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1981 FAA R. & D. AUTHORIZATION

DOCUMENTS

JUN 16 1980

HEARINGS

BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION,
AVIATION AND COMMUNICATIONS

OF THE

COMMITTEE ON

SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

NINETY-SIXTH CONGRESS

SECOND SESSION

FEBRUARY 19, 20, 21, 1980

[No. 91]

Printed for the use of the
Committee on Science and Technology



U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON : 1980

59-710 O

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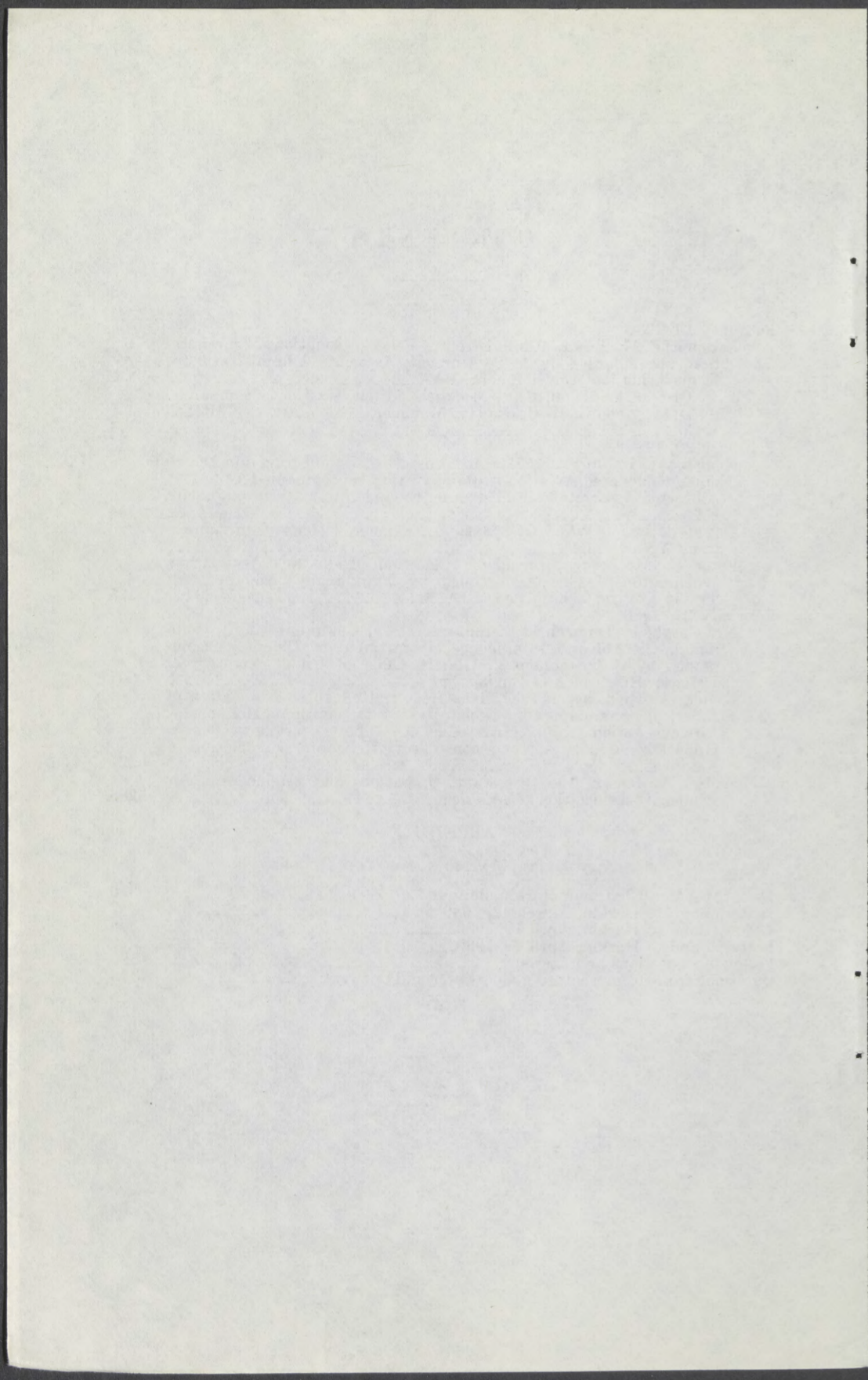
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H.R. 6721

1981 FAA R. & D. AUTHORIZATION

TUESDAY, FEBRUARY 19, 1980

U.S. HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON TRANSPORTATION,
AVIATION AND COMMUNICATIONS,
Washington, D.C.

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

Mr. HARKIN. The Subcommittee on Transportation, Aviation and Communications will come to order.

Today the subcommittee will begin 3 days of hearings regarding authorization of funds for the Federal Aviation Administration's fiscal year 1981 research and development program.

Because the administration is proposing that such authorization again be part of the airport and airway improvement legislation, our hearings this year take on a greater significance than in recent years. And because of the trends of the FAA's R. & D. budget over the past few years, these hearings will take on additional importance regarding the adequacy of the budget.

Last fall, the FAA provided us with a comprehensive review of its activities since 1975 and its overall plans through 1985. With this excellent foundation, we are anxious to get into greater detail on the specific programs for fiscal year 1981.

There are several subjects which I hope we can shed some light on during our hearings:

First, this committee has been interested in assuring that the FAA is performing adequate long-range planning. We have also recommended for some time that the FAA seek additional advice on a continuing basis from a group of technical experts outside of the Agency.

Second, this committee has traditionally acted to provide annual authorization for the FAA's R. & D. funding. In this year of ADAP renewal we will be looking to strengthen our role concerning annual authorization of the R. & D. funds.

Third, this committee is concerned in particular about the modernization of the en route traffic control system. Several of us have spoken to other committees concerning the need for an appropriate development program which will meet the demands for increased capacity and greater safety.

Mr. Goldwater, do you have an opening statement?

[Opening statement of Congressman Goldwater follows:]

OPENING STATEMENT/QUESTION, HON. BARRY M. GOLDWATER, JR., SUBCOMMITTEE
ON TRANSPORTATION, AVIATION AND COMMUNICATION

Mr. Bond and Mr. Albrecht, it's good to have you both back with us today. Today's FAA FY 81 Authorization Hearing is somewhat of a follow-on to the FAA Posture Hearing of January 29. In that hearing I was having a productive question and answer session with you, Mr. Bond, until we were cutoff by a time limitation.

I'd like to recap our earlier discussion and then proceed from where we left off.

First of all, we both agreed that your proposed R&D budget for FY 81 through FY 85 is going downhill when inflation is considered. I'd like to paraphrase your words from the hearing transcript on this subject:

(Mr. Bond.) "The R&D budget is going downhill. It's not just a matter of appearance. It's a reality. All you have to do is add. The fact of the matter is that if you were to compare the 1985 number for the research proposal—and it is up in dollars—with what we got in 1976, which would be a ten-year span, you would see that in real purchasing dollars it has fallen from about 67 million to some 44 or 45 million dollars. That assumes only 10% inflation for the next five years.

"The inflation impact, in short, has been savage upon our program, and we are looking at system requirements which are going up exponentially. There are more and more airplanes in the airspace. There has been greater and greater public demand for safety. And there is a limit to what the FAA can do with numbers of this kind."

I then asked how you are going to be able to do the necessary work on the new ATC computer system and also complete the R&D on all the other systems you're working on. Your response was:

(Mr. Bond.) "The answer is we can't do it all. We will have to sort out amongst the priorities and pick those that are the best for us to do, the highest priority, and also stretch out and phase out the rest and try to work and meld it all together until we get the best mix for the dollars available, but it won't do it quickly and it won't do it all right now. We have to set priorities."

Now your response would have perhaps been satisfactory if there really was no money available. But in fact there is about a \$3.5 billion uncommitted surplus in the Aviation Trust Fund. To put this in perspective, I just saw the figures for November 1979: that month alone the surplus grew by \$88 million, which is more than your entire *yearly* R&D request for FY 81. I should probably introduce a bill to put one *week's* worth of the Trust Fund surplus growth into R&D, and then you might be able to do your job properly.

Mr. Bond, we now come to the crux of the matter: I'm totally dissatisfied with the Administration's plan to spend ever-decreasing amounts on R&D for the next five years, while aviation's needs are growing each year. I intend to work with Tom Harkin and the other Members here to force FAA to draw from the Trust Fund surplus enough funding to fulfill aviation's unmet needs—not the amount the *beancounters* at OMB and DOT feel like releasing.

Now you obviously have the funding information I need—and you developed at *taxpayer's expense*. My intention today is to get that information from you.

Thank you, Mr. Chairman.

Mr. HARKIN. Our first witness today is Mr. Langhorne Bond, Administrator of the Federal Aviation Administration. Mr. Bond is accompanied by Mr. Al Albrecht, Associate Administrator for Engineering and Developing.

Mr. Bond, we have a copy of your prepared statement. Without objection, it will be made a part of the record in its entirety. Please proceed in any manner you so desire.

STATEMENT OF LANGHORNE M. BOND, ADMINISTRATOR, FEDERAL
AVIATION ADMINISTRATION; ACCOMPANIED BY AL P. AL-
BRECHT, ASSOCIATE ADMINISTRATOR FOR ENGINEERING AND
DEVELOPMENT, FEDERAL AVIATION ADMINISTRATION

Mr. BOND. Thank you for letting us appear today on this subject. American aviation is at an important crossroads. We have a juxta-

position of a number of factors which are pressing the industry and the FAA. How we deal now with those demands and challenges will influence the shape of American aviation in the future.

Over the next several days, we will be describing for you the program we have developed to influence American aviation for the better. You, of course, have the task of independently evaluating our planned activities and deciding whether they will, in fact, meet those challenges. I assure you the FAA has done its best to define the needs of the system and to put together a program to meet them.

I said a moment ago that we and the industry were pressed from a number of different directions. Let me expand a little on that theme.

We have experienced an almost unbelievable surge in the cost of operating aircraft which is directly attributable to escalating fuel prices. We haven't seen the end of that price rise, either. Anyone who reads the newspaper knows that to be a fact. There aren't easy answers we can point to that will fully address this growing problem.

What does the rising cost of fuel mean to aviation? Let me tell you.

It means that the fuel costs in 1980 for the U.S. trunk carriers—estimated to be somewhere around \$8.4 billion—will probably exceed the total operating revenues of the trunk carriers just one decade ago. And these same high costs contributed to an estimated 12-percent decrease in operating profits for the U.S. airlines in 1979, the same airline industry which, in 1978, had experienced a 50-percent increase in operating profits over 1977. Projections for continuing high increases in fuel costs don't make the picture look any better—in my estimation—over the next few years.

It is clear to me that it will be necessary for industry to continue to develop and build more fuel-efficient aircraft; not just transport category, but all sizes of aircraft.

The other thing we have to do is to eliminate inefficiencies in the air traffic system. We are particularly concerned about systems delays from weather conditions and excessive demands on airports or on the air traffic control system capacity.

Looking at 34 selected airports in the system, we can see an unfavorable pattern emerging from 1975 through 1979. Delays at those airports have progressively increased to the point that, in 1979, we had almost double the delays we experienced in 1975: 61,598 aircraft delayed 30 minutes or more in 1979 contrasted with 31,682 in 1975. Admittedly, total airport operations increased at those airports, but nowhere near the same proportion.

Not only is it necessary to improve our weather detection and information capabilities to assist in reducing delays, but it is important to develop equipment and techniques to maximize the use of available airport capacity.

Wake vortex detection techniques and reduction of wake vortex at the source will pay dividends. But these aren't the total solution. There is a need for greater airport capacity in our system.

Today, however, it is not a simple matter to build new airports, or, even for that matter, add new runways. Airport neighbors are concerned about the noise generated by aircraft. Further improvements must be brought about in the development of aircraft to reduce noise impacts.

Aircraft operations in the United States have continued to rise. I don't know how many television shows on aviation safety I've seen

that start off by referring to "the crowded skies." And they are right. The skies of today are far more crowded than they were in past years.

Our system has to keep pace with those demands, as well as meet future demands safely. Air traffic procedures can only accommodate a finite amount of growth, and that only with some penalties in lost efficiency. They have to be supplemented by better and more sophisticated facilities and equipment, both on the ground and in the cockpit.

Ultimately, what is required if we want to preserve our system of air transportation is new approaches. This means finding ways to do more with the system we have through application of new technology.

I think it's extremely important for the subcommittee to take into account the kinds of problems we face today and will face tomorrow when looking at how the FAA has attempted to meet those problems, as we perceive them, through our research programs.

Though in the development of our 5-year R. & D. program, we have applied the same principles and priorities that have driven our program for some time now, we have made significant changes in how we go about executing that program.

As Al Albrecht will describe later, we have made a number of changes to strengthen our organizational structure so that the execution of our R. & D. programs will be improved. Also, in the development of our plans, we have done far better than ever before in comprehensively involving the aviation community in the formulation of plans that will ultimately have significant impact on them. Our program is intended to emphasize aviation safety, system capacity and performance, and productivity—essentially in that order. And, as in the formulation of any program, we have had to make hard choices, seeking to maximize the pursuit of priority items.

These choices necessarily require balancing timeliness of each project with the scope of the whole program. My choice is safety first and soonest. However, I did not choose to narrow the range of projects so that the needs of our air transportation system went unmet.

During the time covered by our 5-year program, there are a number of important efforts we will complete.

The Discrete Address Beacon System—DABS—its data link, and the Automatic Traffic Advisory and Resolution Service—which we call ATARS—will become available to provide the basis for improved safety, productivity, and services.

The Active and Full Beacon Collision Avoidance Systems—BCAS—will become available to provide additional measures of safety to all equipped aircraft.

All elements of the civil family of Microwave Landing Systems—MLS—will be available for the evolutionary transition from the Instrument Landing System to MLS.

The Airport Surface Detection Equipment—ASDE—a highly improved radar for the control of traffic on the airport will be available for deployment at the higher-density airports. Ongoing efforts to provide alpha-numeric tags on the ground controllers' displays should be nearing completion by the end of the plan period.

In the automation areas, the replacements for the labor-intensive paper flight progress strips in both centers and automated towers by Electronic Tabular Displays—ETABS—and Terminal Information

Processing Systems—TIPS—will be available. These systems will bring important productivity savings with their implementation.

In essence, we will have completed the development that has been addressed as the Upgraded Third Generation Air Traffic Control System.

We also intend to develop the technical data for the production procurement of a modular/evolutionary upgrading of our communications control and switching systems, and to have completed the efforts required to identify the navigation system or systems for the late 1990's and beyond.

Moreover, work will continue in conjunction with the Weather Service and DOD on the doppler weather radar program, which holds the promise of providing current and detailed weather data to the controller.

I should also mention that, apart from the numerous programs in our 5-year R.E. & D. plan, which is funded through the Trust Fund, we undertake a variety of engineering and development efforts in support of the FAA's regulatory activities in the fields of aircraft safety, environmental protection, and aviation medicine.

The aircraft safety programs include activities designed to demonstrate the technical, operational, and economic feasibility of improving the operational performance of aircraft.

The environmental protection program embraces activities aimed at demonstrating the technical, operational, and economic feasibility of reducing the noise and air pollution generated by aircraft during in-flight and ground—airport—operations.

The aviation medicine program is an applied research effort aimed at the identification and elimination of biomedical factors that cause aviation accidents and the improvement of the performance, health, and safety of pilots, ground personnel, and passengers.

The FAA's fiscal year 1981 request provides \$19,250,000 for continuing these programs, broken down as follows: 67 percent for aircraft safety, 22 percent for environmental protection, and 11 percent for aviation medicine.

I am sure that all on the subcommittee will agree that a well-conceived and comprehensive aviation R.E. & D. effort is critical to the future of our air transportation system, not only in terms of improving safety for the traveling public, but in terms of helping the United States maintain its preeminence in world aviation.

That raises an issue which I would like to touch briefly on, Mr. Chairman.

I know that this subcommittee is considering the desirability of annual authorizations for our R.E. & D. program. I am opposed to that idea.

For one thing, our R.E. & D. efforts frequently result in products which, because of their complexity, are a long time in coming. I think it's important to retain a multiyear authorization scheme so that we can plan a program that has a clear sense of continuity, with future funding levels that can reasonably be counted on. An annual authorization deprives us of that continuity.

Also, with annual authorizations, there exists the possibility of relay in their enactment. The failure of either body of Congress to act timely

on an authorization bill could cause disruptions in important safety programs.

I am confident many of the benefits that members of the subcommittee believe would accrue from an annual authorization process for our R.E. & D. budget can be attained by continuing to foster a close working relationship between the FAA and the subcommittee.

If the members of the subcommittee sense any lapses in our having worked closely with them in the past, you have my assurance that we will improve in the future.

I said earlier that we are at an important crossroads where a number of problems have to be dealt with. We are also at another important juncture. We are nearing the time when some key safety programs—collision avoidance systems and DABS, for example—will be coming on line. It's an important time for the FAA, this subcommittee and the system users to work closely together to see that the products of many years of effort are introduced into the system smoothly and timely.

We also expect to work closely with you as we progress in our efforts to define the air traffic control system of the future. Our computer replacement program is a key element in the evolution of today's system to meet the demands of the future.

It is apparent to all that the age of our current computer system and technical constraints on expanding its capabilities mean we have to develop a new baseline system. A major facet of that effort, of course, will be to replace our current 9020 computers, used in the centers, with new systems that offer much greater capacity and reliability.

But it is not as simple as going out and buying today's computers, which admittedly provide substantial improvements over our mid-1960 vintage computers, and putting them into place. It is going to be one massive job, as the members of this subcommittee recognize.

There are many, many tasks the FAA has to accomplish before a new system can be introduced, and the future safety of our air traffic control system hinges on how well we do them. Before we can even begin to try to define the kind of equipment we need to procure, we must deal with a multitude of issues.

Simply put, we have to figure out what the future system should look like and do, and then make the decisions that will give us what we want and need.

As you will hear later on from Neal Blake, that drives us to consider and make decisions on issues such as what the respective roles of controllers and pilots should be; the level of automation we should have; the future relationship of en route and terminal functions; the extent to which the current role of primary radar may change; as well as a variety of other issues.

Most of the decisions we will have to make will be complex; yet the difficulty of making those decisions cannot excuse us from making them in a timely manner. In order for a new system to be in place when it is needed, we have to progress in a phased, orderly manner. I believe we are on track with our current plans, though undoubtedly it will be a demanding challenge to keep the program running smoothly and in sync with all prescribed milestones.

In closing, Mr. Chairman, I want to emphasize that we welcome your views and those of other members of the subcommittee on our proposed plans.

Are we doing enough of the right thing? Do you agree with the priorities that we have set? Have we developed a program which will meet the needs of the future, both near- and long-term?

We have sought the counsel and support of the user community in developing our plans. We seek your guidance and support also.

I would like to turn now to Al Albrecht, FAA's Associate Administrator for Engineering and Development, who will go into further detail on the FAA's R.E. & D. organization, management and plans.

Thank you.

Mr. ALBRECHT. Mr. Chairman, it is again my pleasure to present to you the Federal Aviation Administration's future program plan for research, engineering, and development for your review, consideration and—we trust—affirmative action in your authorization report.

Our presentations will be divided into two parts. I will summarize our 5-year research, engineering, and development plan, leaving the details to your review of the material contained in my prepared statement.

I will discuss our organizational and management plans to achieve our objectives, the role of the elements of the engineering and development organization in carrying out the program, and the adjustments recently made as a result of reorganization.

I will also touch upon the Office of Management and Budget's Circular A-109 and how we view its impact upon our plans and programs.

Tomorrow, Neal Blake will give you a full-blown briefing on the advanced computer program. Neal's presentation will include our plans for funding and physical execution of the program, including details of system development, program management, and how A-109 applies to the development and acquisition phases of that program.

Mr. Bond highlighted many of the efforts contained in our 5-year plan. Several others which should be mentioned are: First, we will work on a terminal capacity-delay program which will include both airside and airport aspects of the capacity-delay problem. We will endeavor to parlay some of our current work, such as an integrated flow management effort and our wake vortex research with the micro-wave landing system capabilities, improved runway occupancy time and revised procedures to optimize the utilization of existing concrete.

High in our priorities are human factor considerations in the roles of both controllers and pilots. These efforts will address their roles in a highly automated system, including the expanded use of airborne data processing, and integration efforts to reduce human error and blunders, best use of human talents in a more automated ATC environment, and the determination of optimum roles for cockpit displays of traffic information (CDTI).

We will assign increased effort to our airport-related programs. These will be directed towards the development of new techniques and methods associated with the design and construction of runways and taxiways. Over 50 percent of ADAP funding each year goes into this type of construction, so any cost-saving measures we can come up with should have a highly leveraged payoff for the development investment.

We will also be seeking new and improved methods to improve runway traction. These will be multiple-type efforts which will have spin-offs throughout the plan period, and which will find their way into advisory circulars for the use of airport operators and designers.

Where are the new initiatives? They are spread among a number of the programs mentioned above.

For example, the critical first phase of the development of higher levels of automation for the controller will be moving from feasibility demonstration into the equipment development phase during the plan period.

Also, application of the DABS data link to provide weather information and en route clearances for display in the cockpit will be proceeding. The future role of primary radar will have been determined and we look for valuable results from our work to examine alternative air traffic control separation concepts.

Our development plan for the next 5 years is ambitious, but critical to meet the forecast demands for air traffic control services. As in any complex development program, there are elements of risk which must be assessed for their potential impact on our progress.

We are confident we are moving in the right direction. Overall, we have the backing of the user community, and, we believe, the Congress. We must continue to improve the safety of the system, its overall productivity and capacity. Our future plans are dedicated to those objectives.

Now a few words about the management processes with which we direct the programs which comprise our future plan.

The FAA organization is divided along functional lines of responsibility. There are established procedures to assure coordination and correlation of the efforts of each organizational element.

Of much greater importance and impact on our performance is the fact that the people who today man the associate, service director and divisional management structure do indeed function to a very substantial degree as a coordinated, cooperative, yet self-critical body, through their everyday working relations.

To illustrate one element of our management process, let me describe how programs are initiated, identified, and monitored for program decision action through the FAA's systems acquisition management procedure—known as SAM.

Programs are selected for inclusion in the SAM process because of cost, future importance, or some other significant impact on our program.

They are monitored by a group of service director-level management personnel throughout the program's life; that is, from requirements determination, concept development, system development and implementation. This group oversees the preparation and coordination of an established series of documentation through which all concerned elements of the agency contribute their expertise to assure the orderly and timely introduction of new or improved capabilities into the system.

This group is not a decisionmaking committee, but it does develop recommendations or alternatives for referral to the Associate Administrator, or through them, to the Administrator.

The SAM process can perhaps be appreciated by noting the key documents produced, coordinated and approved through this process:

The starting point is the "System Requirements Statement." It documents the requirements for the program stated in terms of mis-

sion need. It provides the authority to begin development or to begin implementation if development is not required.

An "Engineering and Development Program Plan" is prepared to define the development efforts necessary to fulfill requirements established in the "System Requirements Statement." This plan identifies alternatives, expected end item products, scheduling information, resources requirements, and, if appropriate, an assessment of risk.

For systems involving a substantial capital investment over several budget years, a formal "Transition Plan" is also developed. This describes the manner in which new equipment and facilities will be introduced into the National Airspace System.

A decision to implement is documented by an "Acquisition Authorization." This document requires the Administrator's approval. This is a management level document that provides the authority for a new system acquisition to move from the development to the implementation phase.

During the development stage, an "Acquisition Paper" is also prepared. This carries approval of the engineering approach and provides authority to commit research and development funds. Where development is not required, it conveys approval to commit facilities and equipment funds. This requires both the administrator and the secretary's approval.

The end product of the development process is the "Technical Data Package." This describes the functional and technical characteristics of the system from which a production specification can be prepared.

