration to petitions from industry, led by the AirLine Pilots Association (ALPA), to enhance visibility at minimum cost by at least encouraging if not mandating the carriage of condenser-discharge aircraft lighting. Besides the obvious benefit of increased visibility, the 'strobe' lighting is high in infra-red emissions due to its xenon-filled discharge tube. This provided a free source of IR for airborne detectors. Once ignored, the FAA is now endeavoring to flight test such equipment out of its stated concern for general aviation. And so we now see the DABS/IPC program being born of which a key element is the need for a CAS.

To summarize, NBAA does not find justification for more than a minimum effort researching the CAS environment. Although NBAA feels that statistics do not justify the mandatory carriage of CAS equipment, if one is so ordered it should be an air-derived independent system (ACAS).

The system used should permit the smaller aircraft to carry a minimum passive device (known as an 'emitter') on an optional basis.

Only those aircraft engaged in public carriage should be considered for mandatory installation of such a system. The FAA's own Near-Miss records show that encounters between fast and slow aircraft are usually overtaking situations. No incidents are on record of the lighter airplane backing into the faster one.

Further, NBAA recommends that the Committee express its concern over using alleged 'collision avoidance' capabilities as justification for increased positive control where no fundamental requirement exists.

And last, NBAA respectfully recommends that FAA be advised that more efficient use of existing air space is a prerequisite to approval of programs requiring increased positive control. We believe that the President and Congress were serious when they established a national priority to slow, if not reverse, the unnecessary growth of governmental agencies. Our recommendations, we believe, will assist in reaching that goal without derogating vital aviation safety.

MICROWAVE LANDING SYSTEM (MLS)

Perhaps no single program has stirred up so much controversy and been misunderstood than the next generation precision landing system known as MLS. The confusion has not been helped by the international impact of honest technological disagreements nor, unfortunately, has the FAA method of program direction and management assisted.

The FAA, as a matter of fact, is to be complimented on recognizing that the existing VHF ILS system, that has become the standard world-wide, had limitations and a new system needs to be developed for a logical and timely replacement in the future.

The decision to move, frequency-wise, up into the 'microwave' spectrum with its operational and electronic advantages was applauded by aviation users around-the-world. It was at the place where the applause died down that the troubles began.

Any changes in an accepted international system must, of necessity, take considerable time to gain approval. If the new system requires sizeable amounts of fundamental research, let alone development, then the time required will be further extended. And worse, if a fundamental difference in technological solutions arises due either to economic issues or effectiveness, then the time span from concept through international agreement to operational installation cannot be accurately estimated.

The point is, that any attempts at unilateral decisions and implementation programs in a problem area of the magnitude of the next generation instrument landing system can set the stage for a system and financial calamity of severe proportions.

It is not NBAA's position to argue the pro's and con's of scanning beam versus doppler. NBAA personnel have actively participated at all levels of the MLS program and still do.

NBAA does feel, however, that the FAA is attempting to push too hard on too many fronts at the same time while arbitrarily (in NBAA's opinion) unnecessarily restricting the early use of microwave technology.

We are faced with the unique situation where the future of microwave utilization in the United States will succeed or fail on the long-term success of the U.S. in selling an incomplete development program to the international community.

We appear to be faced with a situation where the research element of FAA is working hard (and expensively) on a system for which the operating arms of the FAA, namely the Air Traffic and Airport Services have staked, at best, a long range requirement. Certainly, neither operating service has established programs for stopping the installation of existing ILS nor for priorities in installation of the replacement system. But they cannot be blamed for this as such a system must be established as an international standard and that is believed, by most knowledgeable persons, to be a long way off.

NBAA's comments, although appearing negative, are meant in a constructive manner. The decision to use microwave techniques, with all its advantages, for

the next generation ILS is the right one. The need for reaching an international standard and agreement is absolutely necessary. The United States, under the leadership of the FAA, should endeavor to secure such international agreement on the format and technology base that the U.S. feels is proper and necessary. After that international agreement, and only after that ICAO agreement has been reached should the final system development and programming go forward. Full service testing of all ground-based and aircraft carried components should be accomplished together with an appropriate implementation program.

There is no hurry for such a system. Our friends in air carriers have stated that even if MLS was here today that there is still a requirement for upgrading and modernizing the existing ILS systems.

MLS cannot be discussed without some reference to the so-called Interim MLS (ISMLS). The FAA researchers have properly developed specifications for new MLS that includes a series of installed capabilities. These range from the near-ultimate of cockpit-selectable angles of approach, curved approaches for noise abatement or traffic separation, down to the smallest box that will provide the much needed precise approach capability to small airports.

Obviously, the final standard microwave signal format must be designed to accommodate the most complex capability and installation and ultimately all aircraft equipment, simple and complex, will be modified to this standard. But the 10 to 15 year time frame should permit and encourage the earlier use of microwave technology.

All this will and must come to be when the final international standard is signed in Montreal. But to restrict use of MLS technology in any form until such agreement is reached is, in NBAA's opinion arbitrary and short-sighted. Even worse, there are reported to be FAA advocates who would insist on the continued development of the new 'small' system and require its installation whether or not the international standard is ever adopted!

In summary, NBAA feels that FAA's MLS priorities are too high and not justifiable either from a requirement or financial cost/benefit analysis. Any single program that utilizes a large portion of a research and development budget must be based on firm and urgent priorities and needs.

FAA should reprogram their MLS program and more realistically recognize the stated needs of the users and the system which they (FAA) operate.

The FAA should recognize the hard, practical realities of international standardization. FAA is not the rule-maker in ICAO. If the FAA solution is the best, and NBAA believes that it is, unfortunately, this fact may have little bearing on the outcome in this important political arena.

And last, the FAA should permit, yes, even encourage, the procurement and installation of available ISMLS equipment under reasonable ground rules for use at airports that cannot have ILS for reasons of siting, traffic or economic requirements.

A joint-statement by the Airline Pilots Associates (ALPA), Aircraft Owners and Pilots Association (AOPA), National Association of State Aviation Officials (NASAO), and NBAA on the subject of ISMLS utilization is attached for the record.

AEROSAT

With satellite technology advancing as rapidly as it has, it was to be expected that use of a satellite for aviation communications and possibly navigation would be proposed. There may or may not be a future requirement for such a system but NBAA cannot find justification for one based on aviation needs alone.

NBAA considers the satellite to be a "tool" the same as a VOR or an FAA-operated ground transmitting or receiving station. If it has a place in the system then the requirements must be those primarily of the FAA and not the users. NBAA is further concerned that use of such a system would be placing all 'your eggs in one basket' particularly if a domestic satellite was used.

Critics could say that the existing system would be kept in place and used as a backup. This proposal would highlight what has become the number one problem with dealing with the Department of Transportation and the FAA. Ways must be found to reduce the expenditures and manpower required by DOT and the FAA and any system that is not required on a programmed priority basis should be either eliminated or funded at as low a level as feasible to ensure that the technology will be available when it is truly needed.

There may be some justification for sharing with the maritime interests on extended transoceanic routes but this is a national requirement and decision.

The prolonged argument over the frequency capabilities of the proposed satellite, to us was strong indication that aviation was probably only being used as a supporting factor for an expensive system desired for other functions.

In summary, NBAA sees no operational requirement by general aviation for satellite technology that cannot be satisfied with existing facilities. Although it would appear that FAA has made their decision since Mr. McLucas has already announced their continuing support for Aerosat, the fact remains that doubt exists if such an expensive project can, in fact, withstand the justification ordered by the President with cost/benefit and regulatory impact studies. NBAA is of the opinion that such an impact study is designed to measure the cost/benefit and cost of regulatory action upon the consumer—the user—and not primarily the Federal agency contemplating the program.

That concludes our formal testimony and we will be happy to answer any questions the Subcommittee might have or to provide any additional specific data that might be requested. Any one not used to the manner and method of hearings such as this could easily get the impression that we believe the FAA program is totally bad and poorly managed. This is obviously not so. Considering the magnitude of the FAA in terms of people, monies and the responsibilities carried by those personnel, it is a tribute to good management that so few programs warrant changes.

We appreciate the opportunity to express those views.

Mr. McINTOSH. Thank you, Mr. Chairman. In light of the positive testimony by our friends of FAA I can briefly summarize three of my five areas. However, two of them, particularly in view of their testimony, deserve a little more expansion.

You will note first on page 1 of our testimony that we outline the composition of the aircraft registry operating in the United States. We do that simply to provide the committee with the size and scope of what we see to be the activities.

In the matter of airport security, very briefly, we are very grateful for the work that the FAA has done in the area and they have programmed in the area but the very nature of general aviation operation tends to place primary emphasis in such critical areas as the ramp and parking spaces. In other words, an area or a zone type security, as you well know. We are pleased to note that increasing numbers of FBO's are conscious of this need and have taken initial steps.

There is one area that NBAA does solicit assistance of the committee and it relates directly to one of the unfortunate side effects of the necessary security of commercial terminal areas. It is quite possible that the chairman has also run into this.

For practical purposes there is no way that a general aviation airplane can drop or pick up passengers in the airline terminal area at most airports. There are exceptions, of course.

In considering that, industry and FAA-accepted surveys show that over one-third of the passengers hauled in business and executive and/or general aviation aircraft are destined for airline connections or debarkation, this degradation of the old system provides an unnecessary hardship, we believe, and inconvenience.

So NBAA respectfully asks the committee to indicate in some proper fashion that a legitimate need exists for such general aviation egress when security measures are undertaken at airports benefiting from the use of Federal moneys.

Your distinguished colleagues in the Senate have included such phraseology in the forthcoming recommended legislation on ADAP funding.

I would like to summarize our recommendations on the flight service station, particularly in light of the progress report we just listened to. The demonstration referred to at the Washington ARTC near Leesburg was the result of industry cooperation and evaluation with the FAA on their concept of a **pilot self-briefing terminal**.

The surveys showed—would you believe—that over 90 percent of the contacts with flight service stations are made over the telephone. To put it another way, the pilot is not there physically looking at the charts and talking face to face with the briefer.

So the pilots' self-briefing terminal as developed by the FAA really would have lacked for business because the pilot would not have been there to use the self-briefing terminal.

A considerable amount of R. & D. moneys were expended in developing this equipment but we believe the results will be usable in special applications. But we believe that the funding of the self-briefing concept need not be continued except at a low level to insure the necessary compatibility with the ATC system.

In light of the thorough briefing and the Vugraphs I want to be sure I do not confuse the question. The hand-held and other means of querying the computer are part of the new consolidation effort and should be encouraged financially as well.

In the matter of Aerosat, if I may jump to the short item before taking the longer item, with satellite technology advancing as rapidly as it has, it is expected that the use of satellites for aviation communication and possibly for navigation would be proposed. NBAA considers the satellite to be a tool, the same as any VOR, any FAA-operated ground transmitting or receiving station. And if it has a place in the system, then the requirements must be those primarily of the FAA and not the user.

We are further concerned that the use of such a system would be placing all your eggs in one basket, particularly in the domestic satellite mentioned. Critics, of course, would say that the existing radar ground communications system would be kept in place and used as a backup. If that were to be true this proposal would highlight what has become the No. 1 problem in dealing with the Department of Transportation and the FAA. Ways must be found to reduce, not increase, expenditures and manpower required by DOT and the FAA and any system that is not required on a programmed priority basis should be either eliminated or funded at as low a level as feasible to insure that the technology will be available when it is truly needed. It is quite obvious, might I add, that President Ford and the Administrator have made the decision on Aerosat.

In the matter of collision avoidance, this one takes serious exploration, we think. The FAA's program on collision avoidance can best be described as part holding action and part indecision. On one hand, the FAA is fearful that either another series of apparent near miss situations involving an airliner will result in a congressional mandate to install not only equipment but will mandate the type and kind of CAS to be utilized.

The FAA has finished evaluating the three existing designs and would probably make a recommendation if pressed to do so. The Administrator spoke to this point.

On the other hand, FAA engineers have devised a scheme in which collision avoidance would be a byproduct of a new long-range program known as DABS/IPC, an acronym for discrete address beacon system and intermittent positive control.

Although the DABS/IPC concept will be discussed later, it is important to note that mandatory carriage of the so-called beacon CAS or BCAS is a cornerstone of the DABS/IPC concept.

NBAA after participation in the now defunct Collision Prevention and Avoidance Advisory Group [COPAG] for almost 10 years, fails to see the need for mandatory carriage of any CAS, at least at this time.

If we review the individual circumstances of the much-publicized incidents, we find that: (1) the only ones that were publicized were under FAA positive control; and (2) they were air carrier aircraft.

If it had not been for the resulting publicity and the congressional interest the other incidents would probably never have come to public light.

There is a lesson to be learned from this, we believe. If it is deemed necessary to provide aircraft with cockpit anticollision devices, the system must be independent of the system whose failure it must monitor and guard against. And this means an independent or air-derived collision avoidance system or ACAS to use the FAA acronym.

Now FAA, to their credit, have expedited the installation of separation warning indicators at their control centers and it is realistic to expect this capability to reduce or hopefully eliminate these situations.

As we stated earlier, there are air-derived systems that could be used for this function if the need be. Two are truly independent of the ground environment and one must utilize ground-based accurate timing devices for calibration.

FAA has an active program investigating the BCAS. The reasoning for preference of the beacon/ground environment is simply that it fits better into a long-range program of extending positive control over all the airspace in the United States. The reasons given for the BCAS system lean heavily toward the availability of transponders in many general aviation airplanes and it was mentioned there would be need for an encoding altimeter.

Further reasoning goes that general aviation could come and go as they wished without the formality of contacting FAA more than a minimum. Yet FAA would be able to track each and every aircraft, if they wished, literally from the ground up.

May I add to my prepared text that the FAA forgot to mention that they are looking at two BCAS's. Fundamentally different in concept, and the one BCAS that they are referring to in their charts allegedly has a saturation problem. It has a limit on the number of units that can be used in certain areas and that was why the statement was made that it would be limited to air carrier aircraft.

The other payoff would be the ability to pass instructions to suitably equipped aircraft, about 5,000 by 1980, of flight plan, clearance information, and so forth, through a data link. The data link system or DABS would also permit ground-based collision avoidance computation and alert.

Unfortunately, the facts do not justify the reasoning. Every time FAA raises the specter of congestion or alleged increase in traffic, the proposed solution is some means of increasing positive control from the ground. Past efforts to lower the floor of the controlled airspace have been successfully resisted. In one case the reasoning was that "we now have the capability."

NBAA submits that "Mother Nature" has provided a sure and proper limit to the area of positive control, at least for another 10 years. When a pilot climbs above the physiological level that requires oxygen augmentation, approximately 12,500 or 13,000 feet, the environment undergoes a complete change for everything and everybody. The pilot needs oxygen usually through cabin pressurization, the aircraft must fly faster to stay aloft, the engines must be assisted in a manner similar to the pilot and passengers and the price of the airplane and its operational costs also go up. It is a logical place to be a dividing line.

Admittedly, this would not be valid if all of the airspace above 12,500 feet was being utilized and traffic demanded more. NBAA believes that no further increases in FAA ground control, either through equipment or personnel, should be permitted until more effective use is made of the airspace already available. With terminal control areas (TCA) providing positive ground control from runway-to-runway for the vast majority of public carriage flights as well as those airplanes capable of operating in the area of positive control, NBAA cannot justify additional expenditures either by FAA or our members for such equipment.

Increased use of area navigation routes should be used. This would include any technique that can navigate the pilot from point to point such as inertial, doppler or VOR-RNAV as examples. There are several hundred RNAV routes published but being published and being utilized are two very different things. Accepted studies show that almost 30 percent of flights by business aircraft are between two points, neither of which are serviced by public air carriage and thus lessening the need for collision exposure on the well traveled main airways between the air carrier hubs.

Gentlemen, NBAA must be excused for its apparent "doubting Thomas" attitude. FAA's concern over collision avoidance at this time, when viewed through the transparency of history, leaves room for honest doubt. The much-heralded time-frequency CAS was pushed hard by the FAA in years past to the total exclusion and refusal to consider other alternatives. Designed, as properly it should be, to protect two jet airliners in a head-on encounter, the system required, at one time, an expensive number, at taxpayer investment, of ground stations to synchronize the precise atomic clocks utilized by the CAS.

It suffered from practical as well as cost-effective drawbacks but it was only through the combined efforts of the Department of Defense and general aviation that the imposition of a national standard and mandatory carriage was stopped. It is a good system and probably as precise as any available, but not deemed practical by the majority of users. One group did request it.

The FAA, unfortunately, refused to give consideration to petitions from industry, led by the Airline Pilots Association (ALPA), to enhance visibility at minimum cost by at least encouraging if not man-

dating the carriage of condenser-discharge aircraft lighting. Besides the obvious benefit of increased visibility, the strobe lighting is high in infrared emissions due to its xenon-filled discharge tube. This provided a free source of IR for airborne detectors. Once ignored, the FAA is now endeavoring to flight test such equipment out of its stated concern for general aviation. And so now we see the DABS/IPC program being born of which a key element is the need for a CAS.