An "Implementation Plan" is also prepared which describes the actions necessary to establish systems at field facilities. It contains a management plan, schedules, hardware and software requirements, operational concepts and planning standards, maintenance concepts, together with personnel training, logistics and regulatory considerations. It also contains multiyear budget actions and resource allocation information.

Upon implementation approval, a "System Specification" is developed utilizing information contained in the "Technical Data Package." This then becomes an attachment to the procurement request which initiates production.

At the present time, the following programs are covered by the SAM process: the Beacon Collision Avoidance System, Flight Service Station Program, the Discrete Address Beacon System, the Microwave Landing System, the Very High Frequency Omni-Range/Tactical Air Navigation System, the Airport Surveillance Radar, the Approach Landing System Improvements, the Air Route Surveillance Radar, Low-Level Wind Shear Alerting System, Voice Switching and Control system, Electronic Tabular Display Subsystem, and the Air Traffic Control Computer Replacement Program.

The SAM process is being reviewed and will be revised as necessary to be fully compliant with OMB's Circular A-109. We believe SAM is compatible with processes established by the office of the secretary to monitor major acquisitions and, where applicable, is complementary to OMB's Circular A-109.

A-109 provides for four key decisions by a cabinet-level agency head on any major acquisition. They are to first, approve the mission

need; second, selection of the design concept(s); third, approve development and limited production after concept is chosen; and fourth, approve full production.

We believe that our efforts will evolve into an orderly and well-planned program that will be fully compatible with the concepts of A-109.

From a resource standpoint, the A-109 requirement for maximum competition among multiple contractors will introduce costs that we have not encountered in previous major programs. This we will accommodate in our future planning estimates.

I would like to make a few observations on the structure and responsibilities of our engineering and development organization. Historically, our Office of Systems Engineering Management—OSEM—has been our advanced engineering, future system focal point.

The Systems Research and Development Service—SRDS—conducts all of our major systems developments and hands off the technical products to the operating services for implementation.

The National Aviation Facilities Experimental Center (NAFEC) conducts all of our test and evaluation activities. Over the past 5 years, NAFEC has also been assuming an increasing role in providing the development work associated with support to the operating system. We have established, at NAFEC, a unique capability for direct support of the Air Traffic and Airway Facilities Services.

We have just completed a reorganization in which we strengthened the SRDS' capabilities to conduct the development of hardware and software systems. We have assigned to NAFEC full development responsibilities for the critical aircraft safety program and some elements of the airports program. This makes maximum utilization of NAFEC's technical personnel and facilities and will achieve significant improvement in the overall use of our resources.

In developing our new organization, particular attention was given to the problem of maintaining continuing, day-to-day coordination between the elements of the engineering and development organization and the operating and implementing services.

We reorganized SRDS into four divisions having as their prime role the improvement of the air traffic control system and located in close proximity to their operational counterparts.

Our reorganization was carried out when a substantial number of our personnel had reached retirement age, and that, combined with the benefits available to retirees, resulted in a significant reduction in numbers of our technical work force. We have been actively recruiting for replacements, and I believe we will backfill most of our critical positions with highly qualified and experienced people within the next few months. We are not settling for second-best. We are staffing to do the job we set out for ourselves in the 5-year plan.

Mr. Chairman, that concludes my statement.

[Supplementary material submitted with Mr. Albrecht's statement follows:]

OBJECTIVES OF FAA RESEARCH
ENGINEERING AND DEVELOPMENT PROGRAM

SAFETY

1. To improve the FAA ATC Separation and Advisory Service, and reduce the risk of mid-air collisions (with a minimum economic and operational burden on the users of the system, especially general aviation.)
2. To achieve improvements in the air traffic control system and in aircraft operations which take into full account the limits and capabilities of the men and women operating the system.
3. To reduce the number of accidents which occur during the approach and landing phase of aircraft operations.

PRODUCTIVITY (COST)

1. To reduce the labor intensiveness of the FAA air traffic control system and the facilities maintenance system by the better use of people and the use of automation.
2. To achieve improvements in FAA's communications, navigation, and surveillance systems to explore the possibilities of systems integration to achieve a better system at lower costs to both the government and the users.

PERFORMANCE (CAPACITY/DELAY)

1. To achieve a more energy efficient system through reduction of ATC delays and increases in airspace and airport capacity, especially at and near major hub airports where expected increases in operations and enplanement must be accommodated.
2. To reduce the impact of delays due to weather.
3. To improve airport pavement by application of new technology to its design, construction and maintenance.
4. To gain a better understanding of factors such as demand/capacity/delay relationships and the impact of specific improvements in terms of safety effectiveness, real costs, and other benefits.
5. To examine longer range technological alternatives for system improvements and innovation so as to permit evolution to new capabilities in a timely fashion.
6. To reduce negative impacts of aviation on the environment, and to accommodate the impact of aviation activity on landside congestion.

FAA RESEARCH, ENGINEERING AND DEVELOPMENT
FINANCIAL PROGRAM ANALYSIS
R, E&D APPROPRIATION
(\$ IN 000'S)

	FY-1980 <u>Approp.</u>	FY-1981 <u>Cong.</u>	FY-1982/85 <u>Estimate</u>	Total <u>FY-1981/85</u>
<u>TOTAL RE&D</u>	75,000	85,000	415,000	500,000
Air Traffic Control	57,173	65,415	340,500	405,915
01 System	8,213	11,850	71,200	83,050
02 Radar	-	-	3,670	3,670
03 Beacon	9,100	6,280	17,000	23,280
05 Arcft. Sep. Assurance	5,330	5,400	17,600	23,000
06 Communications	3,227	7,085	31,800	38,885
08 Airport/Airside	2,965	3,080	17,830	20,910
09 Airport/Landside	123	350	400	750
10 Oceanic	-	-	3,900	3,900
12 Enroute Control	10,834	9,580	64,800	74,380
13 Flight Service Stations	3,704	5,090	15,000	20,090
14 Terminal/Tower Control	10,591	11,505	59,900	71,405
16 Technology	1,975	3,800	31,400	35,200
21 Support	1,111	1,395	6,000	7,395
Navigation	12,277	11,335	45,000	56,335
04 Navigation	4,027	5,970	26,000	31,970
07 Approach & Landing System	8,250	5,365	19,000	24,365
Aviation Weather	4,750	7,050	23,500	30,550
15 Aviation Weather	4,750	7,050	23,500	30,550
Aviation Medicine	800	1,200	6,000	7,200
19 Aviation Medicine	800	1,200	6,000	7,200

SUMMARY - RE&D APPROPRIATION

Air Traffic Control	57,173	65,415	340,500	405,915
Navigation	12,277	11,335	45,000	56,335
Aviation Weather	4,750	7,050	23,500	30,550
Aviation Medicine	<u>800</u>	<u>1,200</u>	<u>6,000</u>	<u>7,200</u>
TOTAL	75,000	85,000	415,000	500,000

FIVE-YEAR PLAN FY-1981/1985 - R, E&D APPROPRIATION

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PROGRAM		SYSTEM									
CY 79	CY-80	CY-81	CY-82	CY-83	CY-84	CY-85	TOTAL FY-85				
	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85					
(000)											
PROGRAM TOTALS	8,213	11,850		66,200			78,050				
SYSTEM ECONOMIC ANALYSIS	829	880		6,100			6,980				
● Milestones											
	ATS Hqmts.	Computer Replacement C/B Study		AERA C/B Study	Data Link Phase I						
	VSCS Analysis	Term. Flow Mgmt. C/B Study		Doppler Wx. Radar C/B Study							
	WVAS Safety Analysis										
ADVANCED SYSTEM	3,079	5,159		21,300			26,459				
CONCEPTS											
● AERA	Baseline & Conflict Probe	Delay Absorption		Test-Bed Opn'l.	Test-Bed Opn'l. Support	Initial T&E Complete					
● COCKPIT SYS. ENG.			Advanced Nav. Sys.	Gen. Av. Human Factors	CDTI	Hardware/Software Pilot interface					

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FIVE-YEAR PLAN FY-1981/1985 - R, E&D APPROPRIATION

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PROGRAM 01		SYSTEM									
CY 79	CY-80	CY-81	CY-82	CY-83	CY-84	CY-85	TOTAL FY-81 - FY-85				
	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85					
(000)											
PROGRAM TOTALS	8,213	11,850	66,200								78,050
SYS. ENG. ROOMTS. & INTEGRATION	3,067	3,982	23,500								27,482
● SEPARATION/NAV. STANDARDS	▲ Lateral Separation of VOR Routes Study	▲ Composite Separation for N. Pacific	▲ Vertical Separation Studies								
	▲ Long. Sep. for N. Atlantic Study	▲ CONUS VOR Separation of Non-Parallel/ Connecting Routes	▲ Selected Lateral and Oceanic Studies								
● INTEGRATED FLOW MANAGEMENT		▲ Avionics Analysis Rpt.	▲ Term. Operations Analysis	▲ Functional Spec. to R&D		▲ Expanded Sys. Simulation completed					
			HUB traffic Flow Anal.								
● OTHER			Rpt.	Developed as Rqmts. (Concepts Identified)							

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PROGRAM 03		BEACON										
	CY 79	CY-80		CY-81		CY-82		CY-83		CY-84		CY-85
		FY-80		FY-81		FY-82		FY-83		FY-84		FY-85
(000)												
PROGRAM TOTALS		9,100		6,280				17,000				
DABS		6,300		4,215			1,000					
● Milestones		▲ Single Site Sensor TDP				▲ Multisite Sensor TDP						
ATARS		2,800		2,065			3,500					5,565
● Milestones		▲ ATARS Input to DABS TDP		▲ Final ATARS Software Spec.								
BEACON IMPROVEMENTS & ENHANCEMENTS								12,500				12,500
● Milestones			▲									
To be established as support requirements identified.												
TOTAL FY-81 - FY-85												

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FIVE-YEAR PLAN FY-1981/1985 - R, E&D APPROPRIATION

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PROGRAM 09		AIRPORT/LANDSIDE									
CY 79	CY 80	CY 81	CY 82	CY 83	CY 84	CY 85	TOTAL FY-81 - FY-85				
	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85					
(000)											
PROGRAM TOTALS											
	123	350	400								750
AUTOMATED GROUND											
	123	350	400								750
TRANS INFO, SYS, DEMO											
● Milestones											
▲ Complete Demo (Logan Arprt)											
▲ Demo Planning Support to OST											

FIVE-YEAR PLAN FY-1981/1985 - R, E&D APPROPRIATION

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PROGRAM 13		FLIGHT SERVICE STATIONS									
CY 79	CY-80	CY-81	CY-82	CY-83	CY-84	CY-85	TOTAL FY-81 - FY-85				
	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85					
(000)											
PROGRAM TOTALS	3,704	5,090		15,000			20,090				
FSS	3,704	5,090		12,000			17,090				
● Milestones											
	▲ Voice Response TDP	▲ Delivery Mod. I NAFEC	▲ Mod. II Delivery NAFEC	▲ Mod. III Delivery NAFEC							
		▲ Mod. III Eng. Model Buy	▲ Mod. II Delvd. 1st Opns. Site								
IMPLEMENTATION SUP.					3,000		3,000				

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PROGRAM 14 TERMINAL/TOWER CONTROL													
	CY 79	CY-80	CY-81	CY-82	CY-83	CY-84	CY-85	TOTAL FY-85					
	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85	FY-86						
(000)													
PROGRAM TOTALS	10,591	11,505	59,900										71,405
EXPERIMENTATION AND DEVELOPMENT	8,152	8,860	27,900										36,760
● Milestones													
Tampa / Sarasota Remoting Spec.	▲	▲	▲	▲	▲	▲	▲						
ATARS/ ARTS III Software Spec.													
ARTS/DABS SEAP TDP	▲	▲	▲	▲	▲	▲	▲						
Full Digital ARTS Display TDP													
AIRPORT SURFACE TRAFFIC CONTROL	1,617	1,185	6,000										7,185
● Milestones													
ASDE-3 TDP	▲	▲	▲	▲	▲	▲	▲						
VICON Rpt.													
TACS Eng. Model Spec.													
TACS/TDP FY-86													
TACS Eng. Mod. Contract													

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PROGRAM 16 TECHNOLOGY											
CY 79	CY-80	CY-81	CY-82	CY-83	CY-84	CY-85	TOTAL FY-81 - FY-85				
	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85					
(000)											
PROGRAM TOTALS	1,975	3,800		31,400							35,200
ADVANCED HUMAN FACTORS	712	1,000		5,900							6,900
● Milestones											
- ATC Sim. FAC.			1985 ATC Scenario	1990 ATC Scenario	1995 ATC Scenario	Advanced Software Design					
- Measures/Interfaces			System Effectiveness Measures	Validate Controller Measures Enroute/Term.	Controller Workload Validate						
- Safety/Human Impact of Automation				Enroute High (Basic) Terminal Flow (Basic)							
ADVANCED COMPUTER TECHNOLOGY	1,263	2,520			24,300						26,820
● Milestones											
	(Combined with Programs 12, 14, & 16 on Sheet 3 of 3, this program.)										

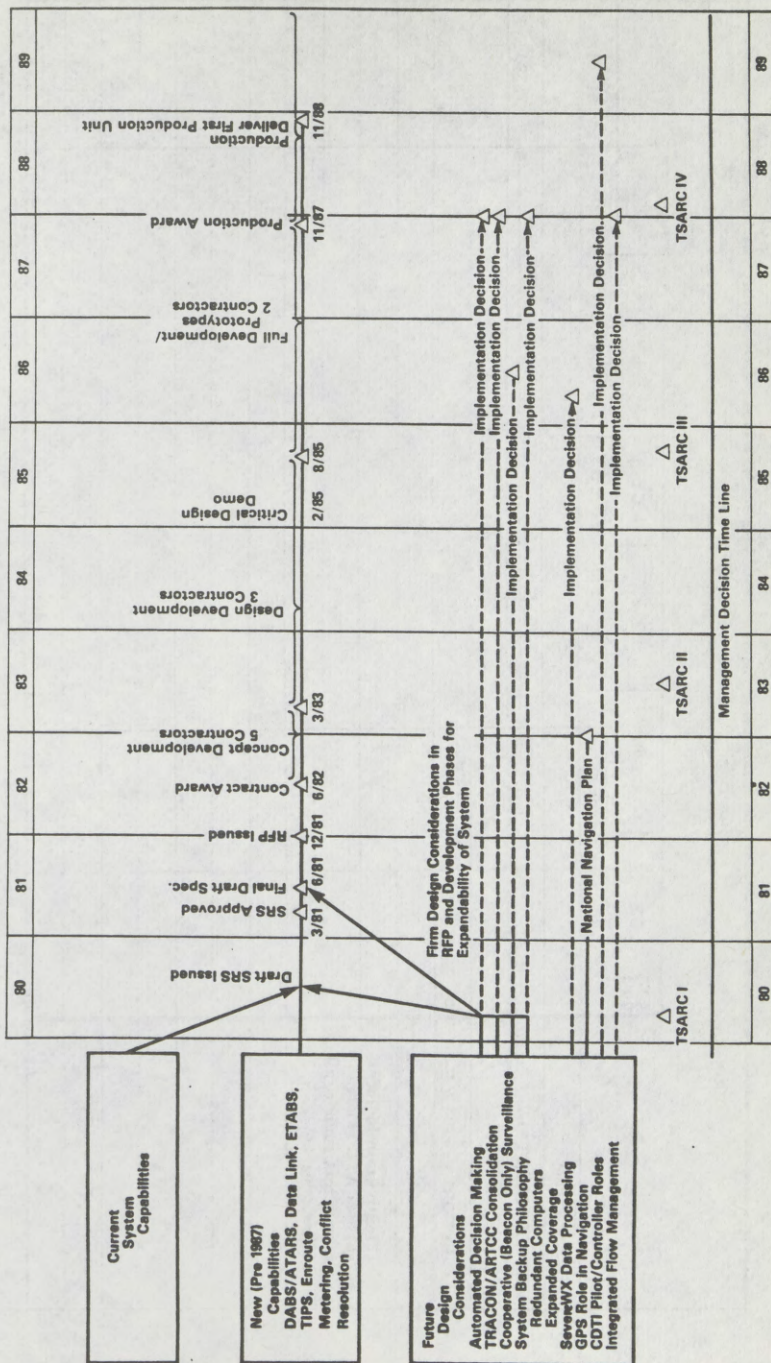
ADVANCED COMPUTER REPLACEMENT PROGRAM COMBINED FUNDING
IN PROGRAMS 12, 14 & 16

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(000)	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85	TOTAL FY-81/85
Program 12 (Computer Replacement Portion)	2,897	2,500	↔	37,000	↔	↔	39,500
Program 14 (Computer Replacement Portion)	822	1,460	↔	26,000	↔	↔	27,460
Program 16 (Computer Replacement Portion)	1,263	2,520	↔	24,300	↔	↔	26,820
TOTALS	4,982	6,480		87,300			93,780

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ATC Computer Replacement Program



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PROGRAM 04		NAVIGATION									
	CY 79	CY-80	CY-81	CY-82	CY-83	CY-84	CY-85				
	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85					
(000)											TOTAL FY-85
PROGRAM TOTALS	4,027	5,970		26,000							31,970
NAV. SYS ACCURACY & PERFORMANCE	530	1,985		7,700							9,685
● Milestones											
	Precision DME Spec.	Civil Air Nav. Rgmts.	Nav Policy Decision								
FUTURE NAV. SYSTEM	686	1,360		7,500							8,860
● Milestones											
	Y Set Rcvr Rpt. Antenna Rpt.	New Rpt.	Phase II Rcvr. Rpt.								
OPN. USE OF LORAN-C IN AVIATION	578	1,115		2,000							3,115
● Milestones											
	Verhont Eval.		Assessment of LORAN-C								

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PROGRAM		NAVIGATION									
CY 79	CY-80	CY-81	CY-82	CY-83	CY-84	CY-85	TOTAL FY-81 - FY-85				
	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85					
(000)											
PROGRAM TOTALS	4,027	5,970		26,000			31,970				
HELICOPTER OPNS.	1,030	1,035		4,000			5,035				
● Milestones											
	LORAN-C for Opn'l. Heli.	▲ Northeast Corridor Report	▲ Heliport IFR Stds.		▲ IFR Certification						
		▲ Comm. Rqmts. for Heli.									
VLF/OCEANIC NAV. SYS	1,203	475		4,800			5,275				
● Milestones											
		▲ Omega in Alaska Rpt.		Continued support to be determined							

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PROGRAM 07		APPROACH AND LANDING SYSTEMS									
	CY 79	CY-80	CY-81	CY-82	CY-83	CY-84	CY-85				
	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85	TOTAL FY-85				
(000)											
PROGRAM TOTALS	8,250	5,365			19,000		24,365				
HEAD-UP DISPLAY (HUD)	807	200			2,000		2,200				
● Milestones											
	Draft Report HUD Demo.				Operational Support						
AIRCRAFT ALERTING	509	190			2,800		2,990				
● Milestones											
	Guidelines for Stnds. Issued	Issue Certification Criteria			Operational Support						
					Alert prior to system/configuration faults						
FLIGHT DECK INFO SYSTEMS		725			2,000		2,725				
● Milestones											
					To be determined						

FIVE-YEAR PLAN FY-1981/1985 - R, E&D APPROPRIATION

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PROGRAM 15 AVIATION WEATHER											
	CY 79	CY-80	CY-81	CY-82	CY-83	CY-84	CY-85	TOTAL FY-81 - FY-85			
	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85	FY-85				
(000)											
PROGRAM TOTALS	4,750	7,050		23,500							30,550
WX DATA PROCESSING & DISTRIBUTION	1,838	3,580			11,400						14,980
● Milestones											
	▲ AWES Plan			Weather System Processor	AWES Detailed System Design						
NEXT GEN. RADAR (NEXRAD)	1,050	1,910			6,000						7,910
● Milestones											
	▲ NEXRAD Prog. Plan			NEXRAD Test Bed Dlvrd.	NEXRAD Engr. Mod. Dlvrd.	Spec. Handoff					Full Production Buy
WIND SHEAR	1,445	785			3,200						3,985
● Milestones											
	▲ Report Integ. w/NAS			Report Integ. w/NAS	Field Support						
OTHER SUPPORT	417	775			2,900						3,675

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FIVE-YEAR PLAN FY-1981/1985 - R, E&D APPROPRIATION

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PROGRAM 19 AVIATION MEDICINE									
	CY 79	CY-80	CY-81	CY-82	CY-83	CY-84	CY-85	TOTAL FY-81 - FY-85	
	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85			
(000)									
PROGRAM TOTALS	800	1,200	6,000						7,200
ATCS Selection Battery									
• Milestones	▲		Continuing						
	New Battery OPM operational								Replacement Battery OPM Operational
Radar Training Facility									
• Milestones	▲	▲							
	Comp. Functional Specs.	Pass-Fail Standards							
ATCS Tracking System									
• Milestones	▲	▲		Continuing					
	Predevelop Mentals	FSS Option	Incorporate RTF Scores						
Other projects of a continuing nature									

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GLOSSARY

Add'l.	Additional
Adv	Advisory
AERA	Automated En Route Air Traffic
Anal	Analysis
ANPRM	Advance Notice of Proposed Rule Making
ASDE-3	Airport Surface Detection Equipment-3
ARTCC	Air Route Traffic Control Center
ARTS	Automated Radar Terminal System
ATARS	Automated Traffic Advisories and Resolution Service
ATC	Air Traffic Center
ATCS	Air Traffic Control Specialist
ATS	Automated Terminal Services
Av	Aviation
AWES	Aviation Weather System
BCAS	Beacon Collision Avoidance System
C/B	Cost/Benefit
CDTI	Cockpit Display Traffic Information
Comm	Communications
Comp	Computer
DABS	Discrete Address Beacon System
DARC	Direct Access Radar Channel
Dec	Decision
Demo	Demonstration
Divd.	Delivered
DME	Distant Measuring Equipment
EARTS	En Route Automated Radar Terminal Systems
Eng	Engineering
Enh	Enhancement
Eval	Evaluation
Fac	Facility
Flt	Flight
Freq	Frequency
FSS	Flight Service Stations
Gen	General
Heli	Helicopter
HF	High Frequency
HUD	Head-Up Display
ICAO	International Civil Aviation Organization
Info	Information
IFR	Instrument Flight Role
Instald	Installed
Integ	Integration
Mod	Modification
NADIN	National Airspace Data Interchange Network
Nav	Navigation
NDT	Non-Destructive Testing
NEXRAD	Next Generation Radar
Opnl	Operational
OPM	Office of Personnel Management
Opns.	Operations
PCC	Portland Cement Concrete
Perf	Performance
Rcrd	Recorder
Rpt.	Report
Rqmts.	Requirements
RTF	Radar Training Facility
SARPS	Standard and Recommended Practices
Sim	Simulation

Spec.	Specification
SRAP	Sensor Receiver and Processor
Std.	Standards
STEP	Service Test and Evaluation Program
SVSS	Small Voice Switching System
Sys.	System
TAGS	Tower Automated Ground Surveillance
TDP	Technical Data Package
T&E	Test and Evaluation
Term	Terminal
TIPS	Terminal Information Processing System
VAS	Vortex Advisory System
VICON	Visual Confirmation of Take-off Clearance
VSCS	Voice Switching and Control System
WVAS	Wake Vortex Advisory System
Wx	Weather

Mr. HARKIN. Thank you very much, Mr. Albrecht.

Talking about the 5-year plan and the ADAP legislation, I want to discuss with you how you feel about the level of money in your proposed ADAP legislation, and whether or not it will meet all the R.E. & D. requirements.

Mr. BOND. Will it meet all of them? Oh, no. It will not meet all of them.

Mr. HARKIN. Can you kind of walk me through that?

Mr. BOND. Well, I don't think you are going to see any budget that is proposed before this or any other committee, Mr. Chairman, that is going to meet all of the requirements that anybody can think up.

Our budget is a fiscally constrained one. It goes through the congressionally ordered budget process—the Budget Control Act—and, along the way, it is squeezed—along with other programs—into the final ceiling that is set by the Congress. It is therefore unlike many other Federal programs which are the entitlement programs—the uncontrolled spending programs—which automatically correct themselves for inflation.

The biggest problem we have with our funding levels, and it is the same story with highway or anyone else that comes before this committee, is inflation. It has a savage impact on what we can buy with our money.

I was just looking at some numbers the other day. Let me just throw one out on to you, which I think is as good as any. Our appropriation in 1976 was \$67.5 million for this aviation research. In constant dollars, in 1985, the authorization level will represent—in 1976 dollars—only \$44 million. That means that what we will be able to buy with our money in 1985 will represent about a one-third reduction over what we were able to get 10 years ago.

That is a very discouraging story. It is as discouraging as the rise in fuel costs are to operators and the massive increases in capital investment that auto manufacturers have to put out, and it is not a happy circumstance for any of us.

Let me expand just a bit on that, if I may, and that is taking, from 1981 onward to 1985, inflation to be at 10 percent. The first half of that decade that I mentioned to you a moment ago is historical figures, but inflation seems to have gone up some, and the current level of inflation is, in fact, higher than 10 percent. And we have noted that it may not fall below that in the coming fiscal year, so the impact on our purchasing power could very possibly be even worse than that, and I hope that it will not be so bad. In any case, it's based on 10 percent, steadily progressing to the next 5 years of this program.

Mr. HARKIN. The funding comes from the fuel tax and the ticket tax?

Mr. BOND. The ticket tax is the largest portion of it.

Mr. HARKIN. Is the ticket tax fixed, or is it a percentage?

Mr. BOND. It's 8 percent. So the income in our program inflates. There are other taxes, too, such as sales of parts and so on?

Mr. HARKIN. So unlike the cigarette tax, which is a fixed amount, the money comes into ADAP does, in fact, reflect inflation. When the prices go up, it goes up.

Mr. BOND. That's right. It's a better sort of tax from our point of view, for example, than the fuel tax on automobiles is to the highway

program. Federal and State taxes is cents-per-gallon. It's disappearing as a revenue source.

Mr. HARKIN. I guess when you say that in fiscal 1985 that the amount of dollars on a constant dollar basis will be one-third less, that would be true. I understand. However, the amount of the money coming into the trust fund as inflation goes up ought to reflect that inflationary trend.

Mr. BOND. Oh, yes. The income from the users of the system goes right up. The money is unquestionably coming in.

Mr. HARKIN. So that the \$67.5 million for fiscal year 1976, then, will be worth \$44 million in fiscal year 1985, based on the 10 percent inflation rate?

Mr. BOND. It does not correct itself for inflation over that 10-year period. That's entirely correct. Our planning numbers go up to \$110 million in 1985, but that doesn't correct for inflation. You are quite correct.

Mr. HARKIN. Elaborating on my first question about having enough money, you said, no, you never have enough money to meet all the things you want.

Mr. BOND. That's right.

Mr. HARKIN. All right. Aside from all of the things that you may want, looking at the things that you feel are necessary for your primary mission of air safety, I guess you have prioritized what we must do, whether its' full BCAS, ATARS, DABS—all of these other things that we are bringing on line within that 5-year period of time—we are also looking at the development of a new en route computer system?

Mr. BOND. Right.

Mr. HARKIN. That hopefully we are going to start implementing about that time. Is there enough money in this budget to do those necessary things to bring us to the point in 1985 that we can begin to implement the new computer system?

Mr. BOND. Well, we don't anticipate to start folding them in—implementation of them—until maybe the late 1988 time frame, with completion in about 1992. That is a schedule which we have more or less pinned down in the last couple of months of work. That's an accelerated schedule. We probably will be hard pressed to meet that schedule under present funding levels.

Mr. HARKIN. You are saying that you are planning on bolting down the computers beginning in the 1988 time frame.

Mr. BOND. That's correct.

Mr. HARKIN. To be completed in 1992, and that's an accelerated plan?

Mr. BOND. That's right. That's a financially unconstrained sort of schedule.

Mr. HARKIN. Hmm. I thought we were talking about beginning implementation around 1985 or 1986.

Mr. BOND. Well, that has been a number that we have discussed, but the more recent and the more firm schedule that has been developed by our research people and our F. & E. people is that it's about 1988.

Mr. HARKIN. OK. You say that is not because of technical problems, but is it a budgetary problem?

Mr. BOND. That is an unconstrained financial number, without financial constraints on it and—

Mr. HARKIN. So it is a technical thing. The new computer system won't be available until late 1988.

Mr. BOND. Well, I think we would be very hard put to get them running before that time under any level of funding; yes. That is the best guess we have now. And we have a strategy for filling the gap until that time. We intend to continue to expand what we have as best we can and so on.

Mr. HARKIN. Then, you feel the present 9020 computers will handle the increased air traffic safely from now until 1988?

Mr. BOND. I think the answer to that is "yes."

The larger problem is not just computers, but the entirety of air traffic control, Mr. Chairman. And assuming that all our projections for IFR flying and system use for the next 5 years or 10 years are correct, it really means that we are going to have what can only be described as an enormous growth in general aviation, in business aviation flying, and a steadier but lesser growth by air carriers of all kinds.

Our role to date, and clearly the dictates of the Federal Aviation Act have led us in that direction, has been to try to meet demand on our system at all cost. No constraints should be—or minimum amounts of constraints should be placed upon them. Whether or not we can continue that into the next decade, in my opinion, is increasingly debatable. I am more and more troubled by that question, whether we can meet unconstrained growth.

There are some alternatives to this. We have already seen, for example, the problem of finite resources occur now in airport areas; gate capacity is a problem; arrival slots for airports are now limited—we are discussing auctioning them off to the highest bidder, and so forth.

I suspect that we may have to apply the same sort of rationing logic to air space use in terminal areas and critical en route facilities in the years ahead as well, because it is debatable whether our system will have the capacity to accommodate the full growth of general and business aviation and commuters and air carriers within the constraints that exist today.

The Federal Aviation Act clearly says that all users have free access to the air space, so I suspect that we shall either have to go through the regulatory process or we'll have to suggest to the Congress new legislative language that will sort out the demands on that limited resource. And it will obviously be a debate between business aviation users and the air carriers, as is always the case. I do not relish the thought of going through that process.

Mr. HARKIN. Again, I am still trying to pin down in my own mind what is adequate funding.

I sent out a memorandum to the members of the subcommittee dated February 14. One of the things I asked was, "Is FAA being provided adequate R. & D. funds?" I said, "probably not." I pointed out the ADAP trust fund will have an estimated unexpended balance of \$5.54 billion by the end of fiscal year 1981.

Now, let me ask you this. From your last budget to the current one we're working on right now, fiscal year 1981, does it include an increase for inflation?

Mr. BOND. When we prepared our budget encased in this legislation and it has gone through the administration's process, we simply did not correct for inflation at all. We corrected for system requirements, for the growth that's going to be ahead, for the increased safety demands that are placed upon us; we did not factor into our estimates inflation growth.

We simply didn't. It is now apparent to me that this program—and every other program that comes along—is constrained and damaged by inflation.

Mr. HARKIN. Well, I understand that.

Mr. BOND. The budget process doesn't seem to work that way, at least for us, so there you are.

Mr. HARKIN. I serve on other committees too, and I know what it means to have a constrained budget and try to cope with inflation. We have to try to make decisions on whether the budget should be increased, left the same, perhaps even decreased in some cases. Should the FAA budget be decreased? Should it be left the same? How much more do you need to meet the requirements of air safety, not only next year, but from now through fiscal year 1985?

Now, it seems to me that we could pull any figure out. We can say, "Sure, \$110 million by 1985 will help us meet certain requirements." But will those requirements be sufficient to provide the kind of air safety that we're going to need by 1985—or beyond—for, as you said, the increase in business, private, and commercial air activity?

Mr. BOND. Well, the question is twofold. One is the level of safety that we can impose out there, and the other is the system capacity. And I alluded to both of those quite deliberately.

The level of activity is less than what we could do, just in the field of air safety, if we had more money. I think that's obvious. Any person that comes before this committee, or any committee, can do more with more money. I believe it is probably less, as well, than the public expectation of us to provide for air safety, and the expectation is extraordinarily high in the aviation business.

We have a very good record to date. I don't want to be unduly alarmist to the committee, because I feel very at ease in defending the aviation safety record over the years. But the expectations are clearly higher than what we have achieved in the past and I don't think we can make the representation that we are going to live up to the very highest level of aviation safety with this funding level.

Mr. HARKIN. You say those expectations are unduly high? Forgetting about budget, can we meet those expectations if we had the money?

Mr. BOND. If we had more money? We could certainly make a better record. There's no question about that. More money will buy us more safety in the system, but whether or not the expectations are unduly high is a larger philosophical question that the members will have to address and not me.

One of the things that I find when a tragedy occurs is that it is never good enough to say "On average, it's very safe." Yet that is true, as I know you and members of the committee understand.

But there is another element to your question which I want to return to, which is system capacity. I seriously doubt that we can

accommodate within our system all of the staggering amounts of growth that we are going to see in the near future—the 5- and 10-year horizon that is ahead—in a constrained budget. We must be realistic about that.

Just to give you an example, during the fall, I went to the National Business Aircraft Association convention in Atlanta, and the fine producers from Kansas, Cessna, Beech, Lear-jet were down there in force. My own view is that by the year 2000, every third American family is going to have a King-Air in the backyard.

Mr. GLICKMAN. I would appreciate that very much.

Mr. BOND. Well, I want to tell you, there is going to be no place to fly it, because the system capacity cannot keep up with this growth. As American industry distributes itself more evenly and broadly throughout the land, and the need for better and tighter management of scattered assets increases, general and business aviation is the way to meet that requirement. It is an important element of the national economic system. It is no way a luxury, if you ask my opinion on the subject.

Also, air carrier service is pulling out of some routes and is getting more concentrated on the heavier routes, and we are seeing more and more hub operations by air carriers, all of which means that the growth of business aviation is “the” way of transportation for many communities.

It is going to put a strain on the air traffic control system, which I seriously doubt we will be able to meet in the next 10-year time frame. And that is going to place a constraint on the manufacture of new aircraft. They are no good if you can’t use them.

Mr. HARKIN. I find that somewhat alarming in the context of my previous questions. Again, I look at the necessity for updating the computers, which is a part of providing that type of system capacity, is it not? Or am I wrong?

Mr. BOND. It is a part of system capacity. I don’t think we are going to be limited before 1988 by computer capacity, however. I just intuitively believe we can meet that problem.

I think the question of dense airspace and demands to get into terminal areas and to use airspace which the technology will not allow us to compress, separation and so on, is going to be a larger question than our computer capacity, but that may intrude as well.

Mr. HARKIN. One followup question. Have you, or do you intend, to revise the 5-year R.E. & D. plan?

Mr. BOND. Well, we’re going to have to revise our plan as inflation bites into us each year. There is no way that we can accurately predict inflation ahead of time. Every year we’ve got to update it, and if the bite of inflation is as savage on our programs as we anticipate it will be, it’s going to be a revision downward. That means not starting some programs and stretching others out.

Again, to return to the question of unconstrained growth, I think that Congress is going to have to address this question. Every other activity that we undertake, whether it’s defense or highway systems in urban areas, represent constrained growth, and aviation, I guess, over the years has been almost unique in that it has been able to provide system capacity for unconstrained growth in the past. I don’t

think the fact that that can't continue forever should be news. In other words, we may not be able to get everything we want in the future.

Mr. HARKIN. Looking at R. & D. generally, in defense, the average R. & D. growth is 10.8 percent, from 1976 through 1981. Space is 10.8; civilian other than space is 12.5; FAA is 6.1.

Mr. BOND. That's correct. For some reason, the FAA's research program has done poorer than almost every other technological program that I can address.

I will say that I think part of the responsibility is our own. I don't want to lay the blame. I don't think there are any villains of this piece, Mr. Chairman, and if I'm giving that impression, I don't want to do so.

Mr. HARKIN. No, no.

Mr. BOND. Our program has been subject to a fair amount of criticism: It takes too long to develop a product, our coordination from piece to piece is not so good, the user community has reservations about that.

We have done our best to cure that problem, but I recognize that it still exists. What Al Albrecht has described to you a minute ago in terms of reorganizing our program, getting our user community together behind the collision avoidance system, just for one example, and the new DABS transponder, and so on, are examples of how we work as best as we can to overcome those criticisms, and I think we've made substantial progress.

For example, the collision avoidance system, I think in logic, is now widely accepted and understood—that we are going to implement it and so on—and that really is a lot of progress. It was an open question 2 years ago, but I don't think it's open any more, so we've made progress on that.

In any case, part of the responsibility is our own. But we are beyond that now, I think, and I think that our coordination, our deadlines, are better established now, and I promise you we are going to make this program a better program.

The larger question, though, is one of technological growth, and I am distressed at the larger implications for American society of a suppression of technological growth.

Somehow I have to think that many of the research programs, ours and others' defense and so on, in the Vietnam era of the 1970's, suffered from a rejection of technology by the American society. It wasn't important. Social programs, pensions, welfare, things like that, were more important. We didn't have to worry about this other stuff.

I think today, with the realization that we are in direct head-to-head competition with the Europeans or the Japanese for American jobs, I believe that it is imperative that the Americans retain a logical leadership in all phases, and I think that is the larger problem with our R. & D. budget, and not just system capacity. If we don't stay ahead on this front, our society really has got a lot of tough times ahead of it.

Mr. HARKIN. Well, I can't help but repeat my statement that the trust fund will have \$5.54 billion in it.

When I talk to people, whether it's aircraft manufacturers, users' group, trade associations—even talking to constituents of mine who

live in Iowa, if they have any connection with aviation whatsoever, they can't understand why we have all that money, and yet we don't seem to be doing enough in the R. & D. area to provide adequate system capacity and safety.

Mr. BOND. Well, I can tell you very briefly the reason for the disparity. It has its origins in the Congressional Budget Act. When this program and the highway trust fund were enacted, with a dedicated source of revenue flowing into it, it was anticipated by the Congress that all the money that came into that program, into that account, would be spent for those purposes because it could only be spent for those purposes.

Subsequently, however, the Congress has enacted a net overall gross ceiling on Federal expenditures, and, in order to meet that ceiling, all program expenditures have to be squeezed within the ceiling. So the result is—the consequence of that congressional decision is—that programs, even though they are funded from the dedicated revenue stream, do not have all the money that comes in spent on them. Otherwise, you couldn't spend any money if you would exceed the expenditure ceiling under the Congressional Budget Act.

So the consequence is exactly the opposite of what the Congress intended, and it's not the President's fault, it isn't the OMB's fault; it is the rules of this game that have been established by both the President and Congress. And there are no villains in this piece. The OMB has to squeeze everything in some prioritized way. We have to do so. Those are the rules that the game is played under.

No one, not the executive branch, and not the Congress, likes this stupid surplus to exist in our program. It ought to be addressed. Either we should spend all the money or cut the taxes or something. We proposed a way to get there, but the surplus is really dumb. And it is a product of the existing rules.

Mr. HARKIN. You are saying that it's because of our congressional budget program and the way we pass our budget ceilings.

Mr. BOND. Right.

Mr. HARKIN. That this comes under that.

Mr. BOND. Yes.

Mr. HARKIN. Then you are saying that, within that goal, you have a budget—FAA has a budget.

Mr. BOND. Yes.

Mr. HARKIN. And the total FAA request, I guess, is \$3.3 billion for fiscal year 1981.

Mr. BOND. Right.

Mr. HARKIN. Well, how much of that is R. & D.?

Mr. BOND. \$85 million, plus the other—\$85 million for the R.E. & D. portion of it, and another \$19 or so for F.E. & D. which does not come out of the trust fund.

Mr. HARKIN. All right. I guess what I'm asking, then, obviously, it is your judgment that the \$85 million represents the proper amount of money out of \$3.3 billion that ought to go to R. & D. That is a small fraction.

Mr. BOND. That is a small fraction, and I don't necessarily represent that and neither, I think, does the Presidential budget on any single item that comes in there.

Nobody is saying that it is the very best effort that can be made. What we are saying is, it is the best effort within constrained fiscal restraints that can be made.

I feel better about making that statement than I do about saying that it's the best effort that we can make, because it isn't. It isn't in the highway field; it isn't in defense; it isn't anywhere else. Everything is constrained.

Mr. HARKIN. Let me return just once more. I want to get a very clear picture of this. Your budget request is \$85 million. That's \$5 million below the administration's planned request in the 1979 airport and airway development bill. Both the \$90 million and the request of \$85 million were prepared some time ago.

Mr. BOND. Well, the \$90 million was almost 2 years ago when we put that together.

Mr. HARKIN. And the \$85 was last year?

Mr. BOND. Subsequent to this. A year ago or so. Something like that.

Mr. HARKIN. All right, so we are talking about the impact of inflation.

Mr. BOND. Right.

Mr. HARKIN. So here we are with an \$85 million request, prepared over a year ago, and we're trying to look ahead for fiscal year 1981, which begins, obviously, this October, so we are talking about passage of a year and a half.

I guess I'm making more of a statement than a question. We both know what the impact of inflation is. We're looking at the various activities you want to accomplish in fiscal year 1981 in the beginning of that 5-year program.

I guess my statement is that you can't do it. I mean, there just isn't enough money requested. I guess I would ask you again. Do you feel that there's the money there to get you started on the first year of that 5 years where you say we've got to be?

Mr. BOND. We will have to be limited in what we spend. Your statement is exactly correct. It is not enough and nobody suggests that it is.

Mr. HARKIN. All right, it's not enough.

Mr. BOND. Right.

Mr. HARKIN. And the people of this country and the people of this Congress have got to understand that air safety is going to be jeopardized. I didn't say "may be jeopardized," is "going to be jeopardized" if we don't put the money in there. We don't have to do everything, but just those minimal things that have to be done to get us where we want to be by 1985, to meet the safety, the capacity, the growth, in air travel.

You don't want to make a comment. I know you don't. I don't want to put you on the spot, either.

Mr. BOND. I don't mind being put on the spot. I'm well beyond that, believe me. Believe me. I've been on hotter spots than this committee puts me on. So I'm pretty well battered.

The question of air safety is paramount in our interest here, and we get caught between two extremes. One is that the very highest level of air safety that is attainable should be achieved. We're not proposing that. Second, the funding that we propose does not achieve that, but the level of air safety that we have achieved is still very, very high, and

I think it is an acceptable level. Every statistic that we can look at indicates that it is very, very safe compared to anything else that I know of. It is more safe. It is getting safer.

Mr. HARKIN. Well, it is safe, I have no doubt about that. It is getting safer, but I think the demands on the system are increasing at a more rapid rate than the increase in safety.

Mr. BOND. That is the point that I've been trying to make, and I must say it is a troublesome one for me. As the use of non-air-carrier aircraft goes up at such a rapid and exponential rate, the density of aircraft in the air space gets greater. And as our algorithms have shown us, for example, the risk of midair collision, given a certain number of aircraft in a given amount of airspace, goes up logarithmically. Going from two airplanes to four does not double—it quadruples—the risk of midair collision, and so the growth that we expect to see in the years ahead is the variable that I can't predict, and it is a troubling problem.

Mr. HARKIN. OK. Let me bring up another point. Dr. Goldmuntz gave me a list last week which he believes you are pursuing but which could provide much greater and earlier benefit if FAA were pursuing it more expeditiously.

One of those is the implementation of MLS, DABS, associated DAB link, and cockpit displays of traffic information, which could lead to the use of general aviation runways at the major hub airports under IMC conditions with spacing as close as 2,500 feet to airline runways. You know what I'm talking about.

Mr. BOND. I do, indeed.

Mr. HARKIN. All right. That obviously is one way of increasing the capacity of major hub airports.

Mr. BOND. Right.

Mr. HARKIN. Again, I look at these items, I look at the budget, and I say "I don't know if we're going to get there by 1985."

Mr. BOND. Well, I don't know; Larry Goldmuntz has one list and someone else—Congressman Lloyd—may have another and someone else may have another, but you can always put together a list of things that if we had more money we could do more quickly. That's hardly news.

I think that's a pretty good list of priorities, by the way. I'm not sure if I would go for the MLS component of that, but DABS and the other parts of it are very important as well as a link, and we can always buy time—in many of our programs, not all, but in many of our programs we can buy time—with money and we are having to string it out some.

Mr. HARKIN. Well, let's move on to the other hot spot.

On the first page of your testimony, Langhorne, you said the following: "You, of course," meaning us, "have the task of independently evaluating our planned activities and deciding whether they will, in fact, meet those challenges."

Mr. BOND. That's right.

Mr. HARKIN. "Evaluating and deciding" it, whether we authorize more or authorize less, I guess. Obviously, the Appropriations Committee can always appropriate up to what we authorize, but they can't appropriate more than we authorize.

Mr. BOND. My understanding is that they can.

Mr. HARKIN. They can appropriate more than we authorize?

Mr. LLOYD. No; they may not.

Mr. HARKIN. Unless something has changed in Congress, then we might as well just go home and let the Appropriations Committee handle it.

Mr. LLOYD. Mr. Chairman, they can come up with a supplemental if they want, but they can't appropriate more than what we authorize.

Mr. BOND. Well, first of all, there have been a number of instances in the past where the Appropriations Committee has exceeded authorizations, and my understanding is that if it is not made a point of order on the floor it's fact, and we can expend it.

And furthermore that it's a question of the precise language of each authorization and appropriation bill; but the issue is not as clear as it might be.

Mr. HARKIN. My understanding is that you're right, a point of order can be raised. Obviously, the Appropriations Committee can recommend to appropriate more money if they want, but if this committee or any member thereof objects to it, there's no way the Appropriations Committee can do it. Of course, they can come up with a supplemental request.

Mr. BOND. We've dealt with a number of these issues. Our fiscal accounts are very complicated, and there seems to be a way around all this if the need is there.

Mr. HARKIN. Well, we'll see about that.

Anyway, you said that we have "the task of independently evaluating" and "deciding whether they will meet those challenges." Therefore, we have to come up with authorizations.

Later on, on page 8, you say this committee is "considering the desirability of annual authorizations," and you are "opposed to that idea." You know we have passed annual authorizations, not only this committee, but in the House in the past, and we are going to do so again this year.

I understand the need for a sense of continuity in future funding levels that can be reasonably counted on, as you say, but you just said to me a little bit ago that you do intend to revise your 5-year R. E. & D. plan.

Mr. BOND. We will revise and adjust it every year.

Mr. HARKIN. I guess what you are saying is that you would rather do it without being involved with this committee's involvement in that process.

Mr. BOND. That is not what we said. The statement doesn't say that, and I don't mean to imply it. The committee, I expect, will continue to hold oversight hearings every year. It's a question of whether or not you have to have legislation each year to achieve that, that is a separate issue, and that is what we addressed here.

Mr. HARKIN. I am getting to the point, I guess, in my congressional career, where I wonder what good oversight hearings are unless we have the authorization capability. And if you sit there and tell me that the Appropriations Committee doesn't care what we do, they can go over what we authorize anyway, we might as well just all go home and leave everything to the Appropriations Committee.

Mr. BOND. Well, that is a debate which I am glad I am not a central party to.

Let me give you an example of this conundrum. The Congress just enacted a bill, the noise bill, and portions of it read as follows: "There shall be appropriated—three accounts—no more than and no less than." That's an authorization bill. Now, if you think the Appropriations Committees are going to find that they—well, they won't. They will do what they like. They are not going to feel constrained that they have to follow the dictates of that law, I predict.

Mr. HARKIN. No, but when we send our budget requests to the Budget Committee and the budget is finally passed by the House, the Appropriations Committee have to—they have to stay within the confines of that budget.

Mr. GLICKMAN. Will the gentleman yield?

The problem is, they can reprogram and do other things within the agency that we don't have any control over.

Mr. HARKIN. That's very true. They certainly can.