To summarize, NBAA does not find justification for more than a minimum effort on researching the CAS environment. Although NBAA feels that statistics do not justify the mandatory carriage of CAS equipment, if one is so ordered it should be an air-derived independent system or ACAS.

The system used should permit the smaller aircraft to carry a minimum passive device known as an emitter in some cases on an optional basis.

Only those aircraft engaged in public carriage should be considered for mandatory installation of such a system. The FAA's own near-miss records show that encounters between fast and slow aircraft are usually overtaking situations. No incidents are on record of the lighter airplane backing into the faster one.

Further, NBAA recommends that the committee express its concern over using alleged collision avoidance capabilities as justification for increased positive control where no fundamental requirement exists.

And last, NBAA respectfully recommends that FAA be advised that more efficient use of existing airspace is a prerequisite to approval of programs requiring increased positive control. And I might add there, control and equipment.

We believe that the President and Congress were serious when they established a national priority to slow, if not reverse, the unnecessary growth of governmental agencies. Our recommendations, we believe, will assist in reaching that goal without derogating vital aviation safety.

Finally, Mr. Chairman, the microwave landing system or MLS.

Perhaps no single program has stirred up so much controversy and been misunderstood than the next generation precision landing system known as MLS. The confusion has not been helped by the international impact of honest technological disagreements nor, unfortunately, has the FAA method of program direction and management assisted.

The FAA, as a matter of fact, is to be complimented on recognizing that the existing VHF/ILS system, that has become the standard worldwide, had limitations and a new system needed to be developed for a logical and timely replacement in the future.

The decision to move, frequencywise, up into the microwave spectrum with its operational and electronic advantages was applauded by aviation users around the world. It was at the place where the applause died down that the troubles began.

Any changes in an accepted international system just, of necessity, take considerable time to gain approval. If the new system requires sizable amounts of fundamental research, let alone development, then the time required will be further extended. And worse, if a fundamental difference in technological solutions arises due either to eco-

nomic issues or effectiveness, then the time span from concept through international agreement to operational installation cannot be accurately estimated.

The point is that any attempts at unilateral decisions and implementation programs by the United States, that is, in a problem area of the magnitude of the next generation instrument landing system can set the stage for a system and financial calamity of severe proportions.

It is not NBAA's position to argue the pro's and con's of scanning beam versus doppler. NBAA personnel have actively participated at all levels of the MLS program and still do.

NBAA does feel, however, that the FAA is attempting to push too hard on too many fronts at the same time while arbitrarily—at least in NBAA's opinion—unnecessarily restricting the early use of microwave technology.

We are faced with the unique situation where the future of microwave utilization in the United States will succeed or fail on the long-term success of the United States in selling an incomplete development program to the international community.

We appear to be faced with a situation where the research element of FAA is working hard—and expensively—on a system for which the operating arms of the FAA; namely, the Air Traffic and Airport Services, have stated, at best, a long-range requirement. Certainly neither operating service has established programs for stopping the installation of existing ILS nor for priorities in installation of the replacement system. But they cannot be blamed for this as such a system must be established as an international standard and that is believed, by most knowledgeable persons, to be a long way off.

NBAA's comments, although appearing negative, are meant in a constructive manner. The decision to use microwave techniques, with all its advantages, for the next generation ILS is the right one. The need for reaching an international standard and agreement is absolutely necessary. The United States, under the leadership of the FAA, should endeavor to secure such international agreement on the format and technology base that the United States feels is proper and necessary. After, and only after, that international agreement, and only after the ICAO agreement has been reached should the final system development and programing go forward. Full service testing of all ground-based and aircraft carried components should be accomplished together with an appropriate implementation program.

Gentlemen, there is no hurry for such a system. Our friends in air carriers have stated that even if MLS was here today that there is still a requirement for upgrading and modernizing the existing ILS systems.

As an addition, we found the other day that a procurement order for additional ILS's was issued last week.

MLS cannot be discussed without some reference to the so-called Interim MLS (ISMLS). The FAA researchers have properly developed, as you saw, specifications for new MLS that includes a series of installed capabilities. These range from the near-ultimate of cockpit-selectable angles of approach, curved approaches for noise abatement or traffic separation, down to the smallest box that will provide the much needed precise approach capability to small airports.

Obviously, the final standard microwave signal format must be designed to accommodate the most complex capability and installation and ultimately all aircraft, I repeat, all aircraft equipment, simple and complex, will be modified to this standard. But the 10-to-15-year time frame should permit and encourage the earlier use of microwave technology.

All this will and must come to be when the final international standard is signed in Montreal. But to restrict use of MLS technology in any form until such agreement is reached is, in NBAA's opinion, arbitrary and shortsighted. Even worse, there are reported to be FAA advocates who would insist on the continued development of the new small system and require its installation whether or not the international standard is ever adopted.

In summary then, NBAA feels that FAA's MLS priorities are too high and not justifiable either from a requirement or financial cost/benefit analysis. Any single program that utilizes a large portion of a research and development budget must be based on firm and urgent priorities and needs.

FAA should reprogram their MLS program and more realistically recognize the stated need of the users and the system which they, the FAA, operate.

The FAA should recognize the hard, practical realities of international standardization. FAA is not the rulemaker in ICAO. If the FAA solution is the best, and NBAA believes that it is, unfortunately this fact may have little bearing on the outcome in this important political arena.

And last, the FAA should permit, yes, even encourage, the procurement and installation of available ISMLS equipment under reasonable ground rules for use at airports that cannot have ILS for reasons of siting, traffic, or economic requirements.

A joint statement by the Airline Pilots Associates (ALPA), Aircraft Owners and Pilots Association (AOPA), National Association of State Aviation Officials (NASAO), and NBAA on the subject of ISMLS utilization is attached for the record. And may I add, Mr. Chairman, since these remarks were prepared and submitted, that the Helicopter Association of America and the Professional Air Traffic Controllers Organization have submitted letters to Mr. McLucas firmly endorsing the position of our four organizations.

[The attachment is as follows:]

POSITION PAPER

The following organizations—Aircraft Owners and Pilots Association, Air Line Pilots Association, National Business Aircraft Association and National Association of State Aviation Officials—fully support the Federal Aviation Administration's position that landing systems of the future may utilize microwave technology. In public and visible support of this position, the above-named organizations have provided personnel and requirement inputs to the FAA in direct assistance to the development of such a microwave landing system (MLS) to insure, if it ultimately proves technically and economically feasible, that a usable system evolves.

While the diverse nature of our members' equipment and operational needs precludes unanimous agreement on support of the ultimate national MLS system now under early development, there exists today, by this position paper, complete agreement among the four organizations on the need for timely and positive support of the ISMLS program.

Our organizations are deeply concerned over the attitude of the FAA towards the relationship of the longer-range MLS program and the existing (badly named) interim MLS (ISMLS). Instead of utilizing the low-cost equipment already available, there are increasing signs that some FAA staff members view the implementation of the ISMLS as a "threat" to the long range MLS program.

The FAA-designated standard ISMLS was developed by private industry at a minimum cost to the federal government and provides a unique capability and usefulness for certain applications for a wide range of the aviation community. We believe that the FAA should encourage the use of ISMLS where its advantages are significantly apparent. At the minimum, the FAA should discontinue its present attitude of discouragement of ISMLS utilization. Where applicable, either Facilities and Equipment (F&E) or ADAP funds should be utilized for installation of the ISMLS.

We call attention of all concerned to the fact that the ISMLS is available now. Further, it is authorized to be used for public IFR service. Through the immediate implementation of the ISMLS the FAA, for suitably equipped aircraft, can:

- (a) Provide reliable precision approach service at difficult sites.
- (b) Provide service at additional locations and runways without resorting to the split channel (50 kHz) frequency plan.
- (c) Reduce site preparation costs that would be associated with ILS.
- (d) Make available needed precision approach capability now for commuter, general aviation, and local (regional) service by air carriers to small communities.
- (e) Reduce the operations and maintenance costs associated with rain, snow and other environmental effects.
- (f) Gain operational experience with a microwave system.

Our organizations share with FAA a primary concern for the enhancement of flight safety which can be achieved through the installation of precision approach equipment. We believe that this concern can most effectively be met by encouraging the installation and use of the ISMLS now approved and available. In addition to the several operational advantages it would provide to aircraft operators, it could also benefit communities by diminishing aircraft noise exposure to the same degree that any vertical guidance system will assist in reducing aircraft noise exposure. It would also benefit communities by bringing to them increased business and related economic advantages which result from the addition of precision approach capability to the community's airport.

This concludes our formal testimony and I will be happy to answer any questions that the subcommittee might have or to provide any additional specific data.

Anyone not used to the manner and method of hearings such as this would easily get the impression that we believe the FAA program is totally bad and poorly managed. And this is obviously not so.

Considering the magnitude of the FAA in terms of people, moneys, and the responsibilities carried by those personnel, it is a tribute to good management that so few programs warrant changes. We appreciate this opportunity to express our views.

Mr. MILFORD. Thank you, Mr. McIntosh.

You noted something rather briefly in the first part of your statement that kind of got my attention. That is this business of general aviation access through airport security systems. That is the first I had heard of this particular problem. Just how widespread is that; what classes of airports do you run into that problem?

Mr. MCINTOSH. Unfortunately, it is quite widespread and in reality we can't blame the airport operators, there is a financial and economic problem here.

With most airports going to an entire zone or bay sanitation, if you will, "sterilization" is a better word, for security purposes, the old days of having a sign over the gate outside that says, "General Aviation Gate" and you stepped up into the wing or the lobby of the airline terminal for practical purposes has disappeared.

The airplane must now be parked, usually at the general aviation airline terminal, and as you well know some of these are some physical distance if not clear across the airport from the main terminal. And you debark your passengers and they go by ground to the front of the terminal and enter directly as any other passenger.

Mr. MILFORD. But if you are, as you stated in your statement, 90 percent of the time flying somebody to catch a commercial or flying to pick up someone, this should mean that security personnel should be on duty at or near the commercial gate. Why should it be such a great problem to get passengers in and out?

Mr. McINTOSH. Direct access to the ramp where the general aviation aircraft could pick up are nonexistent except to employees of the airport with keys. There is no way that any passenger except being marshaled by an airline representative or security personnel may pass through a door onto the open ramp. That is, unfortunately, a hard-core fact of life. And what we would like is at an airport that has security arrangements of this nature, that a gate be designated as being an access gate from general aviation aircraft and it could have a magnetometer or whatever device is necessary, hand search if you will, but the airplane can pull up, drop its passengers and the passenger can walk directly into the wing or at least the main part of the airline terminal.

That has been a—has fallen by the wayside as a result of the necessary tightening of security.

Mr. MILFORD. OK.

Would I summarize your testimony correctly that NBAA opposes Aerosat; is that a fair statement?

Mr. McINTOSH. It would be easy to say "Yes," which is essentially true. We are stating that at least from the general aviation's point of view and possibly all of aviation, we do not think the expenditures for Aerosat can be justified. There may be some in connection with maritime and there may be some reasons justifiable on an international basis but we wanted the record to show that aviation as we know it does not have any need, at least for some time to come, for something of that magnitude on its own.

Mr. MILFORD. As a practical matter would many general aviation aircraft use Aerosat? I mean, how many airplanes do you have flying across the Atlantic?

Mr. McINTOSH. We have a fair number. I do not have the immediate statistics in front of me but there are roughly 200 Gulfstream II's in existence and all of them at one time or another make that crossing.

The LORAN and HF net has worked satisfactorily for us at the moment. The ratio of general aviation crossings to air carrier—commercial, supplementary, and charter or cargo operations—is fairly minute and there may be other reasons and other justifications for Aerosat, but at this time and with this tight necessity of money and in our economic conditions in this country, we thought the record should best show that we do not have that need ourselves.

Mr. MILFORD. Thank you very much.

Mr. Wydler?

Mr. WYDLER. Yes; thank you.

If I could try to summarize your testimony, you seem to suggest a lot less of various things.

Do you have any areas where you would suggest more?

Mr. McINTOSH. Any areas in which we suggest more?

Mr. WYDLER. We, more or less, as I read and listened to the testimony you gave, you suggest we do less of various types of things, collision avoidance, microwave landing system, Aerosat, I wonder if there are any areas, assuming we did that we would have budget money left over, what would you give a high priority to that the FAA isn't?

Mr. McINTOSH. At the present time the highest priority we feel the FAA has is in the consolidation of the flight service stations and increased use of RNAV routes.

Mr. WYDLER. You are talking to a layman here, I know some of these members are pilots like probably yourself but I am not, so you are going to have to use some words that I can understand and not do all this shortcutting.

Mr. McINTOSH. Sometimes it is to our advantage that folks like yourself ask questions, Mr. Wydler. Thank you.

The consolidation of the flight service stations will accomplish several things. Besides decreasing an already overly labor-sensitive area, the companion work and increasing weather, the transmission of proper weather data will be increased.

Mr. WYDLER. I am talking about R. & D. now.

Mr. McINTOSH. That is right, R. & D. That is a major portion of this.

The very excellent equipment that you saw—

Mr. WYDLER. You think we could speed up that program; is that what you are saying?

Mr. McINTOSH. Actually, no, because the National Weather Service is very deeply involved with it and it was speeded up several years ago when trust fund R. & D. money became available and I assure you we would be the first to come in and ask you to speed it up if it were possible to do so.

The increased use of RNAV routes may require some R. & D. in computer simulation. They have published over 500 RNAV routes but there are—there appears to be a reluctance on the part of the controllers to utilize them, for what exact reasons we have not been able to pinpoint. That means airspace that is not being used, and airspace not being used means that more airplanes go down the same tracks time and time again, which increases the possibility of near misses we were discussing.

Mr. WYDLER. I noticed you speak about the problem with the MLS to get international agreement on this and am I correct, I know a little about the background, but didn't we select a system that was not generally the one that the international community was kind of pushing? Isn't it likely to be a severe problem to convince them to do something they earlier didn't think was a very good idea?

Mr. McINTOSH. You will hear testimony tomorrow probably contrary to our testimony from the airlines; however, your statement is correct as we understand it. Great Britain has a Doppler technology and is rightfully very proud of it. And the technical differences between the two systems are open to argument between any two engineers as I understand it. The AWOP, the All-Weather Operations

Panel of ICAO, has suggested that they not return to the General Assembly for approval unless there is 100-percent agreement on the new landing system.

And this bodes, we believe, delays and delays because there is a \$1 billion market among other things between the two systems.

Mr. WYDLER. I like what you have to say on Aerosat even though you didn't read it from your statement. I read the summary in your statement regarding the idea that possibly they could hook this into some other type of system in the future. I tend to agree with you. I don't see why everybody has to have their own system, particularly when it involves the launching of satellites which are extremely expensive. What immediately comes into my mind is if NASA is in the process of trying to put up its own system for TDRSS, the new special tracking system based on two stationary, fixed satellites and so forth, sounds like almost made to order for something like Aerosat although I know very little about the technical requirements. I can't imagine that that system couldn't carry this system as well. So I am just—right off the bat I would wonder why we couldn't put those two things together and save ourselves a devil of a lot of money.

Do you have any idea what I am talking about in regard to TDRSS?

Mr. McINTOSH. Yes; I know very well what you are discussing. However, I would bow to the expertise of our friend from the airlines who will testify tomorrow and Mr. Poritsky particularly, who is in the room, who have done exhaustive technical work in conjunction with the traffic demands and so forth, which are very appropos to what you are talking about. As I said earlier, our traffic demands would be extremely small and there may be other reasons for either combining or having singular satellites. But we are not technically competent to testify on that.

Mr. WYDLER. Well, that is a question of engineering, let's face it, if we are going to stick up two satellites in a synchronous orbit for the purpose of being able to track all over the globe it is an engineering problem to design it in such a way that it can carry what you want it to carry.

Mr. McINTOSH. That is right.

Mr. WYDLER. That is just plain engineering. There is no reason to go in and assume that it has to be done in a certain way in the beginning and then say, our system won't match that because that satellite isn't big enough. We can make it bigger, so I am not going to be swayed by that argument unless there is some reason why engineeringwise it doesn't make sense to combine those two systems into one satellite. Again I can't see the slightest reason why it wouldn't.

Mr. McINTOSH. I think I could expand on your understanding of it perhaps. NASA to the best of our knowledge has never been officially requested by the FAA to provide recommendations for an air traffic control system or any changes to the air traffic control system.

As a matter of fact, if you wish to cause consternation in the FAA at some engineering meeting in the area of basic ATC, ask what NASA would do under these conditions.

It is entirely possible that that agreement either verbal or written may have something to do with the question you raised, sir.

Mr. WYDLER. We have had this kind of struggle before. I mean NASA at one point in history wanted to build a group of satellite tracking ships to sail all over the globe and track our satellites and so forth, which wasn't a bad idea. They had some need for them, but myself and others pointed out that we had a unit of the U.S. Government which was in the business of running ships called the Navy and maybe they could be pressed into service to sort of help out in running the ships because they would otherwise have to in effect set up a Navy, the seamen and commanders and captains and the whole shooting match.