Mr. LLOYD. If the gentleman would yield?

Mr. HARKIN. I'll be glad to yield.

Mr. LLOYD. Thank you, Mr. Chairman.

I would point out to you that even the moneys that you finally get out of appropriations to the FAA, Mr. Bond, Mr. Albrecht and the people over there can shift those moneys around into other programs. This is not an uncommon practice—and I won't pick on this specific agency—probably far more prevalent in the Department of Defense. I am witness to that, serving on the Armed Services Committee all the time.

Mr. BOND. I don't think we do very much of that in the FAA. The language is always a little hard to pin down, but for the most part, I don't believe we do too much from one category to another.

Mr. HARKIN. Well, we either have the task of "independently evaluating the planned activities and deciding whether they will meet those challenges," or we don't. If we do have that task of independent evaluation, then it seems that the only way that we can do that is through annual authorization.

This subcommittee annually authorizes all of NASA's aeronautical R. & D.; we've had no problems with that, and I think the relationship has been mutually beneficial.

I have a number of other questions, but I want to defer to members of the subcommittee who have come in. I would recognize the gentleman from Kansas, Mr. Glickman.

Mr. GLICKMAN. Thank you. Langborne, it's nice to see you. I will try not to repeat any of the questions.

I would just comment to the gentleman from Iowa. I agree with you. Oversight doesn't mean very much unless all of the operations of the FAA and at certain dates. Otherwise, I kind of agree with Mr. Bond. That's really an appropriate reason for a meaningful piece of sunset legislation. Just terminate the agency every 5 years. Some people would disagree with that. We did it with one agency, the Commodity Futures Trading Commission. It is really the only agency of Government that is actually sunset. It ends every 4 years.

I realize that throws havoc on the agency itself, but there is no other way to effectively keep this carrot and the stick both over the agencies unless they know that their very existence is threatened every, let's

say, 5 years. I don't know how you feel about that, but in terms of appropriate congressional control, I think that is the best way.

Mr. BOND. I think you could suggest the termination of a regulatory commission, the ICC or the CAB, but I have a hard time imagining the State Department going out of existence, or the Defense Department, or even the FAA.

Mr. LLOYD. I am willing to work on it. [Laughter.]

Mr. GLICKMAN. I am not suggesting to you that Congress would ever let them go out of existence, but I am saying the concept is one that may make some realistic sense.

Mr. BOND. And if it's implemented correctly, it will, but if it's not taken seriously and it is pulled to pieces bit by bit, then it won't work.

Mr. GLICKMAN. Let me ask you a couple of questions.

On the ADAP fund for fiscal 1981, how much of that fund will be unexpended?

How much are you going to spend in fiscal 1981 out of ADAP?

Let's go back to this year, fiscal 1980.

Mr. BOND. Yes; in light of the fact that the bill is not enacted for 1981, it's a little hard to say. But we have presented a fiscal plan that would draw the surplus down to zero at the end of approximately 10 years. So we will spend more than we bring in and gradually reduce the surplus.

Now, the questions for 1980 is another question. Those appropriations have all been enacted and we are in the midst of it. We are spending less than comes in, so the surplus continues to build.

Mr. GLICKMAN. And again, the reason why money can't be expended is because when we set budget ceiling, you cannot spend more money out of that account than the Congress has so authorized in the final resolution; is that correct?

Mr. BOND. Well, I think the point is that all the expenditures, whether they come from a trust fund or general revenues, are treated under the same budget ceiling. That's the cause.

Mr. GLICKMAN. How are the revenues treated? Are they lumped with income tax revenues?

Mr. BOND. My understanding is the answer to that is yes, but I'm not an expert on that side. All I know is that we try to get more money and try to—the fact that there is a trust fund up there is not a determining factor. It all has to be squeezed in under the same limits.

Mr. GLICKMAN. Then it really isn't a "trust fund" at all.

Mr. BOND. It is in the sense that the money can't be spent for any other purpose. That is true.

Mr. GLICKMAN. I want to ask you another question that is a bit unrelated. This is a personal experience.

When I came back from Wichita yesterday, I left in a 707 and we waited on the ground for 50 minutes while three planes landed and four took off. In flight, the pilot came back and he said "I understand you're a Congressman, and I just want you to know that we just burned up \$1,600 worth of fuel waiting on the ground to take off."

Are you doing any kind of cost analysis or research into the whole issue of burning fuel in the air and on the ground? And how do you best accommodate—let's say—commercial air carriers who are just burning up such enormous amounts of fuel?

Mr. BOND. Well, let me try to break the questions down into the component parts.

First of all, I don't personally know why your plane held for 50 minutes in Wichita, but I can find that out and I will do so. I speculate that somewhere else in the system where you were going was delayed or down and we gave you a fuel advisory delay to hold you on the ground. You would burn less fuel on the ground than if you were flying around holding somewhere. I speculate, but we'll find that out.

In the question of delays overall—

Mr. GLICKMAN. By the way, that was TWA flight 242. Wichita—St. Louis. Yesterday. The pilot came back and said "No; there's no fuel advisory, they just held us at Wichita." But you find out, OK?

Mr. BOND. I will. That's very unusual. There's no reason to hold. We really work hard on it.

Anyway, from 1976 to 1980, we have doubled the number of delays in our air traffic control system of over 30 minutes. They've gone from 30,000—approximately to 60,000—approximately, and that is at a period when we have been introducing new technology and new radars and so on into our system.

The growth for the years ahead, if anything, is going to be even stronger in terms of air traffic movements because of the growth of business aviation, because of the growth of commuters, and because of the withdrawal of service by the major carriers from the smaller communities.

So put it all together, the prospect of delay in the air traffic control system—capacity, in other words—is going to become even more critical in the next 5 to 10 years. It's only going to get worse.

Mr. GLICKMAN. I know so much of your research is on traffic avoidance and collection avoidance.

Is any of your research being pinpointed to fuel-use reduction in connection with traffic delays?

Mr. BOND. Oh; a whole family of efforts, both operational and technological, are directed at fuel reduction. System capacity. Very much so.

Mr. GLICKMAN. In light of that, the memo from the staff said "Although FAA is consulting with part of its user community, it does not have a continuing technical advisory group."

Mr. BOND. That's true. That was a question that the chairman brought up earlier. I guess we have had some hesitancy to have a permanent technical advisory committee. There was one in the past. It was abolished early in the administration because a lot of other committees were abolished, and the feeling was that it was not all that useful.

What we have substituted for it in the last 3 years—my time on my watch—was a more comprehensive working relationship with the user community on new initiatives in engineering and development. It was a very large deal; five working groups, hundreds of people on reports, so that the user community and the technical community would understand what we were up to and hopefully agree with and, in most cases, that's been done.

But we think we have achieved much of the goals of a permanent advisory committee.

Mr. GLICKMAN. OK, that's fine. I would just close by saying that we are facing a shortage of gasoline in general aviation because the major

refinery in Texas blew up. I would hope that you would not have the relationship with the users on technical matters and construction matters, but particularly in the issue of fuel consumption, because, as I understand it right now, there is no substitute for the kind of petroleum that we use in jet aircraft, period.

Mr. BOND. That's correct; other than more jet fuel.

Mr. LLOYD. That's simply not true. We're not locked into a specific type fuel. We have far more latitude in a jet engine or a turbine engine than we do in a reciprocating engine with regard to the use of fuel. As long as you can filter it, you can burn home-heating oil. All you have to do is set the pumps for it, and it can be done.

Mr. GLICKMAN. But it's all petroleum based.

Mr. LLOYD. Oh; I'm sorry. If you're saying that, the answer is, "Yes."

Mr. GLICKMAN. You know, I've seen the cost of a ticket go up 100 percent in the last 3 years, and its primarily fuel oriented, and that's just got to be focus of your concern—or nobody's going to be able to fly.

Mr. BOND. Well, it is, indeed, a focus of our concern and we are working in many areas: wake vortex avoidance, which is essentially a capacity—increasing device; cutting down separation and profile descents; centralized flow control, which is a way of, among other things, weather avoidance; and better weather reporting. There is a lot of delay associated with weather. Increasing our information on weather—and that's in our system as well, in our NEXRAD program—is aimed at fuel efficiency.

In truth, the air carriers have made spectacular improvements, by any standard that I know of, in fuel efficiency over the last 5 years, and I predict that it's going to continue.

We are doing a little better on our end, the engines are getting more efficient, the aircraft turbines are bigger and more productive and, therefore, there's less fuel usage per seat. So the trend is in the right direction.

Mr. GLICKMAN. Thank you, Mr. Chairman.

Mr. HARKIN. Thank you. Mr. Goldwater?

Mr. GOLDWATER. This subcommittee has been interested in getting the cooperation of the FAA to assign discrete VHF frequencies to uncontrolled fields in order to provide better communications between airplanes. We don't seem to be able to get any real dialog as to what problems you see in it. You tell us that the reason you can't go along with it is because there are no available frequencies, and yet you are trying to get frequencies yourself for ATS—automated terminal system. I am wondering which way it is and what the real problems are with that kind of idea. It seems very simple and straightforward, and nonbureaucratic to just assign a frequency that's not being used in that particular area.

Mr. BOND. Well; I was flying out of Manassas the other day and was listening to the UNICOM at Teterboro, and I know the problem you're talking about; there are no frequencies.

I would like to ask Al to answer that question. He is an expert since he is more than 50 miles from home.

Mr. ALBRECHT. Thanks a lot.

Mr. GOLDWATER. I don't want to keep beating a dead horse if it's already dead, but I want to know if it's dead.

Mr. ALBRECHT. Well; let me try to tell you where we are now.

Mr. GOLDWATER. What's wrong with that idea?

Mr. ALBRECHT. There is nothing wrong with the basic idea, Mr. Congressman. Let's separate the questions. Let's talk about ATS. ATS was envisioned as a device that could be used at small airfields in lieu of a tower, and, as far as the R. & D. program is concerned, we attempted to develop technical solutions that assumed the use of a frequency.

The assumption was made on the basis that if a tower is there, they need communication coverage, and that same communication coverage would apply to ATS. It might have been a wrong assumption, but that's the basis on which that development program was concluded.

As far as the real problem is concerned, the use of UNICOM frequencies and why can't we find more and assign them to small airfields, this is—thank goodness—not a basic R. & D. problem, it's an operating service problem, but let me tell you what we've done.

These frequencies are not controlled by the FAA. The FCC issues these frequencies upon request from operators, and we have a close working relationship with the FCC. But if you look at the distribution of 100 megahertz separation frequencies right now, it is very non-uniform. At 122.7 there are 97 frequencies assigned; at 122.8, there are 1,807 assigned; at 123, there are 441 assigned. So the distribution is sort of askew.

Now, we are working to try to change this distribution. In fact, in the February 7, 1980 edition of "Notices to Airmen," a frequency assignment plan is being implemented in 15 areas of the country to attempt to smooth out this problem somewhat.

But part of the basic problem is one of equipment, as we've mentioned before. I think we, with the FCC, will do all we can to clear up the current 100 megahertz separation and distribution problem, but nevertheless, sooner or later, someone's got to carry equipment that can allow 50 and even 25 megahertz separation to free up enough frequencies—make them available—so that they can be used. So it's a combination of our working with the FCC and the users and operators being willing to change over as far as their equipment is concerned. That's where we are.

Mr. GOLDWATER. Well, the idea here is to try and find a usable frequency that's not being used in that particular area. A tower frequency, for instance, that's not being used. It's not a matter of finding a brandnew, previously unused frequency. I think the concept is to find a frequency—such as a tower frequency—that's not being used in that particular area.

Mr. ALBRECHT. Well, since we talked a year ago, it's clear that we've been unsuccessful in that approach.

Mr. GOLDWATER. Have you tried that?

Mr. ALBRECHT. The operating services have worked very hard on it in this area, and I think—

Mr. GOLDWATER. But have they been trying to find a brand new frequency or are they looking at commonly used frequencies which may not be assigned in that particular area.

Mr. ALBRECHT. I think they've been looking at both. They've been looking at frequencies as assigned and looking at the possibility for obtaining other frequencies. It is my understanding they have not been successful.

Mr. GOLDWATER. And who is this?

Mr. ALBRECHT. The operating services—air traffic and airway facilities people.

Mr. GOLDWATER. Who would I talk to over there?

Mr. ALBRECHT. Warren Sharp.

Mr. GOLDWATER. This frequency problem is bigger than just the ATS and the self-service concept. NASA is working on a system called automatic pilot advisory system, which has the same frequency problem. The FAA will hopefully eventually install automatic weather reporting systems at the approximately 900 airports which now have published IFR approaches, but no weather reporting. These automatic weather systems will need frequencies, too. So will high-altitude flight watch and the approach light systems which are turned on by pilots keying their microphones.

It seems that the R. & D. people are operating completely independently from the frequency management people.

Mr. ALBRECHT. I don't think that's true, Mr. Congressman. The R. & D. people are working closely with our frequency assignment personnel in terms of making sure they understand our forecasted needs.

Now, providing frequencies is not an R. & D. function, so when this doesn't take place in a timely manner it is a problem and we are, of course, addressing it.

Mr. GOLDWATER. Would it be possible to get from you a frequency plan?

Mr. ALBRECHT. Yes. We can certainly show you—first of all—a geographical distribution of assigned frequencies, and we can provide for the record usage of frequencies.

Mr. GOLDWATER. Mr. Bond, at the Science and Technology Committee hearing on January 29 we were in the middle of a discussion on the R. & D. funding level. We discussed about the fact that it's going downhill, you tended to agree, but you never really got a chance to fill in the blanks.

I asked you how you were going to be able to do the necessary work on the new air traffic control computer system, and also complete the R. & D. on all other systems you are working on. Your response was that you couldn't do it all; you had to sort amongst different projects and come up with priorities.

Your response obviously would have been satisfactory if there was no money available. But in fact, there is a \$3.5 billion uncommitted surplus in the trust fund. And I saw the figures for November 1979; that month alone, the surplus grew by \$88 million, which is more than your entire year's R. & D. request for 1981.

I would like to find out more specifics as to projects which you feel are very high priority, yet which, because of DOT and OMB constraints, you had to eliminate from your "desire" list. I intend to work with this committee to try and find out exactly what those areas are and what levels of funding seemed reasonable to you in your initial request to the Department of Transportation.

I wonder if you could start with 1981.

Mr. BOND. I think this is improper—incorrect—to characterize this as though it is under the heel of the Department or the OMB. That's not right. The problem is one of countervailing legitimate public goods, and it operates under a system which the Congress has established.

We discussed this earlier before you came in, but I do not think there is necessarily a villain, other than the system which does not treat trust-fund revenues as mandatorily expended.

Mr. GOLDWATER. Mr. Bond, we've gone through that before—the last time. What I'm looking for is the things that you feel, as Administrator of the FAA, are needed to enhance safety and enhance the air traffic control system.

Mr. BOND. I would accelerate the pace of development of most of the projects—although not all—that are in our system that we have talked about today.

Offhand, I would like to improve our weather capability; I would like to continue the development of our collision avoidance system on a higher—

Mr. GOLDWATER. When you say “weather capability,” how much are you talking about?

Mr. BOND. Well, I don't know. I'm kind of nervous when I get a paper shoved under my nose.

[Material subsequently provided is included later.]

Mr. GOLDWATER. Well, that just keeps it orderly.

Mr. BOND. Well, I've seen them before, and there have been times when I didn't know what they were, and I don't know what this is, either.

Mr. GOLDWATER. Well, it's the FAA R. & D. budget for 1981 through 1985 with some blank spaces left open—

Mr. BOND. Oh.

Mr. GOLDWATER [continuing]. That I'd like to have filled in if we could.

Mr. BOND. Well, I would be happy to provide that for the record if you will let us do that. The inflation numbers, they look correct to me. They are very, very punitive and they do damage the program, there's no question about that.

Mr. GOLDWATER. I understand your situation down there, and I recognize all the constraints on the way we set up the budgetary process, but I think it is important for us to know this information. I mean, you obviously have gone through and prioritized different projects—

Mr. BOND. We have; yes.

Mr. GOLDWATER [continuing]. And obviously, when you draw the bottom line, there's something left out.

Mr. BOND. That's right.

Mr. GOLDWATER. What we'd like to do is have you share that with us, then we can decide for ourselves what we want to do with it. You don't like the constraints, and obviously we don't either.

Mr. BOND. Well, I will be happy to fill in the blanks and do whatever else we can do to meet your request.

Mr. GOLDWATER. And I'd like that back up here in a couple of days.

Mr. BOND. We'll do our best.

Mr. GOLDWATER. Well, I know you have it.

Mr. BOND. There's only a little blank here, but getting there is kind of hard.

Mr. GOLDWATER. I don't think so, because I know you already have that information. It's just a matter of pulling it out of your books. It's not something you have to dream up, it's already in existence.

Mr. BOND. We'll do our best.

Mr. GOLDWATER. I'd like to have it back to me just as soon as possible. In detail. We want to try and help you.

Mr. Albrecht, do you have any problems with that? Do you have any problems with filling those in?

Mr. ALBRECHT. I'm sure we'll have a few problems, Mr. Congressman. You said "in detail." If there is an implication that there are important high-priority programs that have not been included in our budget, I want to set this straight. That's not right.

Mr. GOLDWATER. No implications whatsoever. None at all. I think you guys are doing the best you can under budgetary constraints as set forth by the Congress and the administration. I think it's pretty well acknowledged that these dollars are not enough. Mr. Bond says, "Well, it's the Congress" because Congress put the lid on through the budgetary process. In order to bust through that lid, we've got to be able to make a case. What we want to do is have you help us make that case, and see if we can't get you some additional dollars to fund those projects which I know you want to do, but you can't because of the restrictions.

No implications at all. I'm sure you are putting your available dollars where you think they should be going based on the total picture, but there's some left out. We'd like to have you share that with us in as much detail as possible. I don't think you'll have any trouble doing that, will you?

Mr. BOND. We'll do our best to put it together.

Mr. ALBRECHT. We'll be responsive to it.

[Material to be supplied follows:]

EXTRACT FROM ENCLOSURE 1 OF A LETTER FROM ADMINISTRATOR BOND
TO CHAIRMAN HARKIN, MARCH 12, 1980 IN PART RESPONDING TO
MR. GOLDWATER'S REQUEST

	<u>FY-81</u>	<u>FY-82</u>	<u>FY-83</u>	<u>FY-84</u>	<u>FY-85</u>	<u>Total</u>
Inflation	9.0M	19.0M	33.0M	49.0M	68.2M	178.6
*Doppler Wx radar	-	4.4	4.6	2.9	4.1	16.0
*Add'l. Advanced Computer	-0-	-0-	55.0	97.0	103.0	255.0
Other (see below) ^{1/}	9.0	-0-	-0-	-0-	-0-	9.0
Request Plan	85.0	95.0	100.0	105.0	110.0	495.0
Total	\$103.0	118.4	192.0	254.3	285.3	953.6

* Inflated - 1980 dollar base

^{1/} There are several efforts which could be effectively expedited with positive results on product availability by funding them in FY-1981. They are:

STEP (MLS) - \$5.0M Restoration of the plan to deploy a limited number of MLS systems for user and operators familiarity.

FL-290 - \$1.0 Initiation of studies to establish the feasibility of reducing aircraft separation to 1,000 feet in the airspace above flight level 290. Potential high level benefits in fuel consumption.

DELAY/CAPACITY - \$2.0-Expansion and acceleration of studies to develop new/alternate technological, operating and procedural methods to improve airport capacities and decrease delays.

HUMAN FACTORS - \$1.0M-Expand the cockpit alerting and warning system program to include a study of causes of major accidents and develop additional monitoring and warning capabilities to assist pilots in avoiding the type of accidents that have been catastrophic in the past, and the development of algorithms to detect and prevent the execution of erroneous human directions in a highly automated system.

MR. GOLDWATER. I wanted to thank you, Mr. Bond and Mr. Albrecht, for continuing to work with NASA on the wake vortex alleviation problem. I understand that you have a flight test program using the L-1011 and a more aggressive approach. I'd like to be kept informed on how that's going.

MR. BOND. It's a good program and we're working hard on it and we support it.

MR. ALBRECHT. As I think you may know, Mr. Congressman, we are working cooperatively with Lockheed on that program. We are funding that program. The funding is being supplied by us through NASA to supplement the program. We expect that we will have some preliminary results in April.

MR. GOLDWATER. Mr. Bond, recently I observed some disturbing things in the aviation press concerning the relationship of the Department of Transportation and the FAA. Secretary Goldschmidt reversed the FAA's position on the noise bill without consulting anyone in the FAA. And then he didn't inform FAA what the new compromise was, so the FAA people had to find out from congressional staffers.

In addition to that, the new Secretary's Office was reported to be quite disorganized, resulting in undue delays for approval of FAA's R. & D. and regulatory plans.

I wonder if you could comment on that.

MR. BOND. Well, that's quite a mouthful.

The noise bill compromise was arrived at very quickly. That's correct. However, I don't think anybody knew what was in it—not only the FAA, not the Secretary's Office people—hardly anybody knew what the final details of it were.

We worked very hard with the conferees to try to get portions of it, such as the funding and technical content and the international portion of that bill, straightened out as best we could by language on the floor. And I think we have done our very best on that. I hope we have.

The problem came on the domestic noise portions of it. That's the part that Secretary Goldschmidt addressed, on domestic noise. It's a pretty good deal and I am very happy with it.

I'm trying to think what the rest of your question was. The question of approval of FAA regulations is a perennial one. There is a regulatory council that has been established—that Secretary Adams established—in the OST. We have to send all significant regulations for their approval.

We tend to get frustrated with it a little bit. Sometimes it takes 30 days, 60 days, sometimes a lot more, and sometimes the request comes back for more data. But I cannot honestly tell you that it is a policy that is either cumbersome or unduly delaying our work.

Sometimes we take 3 years to do something, send it over to the OST and demand that it be approved in 20 days, and that's not fair. We do not apply to ourselves the same standards of promptness that we do on the regulatory review OST. Furthermore, many of the complaints about what we produce are right. We are not often that wrong technically, but we are often wrong on the economic analysis of the impact statements that have to be placed in the rule by law, and it is a legitimate criticism of our work. We are trying to do better on that, and

that is a significant shortcoming of FAA regulatory processes and the law requires that we be good at it.

So on the whole, I don't think that there is a significant problem.

Incidentally, safety regulations were not submitted to the Secretary's level until Secretary Adams changed that rule, and that previous policy was based on the statutory language in the Department that safety regulations are vested in the administrator. Secretary Adams changed that policy, but it has caused no difficulty. I want to emphasize that. In fact, I think it has been instructive for us.

More broadly, there has never been a case where any safety decision that I have wanted to make has been overruled by the Secretary, any Secretary, with whom I have ever worked. The relationship has been very, very good. Supportive, tolerant, very good. I don't have any complaints about that. I couldn't say any privately and I won't say it publicly, on the record.

Now the money question is yet another issue. That is subject to all of the difficulties that we have talked about here today, but if we didn't have to deal with the Secretary on it, we'd have to deal with the OMB. I can't conceive of any scheme that would take us out—that would make us an uncontrolled funding mechanism. The Congress would never tolerate that. It is a process we have to go through every year, and it is painful, but it's no less painful for us or Defense than it is for the folks over in OMB that have to make the decisions between highways and us and social programs. The Congress has to make those same decisions as well.

I guess I've tried to touch on everything you alluded to.

Mr. GOLDWATER. Yes. Would you get fired if you went outside the ordinary process and brought public pressure against somebody to increase your funding?

Mr. BOND. Did you mean, for example, a Member of Congress?

Mr. GOLDWATER. Yes; a Member of Congress or the public. Get out and stump.

Mr. BOND. I think that I would be awarded a medal for telling the truth if I were to tell the truth, and so I've tried to stick to that single rule in whatever I do, whether it's before a congressional committee like this or whether it's before a user group or whether it's in my own dining room. If I stick to the truth, I have got to—

Mr. GOLDWATER. Your dining room?

Mr. BOND. Well, all the deals are cut in Washington in dining rooms in Georgetown, at the Democratic Club, the Republican Club or in the cloakroom. I read that in the Washington Post.

Mr. GOLDWATER. Over the years I have been concerned about the relationship between the Administrator and the Secretary of Transportation, and it has not been all that cozy a relationship.

Mr. BOND. They have not in the past, that's true.

Mr. GOLDWATER. I was very pleased to see the relationship that you were able to establish with Secretary Adams, but Secretary Adams is not here now, and Goldschmidt is. I was sorry to hear the same kind of things that I heard in the past. I was wondering if maybe it was not time to reintroduce my bill to separate the two organizations.

Mr. BOND. I want to make it clear that I do not endorse that proposal, Congressman. I don't see any need for it.

Mr. GOLDWATER. I wasn't trying to get your support right away. [Laughter.]

Just lay the groundwork for it.

Mr. BOND. You're on your own. I don't see any need for it, and if I did, I believe I would be willing to say that.

Mr. GOLDWATER. I want to find out more about the DOT Transportation System Center in Cambridge. I think you are planning to give them about \$5.6 million in 1981 out of your \$85 million total. On the surface it seems like your relationship to the Transportation System Center would be like a businessman's relationship to his boss' son.

I was wondering, do you have much discretion over the amount of money you give TSC every year?

Mr. ALBRECHT. The answer is, we have complete discretion, Mr. Goldwater. TSC is a pool of technical talent that is used on a variety of programs, but we fund those programs that we believe they can help support. We have no interference or no directive in terms of how much we need to put up there. It's usually based on their capabilities and how much we think they can handle.

Mr. GOLDWATER. Are you able to hold them accountable for doing a good job or a bad job?

Mr. ALBRECHT. We certainly do. We don't have to pass that responsibility on to anybody else. Organizationally, they work for RASPA, I believe—Research and Special Projects—but we don't have any interference in terms of our direct dealings with TSC. Our relationships are direct between ourselves and the program people in Cambridge.

Mr. GOLDWATER. You have total freedom to come and go as you want as far as—

Mr. ALBRECHT. I feel no inhibition in that direction.

Mr. GOLDWATER. Mr. Chairman, I have some more questions, but I think Mr. Lloyd would probably like to participate.

Mr. HARKIN. Thank you. Mr. Lloyd?

Mr. LLOYD. Thank you, Mr. Chairman. Thank you very much for being here today, Mr. Bond and Mr. Albrecht.

In looking at your 5-year plan, I think there are some things that go a little deeper than just a 5-year plan.

I would like to commence this thing by saying that I thought—contrary to what some other people have thought—the problems of the wide-bodied aircraft, particularly the accident that occurred was handled in a fine manner. I think the public was extremely well served by you and your organization, and I think that aviation was well served.

I think that in the sensationalism of the press, we didn't look at maybe other facets of that problem. I know that you did. I know that I did, and I know that that information is available further down the line. That really is a "tip-of-the-iceberg" type of thing, but it's an important facet, that which the public perceives. So I think you are to be congratulated on that.

As my good friend from Kansas has indicated, he had a problem in an aircraft taking off and the pilot has indicated that the fault lies directly with the FAA. That's an easy way of doing things. I have a sneaky suspicion that the fault did not lie there. I have a suspicion—and I do not know—I don't think he made his gate. I

think what happened was, he was slow coming out of the chocks, and by the time he got out there, he had missed his time, and now he had to wait in line for somebody to put him back into the system.

You're welcome to respond to that, if you like, Mr. Glickman.

Mr. GLICKMAN. No; my only point was that the pilot did not say the fault lay with the FAA, but he seemed to imply that the fault may lie with some employees of the FAA. [Laughter.]

Mr. LLOYD. That's a distinction, all right. The fact remains that there is the implication that somehow those in general aviation who might also be in the system should immediately step aside and that the commercial operator should be given priority at all times.

I don't live under that impression. I don't believe they should be given that kind of priority. I think they should be part of an integrated system which handles all traffic, whether it be military, commercial endeavor or general aviation inclusive of business aircraft.

Again, I think this is a very difficult problem because, when you are operating an aircraft that has the capacity of clicking along at 600 knots, along with another aircraft that has the capacity of clicking along at maybe 80 or 90 knots, clearly this poses tremendous problems on the system. You are working with those, and I think you are headed in the right direction in working with those.

My problem with you and your organization lies in one of determination of who shall be the ultimate operator in the aviation environment.

I get the feeling that you tend to favor your own people who will be all things to all people and the pilot should check with them. I prefer to put some of the control factors back into the cockpit.

Now I recognize that in dealing with somebody who has an air speed indicator, an altimeter, and a fuel indicator, at that point you have a problem in communicating the problems of traffic control, particularly if he operates into an environment which begins to have some complexity to it. And I am certainly not talking about an environment such as Teterboro Airport or Santa Monica Airport or wherever it might be. I'm talking about even the areas of Kansas City or Lincoln, Nebr., or something of that nature.

The point that I make in all of this is I would like to see a definition of just who controls in the ultimate.

We always talk about the ultimate responsibility of the pilot, but in reality, the ultimate responsibility of the pilot used to know all things about FAR's, the operation of a system. And you know as well as I know that the average guy in the system simply does not know all those things. He says he does. He fakes it a little bit. He takes the test that you have worked out for him and he manages to get a 70 or better, and then at that point he's in the system.

The decisions and the safety of the system really do depend on that individual, and I don't think you are adequately addressing the problems of the individual. I think that you are adequately addressing the problems of the system. In other words, you are systems oriented, you are not person oriented, and I would like to see some reversal of that.

I am only speaking from the point of view of a person who has participated in this arena for some period of time at, in reality, all three levels, and as a result I see it perhaps in a slightly different light.

Not only you as the administrator, but your people should see it that way.

I would also like to see a more aggressive program in public awareness. It's a difficult situation. I know that it is. I would like to see an awareness on the part of the public as to the integration of the systems: military, commercial, and general aviation.

You may, in that awareness, have to split up business aviation because if somebody is operating a Lear Jet, he's really in the commercial aviation environment. He has a capacity to do all of the things probably on a par with those flying commercial aviation.

I was pointing out to a friend of mine last night as we were coming out of Indianapolis the problems of operating a general aviation aircraft and how sometimes the controllers get a little carried away. The story that I told was one of my own when I was flying an Aero-commander out in the Los Angeles environment. The aircraft number was 234-CB, or 234-Charlie Bravo, more affectionately known, by the pilots who fly it out of the airport that I operate out of, as Charlie Brown. The aircraft is just known as that. This is not an uncommon situation.

I inadvertently slipped and referred to it as 234-Charlie Brown, which, of course, shattered the operator, and the operator immediately got very offensive and called it 234-Mickey Mouse. I thought that he overreacted. By the way, it was clear and I was on instruments at the time—running from known icing. I had plenty to do besides get into a discussion with some operator who was demonstrating his prowess as the great controller. I speak as a person who has been a controller in GCA, so I do have some appreciation of their problem.

And I think that you have a learning phase in this area. I think it's a people-related problem. This is the emphasis that I want in some of these areas. The military is frankly way ahead of you in research and development, particularly in the control of aircraft in some very hostile atmosphere, whether it's helicopters or fixed wing. I don't think the fault is yours, by the way, I think there could be a better coordination, cooperation with the military in this area. Particularly, for instance, in the MLS range where the Marines have had MRAALS for some period of time.

All of this needs to be addressed, and there are no easy answers. We have a political picture where there is this ebb and flow right here in this august House. We have individuals who have certain specific attitudes with regard to expenditure of funds. And all of these things come into play in your 5-year program.

Obviously, you would like to have more money. You would like to have more people. I really do understand all of these things. But I think that my major concern is where should we put the emphasis? Who has the final say in all of this?

Sometimes I wonder if you fully understand that if you had all of the programs you have discussed with me in the last 4 or 5 years in my very short tenure in Congress, you would have such overwhelming control that you might not have very many aircraft in the sky. And if we don't have many aircraft in the sky, we no longer need you, which is exactly what my friend from Kansas was pointing out.

Even though I would agree with you, Mr. Administrator, I think that there should be a sunset law. I think that there should be a re-

sponsiveness on the part, not only of yourself to Goldschmidt or to the President, but also to your constituency, which, in this case, happens to be people operating aircraft. I'm talking about the full scale now, not just pilots, I'm talking about the passengers.

It's a very, very difficult situation and I really do appreciate the problems that you face. I hope that in some very small measure I can contribute before I leave here something that will somehow help you all do your job better so that I as a pilot can participate in this arena.

You will note that in any of this I really haven't asked any great questions. I feel at this point that we have to get into specific programs, but if you would like to comment on that dissertation, I would be most pleased to hear from you.

Mr. BOND. I think you're right.

Mr. ALBRECHT. I agree, Mr. Lloyd. Without trying to tell you that we're on top of all the issues that you raised, our people programs—our human factors programs—are not very visible in the budget. They are included in our advanced development program.

We are specifically concerned with what goes on in the cockpit and what goes on on the ground, and what is the best mix in terms of responsibilities. We and NASA have a joint program—a human factors program—to take a look at cockpit workload and the various kinds of instrumentation conditions, you know, what can be done.

If you ask me what are some of the larger problems in the computer replacement program—to determine what can be done to improve them—we'll solve the traffic problems, but getting people into that environment effectively and successfully, I think is going to be extremely difficult.

We are concerned about it and we are doing all we can to put our arms around it. We agree with you in terms of emphasis. It's just that you won't see large dollar amounts in the budget because of the nature of the problem. Right now, it isn't subject to large expenditures.

As far as DOD is concerned, I'm sure you know we have a fairly tight coordination committee with DOD, broken down into areas of specialty. Occasionally, we miss something, but I have to say their cooperation has been outstanding in terms of making available to us the results of their research and development program.

Mr. LLOYD. Mr. Albrecht, when you have time I would like to hear a personal briefing on what problems you face in that kind of coordination or cooperative effort. I think this is a very critical area, and I think that military who uses your facilities could do a great deal more.

One of the programs, Mr. Albrecht, that I have suggested to the Air Force, the Navy, and the Army in their service academies is that those who are interested in involvement in aviation, get a commercial instrument rating as a requirement to graduation. I think that has merit.

I don't think anybody should be afforded the opportunity in the military to be designated an aviator who does not have an equivalent civilian designation. I know you don't have a fighter pilot designation in your organization, but certainly you do have designations such as what I have just suggested, and I think that should be fairly integrated. It's idiotic for a guy who's been flying a B-52 to actually come out of the service and not be qualified in your system. It's simply not true. You know it's not true, and I know it's not true. He's competent

to do that. And I know you have your little 50 questions or whatever they are.

I think, though, that that should be done in the initial training phases which quite frankly gives a better appreciation. I would consider that as something you ought to pursue.

I have been perturbed by that, and I intend to pursue it. In serving here in Congress and with the Armed Services Committee and having a little bit of a say in the area that you are dealing with, I think that it would be of benefit to the total operation of the system.

Would you care to comment?

Mr. ALBRECHT. Well, we welcome that sort of discussion, Mr. Lloyd.

Mr. LLOYD. Thank you, Mr. Chairman. I appreciate it.

Mr. HARKIN. Thank you.

We do have one other witness that we want to have before the subcommittee this morning before we have to break at noon.

Mr. Bond, Congressman Goldwater asked you to fill in the blanks of the table he provided.

I'd like to see the answers as soon as possible. I'd also like to see something else. Our staff gave to Mr. Albrecht this morning a list of programs. The top of the page says "Potential Enhancement of Activities in the FAA fiscal year 1981 R. & D. Program." The first line is "Overall allowance for inflation." Do you have that?

Mr. BOND. Yes, sir.

Mr. HARKIN. I would like to have you take a look at that and, if you could, just prioritize those different programs for me.

Mr. BOND. We'll be happy to do that too, sir.

Mr. HARKIN. Thank you very much.

[Material to be supplied follows:]

EXTRACT FROM ENCLOSURE 2 OF A LETTER FROM ADMINISTRATOR BOND TO CHAIRMAN HARKIN,
MARCH 12, 1980 IN PART RESPONDING TO MR. HARKIN'S REQUEST

HOUSE SUBCOMMITTEE ON TRANSPORTATION, AVIATION, AND COMMUNICATIONS

LIST OF
POTENTIAL ENHANCEMENT OF ACTIVITIES
IN THE FAA FY-81 R,E&D PROGRAM

The Subcommittee directed that these activities be prioritized.

Priority 1

Overall Allowance for inflation	\$9.0M
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Priority 2

Capacity enhancement/delay elimination techniques	2.0M
Human factors studies	1.0M
Studies to reduce altitude separation above FL 290	1.0M
Microwave Landing System procurements for tests	5.0M

Priority 3

Alternative navigation systems studies	}	3.0M
Tests on NAVSTAR low cost avionics		
Investigate techniques for processing pulse doppler radar outputs for weather	}	1.1M
Evaluation of techniques for offshore helicopter operations		
En route modernization - studies on automation	}	2.1M
Studies of center-to-center backup techniques		
Tests of critical components for future en route computers		

Priority 4

Runway visibility sensor evaluations	}	.6M
Wake vortex avoidance sensor development		
Wake vortex impact on parallel and interX runways		
Complete wind shear investigations		

Priority 4 Cont.

Voice switching and control development	}	2.0M
Expand voice response demonstrations for FSSs		
Future aircraft separation concepts studies	}	1.2M
Complete pilot-controller interface for terminal areas		
Studies of future general aviation needs and impacts on aircrews and controllers		
Studies to improve selection and evaluation of controllers		
Demonstrations to eliminate landside restrictions		
		\$28.0M

Mr. HARKIN. Mr. Glickman, did you have anything?

Mr. GLICKMAN. No.

Mr. HARKIN. Mr. Goldwater?

Mr. GOLDWATER. Yes.

As you know, NASA's aeronautical R. & D. is down \$18 million. This comes at a time when U.S. manufacturers of wide-bodied aircraft find foreign competition is on the increase. Foreign helicopter competition is going all out. In the commuter aircraft business they seem to have an edge on us.

Aerospace products in this country are the second largest export item. Now this position seems to be threatened because of the declining funding levels for FAA and NASA aeronautical R. & D. I am just wondering if the FAA and the Department of Transportation should reconsider their traditional policy of silence concerning the issue of the Government's role in aeronautical R. & D.

Mr. BOND. Are you through? May I respond to that?

I think that it is divisible in two parts. The work that NASA does is really more relevant to the export side than what we do, because it has to do primarily with air frames. It is critical to that effort.

I am an admirer of the program; I think it has made contributions to our generation of aircraft. It has made contributions to foreign manufacturers' generation of aircraft also, since the data is not proprietary.

In any case, it certainly has advanced the state of the art. And while I don't know very much about the details of the program, a reduction in it strikes me as being as anathematical to export promotion and technology development as the impact of inflation is on ours. It is severe. And I think the country really has got to reexamine its technology and engineering advances, and I think it's got to stick behind it and promote them if this country is to stay solvent.

If we don't do it, surely the Japanese or the Europeans will do it for us.

Mr. GOLDWATER. Traditionally the FAA has been silent on this sticking-behind-and-promoting business. But it seems to me that you have an interest in the health and welfare of the industry, and that would be a good place for more comments and leadership from the administration.

Mr. BOND. The question of promotion which is in our statute has come up in a slightly different context. That is, we have occasionally been accused of being so far on the side of the operators and the manufacturers, that we don't police them in a regulatory way enough. I don't believe that's true.

I think if there is any problem with the way our safety regulations operate, it is entirely our own fault, and it doesn't have anything to do with that language of promotion in the statute.

I view our promotional role as being one of operating a safe, fuel-efficient and capacity-unlimited system. That is the best way we can promote the business, as well as the safety regulations, of course, and the best way to get there, therefore, is for us to have the very best air traffic control system and the very best safety regulations that we can provide. That's the way we promote.

If you look at the comparison between the United States, for example, and foreign countries that do not recognize the right of a non-air-carrier aircraft to fly where they want, our promotional role is very good, because they don't have that business over there.

Mr. GOLDWATER. Do you agree there is a direct relationship between the advancement in the state of the art and the development of the aerospace industry?

Mr. BOND. I think there is indeed, and I mentioned that earlier before you came in. One of the things that is seriously concerning me in the next 5- to 10-year time frame is the possibility of capacity restrictions in our system, which will force either the Congress or the executive branch in some way—Congressman Glickman got the full benefit of this—in some way to limit access to one or another user, and that really does put a cap on technology and industrial growth and jobs. And that's a very alarming prospect.

Mr. ALBRECHT. Mr. Goldwater, it is certainly a valid question whether our overall R. & D. posture is what it should be in terms of being able to support the aerospace industry.

Mr. Bond asked us to take a look—at our own and NASA's overall aircraft-related R. & D. programs to see if there are any gaps and see if there are some things we should be doing that we aren't, where the support should come from Government. We don't have answers yet, but we are looking at that question.

Aside from aircraft, if you look at the air traffic control area for a moment, we fairly aggressively promote U.S.-based air traffic control designs overseas. We have a number of groups working in different countries. Among ourselves, with support from Mitre Corp., we do a large amount of that kind of activity, and this—in the past—has been successful in providing better access to U.S. manufacturers for overseas marketing.

Mr. GOLDWATER. In light of last year's discussion on the microwave landing systems, I would have to agree.

Mr. ALBRECHT. Well, there's a valid question in terms of Government role. If you look at the Japanese and how they organize themselves—from the Government on down through industry—in the market overseas, it is formidable. We don't do it quite that way, and I think it's a valid question: Should we reexamine the way we sell the procedure?

Mr. BOND. I might add that I just came back from a trip to Japan as did Al before me, and the societal difference and the attitudinal differences between ourselves and the Japanese are absolutely striking. Their system is, if I may characterize my own personal trip, takes them a good deal longer to get to a decision, but when they get to one and decide to do it, they grind exceedingly fine and they think in 5-, 10-, 20-year time frames, and they are very successful in what they do.

Many of the U.S. technology promotion programs have suffered from stop-and-go funding and changes in trending any changes in personnel—be it the Secretary, the President, the committee chairman, whatever it is—there are so many players in the game in the United States it is hard to start from here and get to there without something getting in the way.

The Japanese do not suffer from that problem. They all get together. They have more of a consensus. They really won't start until everybody's in agreement, but they really do go from here to there very well.

A lot of the things that we take for granted in the United States—one branch of the Government suing another, and all kinds of anti-competitive things and so on just don't exist in the Japanese society. And I think it's a serious threat.

Mr. GOLDWATER. It is very serious and there's just not one simple answer. There are other constraints, obviously—policy constraints—as far as exports are concerned. And I get very much concerned that our Government is not reviewing these policies to find out what we can eliminate or redo to enhance export activities.

R. & D. is a very basic kind of activity, it seems to me. The better your R. & D., the easier it is to maintain a superior position, if you can keep your advancement ahead of the competition. Obviously, the industry must make the choices of where those applications must be made, but unless they have that kind of push from R. & D., the industry may not have those choices to make. They can only do so much on their own, and there obviously are some legitimate areas for the Government to be involved in. Perhaps a review would be very beneficial in that regard.

Mr. BOND. There is one more comment I might make on this. I find this the case in Japan and I find it in some of the other Western European countries. That is, those governments have taken the attitude—almost since the Second World War—that the development of the industrial infrastructure is of primary importance, and they will catch up where they were behind. The union, management, private sector, government all seem to agree on that, and that they have placed a very high premium on the development of jobs in the private sector, and the governments' efforts at funding for research and development and highways and railways and so on drive toward that goal.

The Americans have placed social programs—especially in the last 15 years—at a much higher rank than many of these other countries have, this competition for funds has bled off the development of technology in the United States.

I know that it's boring and tendentious, but I just have to come back to the fact that more than half of the Government's investments—probably as high as 60 percent of the Federal expenditures today—are entitlement programs, uncontrollable programs, and what is left, which is our program and defense and highway construction and so on, is what is squeezed in the rest of the way through the Federal budget ceiling.

That is the dilemma we face. I would say this, no matter what the administration's policy is, I don't think there's a sound way to go about business. It ought to be reexamined.

Mr. GOLDWATER. If you raise your hand, I can swear you in as a Republican. [Laughter.]

Mr. BOND. There's a capper to that line, and that is that the dilemma was created just as much by the Republicans as it was by the Democrats. There are no villains in the piece. The country just moved in that direction.

Mr. HARKIN. You will yield on that?

I feel somewhat obliged to respond to that. I'll just give you my opinion of what's happening since the Second World War.

It's not been our expenditure, necessarily, on social programs. It has not been that at all. When you look at the amount of money that the United States taxpayer has expended since World War II on social programs, compared with our GNP, and compare that to the spending in the Western European countries and Japan on social programs, compared to their GNP; ours is less since World War II.

I submit to you that what's happened since World War II—our technological failure—has been partly what you described. There has been a very close working relationship of the governments with business in Western European nations and Japan to promote that kind of technological development.

In this country, perhaps it goes back to the early days of labor unions and the contentiousness between management and labor and Government. We've had this going on in our country, at least in my timespan from World War II to today, where business absolutely does not want the Government anywhere around them. It doesn't want labor anywhere around them. Labor doesn't want business involvement in its affairs. So you have these three competing interests, competing against each other when we all ought to be working together as they do in Japan.

I've been to Japan many times. Sometimes it's hard for me to tell where government ends and business takes up; where business ends and government takes up; where management ends and the unions take over, where the labor organizations take over. It is really a blending of all those, and in that way, they are able to progress much faster than we are.

I don't buy the argument that it's been our spending on social programs at all. One of the biggest hunks of money that came out of the taxpayers' pockets since World War II was the funding for the Vietnam war: \$120 to \$150 billion, give or take a few billion here or there, went to fight that war. There were no technological advancements made during that whole period of time. It sapped our economy. We're still paying for it—the debts that were incurred during that period of time.

Not the meager social programs that we've had, of medicare, medicaid, of food stamps. Not those. Not at all. Look at what other countries are spending. It just so happens that their social systems were much more advanced than ours in the past. Much more advanced and developed in terms of the relationship of citizens with government. Perhaps that's because we are a young nation and we're still trying to find out what that relationship is.

But I think if you'll look at those spending levels, and compare them, you can't make the statement you just made.

I don't know that we want to get into a discussion. Mr. Bond made a statement, I wanted to respond.

Mr. GOLDWATER. Well, I'll tell you, I have to agree with Mr. Bond. [Laughter.]

I don't know where the gentleman gets his figures that Western Europe or Japan are spending more on social programs than the United States, I don't think that's true at all.

Mr. HARKIN. Compared to their GNP they are.

Mr. GOLDWATER. The point which I think is being made here is that we've locked ourselves into entitlement programs that do not allow us any discretion on 60-70 percent of the budget. It's not so much the programs. It's the fact we've locked ourselves in. We have social programs that we are unwilling to do anything about—to correct if they're wrong—to eliminate if they're bad. We just keep funding them year after year after year automatically. We have no control over them. That's the point we're making.

We have so few discretionary dollars—less than one-third of the budget that we fight over every year. The rest of the budget is automatic. That's the point, I think, that we're making here. What we need is more flexibility to shift those dollars around.

The other point I would make is that West Germany—and I think Japan—recognize that social welfare oftentimes takes care of itself if the country's economy is stable and progressive and industry is advancing. People who are working do not need welfare. In Japan and West Germany, they put their emphasis on industrial production and creating incentives for industry and business to create jobs, which then takes care of the social programs. Here in the United States, we have the opposite attitude. We figure that industry is not important—that business activity is not important. We somehow lose the correlation between jobs and welfare, and we assume that we've got to take care of everybody.

Well, I think that is a Catch-22. It's digging your own grave, because what you're doing is emphasizing social welfare instead of social production. The latter could, in essence, solve welfare problems through creating jobs.