Well, there was a lot of resistance to that. No question about it. They wanted their own navy and it was only after a great deal of agony that they decided maybe they could do it with the U.S. Navy after all. We are really all part of one country and we could work together and do something like that and it worked out fairly well. Thank God we didn't end up with all the ships they wanted because we wouldn't know what to do with them if we had them.

But all that aside, I recognize a certain resistance to everybody sharing everything in Government, everybody wants their own. But this is an expensive tax item and it should be looked into most carefully, particularly since we are in the beginning stage of this other system. It is not beyond the point where you could incorporate something like that.

I thank the chairman.

Mr. MILFORD. Mr. Goldwater?

Mr. GOLDWATER. Mr. McIntosh, on the collision avoidance statement that you made, what do you find wrong with the FAA approach on the DABS/IPC? What is wrong with it? Why don't you support that?

Mr. McINTOSH. We have seen no necessity for the FAA to exercise that much positive control; and the near misses are all appearing in a controlled environment.

The discrete address beacon system was designed to make it easier for a relative handful of pilots to be able to look at a cathode ray tube and get his clearance without having to talk to the ground.

We frankly don't feel that either the traffic projections or anything else justify it. We constantly design for the most complicated—

Mr. GOLDWATER. Stop right there for a moment. You are not addressing the question.

I didn't ask you what was wrong with collision avoidance systems, I said what is wrong with the FAA's approach, the DABS/IPC?

Mr. McINTOSH. If you need IPC, and if you need DABS, then the route they are going would appear to be valid. We do not feel that either of them is necessary until they make more efficient use of the airspace they already control.

Mr. GOLDWATER. So you would support airborne CAS?

Mr. McINTOSH. Yes; if one is needed. We do not feel even yet that that is needed.

Mr. GOLDWATER. Let us assume for the moment that there is a need and you have two systems, one is airborne, independent of the ground; the other one is a ground-based system called DABS/IPC. Which one would you prefer to see implemented?

Mr. McINTOSH. ACAS.

Mr. GOLDWATER. What is wrong with DABS/IPC that you wouldn't pick that?

Mr. McINTOSH. We do not believe that you can protect yourself from system failures when the very system you want to protect yourself from is part of the loop.

Mr. GOLDWATER. Systems failure, you mean the failure of the ground-based controller?

Mr. McINTOSH. The failure—

Mr. GOLDWATER. Or the equipment?

Mr. McINTOSH. The ground-based part of the BCAS.

Mr. GOLDWATER. The ACAS could fail also, though. You are talking about the equipment, or are you talking about the man behind the equipment?

Mr. McINTOSH. It is our understanding that the BCAS equipment being developed will work in conjunction with DABS through a ground-based computer.

Now, any—if the ground-based system fails, then you have a near-miss situation. If it fails and produces a near-miss situation, why would not the component that failed be the component that would fail to give you the escape maneuver or the alert? That is why we say an air-derived or independently derived would be the more technically correct CAS, rather than anything tied into the ground system.

Anyway, the BCAS, Mr. Goldwater, that they are talking about is the so-called MITRE BCAS in which we are led to believe there is a limit on the number of aircraft that can utilize it in given areas.

Mr. GOLDWATER. BCAS doesn't even exist, does it?

Mr. McINTOSH. It is being tested in New York and other places, yes.

Mr. GOLDWATER. Strictly bread boards, or just—

Mr. McINTOSH. I prefer not to get into that argument. To one engineer a bread board is one thing and to a salesman a bread board is ready to go.

Mr. GOLDWATER. You can't go buy it off the shelf, then.

Mr. McINTOSH. No. Not to my knowledge, no.

Mr. GOLDWATER. So you feel that as far as business aircraft pilots, and people are concerned, that not being tied into the ground-based system gives you what, better performance; more safety?

Mr. McINTOSH. Well, I—

Mr. GOLDWATER. Reliability?

Mr. McINTOSH. May I answer that in two parts. Any airplane that will operate in the area of positive control, we are suggesting that the lowest he be permitted to come in be 12,500 feet, in that ball game they must be suitably equipped. The FAA will dictate what equipment will be used.

If your airplane and you habitually fly in that environment, then you will have whatever the FAA determines with user input as to the type of equipment. It may be—may end up being a BCAS, it may end up being something else.

But below that area where much is VFR short-haul traffic, this sort of thing, the ACAS, would be the only possible use because we see no need to tie you in through so-called intermittent positive control to a Government computer. Every time you emit something electromagnet-

ically from your airplane there is a Government employee or a Government-funded box who monitors you or reacts and those are the types of costs we do not see justified.

Above 12,500 you buy the equipment and play the game according to the rules. You are under positive control. That is the FAA's real domain. They have not exploited it yet. They have airspace they have not found yet. But not below that level for some period of time, ultimately it will have to come down, we recognize this.

It was not pointed out that the forecast of general aviation activities are almost directly proportional to the fall-off in air carrier operations. If the air carriers drop a route point, as you well know, and the chairman does, there will be an increase in general aviation if you wish to travel to that point.

Mr. GOLDWATER. How long ago was the time frequency system created?

Mr. McINTOSH. Oh, it was a development by McDonnell-Douglas, then McDonnell Electronics, and it was developed as a result of a tragic midair during flight testing a series of fighters for the Government.

My first contact with it was approximately 9 years ago, which would make it about 1966-67. It actually dated earlier than that. But the work on it went on for some time and it is one of the three that the Administrator referred to when he talked about evaluations.

Mr. GOLDWATER. Thank you, Mr. Chairman.

Mr. MILFORD. Thank you very much, Mr. McIntosh. We appreciate your coming before the committee.

Mr. McINTOSH. Thank you, it is our pleasure.

Mr. MILFORD. The subcommittee will stand in adjournment until 10 o'clock tomorrow, February 18, in this room.

[Whereupon, at 11:40 a.m., the subcommittee recessed, to reconvene at 10 a.m., Wednesday, February 18, 1976.]

**SECOND PHASE OF THE FISCAL YEAR 1977 BUDGET
OVERSIGHT, ENGINEERING AND DEVELOPMENT,
FEDERAL AVIATION ADMINISTRATION, DEPART-
MENT OF TRANSPORTATION**

WEDNESDAY, FEBRUARY 18, 1976

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON AVIATION AND TRANSPORTATION R. & D.
Washington, D.C.

The subcommittee met, pursuant to notice, at 10 a.m., in room 2325, Rayburn House Office Building, Hon. Dale Milford, chairman, presiding.

Present: Messrs. Milford, Lloyd, and Wydler.

Mr. MILFORD. The subcommittee will come to order. This morning, the Subcommittee on Aviation and Transportation Research and Development will conclude its hearing on the fiscal year 1977 FAA budget request.

Having heard from the FAA yesterday, today we will hear from interested aviation associations.

Our first witness will be Mr. William B. Cotton, who is chairman of the Air Traffic Control Committee, of the Air Line Pilot's Association.

Welcome to the committee, Mr. Cotton.

**STATEMENT OF WILLIAM B. COTTON, CHAIRMAN, AIR TRAFFIC
CONTROL COMMITTEE, AIR LINE PILOTS' ASSOCIATION, ACCOM-
PANIED BY JOHN O'BRIEN**

Mr. COTTON. Thank you, Mr. Chairman. I have with me Mr. John O'Brien, a staff engineer of the Air Line Pilots' Association.

Mr. MILFORD. We have your formal statement. If you would like, we will make it a part of the record at this time and if you would care to summarize or otherwise present it, whatever is your pleasure.

Mr. COTTON. I would like to speak from a summary version of that statement.

Mr. MILFORD. Fine. The full statement will appear in the record at this point.

Mr. COTTON. Mr. Chairman and members of the subcommittee, I am Bill Cotton, chairman of the Air Traffic Control Committee of the Air Line Pilots Association which represents the interests of more than 37,000 pilots. We are pleased to have the opportunity to discuss

with you the fiscal year 1977 research and development budget of FAA. We strongly feel that improvements in safety and efficiency can be achieved through an effectively managed R. & D. program.

We are convinced that the development of R. & D. programs should truly reflect demonstrated needs. Further, those needs must have a specific priority so that R. & D. resources, which will always be limited, can be expended in a manner which produces the greatest benefits.

We were pleased to note the trend toward increased funding in the fiscal year 1976 level for R. & D. Also, reports of recent statements made by Transportation Secretary Coleman before the House Appropriations Subcommittee seem to indicate a commitment toward increased R. & D. funding. If these reports are true, we hope that this is an indication of the administration's policies and we hope that this committee will see fit to continue its laudable approach to the R. & D. needs of this country as was evidenced by your fiscal year 1976 authorization.

As stated before this committee last November, we have become alarmed over a trend toward larger and larger amounts of money being spent for an ever decreasing number of significant R. & D. programs. One of the obvious results of this trend is that no new efforts of any significance can be initiated. Recognizing this trend, we believe that existing programs should be examined for correlation to demonstrate user requirements and their impact on aviation safety.

Mr. Chairman, as you are aware, a vast majority of fatalities in the aviation industry are occurring during the approach and landing phase of flight. None of the R. & D. programs, with the possible exception of the wind shear program to a very small degree, are directed toward what we consider to be a prime factor in these accidents. This factor, as NASA states, is the breakdown of data transfer between conventional cockpit instrumentation and the pilot, during the transition from head-down instrument flying to cues received from the visual scene outside the cockpit while conducting low visibility approach and landing operations. There has been little, if any, progress made in trying to understand why the man-machine systems that provide air transportation are susceptible to problems of this type. The few studies that have been conducted in this area have either been canceled before completion or the reports which have resulted from these studies have been dismissed as inconclusive. We are convinced that there is a definite requirement for an R. & D. effort to examine this problem.

There is another area of great concern which we feel warrants the subcommittee's special attention. The subject area is the division of responsibility between pilots and air traffic controllers and the profound effect this functional relationship has on both the safety and economy of flight, and the cost of running the ATC system. Control of navigation in the terminal areas, as well as in route, should be returned to the pilots in lieu of the radar vectoring practices by ground controllers used today. Pilot experience shows that future design decision should move toward that end.

Several portions of the FAA's upgraded third generation ATC spacing system are affected by this design philosophy. Specifically RNAV—area navigation—automation, DABS, separation assurance,

and airport surface traffic control are affected. Our analysis of the present plan has shown that RNAV will be incompatible with some of the planned automation programs, especially metering and spacing, unless the RNAV display is of the map type and includes data on other aircraft in the area. The addition of traffic information on the RNAV display is the key to distributed air traffic management. While simulation and limited flight tests have confirmed the potential benefit of this device, FAA funding for role definition, display format, and technical system description has been almost nonexistent.

While this subject is very technical and complex, we believe it is of such importance that the subcommittee should use its valuable influence to assure that this approach to the solution of our air traffic problems is adequately explored. A separate line in the R. & D. budget for evaluation of the appropriate distribution of authority would be the best; but this work could be carried out under the existing programs mentioned above as long as specific mention of the work to be performed in each area was given. We would be pleased to supply such subheadings for funding consideration and to discuss the technical aspects of the subject at the committee's convenience.

Collision avoidance system—CAS—research remains extremely important as evidenced by the near disasters of late 1975. At present, CAS programs come under the "Separation assurance" line of FAA's R. & D. budget. This includes, as its major effort, a ground based collision avoidance scheme called intermittent positive control—IPC. While this system holds promise for some users at a quite distant date, only the airborne collision avoidance system offers an independent backup to errors or failures in the air traffic control system. Therefore, the development of an airborne collision avoidance system must be vigorously pursued to early implementation. It is the considered opinion of ALPA that the collision avoidance system which offers the greatest potential for improving safety for all airspace users is the passive-active BCAS technique. We recommend this system because it employs much of the ground and airborne hardware already in place for normal air traffic control functions. We respectfully urge this committee to provide funding and direction to the FAA to accelerate the implementation of such a system.

Now, I would like to discuss what is at the present one of the most expensive programs in the FAA R. & D. budget.

The microwave landing system—MLS—program as it exists today does not cater to known user requirements nor is the size of the expenditure on this program proportional to the primary safety gain of MLS which, in our opinion, is the ability to locate a precision approach aid at a difficult topographical site.

In 1959, soon after its establishment, the FAA recognized the need for an improved precision landing system and began to explore microwave as the technique which appeared to have the most promise of all systems previously examined. These efforts led to the development and delivery of a prototype microwave landing system in 1965. In recognition of the need for a new landing system and based on the results obtained in prior examination of the microwave technique, the Air Transport Association (ATA) recommended that FAA undertake the development of a new landing system. As a result of this recommenda-

tion, Special Committee 117 of the Radio Technical Commission for Aeronautics (RTCA) was formed in December 1967. In January 1971, the United States presented the recommendations of RTCA Special Committee 117 to International Civil Aviation Organization (ICAO) for consideration by the all-weather operations panel in its attempt to develop an international standard for a new landing system. The ICAO panel will meet again in the fall of this year to consider the recommendations of all States concerned with the selection of new international standard for microwave landing systems. Based on the normal decision process in ICAO, it may be several years before agreement on an international standard can be achieved.

The requirements which existed 18 years ago when FAA began developments of an MLS system are still with us today. These requirements have been compounded, over these intervening 18 years, by frequency congestion and the need for a more precise guidance system associated with automatic landing systems. In recognition of these requirements and other critical user requirements which exist today, the FAA authorized the establishment of an interim microwave landing system (ISMLS) in August 1974.

We are aware of existing user requirements and the implications of these requirements on the need for a decision on an international microwave standard. We have participated in almost all of the FAA development work on MLS, in RTCA Special Committee 117, and in the ICAO all-weather operations panel work. Therefore, we feel confident in recommending that ISMLS become the national standard until an ICAO decision has been reached. It is a system which is here today; it satisfies existing user requirements; it does not prejudice an ICAO decision and provides the capability for the most economical conversion to whatever MLS standard is eventually adopted by ICAO. With these reasons in mind, we would recommend that this committee examine very closely any funding level that is requested for MLS until a decision is made by ICAO on an international standard. We are aware of only one aspect of the MLS R. & D. program that has received insufficient attention—the display of MLS data in the cockpit. Complex MLS curved or multisegment approaches cannot be flown until a satisfactory solution for the problem of MLS data display in the cockpit is found. The airborne traffic situation display (ATSD), referred to earlier in our recommended improvements to area navigation program, may be the solution to this problem.

Finally, we would like to comment on one other major R. & D. effort. The substantial expenditures for the Aerosat program do not correlate with a demonstrated user requirement. The contribution of the proposed experimental satellite system to safety is negligible. Its whole purpose is to improve communications over the North Atlantic in order to make feasible reduced longitudinal separations between aircraft in that region. However, decreased traffic and associated forecasts of very slow recovery make the quick implementation of this system unnecessary. We feel that too much money is being spent on this item to the detriment of other programs more important to safety such as low visibility landing and distributed air traffic management.

As pointed out by the Department of Transportation Task Force on FAA Safety Mission, "FAA must undertake a major safety re-

search program to assure that future aircraft designs make optimum use of crew capabilities and to insure that future systems are designed around reasonable criteria for human error." This committee is in the unique position of being able to provide continuing guidance to the FAA and NASA, who together represent a substantial resource of facilities and professional talent which can and must be utilized in R. & D. efforts which we have described.

In summary, Mr. Chairman, we recommend that increased funding levels be established for those programs attacking known space problems such as the low visibility landing and midair collision.

In addition, we believe that this committee should assist the FAA in the development of policy decisions which affect R. & D. efforts and that this committee should be one of the means of communicating the needs of the aviation community to the Federal agencies so that R. & D. efforts are truly developed in light of public interest.

Thank you for the opportunity to present our views. If you desire any further information, we would be happy to work with you or your staff at any time. We stand ready to answer any questions.

Mr. MILFORD. Mr. Cotton, would you go back over and define for me passive-active B CAS technique?

Mr. COTTON. Sure. Collision avoidance systems require communications between aircraft involved in this test so that they are known to be cooperative. Most of the techniques that have been developed in our active transmission of radio signals from the aircraft which want to be projected to another aircraft—this is a transponding system.

The passive collision avoidance system uses the same signals which are used for air traffic control to make what are called radar beacon transponders in the aircraft known to the ground and also known to the other airplane.

In other words, we are just listening to the replies of transponders which are already in airplanes to interrogations from the ground.

Mr. LLOYD. Mr. Chairman, you are using the transponder and the aircraft and you are going to be tuned in to that frequency?

Mr. COTTON. That is right.

Mr. LLOYD. But using the saturated area like Washington, New York, Los Angeles, or Chicago, you are going to get a transponder receiver and just arbitrarily use code 1200?

Mr. COTTON. Right.

Mr. LLOYD. You are going to get it from everywhere and you won't know which one is which—is that true?

Mr. COTTON. It is not true but you are listening in to the interrogation of the same transponder.