Well, anyway—I wanted to ask you one more question about commuter airline safety. There's a great deal of discussion and emphasis upon the increasing number of accidents in the commuter and air-taxi area. The Public Works Oversight Subcommittee will be holding hearings on this fairly soon.

I understand that most of the commuter safety problems have to do with a lack of compliance with regulations and perhaps a lack of approach aids. What I'm interested in learning is what research and development projects are you working on which might enhance commuter safety?

Mr. BOND. All right. Our thrust in this area is in a number of ways. It is not, however, primarily in the E. & D. program that we are discussing today. The approach aids and the radar coverage and the capacity improvements which apply across the board will help commuter safety. No question about it. Plus capital investments to provide nav aids where needed.

Our thrust in commuter safety is primarily a regulatory thrust—a safety regulatory thrust. Better training, better maintenance, better surveillance by our people, higher quality pilots, upgraded standards and so on, and also down the track, better aircraft through our part 24 development and the new generation of commuter aircraft that is coming along, is really exciting and fuel efficient. They are just hopping right out of the woodwork. We've had about four new aircraft announced in the last 6 months that will be especially tailored for commuters. They will be turboprops and will be very fuel efficient. I pre-

dict the renewal of turboprop in all aircraft sizes—larger sizes—that we use now incidentally because of the fuel efficiency, and because of the work that NASA is doing on propeller design and airframe drag characteristics for turboprop, I recently saw that they are going to achieve maybe 0.75 mach at the upper side with props. If that can happen, it will really be good news for us.

Anyway, our thrust in commuter safety is primarily regulatory at the moment, plus system expansion for smaller airports.

Mr. GOLDWATER. What about the navigational aids?

Mr. BOND. When I mean system expansion, that includes navaids as well, yes. We would like to put more navaids at the airports, but I will have to tell you that the lack of service there is primarily the result of limited funds. The criteria that we apply for ILS's or radar installation or things like that is simply a reflection of the fact that we only have so much money in our facility and equipment budget and we've got to put some into computers and some into this and some into that.

We would expand the service levels if we had more funds.

Mr. GOLDWATER. On the request that I made earlier on this chart, let me ask you something about that. When you start filling in those blanks, do you have to get that signed off by OMB and DOT?

Mr. BOND. Well, I assumed that you had cleared the chart with OMB before you submitted it. [Laughter.]

Mr. GOLDWATER. No; I haven't.

Mr. BOND. Well, we may.

Mr. GOLDWATER. The point is, we could sit here right now and talk about each one of those items. I don't want to take your time now, but at the same time, I don't want this thing laundered through all kinds of different mazes of the bureaucracy. I'd like to find out your working figures which were submitted to DOT.

Mr. BOND. I will see what we can do. We will do our best.

Mr. GOLDWATER. I'm sure somebody in here has got briefing books. They've probably got those figures sitting right here in this room. Right now. But I don't want to take your time if I can get assurance that those are going to be accurate and they are going to reflect exactly what your thinking was at the time. You have your choice. Could you fill those in right now?

Mr. BOND. No, sir.

Mr. ALBRECHT. Not really, no. No, sir.

Mr. GOLDWATER. Could you do it here right now if we took the time?

Mr. BOND. No. I don't think we could.

Mr. ALBRECHT. Not properly.

Mr. GOLDWATER. Not properly?

Mr. ALBRECHT. No.

Mr. GOLDWATER. OK. You're not going to give me any zeroes, are you?

Mr. BOND. I just saw the chart.

Mr. HARKIN. Mr. Volkmer?

Mr. VOLKMER. I would like to ask a couple of general questions, though.

At the time that you began working on DABS and ATARS and microwave landing, that was 4 to 8 years ago?

Mr. BOND. Yes.

Mr. ALBRECHT. Yes, sir.

Mr. VOLKMER. Now, in view of the situation as we see it existing today in the airline industry, and the next 10 years, are you still sticking to the projections that were made at the time that the necessity for all of this was contemplated?

Mr. BOND. Well, if the question is, do we still think that they are necessary, the answer to that is "Yes." Even more so, I think, than they were originally thought to be.

Mr. VOLKMER. Do you envision that commercial aircraft traffic will continue to increase?

Mr. BOND. We anticipate that growth will occur as well, yes.

Mr. VOLKMER. Even with the high cost attributed to it.

Mr. BOND. I can give you our specific figures, but the answer to that is "Yes."

Mr. VOLKMER. I would like to have those figures.

Now, do you see the same increase, say, in the next 10 years in general aviation?

Mr. BOND. We see a greater increase in general aviation usage, especially of our system.

Mr. VOLKMER. Let me ask you this about general aviation fuel. Do you see problems with increase in general aviation?

Mr. BOND. Well, I think we've got to break it down into two pieces. One is gasoline type fuel for general aviation, and the other is kerojet fuel.

Mr. VOLKMER. Let's take it through the gasoline first.

Mr. BOND. Well, that's going to be very tough. The shortages are already showing up around country and I have had a lot of discussions with my friends at AOPA and some of the oil people, and I can tell you why there is a shortage. The reason is that the amount that's used is so small—it's minuscule in terms of gallonage—that even though the price can get much higher, it simply is unproductive for a manufacturer or even a distributor to provide it all, at any price. And the one discussion that was had with a refinery, yes, they could convert their refinery to produce 100 low octane or whatever the GA uses, but it's one day's run for the refinery and millions of dollars to convert back, so the numbers are very unattractive. And, given the demand elsewhere, they'd rather just set it up for diesel fuel or home heating oil or gasoline and automobiles and just run that straight through.

Mr. VOLKMER. That's why I'm asking. If there is no measure taken to correct this and let's say Shell decides, "Forget it! We're out of it!" and other refineries do, too, now what happens to general aviation?

Mr. BOND. Well, general aviation had better find fuel.

Mr. VOLKMER. Let's say it's not there?

Mr. BOND. Well, I think that—oh, my point was that the distribution did not choose to supply it. I suspect that potentially the crude that could be changed into it will be there, and I think that in the medium to long range, they will get fuel.

Mr. VOLKMER. If the refiners don't refine it, you don't have it.

Mr. BOND. Well, I understand that, but I have enough faith in the system. You may recall that the Congress—maybe, 1½ years ago—decontrolled the aviation fuel. There is no longer a price ceiling on aviation fuel.

We now find, with the obligation of a supplier to continue to supply OPA, so it's on the open market, and my guess is that the price will con-

tinue to go up to a point where it becomes economically attractive for somebody to supply it. I hope that's the case.

Mr. VOLKMER. OK. In other words, you are basing your assumption on growth of general aviation on the ability to obtain the fuel.

Mr. BOND. Yes.

Mr. VOLKMER. Where do you see in our modernization of airports for general aviation and VFR? Is that continuing or dropping off?

Mr. BOND. Well, I think that the growth is going to be a little bit less in years ahead in recreational flying, Sunday-type flying, than it will be in business flying. I think that is going to continue very strong indeed. One of the reasons I am so concerned about system capacity as opposed to VFR-type flying is that we are seeing the first of a generation of single-engine, turbocharged, pressurized aircraft with radar fitted into the wing. Now, a plane like that can fly in the system as well as a 747 can, for goodness' sake, and those you can buy for \$85,000.

Mr. HARKIN. Where? I need one badly. If you can get me one for \$85,000 that's radar-equipped, pressurized, I want it.

Mr. BOND. It will be heavily used. Maybe that's underpricing it, but a turbocharged single is up around that price. Maybe not pressurized.

Mr. VOLKMER. Thank you. Would you provide me with the information on commercial forecasts?

Mr. BOND. Demand forecasts? Yes; we will do that.

We were looking at about 2-percent increase per year on system movements for commercials over the next near period and 6 or 7 percent in GA system movements, so you can see where the growth is.

The number of passengers now continue to go up. We are going to see more and more passengers, but from our point of view the system is more than transparent from a testing point of view.

Mr. HARKIN. Thank you, Mr. Volkmer.

Thank you, Mr. Bond and Mr. Albrecht.

We rescheduled a witness for today because of time problems on Thursday. Today we will have Mr. Orman and Dr. Hockaday of Peat, Marwick, Mitchell & Co.

Gentlemen, welcome to the subcommittee. We do have your prepared statement. Without objection it will be made a part of the record in its entirety. Again, you may proceed as you so desire by either reading it or commenting on it or summarizing. Whatever you feel is appropriate.

STATEMENT OF J. C. ORMAN, PRINCIPAL, PEAT, MARWICK, MITCHELL & CO, ACCOMPANIED BY DR. STEPHEN L. M. HOCKADAY, MANAGER, PMM & CO.

Mr. ORMAN. Thank you, Mr. Chairman and members of the subcommittee. Dr. Hockaday and I are pleased to be here today to participate in these hearings on the R. & D. program of FAA.

We will summarize our written statement.

We are from Peat, Marwick, Mitchell & Co.'s airport planning practice which is located in San Mateo, Calif. Our practice has been providing professional advisory services to airport clients throughout the United States and the world since 1946.

We have provided consulting services to more than 400 civil airports during this time period.

Public funds now invested in new airports and airport improvements as a result of our firm's recommendations exceed \$2 billion.

Although most of our work is for public airport sponsors, we have also performed a number of important assignments for the Federal Aviation Administration in the area of capacity and delay. Steve Hockaday serves as a technical project manager for this work for the FAA, and I have served as the firm's responsible principal for this work.

Initially, back in the early 1970's, we assisted FAA by developing a series of mathematical models and a handbook providing techniques for determining capacity of airports and delays to aircraft. These models and the handbook were based on more than 150,000 field observations at 19 high-activity airports in the United States, and we are now the subject of an FAA advisory circular.

Mr. GOLDWATER. What's the subject?

Mr. ORMAN. The models and the handbook are now contained in an advisory circular.

Mr. GOLDWATER. What does it say?

Mr. ORMAN. The advisory circular describes the handbook. The handbook presents procedures for computing capacities and delays for airports. The circular also refers to documentation for the models and model user manuals. They are all in public domain.

Since the mid-seventies we have been assisting the FAA airport improvement task forces in analyzing capacities and delays at the Nations' busiest airports.

These task forces were developed jointly by the FAA Associate Administrator for Air Traffic and Airways Facilities. The FAA Associate Administrator for Engineering and Development, the Air Transport Association of America—the ATA—and the U.S. airlines, and the airport sponsors of the various airports.

This slide 1 shows the task force airports.

Technical work of the task force is complete at Atlanta, Chicago O'Hare, Denver, LaGuardia and Kennedy in New York, and San Francisco. Studies underway in Miami and Los Angeles will be completed early this year. The task force work is being extended to Lambert in St. Louis and Dallas-Fort Worth, among other airports.

The technical discussions we will present today to a large extent are based on the work for the task force airports.

We would like to concentrate our comments on the magnitude and causes of aircraft delays in the system today and in the future, and those generic remedies which appear most promising from our standpoint as technicians.

We do not want to attempt to discuss the full range of questions such as system safety, performance, staffing, productivity. I would like to summarize the points that we would like to leave with you today. Dr. Hockaday's comments will provide further background.

First, the level of delays in the system today is quite serious. It will increase rapidly in the future assuming even a modest growth rate for airline activity. Most of these delays are concentrated in the large hub airports in the major metropolitan areas. The highest delays are experienced during poor weather conditions—IFR conditions—simply because the system operates less efficiently than it does in good weather conditions.

Next, we will discuss three ways to increase capacity and reduce delays ranging from airport improvements to R. & D. programs. Virtually all of these are the subjects of important FAA programs of one type or another.

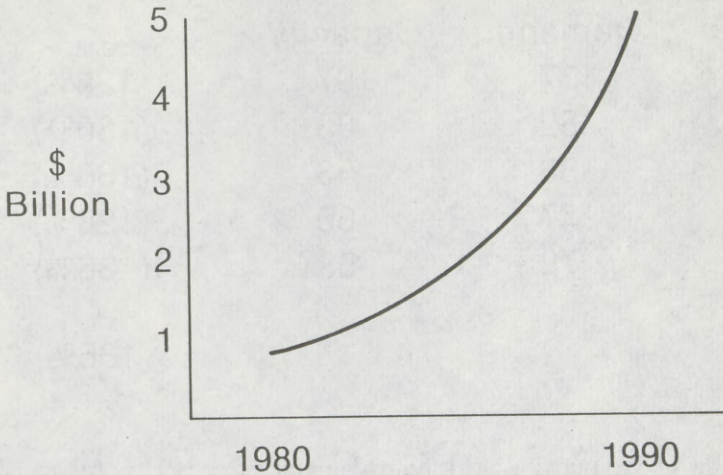
Finally, as mentioned in previous testimony today, unless we are successful in increasing the system capacity, we are faced with the increased use of what we refer to as "demand and delay management techniques, the rationing logic the previous witness referred to. Otherwise, we will have massive and unacceptable delays during the 1980's.

With your permission, Dr. Hockaday now will make a brief statement, and then we'll answer questions that you may have. Thank you.

Dr. Hockaday. Mr. Chairman and members of the subcommittee, I am pleased to be here today to participate in these hearings.

Congestion is severe today and will be much worse in the future. Aircraft delays in the U.S. airport /ATC system in 1979 cost the airlines an estimated \$1 billion. Most of these aircraft delays were concentrated at the Nation's 25 large hub air carrier airports.

COSTS OF DELAYS



SLIDE 2

Slide 2. Current projections indicate that aircraft operations are expected to increase 2 percent per year on average at large hub airports through the 1980's. This modest growth rate will cause annual aircraft delays to increase four times by 1987 and will cost up to \$5 billion per year.

The fuel wasted will also increase fourfold. There are two ways to look at this increase. On one hand, it demonstrates that the aviation system faces congestion and chaos within 10 years. On the other hand, it also justifies an aggressive R. & D. program, because up to \$4 billion a year can be saved just by maintaining delays at today's level.

The high level of delays today and in the future is a direct result of the demand of busy airports regularly exceeding the capacity of the airport, as illustrated in slide 3.

IFR DEMAND — CAPACITY

	Demand	Capacity	
ATL	137	107	(128%)
DEN	82	63	(130%)
JFK	88	53	(166%)
LGA	77	60	(128%)
SFO	72	53	(136%)
Average			(136%)

SLIDE 3

For example, at LaGuardia, peak hour demand exceeds IFR capacity by 28 percent today. The capacities shown here are for instrument flight rules—IFR conditions—when cloud ceiling and visibility are poor. Weather is the most commonly cited cause of delays. Airport congestion and aircraft delays have been attributed to many things, including excessive demand, equipment problems and runway closings. However, on the basis of FAA data for 1979, nearly 90 percent of all aircraft delays are classified as weather related.

Because weather is beyond human control, there is a tendency toward apathy or pessimism about dealing with weather-related problems. Stated another way, the airport/ATC system simply works less efficiently when weather is bad. The FAA requires larger separations between aircraft in instrument-flight-rule conditions than in visual flight rules—VFR conditions.

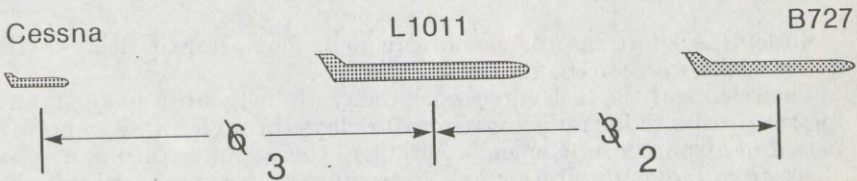
We would now like to focus on three major ways of increasing capacity. The first way, airport improvements, was studied by the task forces. The second way, reduce IFR separations, is the major thrust of the FAA E. & D. capacity program to date. The third way, more IFR arrival streams, is an insight that evolved from the task forces and our work at other airports.

1. AIRPORT IMPROVEMENTS

- Runways, Taxiways, ATC Procedures, Nav aids
- Could Save up to 50% of Delays
- Full Implementation Unlikely

SLIDE 4

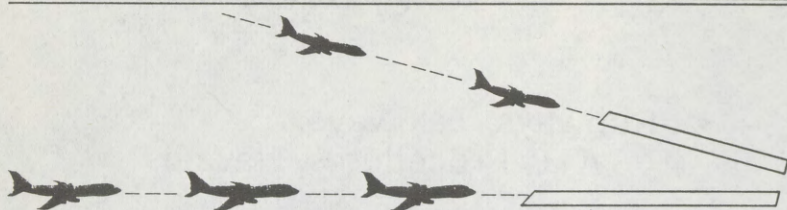
2. REDUCED IFR SEPARATIONS



- Could Save 50-75% of Delays
- Full Implementation Unlikely
- Wake Turbulence Problems

SLIDE 5

3. MORE IFR ARRIVAL STREAMS



- Converging, Reduced Parallels, Small Aircraft Streams, Triples
- Could Save up to 50% of Delays
- Requires New Research

SLIDE 6

Slide 4. Airport improvements can help, but aircraft delays will still be much worse in the future.

The results of the task force work today are helpful in understanding the prospects for reducing aircraft delays through a wide range of potential airport improvements. Although these improvements will be effective in reducing aircraft delays significantly, aircraft delays will still increase rapidly in the future, even if all improvements were implemented.

New runways would provide the greatest benefits, reducing average delays to aircraft by approximately 50 percent. However, new runways are considered potentially feasible at only a few of the large hub airports.

Realistically, implementation of all proposed airport improvements is by no means assured. Conditions external to the assessments of the task forces will have far-reaching implications on the future development and the operation of these airports; for example, inflation—which makes major capital investment programs increasingly prohibitive—and everwidening public sensitivity to environmental quality.

Today, the minimum separation required in IFR conditions between a pair of aircraft on a common approach path is 3 nautical miles, as is shown on slide 5. The separation requirements increase if the leading aircraft of the pair produces wake turbulence that can disturb the flight of the trailing aircraft.

For example, the minimum separation increases to 6 nautical miles when the leading aircraft is heavy and the trailing aircraft is small. The target for minimum separations in the future is to reduce them from the present 3 miles to 2.5 and perhaps 2 miles.

The FAA is currently defining and developing various systems, including hardware, to accomplish this target. The achievement of reduced separations between arrival aircraft at an airport would result in enormous economic benefits. Up to 50 to 75 percent of the delays could be eliminated.

However, there is a real question whether 2- or 2.5-mile separations can be achieved between all aircraft pairs. Achievement of reduced separations without derogating safety requires (1) assurance that wake turbulence is not a hazard; (2) increased accuracy of aircraft positioning in the final approach; (3) improved ATC procedures and automation to accommodate increased data transfer needs; and (4) acceptance by controllers and pilots.

As system development continues, by far the most perplexing and persistent obstacle is wake turbulence. Prototype systems to predict wake turbulence currently being tested have had limited success, and detection of vortexes seems improbable in the short term.

New aircraft being manufactured today still produce serious wakes. Thus, the target reductions in longitudinal aircraft separations, in all likelihood, will not be fully achieved in the future unless there are currently unforeseen breakthroughs.

Additional aircraft arrival streams in IFR conditions can be effective. Analyses of the task force airports as well as other site-specific analyses at high-activity airports point up real opportunities to obtain large capacity and delay payoffs by permitting additional aircraft arrival streams in IFR weather.

A list of eight promising techniques being considered by FAA and various airport sponsors to increase the number of IFR arrival streams is presented in our written testimony. Some examples are given in this slide 6: Converging arrival streams, reduced separations between parallel runways, separate aircraft streams for small aircraft, and triple approaches in IFR weather conditions.

DEMAND AND DELAY MANAGEMENT

- Demand Management Could Save 50% of Delays with Quotas, Redistribution Among Airports, Etc.
- Delay Management Can Minimize Delay Impacts
 - Hold on Ground
 - Flow Control and Metering
 - Revised Priorities for Aircraft Types

Slide 7. Demand and delay management is the other area I would like to discuss. If all of the improvements described previously concerning the airfield, reduced longitudinal separations, and additional arrival streams were implemented, aircraft delays would remain at or below current levels.

Realistically, however, we cannot expect to implement enough of these improvements by the mid-1980's to keep aircraft delays even at current levels. Therefore, it is essential that demand and delay management techniques be explored so that FAA may continue to fulfill its mandate for safe and efficient operation of the airport ATC system.

Management techniques may be unpopular, and they require addressing complex issues such as antitrust considerations, discrimination among users, and free enterprise goals. Furthermore, the means to implement many management techniques are outside the jurisdiction of the FAA.

Nonetheless, the only alternative to such measures will be massive airport congestion with related severe penalties in cost, fuel consumption, and convenience.

It is estimated that demand management techniques could reduce delays by more than 50 percent by the late 1980's. Potential management techniques that could reduce demand to levels lower than airport capacity include enforced quotas and redistribution of air carrier and general aviation traffic among hub airports.

Recognizing that some aircraft delays are inevitable in the aviation system, delay management could be used to insure that delays are minimized and occur in a manner that is least costly and disruptive.

CAPACITY AND DELAY SUMMARY

- Delays are a Major Concern Today
- Modest Growth can Cause Chaos
- 3 Ways to Increase Capacity
Must be Pursued
- Demand and Delay
Management will be Needed

Potential means for accomplishing delay management include fuel advisory departures and gate holds to reduce fuel consumption by substituting delays on the ground for delays in the air, central flow control, en route metering and terminal flow management, and modification of the first-come-first-served rule.

To summarize our statement (slide 8), delays are a major concern today. Modest increases in growth which are projected will cause chaos in the system unless ways to increase capacity are pursued aggressively and demand and delay management tools are made available.

Mr. Chairman, that concludes our statement.

[The prepared statement of Dr. Hockaday follows:]

TESTIMONY OF
STEPHEN L. M. HOCKADAY
MANAGER, PEAT, MARWICK, MITCHELL & CO.

AND

J. C. ORMAN
PRINCIPAL, PEAT, MARWICK, MITCHELL & CO.

BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION,
AVIATION, AND COMMUNICATIONS

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY
UNITED STATES HOUSE OF REPRESENTATIVES

FEBRUARY 19, 1980

Mr. Chairman and Members of the Subcommittee, we are pleased to be here today to participate in these hearings on the FAA's R&D program. The airport consulting practice of Peat, Marwick, Mitchell & Co. (PMM&Co.) has been providing professional advisory services on airport matters throughout the United States and the world since 1946. Most of our work is performed for public airport owners and operators (airport sponsors). We have provided planning, financial, and management consulting services for more than 400 civil and military airports. Public funds now invested in new airports and airport improvements as a result of PMM&Co. planning recommendations exceed \$2 billion.

Since 1972, the Firm has performed a number of assignments for the Federal Aviation Administration (FAA) in the area of airport capacity and aircraft delay. Mr. Orman has served as the Firm's responsible principal for these assignments and Dr. Hockaday has served as the technical project manager.

Initially, PMM&Co. assisted the FAA by developing mathematical models and a handbook which provide techniques for determining the capacity of airports and related delays to aircraft. The models and handbook were based on more than 150,000 field observations at 19 high-activity air carrier and general aviation airports. The techniques were completed

in 1976 and are the subject of FAA Advisory Circular 150/5060-4. (FAA Advisory Circulars are accepted as a standard airport planning reference and are used widely in the planning and evaluation of airports.) In conjunction with this effort, PMM&Co. developed airspace models that extend the capacity/delay techniques to cover the airspace in the terminal area.

Since 1976, PMM&Co. has assisted FAA Airport Improvement Task Forces in analyzing airport capacities and aircraft delays at the nation's busiest airports. These Task Forces were developed jointly by (1) the FAA Associate Administrator for Air Traffic and Airways Facilities, (2) the FAA Associate Administrator for Engineering and Development, (3) the Air Transport Association of America and the U.S. airlines, and (4) the airport sponsors of the various airports. Task Force membership consists of representatives from these organizations.