Mr. LLOYD. How do you separate the 1200 from another 1200?

Mr. COTTON. By the time you receive the interrogation until you hear another aircraft reply to that interrogation.

Mr. MILFORD. If I am understanding you correctly, passive-active B CAS technique involves the transponder that is already present.

Mr. COTTON. Using the existing transponder.

Mr. MILFORD. And you would have interrogation on board?

Mr. COTTON. For those areas where there are no interrogations from the ground, such as over ocean or remote areas of the world and low altitude and low density areas.

In other words, if you do not hear any interrogations from the ground, you start interrogating yourself. That is the passive portion where you are listening in, in order to keep from saturating the system in higher density areas.

Mr. MILFORD. What kind of equipment are we talking about for those that wish to interrogate themselves?

Mr. COTTON. It is another unit in the airplane.

Mr. MILFORD. Another box?

Mr. COTTON. That is right.

Mr. MILFORD. Do you have any idea on the cost of it?

Mr. COTTON. I really don't sir.

Mr. MILFORD. You note in your statement that the vast majority of accidents occur on the approach or landing phase of flight?

Could you be a bit more specific on what plans you would have for funding with the FAA in this area?

Mr. COTTON. John, could you talk about the program?

Mr. O'BRIEN. Well, we are aware of only one program today that looks into the wind shear program.

Mr. MILFORD. Could you speak a little louder?

Mr. O'BRIEN. FAA has contracted with Stanford Research Institute to conduct an examination of techniques which will—

Mr. MILFORD. Could you speak a little louder?

Mr. O'BRIEN. The FAA, R. & D. branch, have contracted with Stanford Research Institute to conduct an examination of different wind shear detection techniques, airborne and ground based.

This program is examining what we consider one small part of the overall problem of approach and landing accidents in wind shear.

The transition in low visibility, transition in low visibility approaching from head down instrumentation to outside visual cues; we consider to be the prime factor in many of the low visibility approaching landing accidents that we are having today.

We can supply in the very near future for the record, if you so desire, a list of accidents that we have attributed to this factor.

We are not aware of any FAA program that is looking at this specific factor.

There have been programs in the past that have looked at it that have been designed to look specifically at this.

These programs were developed as a result of an ICAO request that all States supply data to ICAO on this program.

The FAA and a joint military-FAA program at Wright-Patterson Air Force Base looked specifically at this problem of what factors contribute to low visibility landing and what does the pilot need to see, what automatic systems work better and what conditions of wind shear, cross wind, and what have you, all of these things are going to be examined in great detail.

The program has been in progress for about 2 years.

There was a series of interim reports published.

These reports contain information that certain people disagreed with and therefore, the program was canceled and we had gone to the Administrator, the Acting Administrator to request that that program be continued, not only for the interest that we had in the low-

visibility landing accidents but also for the United States to contribute effectively to the ICAO which is right now a determining factor which will calculate heights, required visual concern, and many other aspects of the whole landing problem.

At this point, there is no effective use program, R. & D. program to contribute information to this ICAO request.

We would recommend very strongly that such a program be instituted or it may be that the aerosat program would be expanded to include these factors because it could be done very easily in simulation facilities or that the joint Air Force-FAA program at Wright-Patterson will be continued.

They are 2 years through a 4-year program.

The program was canceled on December 31. I believe that I am correct about that. It could be very easily reactivated. The staff people are still there. They have not been dispersed at this time. The subcontractor and the Bunker-Ramo for instance is still there so that I hope that can answer your question.

Mr. MILFORD. Thank you very much.

Let me follow that up a little bit. What were the recommendations after 2 years of the program that were made that were upsetting? First, what were the recommendations?

Mr. COTTON. Well, in general the reports were what they called phase 2 reports and they identified the problem areas that require further research and some of it is over my head but I could say that there were some assurances that everyone of the problem areas that they recommended continuing work with was the wind shear and they identified this problem long before the recent accidents that we have had in this area and the special subprograms of this overall was low visibility and low visibility landing simulation program.

These programs were specifically designed to look at wind shear. Many things that we are duplicating right now in SRI program is to look at what actual visual cues were needed by the pilot when he broke out and picked up your approach light on the runway.

How much of the runway and how much of the approach sight that they need to see to judge whether he was high enough, left or right of the center line, based on very high approaches, and we are talking about 140 or something like that, so the minimum of 1200 which gives you 1200 visual segment, you are through that visual segment just like this so that the cue you are picking up is telling you that you may be a little lower or a little off of left or a little left of right when you touch down. These cues go by very rapidly.

Mr. WYDLER. That is what we know. Now, I would like to know what don't we know?

Mr. COTTON. The program represented the relationship between the decision height, where the pilot makes his decision to land or go around and the required visual segment being examined on a basis of factors. There were many factors. One was the height lost and the go-around. Another was wind shear. How much height would you lose in a wind shear situation and the transition time from head down instrumentation when you get your decision height and you look up and compare

visual cues and you take anywhere from 5 to 6 seconds to go to head down looking at the instruments and you go outside and pick up the visual cues and you make a judgment in your mind whether you are proceeding along in the desired flight pattern.

Mr. WYDLER. As I hear what you are telling me, they are things which we know. These are the knowns. What is it that you wanted to know and that you do not know?

Mr. COTTON. The program recommended that——

Mr. WYDLER. You know it is very difficult to land under those conditions and so forth.

What is it that they could have reserved that could have been of value?

Mr. COTTON. They recommended a change.

Mr. WYDLER. They were doing this for 2 years as I understand it. They should have accomplished something in 2 years. Go ahead.

Mr. COTTON. They recommended, their change at that time a specific relationship between DH and RVA relationship.

We have the ICAO program that has broken out the matrix of known decision heights and various approach systems, landing systems. They are 1, 2, and 3 and there is a DH and RVA relationship depending on the type of aircraft approach base and what have you.

ICAO has as a steady diet recommended specific heights and RVA relationship.

This program was designed specifically to look at these and to find out if they were adequate. Some of them they found out were not in fact adequate. They recommended that they be changed.

For example, a specific decision height of 100 feet above the ground or above the runway may require a visual segment of 1,600, 1,800, or 2,000 feet, depending upon your approach speed and the type of aircraft you are flying. They had specific recommendations in this area.

Mr. WYDLER. Again you keep telling me and it is very interesting to me but all of the things that they found out and so on but what I don't know is what they would continue to spend money on for this project. What further information would they develop?

Mr. COTTON. OK. I will ask Mr. O'Brien to speak to that.

Mr. O'BRIEN. Based on the inadequacies of certain DH and RVA relationship that we are operating today, there was a recommended change in procedures.

Airlines would use pilot procedures and things like this.

It was recommended that changes in types of instrumentation would be used.

It was recommended changes in the automatic landing system would be used, the criteria which establishes the certification process, automatic landing system.

For example, it should be designed to handle more wind shear. Those were special recommendations.

The FAA refused to recognize the recommendations. The reason for refusing to recognize these recommendations, they said, was that military aircraft were used and that military equipment was used to determine some of these factors or relationship or recommendation. Therefore, before the air carriers would accept these recommendations, they recommended that airline aircraft, wide-bodied, for ex-

ample, would be used in evaluation to see if the same recommendations would fall out for civil aircraft.

Now, we had a problem with that line of thought because the type of aircraft that we would use, CA-41, is quite similar to conventional air transport aircraft.

Simulators were used as in the case of 135 or the same military equivalent of the 707.

Mr. WYDLER. I am not sure but I think you really switched me in the middle there, didn't you?

You were talking about a study that was made by the FAA, as I understood it.

What kind of airplanes did they use?

Mr. COTTON. OK, the FAA—

Mr. WYDLER. Didn't they use military aircraft and did they say it didn't apply because it was military aircraft? That couldn't possibly be. The FAA study did not use military aircraft, did they?

Mr. COTTON. The FAA and the Air Force had a joint study out to examine.

Mr. WYDLER. Is that the same one you were talking about when you started?

Mr. COTTON. Yes.

Mr. WYDLER. So this was a joint effort?

Mr. COTTON. Right. In the wind-shear study, the current one that I refer to that was conducted by Stanford Research Institute is strictly a civil examination of the same factors that were compared partly under low visibility landing study conducted at Wright-Patterson Air Force Base.

Now, the point that I would like to make is a lot of the work that is planned to be done under the SRI contract has been done under the facilities that we consider adequate. The facilities at Wright-Patterson Air Force Base are some of the most sophisticated in the world.

Now, we cannot see any problem with the FAA using data collected from those facilities.

Another thing, the recommendations that were made or that came out of the low visibility joint program of the FAA and the USAF program we think are very pertinent to some of the problems that we pointed out in the low visibility landing area.

We feel that this program is 2 years into its 4-year sequence and it should be continued.

We also feel that the program should be expanded to a small degree, maybe to look at some of the specific civil problems that occur using existing airline simulators.

It may cater to some of the problems that the air carriers would have with decisions or recommendations that came out of this program.

We don't feel that this is specifically needed but there may be some specific points that the airlines feel need to be covered, using conventional airline wide-bodied aircraft.

Mr. WYDLER. Your recommendation in general, as I read your statement here, seems to me to make one point, if I can suggest that and that is always is that the determination should be given to the pilot and I am not surprised with that but on the other hand, as a layman, I am always hearing the problem of the pilot being overlooked and

having too much to do, having too many things going on in the cockpit now to handle it.

Why would you resist the idea that maybe we can get some of this load off the pilot's back once and put the responsibility somewhere else.

Mr. COTTON. The responsibility can never be anywhere else. It has to be with the pilot.

Mr. WYDLER. I don't know why the fact that there are two sides, someone is saying that it is the pilot's fault and the pilot's group is saying that it wasn't, that it was somebody else's fault, and I never know which is true and I suppose I never will but if you put this responsibility all over the place for determining the location of the aircraft and when the collision is about to take place and so on, you always find that one blames the other one for making a mistake. You never do know who was responsible because each one may be depending on the other one to make a decision and take the action as required and, therefore, nobody takes any blame in the accident and why would it be so bad to focus the responsibility for collision avoidance on the ground controller.

Mr. COTTON. Because they are not ultimately responsible.

Mr. WYDLER. We could make them.

Mr. COTTON. Because you are depending on a radio link which could be cut off at any time. You are taking the one who is responsible, the pilot, out of the loop so he doesn't know what is going on anymore and yet, it still says there is a regulatory requirement that he is ultimately responsible for the safe conduct of that flight and if he doesn't have information that he needs to carry out that responsibility—

Mr. WYDLER. Do you want to make the pilot solely responsible for it?

Mr. COTTON. Obviously, we did not have room in this statement to go into the complete decision of this and the location of responsibility is extremely important and we are not saying that we are doing away with the ground system but we are just including the pilot in the knowledge circuit so that he can participate in this process, optimizing his own flight.

Mr. WYDLER. Two planes crash here. Who is going to be responsible for it?

Mr. COTTON. The pilot. He is responsible now.

Mr. WYDLER. I am just saying that it seems to me always when you divide responsibility for something like that you make more than one group responsible and you really never know who is responsible. That is the basic problem we have in Government. There are so many people who are responsible for something that nobody is responsible for it.

Mr. COTTON. No, you are generalizing. The responsibility has to be very specifically determined and we have differences of responsibility now, between the pilot and the different aircraft controllers and it is spelled out here. I am responsible for doing this, he is responsible for doing that, but what I am saying is if we had some different instrumentation which provides us with more information on what is going on around us, we would then be capable of taking on certain responsibilities that are now on the controllers. He retains most of his other ones; the traffic flow for instance, and we can do a better job at what we are trying to do, to operate safely and efficiently.

Mr. LLOYD. If the gentleman would yield. Maybe I can be of help. I think, Mr. Cotton, that you have not communicated that the discretionary or decisionmaking process is the pilot's, that a controller may put the information in saying, you know, giving vectors to an approach or in the midst of an approach to ask for, that a holding be set for altitude but the pilot at that point when he says, let us say you are now cleared for the approach, the pilot can come back and say, well, he didn't feel comfortable in this approach. How about taking me around? That decision is the pilot's and that is the thing that isn't coming across to you that you are putting the controller and the pilot on an equal plane. It simply is not so. Ultimate discretionary decisionmaking process is always the pilot's. It never changes. Am I correct, sir?

Mr. COTTON. Absolutely. Thank you, Mr. Lloyd.

Mr. WYDLER. I understand that but that doesn't help me because I am not sure of all of the intricacies of collision avoidance systems and how it would work but it would seem to me when there are two planes coming together and you have the same information available the question is will the guy up there take the necessary action? If they hit each other, each side is going to say, which happens all of the time when we have these accidents that it was the other guy, he should have let me know. He never warned me. The other fellow says he never warned him and he has all the information that he needed anyhow and he has it available and thought he was going to take the necessary action to avoid the accident.

Mr. COTTON. I never said we are going to do that. The traffic low collision avoidance system is designed to take care of errors which occur, not the normal process of flying around through the sky but if there is a mistake which occurs and two aircraft could get close together, they would alert those people involved to do something about it so a collision doesn't take place.

Mr. WYDLER. Thank you, Mr. Chairman.

Mr. MILFORD. Mr. Lloyd?

Mr. LLOYD. Thank you, Mr. Chairman.

I have two areas that I would like to pursue. One is the continuance of a discussion that you have. The other is, please explain to me how if you are on a regular IFR situation, you are under 12,000 feet, you are plugged into 1200, can you distinguish between one 1200 from another 1200 when you are flying, say a 737 and you are below the general aviation area, so which would you run into, the transponder code of 1200?

Mr. COTTON. It was done by very precise timing of the time between your reception of the ground interrogation and consequently—

Mr. LLOYD. Now I got it. In other words, you are measuring the time that the interrogation occurs and you get a light on your transponder. You are tuned into 1200 along with somebody else and then as soon as the transponder, the thing hits his plane and it responds, you measure the distance from the interrogative equipment and then you measure the distance of his response to that interrogation.

Mr. COTTON. No. The rotational speed of the antenna so that you can tell what radar and what have you.

Mr. LLOYD. OK. Now, let me respond to the other item of this discussion. The heads up presentation is of course a known technique.

The military already has it. It is not a very, shall we say, state of art, sophisticated system—I am sorry—I do not remember your name.

Mr. O'BRIEN. It is O'Brien.

Mr. LLOYD. Thank you. That is a tough name.

In response to your presentation, when you were talking about 6-second interval, there is no need for that. In the dollar values going into the system, you can take your own system and upgrade it into a heads-up. We would just arbitrarily say that you were getting elevation relationship, horizontal speed.

You are going to have all of those presentations and that is a very simple presentation on heads-up presentation so you do not have to have that transition.

We already know that to be known. That is not a crying need.

All you have to do is make a decision whether you are willing to pay whatever dollars it is for the, whatever aircraft you are flying.

Mr. O'BRIEN. Could I follow that up a little bit?

Mr. LLOYD. Indeed you may. You are the one giving the testimony, not me.

Mr. COTTON. You are doing very well.

Mr. O'BRIEN. There may be a little bit of R. & D. efforts in this area only because we have responses from the carriers and other people saying that there are problems, optical problems. How much does another reflector screen in front of you distort what you are looking at?

There are specific questions that are posed every time the question of heads-up display is brought up.

Mr. LLOYD. The answer is already there.

Mr. O'BRIEN. We say the answer is there but we have not convinced the FAA.

Mr. LLOYD. But the FAA puts it in a F14 so they can see the turf. It is already there. The things you are talking about are totally available.

It is not a question of talking of the state of the art and if they haven't taken the time to go and look, that is their problem and maybe we ought to be on their back about that. What the sophistication is, and what additional requirement electronically or in space lies in the black box, that I do not know.

Mr. O'BRIEN. What we would like to see them do and attempt to do is, in the wind shear program to look at the various concepts of the great number of manufacturers, each one with its own concept of the best type of symbol, the best type of data. If there is R. & D. data, to examine it.

Mr. LLOYD. But to not spend hours on something that we have already done.

Mr. O'BRIEN. I agree.

Mr. LLOYD. In other words, the symbolism, whether the Navy does it or the Air Force does it in the F-15 and heads up display is not very important in that we can standardize the symbol very quickly, such that everybody has the same presentation.

Obviously, I have not flown in the F-14 and obviously the presentation of target designation are really not, have no value to you whatsoever which is very important to them but the head-up operation of the

aircraft itself is not a very difficult technique at this point, it is already there so why should we spend, you are not supposing that we spend dollars on that?

Mr. O'BRIEN. No. The black box work has been done.

Mr. LLOYD. Let us get back to the really basic question and I think that I am not sure that you have communicated fully. We recognize in your presentation today that you are asking for additional technology, the ongoing research and development, all of which leads us to the task of is the pilot really necessary in the loop anyhow. That is really where you are. I have to confess he is very necessary but then I suffer from having, as Mr. Milford does, having operated airplanes so we think we are very important but in reality we have proven conclusively you can fly an airplane rather adequately without a pilot in the loop so if it is a problem you are posing, I think you are on very very thin ice or dangerous ground on some of the things you are talking about.

Would you address yourself to that?

Mr. COTTON. I certainly would. I fly radio-controlled models myself and I know exactly what you are talking about, but I strongly disagree that you can do it very adequately from the ground.

There are so many facets of what goes into your decisionmaking process, what power am I going to use, climb or descend here, shall we go around the thing a little bit wider so that the thunderstorm will not interrupt communications to the ground.

Mr. LLOYD. Let us arbitrarily take one factor out of this. MBH is coming in and you have an automatic button that says 2,200 feet and you go to 92 percent or whatever figure you want to throw in this and we can do that all in an automatic way, can't we?

Mr. COTTON. Sure.

Mr. LLOYD. Without the pilot being in the loop?

Mr. COTTON. Right. He does not need to be in the airplane.

Mr. LLOYD. And we can solve those kind of problems, the question that you are presenting here which I think is an extremely important question is how far do we go before we say no further, we have to have a pilot in the loop.

Mr. COTTON. Well, if this system fails and I have lost communication with my radio-controlled model, in what kind of position is the pilot going to be?

Mr. LLOYD. He better fly pretty fast.

Mr. COTTON. He better if he hasn't been in the loop all along and doesn't know where he is going.

Mr. LLOYD. I am trying to force you to come up with that kind of an answer because I believe that to be the answer.

I do think that you ought to clearly articulate the responsibilities the pilot has and the things that Mr. Wydler has been addressing himself to are very valid from this point of view.

In other words, just who is responsible and how come we have situations where a pilot misinterpreted the comments of the controller when he said, "You are clear for approach," and immediately he started yanking the power off and going down to the minimal altitude when in reality, the terrain features were such that they were at least

2,000 or 3,000 feet off. I do not remember specifically, but something like that. How could they make that kind of a mistake?

Mr. COTTON. This is what comes from, really being on the ground, that procedure.

Mr. LLOYD. He wants to know. You are saying, and the pilot is saying, that they loused up but the ultimate responsibility, and I think this is what Mr. Wydler really wants to know, he wants to prevent the accident, wants to prevent the mid-air collision. He really wants to know how come every time we blame the pilot and the pilot is pointing his finger to the controller and the controller is pointing to someone else.

Mr. COTTON. The system has grown up that way and improperly and it is time to stop it.

We cannot continue to shirk our responsibility for the safety of flight on to some other agency. It is wrong. We have to be aware of our total situation in order to make a judgment on it and in order to proceed with the flight in a safe manner.

Mr. LLOYD. One of the things that occurs to me is that the flight controllers are coming in here, the radio operators are coming in here, and saying, "Look at the responsibility I have."

OK, I see that my time is up. I have a total responsibility here and he indicates to these people how important he is, and obviously, he is selling his stock and that is one of the problems.

Mr. COTTON. Sure, he has become too important. It need not be that way and it would be safer and less expensive if it were not that way.

Mr. MILFORD. Mr. Cotton, thank you very much for your very fine statement.

Mr. COTTON. Thank you for your time.

Mr. WYDLER. Mr. Chairman, I make this kind of request. The witness that we heard from yesterday, from Glenn Aviation and the gentleman who testified this morning have both raised very serious questions about the FAA research and development program, and I think some of these things should be addressed in light of the criticism or the critique we have heard.

I personally would like to have someone back from the FAA to address the questions that have been raised.

Mr. MILFORD. I think I agree with you, Mr. Wydler.

Mr. WYDLER. They are very basic questions about the air safety program that have been raised by two witnesses in a row and they seem to be the people who might benefit from the system so if they do not like it, I am wondering if we are building another thing that we are never going to use.

Mr. MILFORD. Mr. Jensen, welcome to the committee. We have your formal statement before us which we will put in its entirety in the record if you care to summarize or otherwise present it, you are free to do so.

STATEMENT OF WALTER A. JENSEN, VICE PRESIDENT, OPERATIONS AND ENGINEERING, AIR TRANSPORT ASSOCIATION OF AMERICA

Mr. JENSEN. Thank you, Mr. Chairman. This statement is already a summary of a longer statement that we started out with and I think the clearest thing would be to simply read it.

We have a report that is a part of this statement and with your permission, I would like to make that a part of the record.

Mr. MILFORD. It will be.

[Material referred to above follows:]

AIR TRANSPORT ASSOCIATION OF AMERICA,
Washington, D.C., February 27, 1976.

HON. DALE H. MILFORD,
Chairman, Subcommittee on Aviation and Transportation Research and Development, Committee on Science and Technology, U.S. House of Representatives, Washington, D.C.

DEAR MR. MILFORD: Subsequent to my testimony before your Committee on February 18, 1976, you will recall that I asked if I might provide you with airline views on several matters brought up by other witnesses. I would like to offer the following:

1. AIR TRAFFIC SITUATION DISPLAY

Mr. Cotton of ALPA spoke in strong support of further FAA research and development on "distributed air traffic management," and specifically on work related to the Air Traffic Situation Display (ATSD). The airlines have been aware of this work since its inception and have offered specific views to FAA at various times.

The concept of placing in the cockpit a cathode ray tube display of nearby traffic was first proposed in 1946 and has frequently been revived and reconsidered.

It was again considered during the work of the President's Aviation Advisory Commission in 1972-1973. At that time a study was conducted by MIT Lincoln Laboratory which produced an objective, if somewhat optimistic assessment of the value of such devices for air traffic control. The study, in our view, showed that there was no clear indication that such devices would achieve higher capacity of the Air Traffic Control system; nor was it shown that it would significantly enhance the safety of the system.

Recently DOT directed FAA to undertake a study to "establish the role of ATSD and the Upgraded Third Generation Air Traffic Control System." This study will cost more than \$150,000. ATA has objected to this expenditure of funds. We have expressed the following view to FAA:

1. Competent studies by highly qualified people have not shown a clear benefit from ATSD in terms of improved air traffic control efficiency capacity or safety.

2. The work on ATSD tends to mix together the concept and prospective benefits of a device which would display a cleaned-up ground radar display of traffic—ATSD—with 3D and 4D area navigation, digital communications, electronic displays, and separation assurance service. These latter possibilities can, and we think must, be examined on their own merits without mixing them up with the far more limited capabilities of ATSD.

3. We agree that an ATSD might offer certain limited pilot "confidence building" with respect to nearby traffic under certain very limited conditions, but there are other ways of doing that as well, and perhaps in a less complicated way, if it is needed.

4. There seem to be certain risks in providing a pilot with a compelling display, on which he may choose to take inadvisable actions based on the limited information available to him, especially since the information that can be presented cannot convey the complex traffic arrangements being made by the controller to efficiently feed the runways, nor can it present enough information to adequately permit valid assessment of many risks.

5. The display generates additional workload, possibly excessive, and may tend to distract the pilot from other important duties. The "human factors" problem must be analyzed in depth.

The above points do not seem to us to justify major FAA R&D investment, but at the most a reasoned analytical effort. While it is never wrong to do analysis of long-term ATC system philosophy evolution, it does not require ATSD hardware or flying activity at this time.

2. HEAD-UP DISPLAYS

A number of airline experts have recently expressed their views on head-up displays, as follows:

Many airline experts believe that the basic cockpit instrument location, both for all-weather operations and for execution of complex approaches will be "head-down" in the cockpit, and that new aircraft are likely to see electronic displays implemented and take a more dominant role. Many airline experts believe that "head-up" displays, while superficially attractive for general use—and potentially useful for some special uses under VFR conditions—will find little serious application for complex approach operations especially under poor visibility conditions. It is widely felt that adequate system integrity is not likely to be achieved, and inherent optical and eye adaptation problems of such displays relative to the outside scene are likely to be limiting. This does not mean that airlines would not like to see work done on "actual scene" visibility enhancement—devices which might permit pilots to "see" through fog directly and without artificial scene re-creation.

3. TOWING OF AIRCRAFT TO AND FROM RUNWAYS

In response to Mr. O'Reilly's recommendations for more FAA work on towing of aircraft to reduce noise and emissions, the following precis of FAA's work expresses airline views:

In late 1974 the FAA contracted for a study of the feasibility of towing aircraft to and from runways. The study, "An Analysis of Fuel Conservation Through Aircraft Towing" was undertaken by the Mitre Corporation and completed in February, 1975 under DOT Contract DOT-FA70WA-2448. It concluded:

1. The cost of conserving fuel through towing substantially exceeds the market price.

2. No towing scheme is economically feasible unless the price of fuel increases by 150% to 200% without any increase in crew costs. (Fuel price used was 22.5 cents per gallon. Ergo, fuel would have to increase to 45 cents/67.5 cents. Current price is 30 cents per gallon.)

3. Capacity would be affected. Present performance of tow vehicles would increase taxi time 50%.

4. Present vehicles are not designed for this type of operation.

5. There were a number of recognized but unconsidered variables, such as the need for spare vehicles; a perfected dispatch system; increased costs for resource management (tow vehicle/driver scheduling); need for holding pads and tow vehicle roads would increase capital investments.

6. "In general, therefore, from an economic and operational viewpoint towing of aircraft is not a desirable proposition."

4. MICROWAVE LANDING SYSTEM DEVELOPMENT AND THE TULL ISMLS

The current airline view on the Microwave Landing System is given on Page 4 of the attachment to my testimony. In that statement we support early international standardization of the technical specifications for the new Microwave Landing System of the future, and we oppose further support by FAA of interim systems such as ISMLS which we feel can only hamper the MLS effort.

While we sympathize with the needs of some user groups to obtain microwave landing guidance now, we have opposed the Federal involvement in ISMLS basically for two reasons:

Almost without exception interim systems which have been introduced into the Federal Airways System have become permanent fixtures. Thus, proliferation of the ISMLS in our view can only hamper orderly transition to the universal Microwave Landing System.

While the Tull ISMLS system provides an ILS-like service at a higher frequency, it does not contain within it the technological advances which FAA's five-year development effort on MLS has shown to be valuable to a new guidance system. The Tull ISMLS has been given only very limited testing to examine its ability to solve the problems which started the MLS development in the first place, and ISMLS does not have the growth potential which the entire aviation community felt at the inception of the MLS program was essential in a new universal signal format.

Airlines have long pressed FAA to proceed at the earliest possible date with an advance version of the MLS system to meet the needs of those users who have

need for service now; but we feel any new system endorsed by FAA should be a part of the family of systems which will be the new universal MLS.

There are of course frustrations among those who feel the need for service now, but the development is nearly at an end, and there is reason to believe that at least a preliminary international recommendation for the Universal Microwave Landing System will be achieved this year.

As you pointed out, while the Tull ISMLS can utilize substantial portions of the existing ILS in an equipped aircraft, simple versions of the Universal MLS will also utilize a portion of the existing airborne instrumentation. In any event, a new airborne element must be introduced; and we feel it would be unwise to proceed through a two-step transition when a single-step transition for all users is within our grasp.

Mr. Wydler noted that uncertainties remained as to whether the U.S. proposal of a scanning beam MLS, or the Doppler MLS will "win" at ICAO.

There are those who feel that if the U.S. proposed TRSB scanning beam system is not chosen, it would represent a "defeat" for the United States. In our view, the choice of the Doppler MLS would be in no way a defeat. FAA has invested heavily in both techniques and made its selection of the TRSB scanning beam technique after a painstaking technical assessment, in which both techniques were found to be excellent. The early selection by ICAO of either the TRSB scanning beam or the Doppler version of MLS would in our view represent a victory for the United States and the aviation community. The only real defeat would be for ICAO not to agree on a single universal signal format.

We were pleased to hear Mr. Tull testify that his company is in business to build MLS and that he would build whatever MLS is finally chosen by ICAO. We are aware that Mr. Tull is currently working on a TRSB scanning beam version of his system, and believe that work should be strongly encouraged. Airlines have felt from the beginning of the MLS development that a broad range of industrial interests should be involved in MLS development; and Mr. Tull's activities represent an important enterprise, working outside the Federal government structure, to develop landing guidance systems of good quality at low cost. We will be pleased to see his work proceed on the ICAO-standardized system.

5. NOISE REDUCTION

In my statement on the FAA's R&D program I did not cover research and development on aircraft noise reduction. This was not due to lack of interest but only because we believe that NASA has the lead role. Thus the subject of "Noise Analysis and Abatement" was covered in General von Kann's February 17 statement entitled, "Views of the Scheduled Airlines on the NASA FY-1977 Aeronautical Research and Technology Program and Budget" which has been submitted to you and your Subcommittee.

I hope these additional comments will be useful to you and your Subcommittee.

Sincerely,

WALTER A. JENSEN,
Vice President, Operations.

Mr. JENSEN. My name is Walter A. Jensen. I am vice president—operations and engineering of the Air Transport Association of America, representing essentially all of the U.S. scheduled airlines.

The airlines have a strong and vital interest in FAA's research, engineering, and development program. Over the past several years we have seen a reorientation of FAA's R. & D. program into channels we believe will improve the safety and efficiency of the National Airspace System. With certain reservations we believe the program is moving in the right direction.

Because many of FAA's efforts are intertwined, we have in recent weeks completed an airline assessment of FAA's program. We have prepared a brief statement of airline views on FAA's R. & D. program, including a priority list of the R., E. & D. activities which are most vital in the view of the scheduled airlines. With permission, I would like to make this statement a part of the record.

To summarize the attached statement, airlines believe that highest emphasis should be on safe alleviation of wake vortex restrictions; exploitation of automation and other tools to achieve optimum airport performance with minimum delays; work to further improve our already fine safety record, including work on landing safety and the windshear problem; rapid completion of FAA Command Center automation program to achieve more efficient fuel-conservative management of traffic flow, along with better real-time data on the performance of the ATC system; a meaningful airport pavement design, development, and test program; and, finally, work to achieve higher productivity of the FAA system.

With respect to funding the research, engineering, and development program, airlines believe that FAA should work toward a goal of \$50 million annual research, engineering, and development expenditure. However, we believe that under the present structure of the FAA organization and its support organizations and the amount of work to be done, that goal cannot be reached at this time.

There is a great risk in attempting to limit expenditures or to appropriate funds in such a way in which the existing FAA in-house and overhead structure is retained while external work and contract activities are cut. We believe FAA should carefully examine its own staffing and facilities to be sure that it achieves a lean, technically solid organization; but the funding for the next several years must be based on the essential work to be done, and the resources available to do it.

As we understand FAA's fiscal year 1977 program, FAA would slightly expand its safety-related development efforts, especially work on windshear, on accelerated conflict alert software programs, and on automatic aircraft separation assurance; it would sustain momentum on some airport capacity improvement and cost reduction elements such as the automation program, DABS, wake vortex detection systems, surface guidance activities, basic microwave landing systems, and the aeronautical satellite program. However, a number of important programs will not proceed as rapidly as they might. Among them, as we understand it, would be air traffic control automation expansion, including the long-delayed metering-and-spacing program; further and expanded work on the wake vortex avoidance system; work in expanded central flow control automation; work on early implementation of automated flight service stations; meteorological R. & D.; and airport pavement engineering.

I would like to discuss now the strength of FAA's programs as we understand them in the context of our own airline priorities for the research and development program:

1. The wake vortex detection and avoidance system effort has been a well-managed program, and we anticipate practical results in terms of early elimination of increased separation standards any time they are not needed. It is most important that minimum safe separation standards—that take into account wake vortices—be included in the terminal area automation effort.

2. With respect to terminal area metering and spacing and other automation efforts—such as better input/output means to retrieve and use the information of ARTS and NAS in the tower, and work to permit elimination of flight progress strips—need the highest possible

emphasis. These programs have been moving very slowly. Additional efforts may be justified even though a significant part of the fiscal year 1977 E. & D. budget is earmarked for this kind of work.

3. We strongly support FAA's efforts to achieve better collision protection and to lay the base for automatic separation assurance. We believe this is one of FAA's most active efforts. It appears to be properly funded for fiscal year 1977.

4. Airlines have long supported the development of an improved automated air traffic flow management system. This program too has moved very slowly, but it has a major impact on fuel conservation. We are not sure whether adequate funding exists for this program to move it along as rapidly as the technology will permit.

5. We strongly support study and assessment by FAA, working as appropriate with NASA, of the various factors and systems which may help to achieve an even better air transport safety record—particularly in the landing phase of flight. We have been pleased to see a recently increased emphasis on windshear research and development. This program appears to be well funded for fiscal year 1977.

6. The airlines are anxious to see completion of development and implementation of ARTS III improvements and extensions. This is the heart of terminal area automation. This program has moved far more slowly than we had hoped, and we support additional strengthening, particularly in such areas as terminal area conflict alert, advances in automated metering and spacing, and wake vortex avoidance algorithm development.