To date, the technical analyses concerning capacity and delay have been completed for Task Forces at six airports--William B. Hartsfield Atlanta International Airport, Chicago-O'Hare International Airport, Denver Stapleton International Airport, LaGuardia Airport, John F. Kennedy International Airport, and San Francisco International Airport. Task Force analyses at Miami International Airport and Los Angeles International Airport are scheduled for completion early this year. In addition, the Task Force efforts are now being extended

to Lambert-St. Louis International Airport, Dallas/Fort Worth Airport, and others.

The Task Force work has yielded considerable benefits in terms of providing hard "facts" on airport capacity and aircraft delays so that Task Force members can first understand the magnitude of their problems. Task Force members are also learning, at first hand, about those factors that govern capacities and delays at each airport and the effectiveness of proposed improvements, including current FAA Engineering and Development (E&D) programs, to relieve their problems.

The Task Force approach is enabling frequently differing parties to reach a consensus--in some cases, for the first time--on needed improvements at individual airports. A number of improvements have already been implemented as a result of Task Force efforts.

Today, as you have requested, we will concentrate our comments on the magnitude and causes of aircraft delays in the U.S. airport/air traffic control (ATC) system, and those generic development remedies that appear most promising. We will not attempt to discuss considerations of system safety, performance, staffing, productivity, and cost, which, in addition to capacity and delay, will influence the evolution of the airport system of the 1980s.

Congestion Is Severe Today and Will Be Much Worse
in the Future

Aircraft delays in the U.S. airport/ATC system in 1979 cost the airlines alone an estimated \$1 billion. Most of these aircraft delays were concentrated at the nation's 25 large hub air carrier airports.

Available aircraft delay and congestion data, including data from National Airways System Communication (NASCOM) and airline delay reports, confirm that aircraft delays each year are increasing at a significantly faster rate than the growth in aircraft operations. Selected NASCOM data are presented in Exhibit A.

According to the Task Force analyses, aircraft delays at five airports--William B. Hartsfield Atlanta International Airport, Denver Stapleton International Airport, LaGuardia Airport, John F. Kennedy International Airport, and San Francisco International Airport--averaged about 8 minutes per aircraft operation (landing or takeoff) in 1978. During peak periods in instrument flight rule (IFR) conditions, delays reached 1 hour or more. Total annual delays at these five airports amounted to 270,000 hours in 1978.

This high level of delays is a direct result of the demand at these airports regularly exceeding the capacity of the airports, as illustrated in Exhibit B.

Exhibit A

NASCOM DELAY TRENDS--1975 TO 1979
34 Selected Airports

<u>Year</u>	<u>Total airport operations</u>	<u>Number of delays</u>	<u>Number of delays per thousand operations</u>
1975	9,818,403	31,682	3.2
1976	10,378,234	36,196	3.4
1977	10,958,990	39,063	3.5
1978	11,354,471	52,239	4.6
1979	11,800,000 ^b	61,598	5.2 ^b

a. Total number of aircraft delayed 30 minutes and over.

b. Estimated.

Source: Federal Aviation Administration.

Exhibit B

IFR PEAK HOUR DEMAND/CAPACITY COMPARISON--1978

	<u>Demand in typical peak hour</u>	<u>Capacity in typical peak hour</u>	<u>Demand/capacity ratio</u>
William B. Hartsfield Atlanta International Airport	137	107	1.28
Denver Stapleton International Airport	82	63	1.30
John F. Kennedy Inter- national Airport	88	53	1.66
LaGuardia Airport	77	60	1.28
San Francisco Inter- national Airport	72	53	1.36
5 airports combined	456	336	1.36

Source: Task Force Analyses.

Current projections indicate that aircraft operations are expected to increase 2% per year, on average, at these five large hub airports through the 1980s. This modest growth rate will cause annual aircraft delays to increase fourfold by 1987 (to 1,040,000 hours). The annual demand/delay relationship for William B. Hartsfield Atlanta International Airport is illustrated in Exhibit C. As shown, the average annual delay is estimated to exceed 20 minutes per aircraft operation by 1987. During peak periods in IFR conditions, delays will be well in excess of 1 hour.

Weather Is the Most Commonly Cited Cause of Delays

Airport congestion and aircraft delays have been attributed to many things, including excessive demand, equipment problems, and runway closings. However, on the basis of NASCOM data for 1979, summarized in Exhibit D, nearly 90% of all aircraft delays of 30 minutes or more are classified as weather-related. Because weather is beyond human control, there is a tendency toward apathy or pessimism about dealing with weather-related problems.

Stated another way, the airport/ATC system simply works less efficiently when weather is bad.

The FAA requires larger separations between aircraft in instrument flight rule (IFR) conditions than in visual flight

Exhibit D

NASCOM DELAYS BY CAUSE--1979

<u>Cause</u>	<u>Percent of total delays^a</u>
Weather	84%
Weather and equipment	4
Equipment	3
Volume	4
Runway clearance	3
Other	<u>2</u>
	100%

a. Percent of total number of aircraft delayed 30 minutes or more.

Source: Federal Aviation Administration.

rule (VFR) conditions. IFR conditions exist whenever meteorological (weather) conditions are less than required for VFR. The basic difference between IFR and VFR is that the pilot maintains control of spatial orientation of his aircraft by reference to instruments for IFR and by visual reference to the ground for VFR. Flight under VFR requires good visibility, but flight under IFR can be accomplished in poor visibility. Weather conditions that permit flight under VFR are prescribed in Federal Aviation Regulations in terms of visibility and distance from clouds.

In VFR conditions, pilots can see far enough to provide adequate separation from other aircraft. In IFR conditions, separation must be provided by the ATC system. Depending upon the type of equipment and the weight of the aircraft, these separations vary. However, with present-day equipment, separations between aircraft in IFR conditions cannot be as small as in VFR conditions. The requirements for both longitudinal separation (e.g., separation between successive arrival aircraft "in trail") and lateral separation (e.g., spacing between aircraft in arrival streams to parallel runways) are critical in terms of affecting airport capacity and aircraft delays.

Airport Improvements Can Help, but Aircraft Delays Will Still be Much Worse in the Future

The results of the Task Force work to date are helpful in understanding the prospects for reducing aircraft delay

through a wide range of potential airport improvements. A summary of improvements examined by the Task Forces is presented in Exhibit E. Although these improvements would be effective in reducing aircraft delays significantly, aircraft delays will still increase rapidly in the future even if all improvements were implemented.

Assuming all of the improvements contemplated by the Task Forces were implemented (a number have been implemented already), delays in the mid- to late-1980s at the five large hub airports previously cited (William B. Hartsfield Atlanta International Airport, Denver Stapleton International Airport, LaGuardia Airport, John F. Kennedy International Airport, and San Francisco International Airport) would average 12 minutes per operation--roughly half the amount if no improvements were made, but still 50% greater than that today. Without the airport improvements, the delays at the five airports would cost the airlines more than \$1 billion per year; with all the improvements, the cost of the aircraft delays would still amount to about \$600 million, as illustrated in Exhibit F.

For the same five airports, new runways would provide the greatest benefits, reducing average delays to aircraft by approximately 50%. However, new runways are considered potentially

Exhibit E

PARTIAL LIST OF POTENTIAL AIRPORT IMPROVEMENTS
EXAMINED BY TASK FORCES

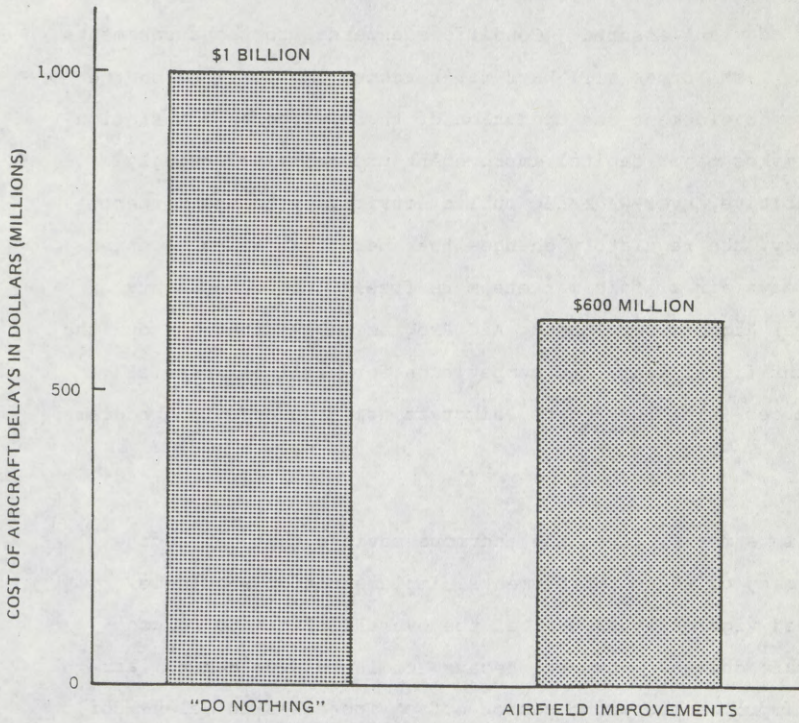
Airfield Facilities

Additional Air Transport Runways
Additional General Utility Runways
Runway Extensions
Taxiways (Exits, Parallel, Dual Parallel Improvements)
Penalty Boxes
Holding Areas

ATC Procedures and Nav aids

Multiple Departure Paths
Staggered Approaches
Intersection Takeoffs
Triple Arrival and Departure Runways
Converging Arrivals in IFR
Removal of Runway Use Restrictions
Additional Ground Control Frequencies
Reduced Interactions With Nearby Airports
Noise Abatement Procedures
Simplified Standard Instrument Departures (SIDS)
Additional Nav aids (ILS, ASDE, HIRL, ALS, VOR/DME, RVR, GS)

EXHIBIT F
IMPACT OF AIRFIELD IMPROVEMENTS AT 5 LARGE HUB AIRPORTS*—1987



*ATL, DEN, JFK, LGA, SFO

Source: Task Force Analyses

feasible at only two of these five airports (William B. Hartsfield Atlanta International Airport and Denver Stapleton International Airport). Other improvements provide more modest reductions in delays.

Realistically, implementation of all of these improvements is by no means assured. Conditions external to the assessments of the Task Forces will have far-reaching implications on the future development and operation of these airports: inflation that makes major capital improvement programs increasingly prohibitive, ever-widening public sensitivity to environmental quality, the regulatory changes that permit airlines to enter and leave air traffic markets more freely, the uncertainty of federal Airport Development Aid Program (ADAP) funds beyond the current fiscal year, and competition for airline financial resources (with fuel costs, aircraft noise suppression programs, etc.).

In summary, given the enormous savings that can accrue from many of these improvements, implementation should be pursued vigorously as part of the overall effort to reduce aircraft delays. However, because of increasing demand, airport improvements alone cannot offset increases in delay--nor, realistically, will they all be implemented by the mid-1980s.

Therefore, other means of reducing airport/ATC delays must be developed. Two major means of reducing delays by increasing system capacity are available:

- Reductions in longitudinal separations between aircraft in IFR conditions
- Development of additional aircraft arrival streams in IFR conditions

Reductions in Longitudinal Separations

Historically, the primary focus of the airport capacity element of FAA's E&D programs has been on increasing the capacity of the system by reducing the minimum IFR radar longitudinal separations between arrival aircraft. The benefits to be obtained will depend on how much these separations can actually be reduced and the details of aircraft operations at individual airports.

Today, the minimum separation required in IFR conditions between a pair of aircraft on a common approach path is 3 nautical miles. The separation requirements increase if the leading aircraft of the pair produces wake turbulence that can disturb the flight of the trailing aircraft. For example, the minimum separation increases to 6 nautical miles when the leading aircraft is heavy (i.e., capable of takeoff weight of 300,000 pounds or more) and the trailing aircraft is small (i.e., less than 12,500 pounds).

Actual aircraft separations are often larger than the minimum separation, because controllers and pilots account for variation in speed and other factors.

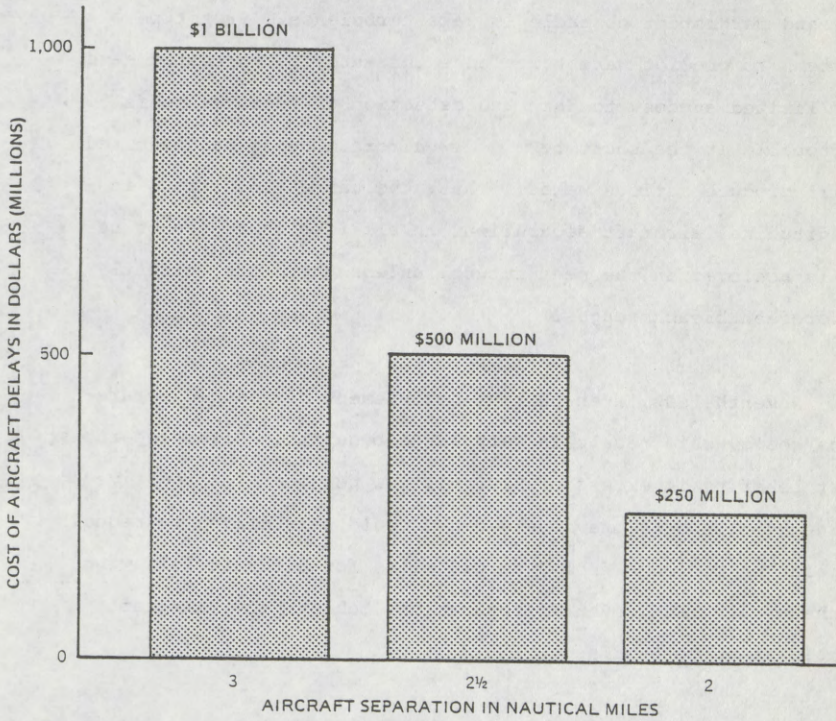
The target for minimum separations in the future is to reduce them from the present 3 miles to 2.5 miles and perhaps to 2 miles. The FAA is currently defining and developing various systems, including hardware, to accomplish this target.

The achievement of reduced separations between arrival aircraft at an airport would result in enormous economic benefits. Analyses performed for the FAA Airport Improvement Task Forces show that if 2-mile separations were achieved at William B. Hartsfield Atlanta International Airport, Denver Stapleton International Airport, John F. Kennedy International Airport, LaGuardia Airport, and San Francisco International Airport, savings in direct airline aircraft operating costs could exceed \$750 million annually by 1987 at these five airports alone, as illustrated in Exhibit G. Corresponding savings for 2.5-mile separations could be on the order of \$500 million per year.

However, there is a question whether 2- or 2.5-mile separations can be achieved between all aircraft pairs. Achievement of reduced separations without derogating safety requires

- (1) assurance that wake turbulence is not a hazard, (2) increased

EXHIBIT G
IMPACT OF REDUCED LONGITUDINAL SEPARATIONS BETWEEN
ARRIVING AIRCRAFT AT 5 LARGE HUB AIRPORTS*—1987



*ATL, DEN, JFK, LGA, SFO

Source: Task Force Analyses

accuracy of aircraft positioning ("station keeping") in the final approach, (3) improved ATC procedures and automation to accommodate increased data transfer needs, and (4) acceptance by controllers and pilots.

As system development continues, by far the most perplexing and persistent obstacle is wake turbulence. Prototype systems to predict wake turbulence currently being tested have had limited success to date and detection of vortexes seems improbable in the short term. New aircraft being manufactured still produce serious wakes. Thus, the target reductions in longitudinal aircraft separations in all likelihood cannot be fully achieved in the near future, unless there are currently unforeseen breakthroughs.

Nevertheless, even partial achievement of reduced separation goals would result in very large benefits. Direct operating cost benefits in excess of \$100 million per year for the five large hub airports previously cited could be realized by reducing separation minimums from 3 to 2.5 miles for aircraft following nonheavy aircraft, even if separations behind heavy aircraft remain at up to 6 miles.

The conclusions are clear: the current FAA programs to reduce minimum IFR radar longitudinal separations between aircraft should be pursued aggressively, even in the face of major

wake turbulence problems. Potential benefits systemwide are on the order of hundreds of millions of dollars each year even if the goals of these programs are only partially accomplished. However, the problems encountered with wake turbulence and other factors mean that any reductions in longitudinal separations will be difficult to attain and additional means of increasing airfield capacity must be pursued.

Additional Aircraft Arrival Streams in IFR Conditions

Analyses at the Task Force airports, as well as other site-specific analyses at high-activity airports, point up real opportunities to obtain large capacity and delay payoffs by permitting additional aircraft arrival streams in IFR weather.

A listing of the more promising techniques being considered by FAA and various airport sponsors to increase the number of IFR arrival streams is presented in Exhibit H. Subject to further analysis of their site-specific operational requirements, it may be possible to implement a number of these techniques within the current technology of the airport/ATC system.

For example, the first item in Exhibit H suggests "reduced spacing between three parallel runways for simultaneous arrivals in IFR conditions." Current ATC rules and procedures permit simultaneous IFR arrivals to two parallel runways if the runways

Exhibit H

TECHNIQUES FOR ADDITIONAL AIRCRAFT ARRIVAL STREAMS

1. Reduced spacing between three parallel runways for simultaneous arrivals in IFR conditions.
2. Reduced spacing between two parallel runways from 4,300 feet to 3,000 feet for simultaneous arrivals in IFR conditions.
3. Reduced longitudinal separations for arrivals to parallel runways separated by less than 4,300 feet in IFR conditions.
4. Independent IFR approaches to converging runways.
5. Independent streams for small aircraft in IFR and VFR conditions.
6. Reduced lateral and vertical separations in the terminal area airspace, including on final approach.
7. Revisions to standards: ATC Handbook, TERPS, FAR, etc.
8. Additional routes in multi-airport terminal areas.

are separated laterally by at least 4,300 feet and equipped with appropriate instruments. At present, if a third independent IFR approach is desired to a third parallel runway, current ATC minimums require the third runway to be separated by 3 miles from the other two parallel runways. The 3-mile separation provides sufficient space for radar separations to be applied.

In practical terms, the current 3-mile separation ATC minimum limits any airport to no more than two independent parallel arrival streams in IFR conditions. This requirement effectively limits the arrival capacity of all airports to between 50 and 70 aircraft operations per hour (depending on site-specific conditions such as aircraft mix). Today, some airports (for example, O'Hare and Atlanta) have IFR peak hour demands in excess of this capacity, and in the future many large hub airports may face this situation.

In the Denver region, the need and location for a new air carrier airport is currently being evaluated. If it is built, and if all air carrier activity is shifted to the new site, this new airport will probably require three independent IFR arrival streams.

Demand and Delay Management

If all the improvements concerning the airfield, reduced longitudinal separations between arriving aircraft, and

additional aircraft arrival streams described previously were implemented, aircraft delays would remain at or below current levels.

The benefits in delay reductions of these improvements could amount to \$5 billion per year or more by the late 1980s. Even partial achievement of improvements should warrant the highest priority by aviation interests.

Realistically, however, we cannot expect to implement enough of these improvements by the mid-1980s to keep aircraft delays even at current levels. Therefore, it is essential that demand and delay management techniques be explored so that FAA may continue to fulfill its mandate for safe and efficient operation of the airport/ATC system.

Management techniques may be unpopular. And they require addressing complex issues such as antitrust considerations, discrimination among users, and free enterprise goals. Furthermore, the means to implement many management techniques are necessarily outside the jurisdiction of FAA. Nonetheless, the only alternative to such measures will be massive airport congestion, with related severe penalties in cost, fuel consumption, and convenience.

It is estimated that demand management techniques could reduce delays by more than 50% by the late 1980s. Potential management techniques that could reduce demand to levels lower than airport capacity include:

- Peak spreading (i.e., increased use of off-peak hours for scheduled flights)
- Enforced quotas
- Redistribution of air carrier and general aviation traffic among hub airports

Recognizing that some aircraft delays are inevitable in the aviation system, delay management could be used to ensure that delays are minimized and occur in a manner that is least costly and disruptive. Potential means for accomplishing delay management include:

- Fuel advisory departures and gate holds to reduce fuel consumption by substituting delays on the ground for delays in the air
- Profile descent
- Central flow control, en route metering, and terminal flow management
- Modification of first-come-first-served-rule

Summary

The following paragraphs summarize the points herein:

1. The level of aircraft delays is serious today, and will worsen rapidly even assuming a modest growth in aircraft operations.

2. The highest number of delays is experienced during IFR conditions because the airport/ATC system operates less efficiently than during VFR conditions.
3. Airport improvements offer a valuable potential in offsetting aircraft delays due to increased demand; realistically, many improvements will not be implemented unless a concerted effort is made at the individual airports.
4. Reductions in (a) longitudinal separations between arrival aircraft and (b) lateral spacing between independent arrival streams would provide major savings in delays now and in the future, and are the subjects of important FAA programs.
5. Unless improvements in airports and reductions in aircraft separations can be achieved in the very near future, demand and delay management techniques must be developed (and used) if massive aircraft delays are to be avoided in the 1980s.

Mr. HARKIN. Thank you very much.

Mr. ROYER?

Mr. ROYER. Thank you very much, Mr. Chairman. First of all, I want to apologize for not getting here sooner. We are marking up a bill in the other committee I serve on in Science and Technology, so I had to sit in there.

I have a couple of quick questions.

Does your report give any specifics pertaining to a particular airport? San Francisco International happens to be in my district, and I am wondering if what's reflected in your study gives any indication of what we might expect if your study was implemented there.

Dr. HOCKADAY. Mr. Royer, yes, our study has included San Francisco International Airport. The projections are that if modest growth continues and significant improvements are not made, there will be much worse congestion than there is today. As you know, delays in good weather at San Francisco International Airport are not that bad, but if a storm comes through, as has happened today, and IFR weather persists, delays of 30 or 40 minutes or more are quite common. That situation will be much worse in the future.

The alternatives available—as we mentioned—include various airport improvements. At San Francisco, it is very difficult to build additional runways, and we may have to rely on the products of the FAA's engineering and development program, either for reduced longitudinal separations, or the provision of additional IFR arrival streams.

However, in the specific case of San Francisco, the prospects are somewhat bleak, and it may be that demand management, including such things as better utilization of the other airports in the hub, or enforcement of quotas at that airport will be necessary.

The need for these demand management techniques can only be alleviated if there are successful conclusions to some of the FAA's research programs.

Mr. ROYER. So what you are saying, then, and I certainly can understand that, is that the study will be helpful in certain areas. Would you have any idea of how many of the airports that you've looked at might be positively impacted because of what you recommend?

Dr. HOCKADAY. Yes. To give some specific examples, one of the pieces of work that was done at Chicago's O'Hare International Airport resulted in the implementation of triple arrival streams. Those arrival streams are capable of saving up to 20 percent or more of the delays at that airport under some conditions.

In another case, we've looked at ways of improving construction management. One 36-hour planned runway closure at William B. Hartsfield-Atlanta International Airport was modified as a result of our work, and more than \$1 million of airline costs were saved for that one 36-hour closure of Atlanta.

So at various airports around the country there are large benefits to be obtained, more at some than at others.

Mr. ROYER. I didn't hear all the testimony this morning, but has the report been out sufficiently long so that you've had an opportunity to get responses back from the airports and analyze what their responses are—positive or otherwise?

Dr. HOCKADAY. Yes. The response from the airport sponsors and the airlines has been very favorable. Airport sponsors, airlines, general aviation, in fact, and the FAA representatives have often—for the first time—been able to understand the nature of the problems at individual airports and the best ways of improving them. And delays have been reduced significantly at many airports around the country and more reductions will occur.

At LaGuardia Airport now, various taxiways are under construction, partly as the result of the work that we're doing. Many of these things will go into place over the next several years.

Mr. ORMAN. I think you can appreciate that not always the airlines, general aviation, FAA, and the airport sponsors do not always agree on things, and the task forces have gained the reputation of being a forum—often for the first time—where these groups have gotten together and agreed on what is required and what is possible within the constraints of the particular airport.

Mr. ROYER. Are there two or three specific recommendations that you are making that you can single out that would have a more positive effect than all others?