7. The airlines are seriously concerned at the lack of funding for an active airport pavement design research, development, and testing program. There is very little money available in FAA's fiscal year 1977 budget for this effort; yet this seems to us an entirely false economy. Major runway repairs and maintenance affect airport capacity, often drastically. Considering the very high percentage of the ADAP investment which goes into pavement construction—something on the order of 55 percent of the ADAP funding—research and development to improve designs and develop new testing procedures for pavement is a clearly essential effort if the ADAP money is to be used wisely. Much useful information has already been produced by the research program; but the highest payoff is still to come through validation of nondestructive test methodology for airfield pavements. This program is vastly underfunded as we see it; and we believe a minimum of \$500,000 should be made available for this purpose.

8. In attempting to achieve an integrated program to optimize airport capacity, airlines and airport operators are working with FAA in a 10 airport improvement study. This effort is essential because it pulls together the capabilities and needs of airports and airport design as well as the capabilities of the electronic support systems. One major output from this work is the development of valid information on capacity, demand, and delay projections. As we understand it, little money is available for fiscal year 1977 to continue the analysis and the optimum use of computer capacity and delay models for this effort.

We believe it is an essential effort for which funding should be found.

Achievement of realistic information on actual capacity and delay at major airports is valuable not only for its own sake and the fuel-conservation advantages it can bring, but also to serve as a basis for determining the value of potential improvements.

9. The airlines support the development of optimum facility implementation plans to increase IFR airport capacity at major terminals, and to reduce terminal area delays and the resultant excessive fuel usage. This is primarily an F. & E. problem, but a limited amount of R., E. & D. funding may be needed to develop optimum plans. There appears to be no funding for this effort for fiscal year 1977.

10. Airlines have a strong interest in the development of improved airport surface traffic control and guidance, and standardization of related marking and lighting, with first emphasis on aircraft management for fuel conservation. We have long urged FAA to move on the development of improved surface detection radar. This work, now begun, has moved very slowly, and we support strengthening this effort and speeding it up, since better airport surface guidance and control offers benefits in both safety and the expedited movement of traffic near and on the ground.

11. The airlines support improvement of FAA's primary and secondary radar surveillance systems and systems analysis to establish the roles of radar in the future air traffic control system. This is not a large money item, but one on which analysis and decisionmaking can pave the way for a more cost-effective FAA system in the future.

12. The airlines strongly support work to assess the system changes needed to achieve higher FAA air traffic controller productivity and FAA maintenance technician productivity. This effort, which is essential if FAA costs are to be kept in bounds, appears to be deemphasized in FAA's 1977 program. We believe this effort should be energetically pursued.

13. The airlines support continued research and development on improvement of the existing instrument landing system and a continued effort to provide reliable, low-cost ILS facilities. The airlines also support continued orderly development of the microwave landing system. Our major interest is for FAA to do the work necessary to promptly achieve an international standard for an MLS signal format. FAA should pursue efforts to demonstrate the capabilities of MLS so that all users may be in the position to judge the benefits to be achieved from implementation of this system. While demonstration of the expanded features of the complete MLS is important from the viewpoint of international standardization, large amounts of money are not necessary at this time for the development of production specifications of full-capability MLS. MLS has been an expensive program, and a substantial amount is requested for fiscal year 1977.

14. We understand no funding will be available in fiscal year 1977 for work in fog-dispersal systems. We believe that this is unwise, and that a small amount of money should be set aside to evaluate the technology and cost effectiveness of fog-dispersal systems.

15. The development of a realtime ATC system performance measurement system is moving very slowly. Last year Congress asked FAA to establish a system performance measurement system so that Con-

gress as well as FAA and the users could have better day-to-day data on the performance of the FAA air traffic control system. With the cost of delays still mounting, this effort is essential and should be speeded up.

16. The airlines support a psychoacoustics research and development effort to permit better understanding of the impact of aircraft noise on people. We understand there is adequate funding for this effort in the fiscal year 1977 budget.

It is clear from the above that we believe FAA's R. & D. program needs to be strengthened in a number of areas. I have not touched upon a number of other valid efforts in FAA's R. & D. program. For example, we support FAA's efforts in automated flight service stations in order to improve the manpower effectiveness of the FAA system.

We endorse FAA's efforts on research and development on bomb detection systems. We support an expanded and expedited effort in this area so that all methods of bomb detection which offer a reasonable possibility of producing results are adequately examined.

As you know, the airlines have never been advocates of the Aero-sat program although we did remove our objection to it. We understand that the fiscal year 1977 request is for approximately \$6 million but that this amount is expected to jump to \$25 to \$30 million in succeeding years. This increase should not be allowed to adversely affect future budgets for higher priority R. & D. programs.

We have examined the FAA's fiscal year 1977 R.E. & D. program and budget, and we have concluded that the general thrust of the program is in the right direction but that the program could be strengthened in a number of important respects as indicated above.

I might add a comment, Mr. Chairman, if I may.

I was not able to be here yesterday when the FAA spoke, but I have been told what they did say and I have seen some of the charts that they used. I have a feeling that the charts forecasting the traffic may be a little more optimistic of the traffic growth than we would expect it to be.

I say that because I think the place that we have to look at traffic growth in terms of where the R. & D. is needed to take care of capacity limitations that exist today is at the higher density terminal areas—O'Hare, Kennedy, Atlanta—these types of locations and these locations will be largely affected by airline aircraft more so than by general aviation increases in growth.

I think the overall figures that FAA gave on growth were largely influenced by general aviation increases in traffic, and therefore, I don't quite see the amount of increase at the major hubs that FAA indicates.

I do not think it is a big discrepancy, but I think it is one we have to keep an eye on.

The other thing, probably more important, is that I think FAA's estimate of the increased capacity that they expect to be produced by a number of programs which they generally refer to as the upgraded third system are probably optimistic again, that we do not see that the programs that FAA has underway, under general title of "Upgraded Third," will produce quite the increases in capacity that FAA expects.

Now, by that I do not mean to say that these programs are bad. I think we must go ahead. I think they are important. We will need the capacity, but I think we must all be alert to the possibility that there may be other things required to increase capacity in the years to come because the upgraded third series of programs won't produce quite as much as FAA is expecting of them.

With that, we are certainly available to answer any questions here or for the record that you might have.

Mr. MILFORD. Mr. Jensen, I wonder if you would mind supplying more details in your later remarks, particularly any charts of your own or specific numbers for a quantitative critique.

Mr. JENSEN. In terms of expected growth, I notice that FAA utilized charts that indicated passenger number growth. That is really not germane to the air traffic control system needs.

The thing that is really germane to aircraft control is the number of aircraft movements when the aircraft are going to be operated in the airport system and in the en route system.

Our estimate of airline growth runs something between 2 and 4 percent, I am told, per year in terms of airline-aircraft movement.

Now, general aviation growth is expected to be higher than that percentage but FAA—

Mr. MILFORD. You may supply these figures at a later time in a quantitative manner if you prefer.

Mr. JENSEN. If I could know more specifically what things you want quantified; I do not think we could quantify the airline growth in the airline-aircraft movement much more closely than 2 to 4 percent.

Mr. MILFORD. In your statement, you contend that large amounts of money are not necessary at this time for the development of a full scale MLS.

Do you think that we should be pushing ahead with interim-MLS at this particular time?

Mr. JENSEN. As I think we pointed out to you when we were last here, you and your committee, Mr. Chairman, we have mixed emotions about the interim MLS.

Our experience in the past has been that things which are brought about as an interim tend to stay with us and are hard to get rid of when one finally arrives at a standard. We do not want to be in the position of having to carry around two sets of equipment in the airplane to do the same job, one, because ISMLS is carried forward in the future of some airport and finally MLS comes in at another airport. So we have concern over the ISMLS becoming too prevalent and causing problems with the future.

On the other hand, we know full well that there are airports where there are difficult citing problems and there is a strong desire to get some instrument landing capability where ILS just won't work. Therefore, there is an interest in having something sooner than the MLS.

So, while there is some value to having an ISMLS, I think it has to be looked at very cautiously so that we do not proliferate any non-standard systems in our general air traffic system.

Mr. MILFORD. Let me switch to another subject. In your association with Aerosat, are there any airline needs that cannot be met by an existing FAA facility and equipment right now?

Mr. JENSEN. I have to answer that this way and I think I will be giving you a direct answer to your question. The airline interest in Aerosat was confined to the communication capability of Aerosat to provide good, solid communications for flight over the water areas.

As opposed to that, the FAA interest and the interest of some of the European governments was not confined just to the communications but also included interest in the navigation and surveillance kinds of functions.

Now, from an airline standpoint, looking to communications, there can be, I think, good communications with available technology without having to go to an aeronautical satellite.

On the other hand, I would have to say that an aeronautical satellite would provide more direct communication because there are times when communication is difficult and messages may have to be relayed from one airplane to another to get to the ground.

That is rare but it happens. So we are not without communications but a satellite could provide better communications. Whether it is worth the cost is a big question.

Now, as to the difference between communications and the other function, you cannot do the surveillance functions that the FAA and the Europeans have talked about with the present facilities—

Mr. MILFORD. How about the timing of it? Is the timing now or is it perhaps a little later.

Mr. JENSEN. I think the timing has shifted some because the traffic in the North Atlantic, which was a primary area of interest, has not grown to the extent that it was thought to grow a few years back, so I think there is a slippage in the time that the traffic over the North Atlantic will require Aerosat seating.

Mr. MILFORD. Let me give you one final question. As you probably heard, Secretary Coleman has strongly appealed to the Congress to establish a national transportation policy. Of course, aviation being one segment of our national transportation system, do you think it is time for us to more or less stop, so far as R. & D. goes and take a brand new total look. Perhaps establish ourselves a goal some point in time, say the year 2000? And taking a top to bottom look as to what we should be doing in the way of aeronautical R. & D. Should we identify the role to be played by Government and the role to be played by industry toward reaching particular goal and establishing long-term plans? Should we have long-term funding plans rather than doing it as we have in the past, coming up each year and saying, well, our R. & D. dollars are going to be here and here and here and this particular program or that program? Should we back off and look at aeronautical R. & D. as a whole establishment and identify the role to be played by the different segments and go at it from that point of view?

What is your comment going to be on such a plan?

Mr. JENSEN. I keep remembering a statement you made earlier on in your remarks, something about should we stop and take a look. I do not want to.

Mr. MILFORD. Not stop here. I do not mean to infer that.

Mr. JENSEN. I do not think we can stop doing what needs to be done.

I think what you meant to say is step back and see where we ought to be going. One cannot argue against doing that from time to time.

I remember that there was a fairly recent study made by DOT and NASA that looked rather thoroughly into the R. & D. and the role played by those two parties and so long as what you say would not duplicate that but simply take that into account, I do not see how one could object to taking the kind of look that I understand you to be suggesting.

Mr. MILFORD. Mr. Wydler?

Mr. WYDLER. On page 2 of your statement, you say FAA should work toward a goal of \$50 million annual research and development expenditure

Where did you get that figure from?

Mr. JENSEN. Very specifically from our Board of Directors, Mr. Wydler. [Laughter.]

Mr. WYDLER. Where did they get it from? I am wondering where you picked these figures up?

Mr. JENSEN. They were looking at the airport and airways development fund, trust fund, when it was being reviewed and the various elements of it. One of the elements is R. & D. and it was their view that, in looking at the relative portion of the money that ought to be allocated out of the trust fund for F. & E. and for airports and so forth, that with respect to the R. & D. part the objective ought to be to bring it down to around \$50 million.

Now, I think the time is fast approaching when we have to go back to them and say, here are the kinds of R. & D. that you have asked to be done and it looks like to us that you may have to revise your figure upward.

Mr. WYDLER. Are you telling me they came for that figure because they wanted more funds for some other purpose? Is that their motivation? Is that what you are saying?

Mr. JENSEN. I think they were trying to achieve a balance between what the bill should say with regard to the various functions, like airports and like F. & E. and R. & D. That is all I can gather from what they did.

Mr. WYDLER. They did not want it to interfere with the runway construction?

Mr. JENSEN. Well—

Mr. WYDLER. You think they had that in mind?

Mr. JENSEN. I think they recognized, as we said in the statement, that part of the R. & D. is very vital to the runway construction.

Mr. WYDLER. I will tell you the truth here that I do not understand, if they are spending 55 percent of the ADAP funding on runway construction, why they cannot do a part of the ADAP research you are calling for on improved technologies and methodizing of airport pavement.

We know generally, you know what might be tried out. Why don't we try it out in the existing program? Why do we have to have another program for \$500,000 to do that?

As a matter of fact, I do not know what that program would do other than possibly build some runways and land planes on them and test them in some way. What would that program do?

Mr. JENSEN. To answer the first part of your question, as I understand it, the FAA, like any agency, has compartments in its budget.

R. & D. is in one compartment and the money to build runways is another.

I do not know why things have to be compartmentalized that much but that is the way it is.

I think that is the answer to your question, the first part of it.

Mr. WYDLER. That is bureaucratic stuff we can get rid of on this committee. It seems to me it would be one of our purposes to make Government operate a little sensibly even though we may offend an occasional official of the Government because we may step on his toes or his jurisdiction or what have you.

Mr. JENSEN. Any way you can get it done, fine. With respect to what should be done, I personally am not aware of all of the details of this. I see the AOCI follows us here and our airports people have been working very closely with the AOCI on this. Our airports people are not here today and I think you probably would get better answers from AOCI on this particular question.

Mr. WYDLER. I will wait and see what they have to say here.

Is there anything that you feel the FAA should do in R. & D. which they are not doing? I do not get that in your statement.

It seems to me that you are approaching what they are doing or suggesting it be done a little more or a little less but anything that they are not doing that you think they should be doing?

Mr. JENSEN. Nothing comes to my mind directly. In answer to your question, no. We identified some areas, like in the pavement design. I think the actual figure for 1977 budget is zero on that.

You can say they are doing nothing in that regard so, other than the things that we said here, we do not have anything further that I can think of.

Mr. WYDLER. You are talking about fog dispersement system?

Mr. JENSEN. Yes.

Mr. WYDLER. I noticed that one thing they seemed to have dropped. Does that prove, is there any reason to think that is going to be a practical economic method of fog dispersal system?

Mr. JENSEN. Some new technology is being proposed that looks like it has enough merit to give it a further try. The technology, in layman terms, consists of blowing ionized water particles up into the air. They tend to bring the fog down. This has been tried briefly under, I believe, a Navy-sponsored program down in Panama.

It needs some further trials to see whether it is good or not and that is really what we are asking for.

Mr. WYDLER. Thank you, Mr. Chairman.

Mr. MILFORD. Thank you, Mr. Jensen. We appreciate your presentation.

The Chair will now recognize Mr. J. Donald Reilly, secretary of the Airport Operators Council International.

Mr. Reilly, welcome to the committee.

STATEMENT OF J. DONALD REILLY, EXECUTIVE VICE PRESIDENT, AIRPORT OPERATORS COUNCIL INTERNATIONAL

Mr. REILLY. Good morning, Mr. Chairman.

Mr. MILFORD. We have your statement, together with certain attachments which we are glad to accept in full. Would you care to summarize or otherwise skip around?

Mr. REILLY. I would like to do that. I would like to have the entire statement in the record and if I may, I will touch on the highlights for the record.

[The statement of Mr. Reilly follows:]

STATEMENT OF AIRPORT OPERATORS COUNCIL INTERNATIONAL ON FAA RESEARCH AND DEVELOPMENT, FISCAL YEAR 1977

Mr. Chairman and members of the subcommittee: I am J. Donald Reilly, Executive Vice President of the Airport Operators Council International (AOCI). Accompanying me is Leo F. Duggan, AOCI's Vice President for Technical Affairs.

The Airport Operators Council International is the association of the governmental bodies which own and operate the principal airports served by the scheduled airlines in the United States, as well as in many countries abroad. Our U.S. member airports (listing attached) annually enplane more than 90% of the domestic and virtually all of the U.S. international scheduled airline passenger and cargo traffic. In addition, our local government members operate many reliever and other general aviation facilities which supplement the larger airports in their communities and regions.

Mr. Chairman, we are grateful for the opportunity to present the views of our United States members on the authorization of funding for the DOT/FAA Research, Engineering and Development program for FY '77.

This Committee may recall that I testified in May, 1975, on authorization of civil aviation research and development funding and took issue at that time with FAA's procedures for determining its R&D priorities and its indifference to aviation industry requests for a greater voice in determining those priorities.

We recognize the merit of developing such safety related items as collision avoidance, wind shear and wake vortex detection systems. We also know that there are, presumably, certain major commitments to Aerosat and the Microwave Landing System and that modernization of the manpower-intensive Flight Service Stations has prospects, in the long-term, of being cost effective.

We do, however, disapprove of the trend to have a few programs of however high-priority so monopolize the FAA R&D effort that other programs cannot be funded even at minimal levels. We do believe that the proposed budget requires closer scrutiny to insure that the priorities are in balance with overall agency program needs and that the funding of these priorities is not unduly influenced again by over-emphasis on "black boxes" and the under-emphasis on critical airport-related E, R&D requirements, such as crash-fire-rescue, pavement testing and evaluation and airport security.

AOCI is reluctant to endorse a budget that is so overwhelmingly oriented toward the air traffic control system, communications, and landing aids systems whose immediate benefit may be far less rewarding and cost effective than engineering efforts in other areas. The microwave landing system illustrates this point. Although the system has considerable potential for improving operational procedures and safety, noise avoidance, and increased airport capacity, we believe the program could be equally effective if it were stretched out over a longer period, thus allowing funds to be made available in the short-term for other programs. Alternatively, we would recommend that the Subcommittee authorize an increase in the Engineering, Research and Development appropriation in consideration of the critical need for airport related programs.

We are again, for FY '77, confronted with a new budget which demonstrates a continued absence of balance between and among conflicting R&D program areas. The FAA research, engineering and development budget of \$76.7 million for FY 1977 has allocated 70% of the budget to the Air Traffic Control System and 23% to Navigation Systems. The remainder is devoted to aviation weather and maintenance.

The budget indicates that the OS program, Airport Airside, is being allocated \$4,830,000 of which \$1,870,000 goes to Airport Surface Traffic Control and \$1,000,000 to the Wake Vortex Avoidance system. It is difficult to determine how the remaining \$1,960,000 is being spent. There is indication that \$.5 million is being expended for improving the design, layout and construction of runways. This is misleading because, in reality, this is \$498,000 that provides salaries for FAA headquarters and NAFEC personnel associated with airport pavement related R&D programs.

At first look, it would appear that the \$4,830,000 in airport airside funding is directed toward airport R&D when actually the bulk of funding is directed toward upgrading the third generation air traffic control system. Although mention is made that FY 1977 studies will continue on such items as recycling of pavement materials to achieve savings in costs, materials and energy and that other items will be researched, in actuality there is substantially no money going into pavement R&D where non-destructive testing, evaluation and design are of extreme importance and very cost effective when weighed against the large amount of ADAP funds that are being spent in pavement rehabilitation.

While the FAA engineering, research and development effort has made significant progress since inception of the Airport and Airway Development Act, considerably more progress is necessary and much remains to be accomplished. We recommend that this Committee give expanded consideration to the following priority airport R&D projects.

CIVIL AVIATION NOISE RESEARCH AND DEVELOPMENT

As this Committee knows, noise pollution is the gravest problem facing the airport operation. We urge that NASA and FAA expedite engineering and development in both engine design and aircraft noise abatement operational procedures that will assist in reducing, to an acceptable level, the nuisance created by an excessive level of aircraft noise.

In our testimony before this Committee on October 2, 1975, we again called for more productive research in the areas of airframe noise, engine jet noise, and core engine noise. This would yield significant information on the maximum possible reduction in noise emission, as well as on the basic characteristics of aircraft noise. The primary benefit resulting would be that the Executive Branch could pace or force—rather than follow—improvements in the state of the art.

PAVEMENT EVALUATION, TESTING AND DESIGN

On a cost-benefit basis, runway/taxiway pavement evaluation and testing with a goal of developing pavement design criteria offers significant potential. Since the inception in 1970 of the ADAP program, 55% of all Grant-In-Aid funds have been expended on runway and taxiway paving and paving-related items. In that same period, however, less than one-half of 1% of available FAA funds for research and development have been aimed at improving methods of pavement non-destructive testing, evaluation and design.

Financing of pavement rehabilitation through local revenue bonds is normally based on a 20-year life cycle; however, a pavement that lasts ten to eleven years is considered exceptional, while seven years is more the norm. Airport pavements are deteriorating because of high aircraft weights and increasing frequencies of larger commercial aircraft operations. The continued use of pavement design, based on highway program experience, is simply not adequate to satisfy the needs of the jet era. It is imperative that improved techniques and concepts be developed to allow today's engineer to design an operational runway surface which will withstand the weights and frequency-of-use of current and future aircraft.

Only in the past year have airport sponsors, the airlines and the aircraft manufacturers been successful in calling the attention of the FAA to the cost-effectiveness of a continuing pavement R&D program. We were pleased to hear that \$1.3 million was initially identified by the FAA in the FY'76 budget for pavement evaluation, non-destructive testing and design. We have learned only recently, though, that this item has now been entirely deleted.

The pavement research and development program must be structured to provide sustained annual allocation of funds that will permit the emergence of an effective non-destructive testing program and the evolution of a lasting pavement design. We urge the Committee to recommend \$1.25 million for this purpose for FY'77 and years following.

CRASH—FIRE—RESCUE

Since Federal implementation of FAR Part 139, Airport Certification, in mid-1973, airport authorities have been required to expend some \$25 million to purchase additional crash-fire-rescue equipment to satisfy the Federally-mandated requirements and some \$60 million each year to maintain and operate this equip-

ment. Meeting these requirements has caused a rise in airport operating budget as much as from 25% to 40%. This places airports in a severe economic squeeze, particularly the smaller airports.

We support efforts to make our air transportation system the safest in the world. We believe, however, that the current method of requiring airline airport sponsors to provide a Crash-Fire-Rescue (CFR) capability based on aircraft size is arbitrarily subjecting every airport to enormous capital investment and operating and maintenance costs which are not cost-effective in light of goals achieved while attending survivable crashes.

The Bureau of Safety of the Civil Aeronautics Board, in a study of U.S. Air Carrier accidents involving fire for the period of 1955-1964, noted that a vast amount of research has been conducted and is presently underway on faster acting and more effective fire extinguishing chemicals, suppression of ignition sources, jelled fuels and methods of containing the fuel within the tanks under impact conditions. Such protective measures installed in the aircraft are of vital importance. The study concluded that based on causes and conditions relative to the deaths and injuries sustained by crew members and passengers, occupation protection, survival and reduction of injuries may be enhanced by further improvement and development of integral fuel inerting, fire suppression and fire extinguishing systems; the suppression or elimination of toxic fumes that originate from burning fabrics and interior furnishings; and improved mobility and effectiveness of firefighting and rescue equipment.

We endorse the conclusions of the Bureau of Safety Study and support the FAA's continued research into fire explosion prevention systems and fire suppression and fire extinguishing systems. We also favor engineering and development of a smaller, quick-reaction, all-purpose airport CFR vehicle that can be purchased, maintained and operated at minimum cost.

Although the FAA is continuing E, R&D in this area, we believe the effort must be intensified. We recommend the Committee authorize \$3,000,000 which would essentially double the funds currently in the program.

TERMINAL AREA CONSIDERATIONS

The decreasing ability of each airport complex to handle increasing numbers of passengers and baggage volume is a growing constraint on air travel growth. Research into developing criteria to measure capacity and levels of service to insure that improvement programs on the airport airside and airport landside are in balance is needed. R&D is needed to develop optimum terminal flow, simulation and analysis models; guides for functional space requirements and criteria based on annual and peak-hour flow; new hardware for improved passenger, cargo and baggage handling; and innovative off-airport systems for passenger and cargo processing. We recommend the Committee authorize the appropriation of \$2,500,000 for this critically needed program.

FOG DISPERSAL

Warm fog is responsible for 95% of all the visibility restrictions and associated delays that occur at airports throughout the world. Although fog at U.S. airports occurs on the average of only 1% to 2% of the airport operating time, it is responsible for the loss in airline revenues of about \$100 million annually through cancellations, delays, and diversions of air carrier flights. And, more importantly, fog causes great inconvenience to the passengers who depend on aviation for reliable scheduled transportation. It is necessary to seek methods to minimize the impact of fog on aircraft operations to improve aviation safety, increase airport capacity and reduce inconvenience to the traveling public through the development of operationally reliable fog dispersal systems.

Current technology is capable of developing an operationally reliable system. We urge the Committee to authorize \$2 million for purchase and testing of equipment for Phase I verification tests.

SECURITY

The recent bombing at La Guardia Airport which cost many lives, injuries, and property damage, highlights the need for expedited engineering research and development to improve the posture of aviation security. FAA proposals to develop short and long term explosive detection systems and improved locker

safety design receives our full support. In addition, we feel that it is important to develop a new building design for major public areas that would include an explosive venting system.

We understand that the FAA has requested a supplemental appropriation of \$8.1 million for FY 76 and \$3.525 million for FY 77 to pursue such needed security research and development. We support this request and urge the Committee to authorize such appropriation.

BIRD STRIKES

Although not widely known, bird strikes constitute a serious hazard to aviation, both in commercial and non-commercial operations, with some 225 bird strikes reported each year in the United States. In addition to being a hazard to safety, bird strikes are costly in that aircraft are frequently severely damaged particularly when ingested by turbojet engines.

While airline aircraft fly well above most birds when cruising, they must penetrate bird-occupied air when landing and taking-off. The hazard is therefore at the airport. Methods must be found to either make the engine bird-tolerant through devices to prevent ingestion; biological studies to be conducted to find a means to make the airport less attractive to birds; or a successful way of repelling birds from the airport environment is necessary.

Individual efforts by airport authorities, airlines and industry to control or minimize bird strikes has been largely unsuccessful. In light of the severity of the hazard, we hope the Federal Government would diligently pursue methods to reduce this danger to a minimum. We ask the Committee to authorize \$1,000,000 to initiate a program to eliminate or at least reduce this hazard.

SYSTEMS FOR TRANSPORTING AIRCRAFT ON THE GROUND

The development of alternatives to the self-propelled taxiing of aircraft at major airports offers the possibility for reduction in the emission of air pollutants and noise levels around airports.

The most direct and effective approach to achieving substantial reductions in the emission of air pollutants is to burn less fuel. Additionally, the conservation of energy has become a national goal equally as significant as relieving air and noise pollution. To illustrate the magnitude of this situation, the U.S. domestic airline fleet has 226,000 take-offs and landings per week, while consuming 1,758,000 gallons of fuel. This consumption figure assumes only a one-minute ground idle prior to take-off and after landing. Based on a more realistic figure of 5 minutes ground idle prior to take-off and after landing, total consumption would approximate 9,000,000 gallons per week.

Introduction of an automotive—perhaps electric—vehicle to provide power to move aircraft between terminal gates and runways would eliminate the need for operation of aircraft engines on the ground in a basically inefficient mode.

The feasibility of this concept was established in 1973 in the first of a two-phase study sponsored by the FAA. But the second phase, the building and testing of a prototype system, was never initiated. We believe its established feasibility warrants further study and we ask the Committee to authorize \$1.25 million for a second phase program which will cover prototyping and demonstration of the system.

SUMMARY

In summary, we feel that:

The FAA engineering, research and development process should be opened up with Congress and industry assisting in assigning priorities and obligating funds for specific programs.

Priorities outlined in the FAA FY 77 budget place almost exclusive emphasis on the Air Traffic Control system, communications, and approach and landing systems. These programs might well be stretched to allow greater flexibility in assigning priorities and funds to programs of equal or greater need.

Other program areas—outlined in our statement—are being starved because of the FAA ATC funding bias. To authorize additional funds for these programs would provide greater overall balance to the FAA FY 77 effort.

Mr. Chairman, we appreciate this opportunity to appear before the Committee to present the views of our United States members on civil aviation engineering,

research and development authorization for FY 1977. If you or any member of the Committee has questions, we will be pleased to respond.

I am J. Donald Reilly, executive vice president of the Airport Operators Council International (AOCI). Accompanying me is Leo F. Duggan, AOCI's vice president for Technical Affairs.

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Mr. Chairman, we are grateful for the opportunity to present the views of our United States members on the authorization of funding for the DOT/FAA research, engineering, and development program for fiscal year 1977.

This committee may recall that I testified in May 1975, on authorization of civil aviation research and development funding and took issue at that time with FAA's procedures for determining its R. & D. priorities and its indifference to aviation industry requests for a greater voice in determining those priorities.

We are again, for fiscal year 1977, confronted with a new budget which demonstrates a continued absence of balance between and among conflicting R. & D. program areas. The FAA research, engineering, and development budget of \$76.7 million for fiscal year 1977 has allocated 70 percent of the budget to the air traffic control system and 23 percent to navigation systems. The remainder is devoted to aviation weather and maintenance.

The budget indicates that the 08 program, airport airside, is being allocated \$4,830,000 of which \$1,870,000 goes to airport surface traffic control and \$1 million to the wake vortex avoidance system. It is difficult to determine how the remaining \$1,960,000 is being spent. There is indication that \$500,000 is being expended for improving the design, layout, and construction of runways. This is misleading because, in reality, this is \$498,000 that provides salaries for FAA headquarters and NAFEC personnel associated with airport pavement related R. & D. programs.

At first look, it would appear that the \$4,830,000 in airport airside funding is directed toward airport R. & D. when actually the bulk of funding is directed toward upgrading the third generation air traffic control system. Although mention is made that fiscal year 1977 studies will continue on such items as recycling of pavement materials to achieve savings in costs, materials and energy and that other items will be researched, in actuality there is substantially no money going into pavement R. & D. where nondestructive testing, evaluation and design are of extreme importance and very cost effective when weighed against the large amount of ADAP funds that are being spent in pavement rehabilitation.

We recognize the merit of developing such safety related items as collision avoidance, wind shear and wake vortex detection systems.

We also know that there are, presumably, certain major commitments to Aerosat and the microwave landing system and that modernization of the manpower-intensive flight service stations has prospects, in the long term, of being cost effective.

We do, however, disapprove of the trend to have a few programs of however high priority so monopolize the FAA R. & D. effort that other programs cannot be funded even at minimal levels. We do believe that the proposed budget requires closer scrutiny to insure that the priorities are in balance with overall agency program needs and that the funding of these priorities is not unduly influenced again by over-emphasis on "black boxes" and the underemphasis on critical airport related R.E. & D. requirements, such as crash-fire-rescue, pavement testing and evaluation and airport security.

AOCI is reluctant to endorse a budget that is so overwhelmingly oriented toward the air traffic control system, communications, and landing aids systems whose immediate benefits may be far less rewarding and cost effective than engineering efforts in other areas. The microwave landing system illustrates this point. Although the system has considerable potential for improving operational procedures and safety, noise avoidance, and increased airport capacity, we believe the program could be equally effective if it were stretched out over a longer period, thus allowing funds to be made available in the short term for other programs. Alternatively, we would recommend that the subcommittee authorize an increase in the engineering, research and development appropriation in consideration of the critical need for airport related programs.

While the FAA engineering, research and development effort has made significant progress since inception of the Airport and Airway Development Act, considerably more progress is necessary and much remains to be accomplished. We recommend that this committee give expanded consideration to the following priority airport R. & D. projects.

As this committee knows, noise pollution is the gravest problem facing the airport operation. We urge that NASA and FAA expedite engineering and development in both engine design and aircraft noise abatement operational procedures that will assist in reducing, to an acceptable level, the nuisance created by an excessive level of aircraft noise.

In our testimony before this committee on October 2, 1975, we again called for more productive research in the areas of airframe noise, engine noise, and core engine noise. This would yield significant information on the maximum possible reduction in noise emission, as well as on the basic characteristics of aircraft noise. The primary benefit resulting would be that the executive branch could pace or force—rather than follow—improvements in the state of the art.

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Financing of pavement rehabilitation through local revenue bonds is normally based on a 20-year life cycle; however, a pavement that lasts 10 to 11 years is considered exceptional, while 7 years is more the norm. Airport pavements are deteriorating because of high aircraft weights and increasing frequencies of larger commercial aircraft operations. The continued use of pavement design, based on highway program experience, is simply not adequate to satisfy the needs of the jet era. It is imperative that improved techniques and concepts be developed to allow today's engineer to design an operational runway surface which will withstand the weights and frequency of use of current and future aircraft.

Only in the past year have airport sponsors, the airlines, and the aircraft manufacturers been successful in calling the attention of the FAA to the cost effectiveness of a continuing pavement R. & D. program. We were pleased to hear that \$1.3 million was initially identified by the FAA in the fiscal year 1976 budget for pavement evaluation, nondestructive testing, and design. We have learned only recently, though, that this item has now been entirely deleted.

The pavement research and development program must be structured to provide sustained annual allocation of funds that will permit the emergence of an effective nondestructive testing program and the evolution of a lasting pavement design. We urge the committee to recommend \$1.25 million for this purpose for fiscal year 1977 and years following.

Since Federal implementation of FAR part 139, Airport Certification, in mid-1973, airport authorities have been required to expend some \$25 million to purchase additional crash-fire-rescue equipment to satisfy the federally mandated requirements and some \$60 million each year to maintain and operate this equipment. Meeting these requirements has caused a rise in airport operating budget as much as from 25 percent to 40 percent. This places airports in a severe economic squeeze, particularly the smaller airports.

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suppression or elimination of toxic fumes that originate from burning fabrics and interior furnishings; and improved mobility and effectiveness of firefighting and rescue equipment.

We endorse the conclusions of the Bureau of Safety Study and support the FAA's continued research into fire explosion prevention systems and fire suppression and fire extinguishing systems. We also favor engineering and development of a smaller, quick-reaction, all-purpose aircraft CFR vehicle that can be purchased, maintained and operated at minimum cost.

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The decreasing ability of each airport complex to handle increasing numbers of passengers and baggage volume is a growing constraint on air travel growth. Research into developing criteria to measure capacity and levels of service to insure that improvement programs on the airport airside and airport landside are in balance is needed. R. & D. is needed to develop optimum terminal flow, simulation, and analysis models; guides for functional space requirements and criteria based on annual and peak-hour flow; new hardware for improved passenger, cargo, and baggage handling; and innovative off-airport systems for passenger and cargo processing. We recommend the committee authorize the appropriation of \$2,500,000 for this critically needed program.

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We understand that the FAA has requested a supplemental appropriation of \$8.1 million for fiscal year 1976 and \$3.525 million for fiscal year 1977 to pursue such needed security research and development. We support this request and urge the committee to authorize such appropriation.

Although not widely known, bird strikes constitute a serious hazard to aviation, both in commercial and noncommercial operations. Between 1968 and 1973, to illustrate the severity of the hazard, there were 330 U.S. air carrier accidents resulting from bird strikes in which 54 aircraft were destroyed and 137 received substantial damage. Worse,

there were 1,273 fatalities associated with these accidents and the heavy loss of life and property continues each year.

Airline aircraft fly well above most birds when cruising but they must penetrate bird-occupied air when landing and taking off. The hazard is therefore at the airport. Methods must be found to either make the engine bird-tolerant through devices to prevent ingestion; biological studies to be conducted to find a means to make the airport less attractive to birds; or a successful way of repelling birds from the airport environment.

Individual efforts by airport authorities, airlines, and industry to control or minimize bird strikes has been largely unsuccessful. In light of the severity of the hazard, we ask the committee to authorize \$1 million to initiate a program to eliminate or at least reduce this hazard.

The development of alternatives to the self-propelled taxiing of aircraft at major airports offers the possibility for reduction in the emission of air pollutants and noise levels around airports.

The most direct and effective approach to achieving substantial reductions in the emissions of air pollutants is to burn less fuel. Additionally, the conservation of energy has become a national goal equally as significant as relieving air and noise pollution. To illustrate the magnitude of this situation, the U.S. domestic airline fleet has 226,000 takeoffs and landings per week, while consuming 1,758,000 gallons of fuel. This consumption figure assumes only a 1-minute ground idle prior to takeoff and after landing. Based on a more realistic figure of 5 minutes average ground idle prior to takeoff and after landing, total consumption would approximate 9 million gallons per week.

Introduction of an automotive—perhaps electric—vehicle to provide power to move aircraft between terminal gates and runways would eliminate the need for operation of aircraft engines on the ground in a basically inefficient mode.

The feasibility of this concept was established in 1973 in the first of a two-phase study sponsored by the FAA. But the second phase, the building and testing of a prototype system, was never initiated. We believe its established feasibility warrants further study and we ask the committee to authorize \$1.25 million for a second phase program which will cover prototyping and demonstration of the system.

In summary, we feel that:

1. The FAA engineering, research, and development process should be opened up with Congress and industry assisting in assigning priorities and obligating funds for specific programs.

2. Priorities outlined in the FAA fiscal year 1977 budget place almost exclusive emphasis on the air traffic control system, communications, and approach systems. These programs might well be stretched to allow greater flexibility in assigning priorities and funds to programs of equal or greater need.

3. Other program areas—outlined in our statement—are being starved because of the apparent FAA ATC funding bias. To authorize additional funds for these programs would provide greater overall balance to the FAA fiscal year 1977 effort.

Mr. Chairman, we appreciate this opportunity to appear before the committee to present the views of our U.S. members on civil aviation engineering, research, and development authorization for fiscal year

1977. If you or any member of the committee have questions, we will be pleased to respond.

Mr. MILFORD. Thank you, Mr. Reilly.

You do offer some questions that I would like to see answers to. I'll agree with you as to the importance of continued research and development in paving in the sense that we are dealing with a situation that is not faced anywhere else except on airports as such and our needs there are going to be totally different from anyplace else, and I will assure you that we will pose that question to the FAA and try to obtain an answer to it.

I am intrigued by your statement concerning systems for transporting aircraft on the ground.

There are some questions that I have previously posed a time or two and this is the first time that I have had a chance to see some actual figures on that. This business of 9 million gallons of fuel per week prompts me to ask why carriers are not pursuing this.

It would appear that this would be a substantial operation savings, if nothing else.

Mr. REILLY. I could not agree more with you, Mr. Chairman.

To us, of course, there are two significant problems. One is the aircraft noise and pollutants around airports. As you know, with the exception of Dallas-Fort Worth, most airports are under terrible constraints because of aircraft noise and pollution being registered in and around airport areas.

We are very much interested to see if a competent system can be devised so that, not only can we save fuel which is uppermost in our minds, but that we can reduce pollutants around airports.

FAA conducted what was going to be a two-phase research program in this area. The first phase was one which apparently showed great indications of success. But, for one reason or another, perhaps lack of funding or lack of some support from within the industry because of higher priorities, FAA did not pursue this any further into phase 2 which would have developed an operating prototype vehicle, and the actual testing of it.

Mr. MILFORD. Does the pushoff tractor, that is used to push the aircraft away from the gate, does that vehicle also contain the power unit that would power the aircraft while it is on the ground normally or do you know?

Mr. DUGGAN. A firm in Renton, Wash., has a vehicle, a modification of a towing cart that has built-in capability and a field test was conducted about 3 months ago at the Seattle, Wash., airport.

Mr. MILFORD. Normally that equipment does not contain the power and the air-conditioning unit, does it?

Mr. REILLY. No, sir.

Mr. WYDLER. Mr. Reilly, it is good to have you here and I know that your association has been one of the associations that have been most aware of the problem. I do not know if it is because you have millions of lawsuits against the operators or whether it is public interest.

Mr. REILLY. That helps to get our attention.

Mr. WYDLER. Whatever the motivation is, I congratulate you on it and I would like for you to comment on it if you would since you

are sensitive to the reality of that problem and other people seem to want to avoid the realities.

A lot of the FAA research, if I understand the bottom line of it, is really to increase the capacity of the airport system so that a lot more planes will be able to land and take off than they can currently handle. That seems to be a lot of the work that they are directed toward achieving.

If they are successful in doing that, they are, of course, going to aggravate the jet noise problem over the airport because they are going to increase the number of planes.

They are increasing the amount of the noise and it can be figured out very quickly how much and they seem, as far as I can tell, to be ignoring that aspect of their research.

Do you have any reaction or any response to that? Am I right in my assumption that they are, in fact, attempting to bring more planes in on the same runways that they are now doing? Isn't that the objection of a great deal of their black box work that they are going through now?

Mr. REILLY. Well, Mr. Wydler, I guess the system is only as strong as the weakest link and if, in fact, we cannot get the aircraft off the runway, through the apron system and taxiways, through the gates and expedite their ability to load and discharge passengers, and get the passengers expeditiously through the terminal, and past the front curb area which is growing as a significant bottleneck, then the aircraft are going to back up in the system.

I guess what I am saying, sir, is that we do not think FAA is putting enough research and development money into expediting the entire process which includes the access roads to the airports, the curb-side at terminals, and the gate system.

We know certainly that aviation is the most convenient means for most people today to travel and there is going to be an increase in the number of operations, but in the public interest. It is no reason, because some of the aircraft today are noisy, that we should destroy this great public convenience.

We should attack the nub issues and reduce the aircraft noise at the source to solve the second problem that you mentioned.

Mr. WYDLER. I think really that the FAA has to address this problem.

They are taking great many efforts to reduce the impact of the environment of these operations but if they could see in doing what they seem to be setting about to do, they are going to achieve increased landing and takeoff rate which is commercially wonderful but just what does that do to all of their plans and proposals to reduce the impact of noise around airports in the next 5 or 10 years that we have been talking about?

I haven't seen that in their projections yet but I suppose it would be. I would like to get some kind of testimony, evidence from FAA just how that is going to affect the jet noise projection.

Mr. REILLY. I would agree with you, I have not seen such projections; but there is no doubt about it. If we are going to work with the current fleet of aircraft and introduce an increasing number of operations, the noise problem is going to grow. There is no way

around it and as we have said before, and as I think you have worked so strenuously for, we must get the current 707, DC-8 aircraft down to FAR 36 noise levels and below them if possible. The wider-body jets now perform at such lower noise levels and they have been acceptable around airports.

I do not think we would have as much of a problem due to the increased number of operations in the future if we could reduce total noise levels.

Mr. WYDLER. One of the other things that you talked about was the question of trying to make better runways. We are spending a fortune every year trying to build runways and I am just curious why we suddenly find ourselves totally, you know, in a situation where we cannot finance a little more runway development and research.

What actually do they have to do now? What do they do with the \$1 million that you want to give them? Will they build another runway or would they test it?

Mr. REILLY. Certainly they would not build another runway. We are facing two problems and that is, one, the high jet blast from the aircraft is deteriorating the runways and, second, because of newer and wider-bodied jets that are of far higher weights, we find that most runways were not engineered to hold and handle them.

Unfortunately, we are still using a lot of the old highway design criteria for building runways. What we need now is a new concept of development. Also, nondestructive testing machines which, without destroying the current runways and putting them out of commission, can test runways to see really how much weight they can handle. Then, based on that, we will know better how much more improvement we have to make in the runway. The second part of this is to conduct some much needed research to design and develop new types of runway methodology. We are not talking about building new runways with this R. & D. money.

Mr. WYDLER. If you had the million dollars, what do you do with this machine, what would you do with the million dollars?

Mr. REILLY. One is to do R. & D. to find out how to construct better runways to hold a heavier weight aircraft without the runways busting up after 5 or 6 years.

Mr. WYDLER. I have a feeling that you are going to have to build some runways and with some ideas in them to use thick materials and different materials and test them and see which ones hold up.

This is what it is going to amount to and if you do that, you can work that into the existing ADAP program.

I would think that you could try some of these methods out at various airports and find out which one is the best.

They do that with the highway on the paintlining materials. How they test that is they determine what white line stays there the longest and they paint ten different kinds of white lines and they let the cars run over it and hit it and so on and they test it out that way and then they decide that line 3 is the one that is the best.

This is something that you are going to have to do with runways. You are going to have to test them with actual conditions and find out if they really work. Don't we have the funds to do that available?

Mr. REILLY. It is almost impossible to go out and build 10 different runways, 10,000 feet long, and test them to see what ones do the best.

Mr. WYDLER. The pressure points are on the end; the middle part of the runway has a very known problem and it is probably not a very severe problem.

The biggest problem comes when the plane lands and takes off and gives it the initial blast and things of that nature.

That is where you have all of your deterioration. I do not know that. I assume that is it. Isn't that a fact?

Mr. DUGGAN. Mr. Wydler, we are very much in favor of pursuing a nondestructive testing program and the airlines are also interested because, as you know, pavements are very costly and huge funding has been going in pavements ever since inception of the ADAP program. There are pavements that last no more than 7 years, and then there are pavements that last 11 years, which is excellent. We believe by pursuing the nondestruction testing program, which includes building a new generation of nondestruct test machine, which is an electrohydraulic vibrator that tests and tells you the condition of your subgrade, that you consequently can design a better runway.

We believe that probably this \$1.25 million may not be needed longer than 5 years.

We believe the evolutionary process of developing a new runway design is that close.

But it was wiped out of the fiscal year 1976 budget. The industry worked for 4 years to get the FAA to understand this was a very cost-effective R. & D. program; and funding was finally put in the fiscal year 1976 budget, initially, and then it was wiped out.

Mr. WYDLER. There is no money in it. In other words, the \$1 million would essentially be to buy this machine that you are talking about, is that the idea?

Mr. DUGGAN. \$250,000 to \$300,000 for the machine, plus continued testing and evaluation, is required. It is a modest program.

Mr. WYDLER. Thank you, Mr. Reilly.

Mr. REILLY. Thank you very much.

Mr. MILFORD. We appreciate your taking the time to appear before this committee.

Mr. REILLY. Thank you very much.

Mr. MILFORD. The Chair will now recognize Mr. William J. Tull.

Mr. Tull we have your statement that you submitted to the committee which without objection will be made a part of the record, and, if you could, give us a little background because we will be running out of here in about 5 minutes.

As I understand, you are a designer of a microwave system?

Mr. TULL. That is correct.

Mr. MILFORD. Where are you presently operating?

Mr. TULL. At the present time we have systems operating in St. Paul, Minn., and in Bellaire, Mich.

Mr. MILFORD. For the record, if I had a microwave landing receiver (ISMLS) and placed it in my airplane and operated it with the now existing ILS system, when and if the FAA then adopted the microwave landing system, what, if anything, would I have to do with the gear that I bought to operate your landing system before I can operate on the permanent microwave landing system?

Mr. TULL. You would have to add to the equipment that you already had, a unit which I will call a data processing system for simplicity. Really, it is a little bit more than that. The cost of this data processing system would be roughly equivalent to the cost you already had invested in the ISMLS microwave equipment which you already had aboard your aircraft. The price you would put on it would depend upon whether it was the TRSB system, the ISMLS, or the United Kingdom Doppler system that was adopted by ICAO.

In either case, it would be possible to add a processor to fit the one that ICAO had established.

Mr. MILFORD. I thought we had pretty well decided that we were not going to go Doppler and this had not been designed.

Mr. TULL. This has not been decided except by the United States. We still have to argue it out in the international forum.

Mr. MILFORD. I still have to buy the secondary piece of gear regardless of which way—

Mr. TULL. That is correct, Congressman Milford.

Mr. MILFORD. And would this secondary piece of gear have to be bought, regardless of whether I wanted to use category 1, a straight single beam approach, or whether I wanted to go to the exotic, curved approaches?

Mr. TULL. You would have to buy it, regardless of which approach you wanted to follow. However, the minimum amount of equipment is what I was referring to earlier as that which you would add for the minimum category 1 capability. Those services which are wanted over and beyond that are largely dependent upon the user and his desire to build up into a more sophisticated system through the addition of new types of computer, et cetera. Obviously, he can only operate with such sophisticated systems at the airports that are equipped with full MLS system.

I should like to point out that we are planning to manufacture MLS equipment. We are not exclusively ISMLS equipment manufacturers and we are very much proponents of MLS, so I don't want to leave a delusion that perhaps we are only going in one direction.

We believe in the long run that there should be an MLS system. It is purely a question of when will it be available and this is pretty much up to the ICAO process.

Mr. MILFORD. Bendix and Texas Instruments right now are in the process of building final prototypes of the MLS system. These prototypes are pretty well known by the industry, how they are going to operate, and the principles upon which they are going to operate.

Why couldn't that type of system be manufactured and installed and called an interim system?

Mr. TULL. It could be. The only thing is that there would be extremely high risk on the part of anyone who bought such a system prior to ICAO decision.

Mr. MILFORD. How would the risk differ in manufacturing the MLS in accordance with the current prototype as opposed to manufacturing MLS of the type you are using right now?

Mr. TULL. It is really quite simple. The current U.S. proposal to ICAO proposes a complete new format (the Bendix and Texas Instruments prototypes).

This is different than is now used by aircraft for ISMLS. ISMLS is nothing more than an ILS system in which the frequencies have been moved into the microwave frequency band in order to obtain microwave advantages and to overcome certain limitations of ILS.

We are still using the same ILS equipment on board the aircraft. We simply use the microwave converter to transform the frequency from the microwave down to the VHF and in order that you can use your on board ILS equipment.

As you know, all communication equipment, be it microwave, VHF, your TV set, or your home radio is usually made up of a series of stages of conversions from one frequency to the next and it isn't until you get to the point of the output stage that you operate on the data or the information and transform it into something useful.

In the case of the ISMLS, all we are doing is adding one stage of conversion to the ILS receiver which already has in it additional stages of conversion and as such, the combination is identical to an MLS receiver of the future.

Most all of the MLS receivers that have been proposed are three-stage receivers. It is simply a part of an MLS that we are adding to and ILS, and that is how it is possible to change to either the Doppler proposal to ICAO, or to the U.S. TRSB should the ICAO select that. In fact, it allows accommodation of some proposals which are totally different from either the U.S. or the Doppler proposals.

To amplify a little bit on that, as you may be aware, the French, the Germans, the British, and I believe the Australians, but I am not positive of that, have stated that they have no requirements for MLS until after the year 1985. The Germans and the French are proposing systems which technologically are totally different from the British and the U.S. proposals.

I sincerely do not think that they have much of a chance of winning at ICAO, but you never know in a political arena such as ICAO what might happen. Both recognize that they are proposing very long term proposals, and that they offer them apparently in the atmosphere that they recognize that they have no need that ILS has not already fulfilled in their country.

Mr. MILFORD. Mr. Tull, we appreciate the time that you have taken to appear before the committee, and your statement will be made a part of the record in the hearing before us.

Mr. TULL. I am not sure what document you mean you are proposing to put in the record, but I do not mind whichever one it is.

Mr. MILFORD. This is the one. Is that satisfactory with you?

Mr. TULL. Sure.

Mr. MILFORD. The committee will be in recess.

Thank you very much.

[Therefore, at 12 o'clock p.m., the committee recessed.]



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