Dr. HOCKADAY. Yes, Mr. Royer. One of the areas that seems to offer tremendous potential is the possibility of providing additional arrival streams in IFR weather conditions. The number of arrival streams at many airports goes down as the weather gets poorer, and that is the reason for many of the significant losses in capacity and increases in delay.

Some of the concepts may be described today as feasible within existing technology, and some analyses are being done in FAA at the moment to see if existing technology can be used in addition to that, I suspect that some new technology will be required to take full advantage of the availability of new IFR arrival streams.

Mr. ROYER. I'd like to suggest that if you have any ideas that you might give us for the San Francisco Airport, we surely would be happy to hear from you. That is, other than transferring it to some other public entity.

Thank you, Mr. Chairman.

Mr. HARKIN. Thank you very much, Mr. Royer.

In your investigations and assessments, did you look at the situation of, let's say, airports like Chicago-O'Hare and Atlanta?

What percentage of passengers that fly into Chicago move on to someplace else, they are just going through? Has that assessment ever been done?

Dr. HOCKADAY. At Atlanta, for example, the number is 75 percent of the passengers are connecting. At Chicago and Denver, I believe it's in excess of 50 percent.

Mr. HARKIN. You know, when I am in Iowa—in Des Moines—to get to Washington, I've got to go through Chicago, or sometimes St. Louis. There's never any problem in St. Louis or Kansas City. Huge airport out there in Kansas City. Empty. I mean, it literally is empty. Beautiful airport.

Why, through management or through FAA, can't they divert traffic? Can they say, "Now, airlines, if you're taking people to certain destinations from other points, you have to use Kansas City, utilize St. Louis, and not utilize Chicago."

Mr. ORMAN. We have seen these kinds of changes in the industry over the past 5 years. Places like Cleveland, Denver, Memphis, St. Louis, and Kansas City have started to become hubs for transfer passengers. They have the good weather and they have available capacity, if you will, and the airline networks favor those airports being developed for connecting stations. There are others as well.

Economics will lead the airlines to make those kinds of decisions as much as the Federal Government at this time.

Mr. HARKIN. Is there anything that the Federal Government could do to encourage that, other than just saying, "You gotta do it"? What incentives could be done to get airlines to shift?

Why not use Omaha, Nebr., or Des Moines, Iowa, airport or something like that? People don't care where they land if they are connecting to go on someplace else. Obviously, those are probably too small, but Kansas City is big enough and St. Louis is big enough.

Mr. ORMAN. That would normally be a CAB function rather than an FAA function. CAB's policy is to let the airlines decide which market to serve. The airlines can make these decisions much more freely now than in the past. So, if anything, the Federal Government's course of action has gone the other way.

Mr. HARKIN. Do you know how much savings could be anticipated by just shifting and moving some of that traffic to other airports?

Dr. HOCKADAY. This would be a sheer order-of-magnitude guess, but I would estimate savings of up to 20 percent of the annual delays if you get full movement of connecting traffic to new, uncongested airports.

Mr. HARKIN. Twenty percent of the delays.

Dr. HOCKADAY. Which might be \$1 billion a year by 1990.

Mr. HARKIN. So it's considerable.

Dr. HOCKADAY. Yes. There would have to be a combination of incentives and disincentives to make it happen. The disincentives might include quotas of the kind that are currently employed at LaGuardia and Chicago. They might be strengthened or stiffened or extended to other airports.

I am not sure how the incentives would best be applied, but I know airlines operations respond to economic considerations.

Mr. HARKIN. Would there be a role for the Federal Government in its taxing policy to provide a kind of credit, rebates, or something to passengers to schedule their flying at off-peak hours, for example?

Here's what I'm getting at. Sometimes Congressmen have to fly at certain times. Our schedule is such that we have to go at a certain time, so I get on a plane and go to Chicago. There are a lot of businessmen, Government people who have to travel at a certain time. On the other hand, there are a lot of people who are just taking the plane because that's the time they got the flight. They could go 2 or 3 hours later if the fare were a little bit cheaper or something. They'd do it.

I am just wondering if shifting some of that load to off-peak hours might not be something that the Government could do through its taxing policy.

Mr. ORMAN. We are not in a position of suggesting ways, outside of the capacity and delay area, for effecting that kind of change.

One of the purposes of our testimony is to explain the sheer magnitude of the delay problem. We are talking about—at current prices of fuel—\$5 billion of delays per year in the mid- to late 1980's.

Mr. HARKIN. How much?

Mr. ORMAN. Five billion per year.

Mr. HARKIN. Five billion per year in delays.

Mr. ORMAN. In delays if nothing is done to change the system.

Mr. HARKIN. By when?

Mr. ORMAN. By the mid- to late 1980's.

Mr. HARKIN. Is that \$5 billion in fuel?

Mr. ORMAN. In airline costs. Direct airline operating costs, fuel, crews and so on. Currently, fuel is approaching 50 percent of those costs, as you know.

Mr. HARKIN. About \$2.5 billion in fuel maybe?

Mr. ORMAN. At today's cost, yes. What it will be then, your guess is as good as anyone else's.

That would seem to us to provide plenty of justification to improve the system.

Mr. HARKIN. In response to Mr. Royer's question, you said that the most important project is providing separation in the terminal area through different streams coming in, parallel runways or whatever, getting them at lesser separation than they are now. That would be your first choice.

Could that be this idea of shifting to other airports?

Dr. HOCKADAY. Absolutely. I think that the situation is severe enough that all avenues need investigation.

Mr. HARKIN. Thank you.

Mr. Goldwater?

Mr. GOLDWATER. How much did this study cost the FAA?

Dr. HOCKADAY. I'm not sure. The task forces have been staffed by FAA headquarters personnel, local FAA personnel, for which there are direct costs to FAA. A large amount of effort is being contributed by airport sponsors and by the airlines that is not a cost to the FAA.

Mr. ORMAN. NAFEC has also been involved in the program.

Dr. HOCKADAY. And FAA has had several contractors, including ourselves, involved in the activity.

Mr. GOLDWATER. So you have not been the prime contractor on this.

Dr. HOCKADAY. Yes; we have been the prime contractor, but there have been other contractors.

Mr. GOLDWATER. What's the total amount that your firm was awarded for this?

Dr. HOCKADAY. I'm not sure of the number, but I suspect it's approximately \$1 million.

Mr. GOLDWATER. \$1 million. For how many years?

Dr. HOCKADAY. Five, the work has been going on since 1975.

Mr. GOLDWATER. Could you say that the things you found out are things that we already knew?

Dr. HOCKADAY. I think some of them may be. I think the difference is that for the first time some senior people are getting together and understanding that something has to be done. Some of the things discovered are real innovations, though.

Mr. GOLDWATER. The reason I asked that question is because the recommendation that you are making may not be achievable. In other words, reduced separation. It is purely controlled by the question of wake turbulence? Of if there weren't any other influences on separa-

tion, could the air traffic controllers bring these aircraft closer together?

Dr. HOCKADAY. I think the answer is that while wake turbulence is the most severe constraint, even in the absence of it there are other things that influence the capability—particularly the accuracy of the metering and spacing system to move aircraft together.

Some studies have illustrated that, in IFR conditions, it is feasible to achieve 2-mile separations. The possibilities involve trade-offs against either increased technology, increased productivity or resource requirements, or alternatively, there may be some associated safety hazards.

Mr. GOLDWATER. Wake vortex problems, are they the paramount constraint that prohibits reducing separation?

Dr. HOCKADAY. In my mind, they are one of the largest constraints on reducing longitudinal separation. In terms of reducing other separation, such as lateral separations between runways in IFR conditions and other ways of using multiple IFR streams, I don't think the wake turbulence is necessarily the constraint.

Mr. GOLDWATER. So there we are talking about advancing the state of technology, I assume, before that constraint can be eliminated.

Dr. HOCKADAY. Yes, sir. And to put this testimony in perspective, the recommendations that we are making are not based on any special insight that it will be possible to make these advances in technology.

Our concern is that delays are going to increase very rapidly in the future, and any avenue that we can pursue is worthwhile because the benefits are so very great. I recognize there may be difficulties in reducing longitudinal separation.

Mr. GOLDWATER. When you talk about management techniques, what specifically are you talking about?

Dr. HOCKADAY. The overall intention of a demand management system would be to assure that demand stays less than or equal to the capacity of the airport so that there are not, at any time, large amounts of aircraft flying around waiting to land or waiting to take off. One way that could be done is by using the quota system that is in force at LaGuardia and Chicago where you set the maximum number of aircraft that can use the airport in that hour and divide the available slots up among the aircraft wishing to be served.

Mr. GOLDWATER. How do you do that?

Dr. HOCKADAY. In the past, it's been done through airline negotiations. Because of antitrust considerations that procedure has an uncertain future, and FAA is now simulating an auction to try and find out if it's possible to auction off slots at major airports.

As I mentioned before, these methods are extremely unpopular. It's very hard to find people in the airlines, in the general aviation community, or airport sponsors who would be in favor of these kind of things. But the alternative of not doing anything would result in chaos.

Mr. GOLDWATER. And you are saying that's just around the corner, then?

Mr. ORMAN. Yes. Demand management is a last resort, but we should be looking at it very seriously. We'll need it at the large airports, the high-activity airports.

Mr. GOLDWATER. Did you look at enhancing the capability and availability of reliever airports. Does that impact on this equation very much?

Dr. HOCKADAY. Yes. It impacts directly on the equation. If ways can be found to more closely balance demand and capacity throughout the region's airports, much better use can be made of the airport, the airspace, and the ATC system. That applies both to moving air carrier operations to less densely used air carrier airports and moving general aviation operations to improved reliever airports. I think it's a fundamental part of the problem.

Mr. GOLDWATER. Mr. Chairman, I don't have any further questions.

Mr. HARKIN. Thank you very much.

This concludes our testimony for today. We resume in this room tomorrow morning at 9 a.m.

The subcommittee stands adjourned.

[Whereupon, at 12:10 p.m., the hearing was adjourned.]

H.R. 6721

1981 FAA R. & D. AUTHORIZATION

WEDNESDAY, FEBRUARY 20, 1980

U.S. HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON TRANSPORTATION,
AVIATION AND COMMUNICATIONS,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9 a.m., in room 2325, Rayburn House Office Building, Hon. Tom Harkins, chairman of the subcommittee, presiding.

Mr. HARKIN. The Subcommittee on Transportation, Aviation and Communications will come to order.

Today, the committee will concentrate on the subject of en route computer modernization and the development activities leading up to replacement of the current system. Yesterday, Administrator Bond asked that we defer detailed consideration of this subject until today.

We are pleased to have Mr. Albrecht return and to have Mr. Blake, Deputy Associate Administrator of Engineering and Development, testify this morning.

First, I believe Mr. Goldwater has some remarks he would like to make. Mr. Goldwater?

Mr. GOLDWATER. Thank you, Mr. Chairman. I join you in welcoming our witnesses today, as we address the important subject of the next generation of ATC computers.

Last November, and again last December, two other House subcommittees held hearings on outages of today's ATC computers. Tom Harkin and I testified together at both of those hearings.

We called for a reasoned, planned approach to computer replacement, as opposed to running out and buying the first thing that became available, as others had proposed. We called for the next generation of ATC computers to offer significant improvements in controller productivity, plus flexibility, safety, and fuel savings for controlled aircraft. Others had proposed just going out and buying bigger and faster versions of today's computers, which would not have had any of these improvements.

Now that Tom and I have stuck our necks out and gone on record for this course of action, we have a large stake in seeing that the job is done right. My main worry along these lines is money. With the meager amounts FAA is proposing to use, I'm afraid the job will be done late, or poorly, or both. If this is the case, I certainly don't

relish the thought of all the hearings on the subject which will be held between now and the time the computers are finally working properly.

Thank you, Mr. Chairman.

Mr. HARKIN. Thank you.

Mr. Blake, we have your prepared statement and it will be put in the record in its entirety. As I tell all witnesses, you may proceed in any manner you would like. You may give the whole statement, or summarize it—anything you feel comfortable with.

Mr. BLAKE. Thank you, Mr. Chairman. If you don't mind, I will read the statement.

STATEMENT OF NEAL A. BLAKE, DEPUTY ASSOCIATE ADMINISTRATOR FOR ENGINEERING AND DEVELOPMENT, FEDERAL AVIATION ADMINISTRATION, ACCOMPANIED BY AL P. ALBRECHT, ASSOCIATE ADMINISTRATOR, ENGINEERING AND DEVELOPMENT, FEDERAL AVIATION ADMINISTRATION

Mr. BLAKE. Continued growth in air traffic, the need to achieve high levels of performance and efficiency in the operation of the air traffic control system, and the increasing age and lack of expansion capability of our current ATC computer complex have established the need to plan for a significant upgrading of the ATC automation system in the late 1980 time period. A part of the upgrading will be the replacement of the current 9020 computers in our air route traffic control centers with systems capable of providing significantly greater capacity and reliability.

Today, I will briefly review the forecast traffic growth and its impact on the ATC system, provide an overview of our future automation development program and its relationship to the computer upgrading program, and then present our approach to developing the advanced computer system.

Continued significant growth is expected in the number of aircraft receiving FAA services over the next decade. The first viewgraph (fig. 1) shows the forecast growth in IFR aircraft handled by our air route traffic control centers which is expected to be 62 percent for the period 1978 to 1990.

The greatest percentage of growth is expected to be for general aviation and air-taxi operations with a forecast cumulative increase of 120 percent and 205 percent respectively. Air carrier growth will be slower, showing only a 28-percent increase during the same time period. Military operations are expected to stay at about today's levels.

Overall national growth, however, is not the only factor of importance in determining when our current computer systems will start to reach their capacity limits. The next viewgraph (fig. 2) shows the average number of aircraft controlled by each center for 1979 with a forecast for 1990.

Several of the centers, including Cleveland and Chicago, have already had peak day traffic counts in excess of 7,000 aircraft. As shown, traffic growth is not expected to be uniform at each facility with forecast growth varying between 35 and 67 percent.

The peak of busy-hour traffic (fig. 3), you will note, is nearly 50 percent higher for the average day and is an important factor in estimating when a computer system will reach its limits.

Going now to the next viewgraph, (fig. 4), although the initial focus of the advanced computer program is on replacing en route computers, the applicability of the computer system architecture to the terminal ATC facilities will also be looked at during the course of our program. This picture shows the summary of all operations for FAA-towered airports. Based on the September 1979 forecasts of aviation activity, the overall growth between 1978 and 1990 is forecast to be 47 percent.

Again, the largest percentage growth is expected to be in general aviation and air-taxi-commuter operations with forecast increases of 47 percent and 125 percent respectively. Air carrier growth is expected to be 28 percent, and military operations are expected to remain about as they are today.

In examining the capabilities of our computer systems, we have found that they have adequate capacity to meet our current and near-term future needs. As we look farther into the future, however, we believe that continued growth in traffic will cause some of our en route systems, performing the current set of air traffic control functions with some near-term enhancements, to begin to reach their capacity limits in the late 1980's. We expect that all systems will need to be replaced by the early 1990's.

Going now to the next picture (fig. 5), although the need for increased capacity is a major factor driving us toward upgrading our computer systems, it is not the only one, and perhaps not the most important one.

If no further improvements are made to our automated ATC system due to lack of computer system expansion capability, the impact of continued growth is expected to be increased delay, additional excess fuel burned, and continued growth in the operations costs in the system as controller staffing increases will parallel traffic growth as shown in this picture.

Hence we believe that the requirement to continually improve system performances and productivity to avoid these penalties is a compelling reason for proceeding with the development of higher levels of automation capability. Achievement of these higher levels, however, requires computer systems with significantly increased capacity and reliability over that which we can obtain with our current mid-1960's technology system.

In determining the requirements for improvements to the air traffic control system and approaches to meeting those requirements, FAA and the Office of the Secretary have sponsored a number of studies over the years which have drawn on the experience of the users and operators of the system to define needed improvements in the air traffic control system and on the expertise of industry to determine what was possible within the current and projected state-of-the-art in such areas as surveillance, navigation, communications, airborne systems, satellite systems and data processing.

The next two pictures (fig. 6) list some of the key studies which have shaped the evolution of the air traffic control automation.

Project Beacon, completed in the early 1960's, recommended automation, widespread use of the air traffic control radar beacon system

for surveillance, and segregation of controlled and uncontrolled traffic flows. The recommendations of this committee resulted in the development and implementation in the late 1960's and early 1970's of the NAS en route 9020 systems and the ARTS family of terminal systems, which provided the basic automation capabilities of flight data processing and radar data processing.

In 1968, the Office of the Secretary of Transportation established the Air Traffic Control Advisory Committee. The traffic congestion, delays, increasing number of near midair and midair collision situations, and increasing flight risk resulting from increased aircraft density led this committee to recommend development of higher levels of automation, intermittent positive control, which has subsequently been renamed automatic traffic advisory and resolution service, airport runway system improvements for increased capacity at major airports, and the microwave landing system.

The recommendations of the committee formed the genesis of much of our current development program and produced automation programs which include conflict alert and minimum safe-altitude warning functions, which have been implemented, and the automatic traffic advisory and resolution service, conflict resolution for en route traffic, electronic tabular displays, and other systems which are still under development.

The committee also recommended that exploration of still higher levels of automation and the application of satellite technology to the air traffic control system be evaluated for the longer term.

In 1972, DOT initiated the advanced air traffic management system program in response to this latter recommendation. This program was to take what was referred to as the clean sheet of paper approach, since industry was asked to take an unconstrained look at developing concepts for the future ATC system design.

The 4 years of industry studies, which were conducted under the advanced air traffic management system, AATMS program, concluded that the air traffic control system should continue to be improved in an evolutionary manner, that higher levels of automation were highly beneficial to the air traffic control process, and further, that continued activity to explore the application of satellites to the air traffic control system was desirable.

To the next picture. In 1978, FAA again went to industry and the user community through the new E. & D. initiatives program and asked for their assistance in answering certain fundamental questions regarding the direction our future air traffic control developments should take.

Some of the recommendations of this committee are shown on this picture (fig. 6 cont.).

First, development of the air traffic control system should continue to be evolutionary. Second, air traffic control clearance generation should continue to be a ground system function. Third, air traffic control clearance execution should continue to be an airborne function. Fourth, additional application of automation to air traffic control will increase safety, improve productivity, and reduce fuel costs.

Automated clearance generation is acceptable to the user community. Some form of cockpit responsibility for separation is acceptable, and

an air traffic control computer system replacement is needed to support these developments.

Based on the results and findings of these studies and activities, engineering and development has prepared a scenario for the national airspace system near the turn of the century which calls for a significantly increased level of automation (figure 7). Our air traffic service has also developed their own picture of what the ATC system should be in the year 2010. This scenario also envisions a very high level of automation in the ground air traffic control system. We plan to start the process of merging these two scenarios soon.

Several years ago, we initiated an advanced en route automation program—called AERA—to determine the feasibility of achieving higher levels of automated assistance for the controller. This program, to date, has examined the feasibility of automatically generating clearances which are essentially conflict free for some 10 to 20 minutes into the future. This program has given us a first look at the computer processing capacity and reliability requirements needed to support the higher levels of automation.

The AERA program, however, is only one part of the overall automation program. This viewgraph shows some of the major elements of that program including AERA (figure 8).

I have divided the potential improvements into two groups; namely, those which we believe can be added to the present 9020 computers, and those which require the increased capacity and reliability of a new computer system.

The first group includes en route minimum safe altitude warning, where implementation has started, conflict resolution for the en route controller, en route metering and possibly some elements of an integrated flow management system to feed the terminal traffic system.

Electronic tabular displays of planning information for the en route controllers and a similar system for terminal controllers represent an automation capability that will be available about the time of the computer replacement. If we implemented prior to replacement, a separate external processor will probably be needed to "offload" that function for the 9020.

We expect that our current computers will start to reach saturation loading due to traffic growth in the late 1980's. Studies underway, which we hope to complete this year, will determine the approximate time at which each center's computer system will approach its capacity limit. In some cases, it may be necessary to offload some of the existing non-air traffic control functions, such as data recording, as an interim measure, particularly during peak traffic periods, in order to extend the useful lifetime of the current computers until the new system is, in fact, available.

Automation programs currently in a relatively early development phase include determination of optimum fuel paths and profiles, an integrated flow management system, automated planning and coordination for direct route flights and automatic generation of conflict-free clearances.

These programs comprise the major elements of our advanced automation program and are expected to mature starting in the late 1980 time period. All of these functions, however, will require the expanded capabilities of a more advanced computer system.

Although the general trend is toward higher levels of automation in both our ground and airborne systems, there are a number of choices to be made during the evolution to the future system.

Mr. LLOYD. You are talking about an advanced computer system. Are you in any way working with the military on this, since they seem to be working on a whole new series of computers? It occurred to me that there might be some savings because of the similarity of application.

Mr. BLAKE. We are following all the military programs and NASA's programs.

Mr. LLOYD. No; I am asking you if you are—you say "We are going to acquire a new computer capability," based on the state of the art, I presume. And at this point, what I'm really trying to get you to do is to tell me that you are actively seeking communications with the military. If not, I would be glad to assist you, because I think that there are savings that could be had.

I don't know what they are doing over there totally, but I have an idea of where they are going in the areas of computers. As a result, I think they clearly can do exactly what you want done, and there's no reason to invent the wheel one more time.

Mr. ALBRECHT. Mr. Lloyd, perhaps we can do more, but we are actively working with DOD.

Mr. LLOYD. OK. That's fine. If you say you are, that's all I'm asking.

Mr. ALBRECHT. We are certainly going to take advantage of anything that they are doing.

Mr. LLOYD. Thank you, sir.

Thank you, Mr. Chairman.

Mr. BLAKE. As you will see in some of the later viewgraphs, this close liaison is a part of our program.

Although the general trend is toward higher levels of automation in both our ground and airborne systems, there are a number of choices to be made as we evolve to the new system. These choices fall generally into three classes; namely, design choices relating to the ground automation system; changes in the division of responsibility for aircraft separation between the controller and the pilot; and use of alternative systems, such as satellites in the surveillance and communications areas.

I would like to touch on each of these briefly and indicate how changes in direction resulting from these future decisions would be handled and what effect this would have on the advanced computer system design.

The first category includes: Possible changes in the role of primary radar with the use gradually shifting from one of surveillance to primarily one of real-time weather acquisition; incorporation of terminal control functions into the en route system; and changes in the role of the controller with increasingly higher levels of automation.

Now, to illustrate the effect this type of change would have on the computer system, we can examine the approach to surveillance processing in our current system and the evolution which might occur should the surveillance function be based entirely on the Discrete Address Beacon System/Air Traffic Control Radar Beacon System (DABS/ATCRBS) in the future.

The majority of the primary radar processing is currently done in a special purpose processor located out at the radar site. The impact of changing surveillance based entirely on secondary radar would fall primarily on the programs executed in the processor located at that site.

In planning the software for the advanced computer system, one of the assumptions underlying its design is that the programming should be conducted in a way that the software associated with the primary radar processing function be a self-contained module, which can be replaced easily when the surveillance system is changed.

The second area shown here relates to the impact that changes in the division of aircraft separation responsibility between the controller and the pilot would have on the future computer system.

We have underway, as you know, a joint program with NASA to examine various divisions of responsibility between the air and ground systems. The initial phases of this work have indicated that even though certain functions, for example, maintaining a fixed separation on the aircraft ahead through the use of the cockpit display of traffic information, may, in fact, be delegated to the pilot. The effect this has on the ground-based system is rather minimal. This is true because the ground air traffic control system must perform certain fundamental tasks to assure an efficient flow of traffic along the route structure and into and out of our major terminal areas.

These functions include all of the functions currently performed by the existing automation systems and those functions associated with the metering and spacing of traffic into and out of the major terminal areas. It also includes those functions such as conflict alert, which warn the controller when violations of separations minima are imminent. Again, the impact on the ground computer system of a future decision to delegate additional responsibilities to the pilots of equipped aircraft we think will be very minimal.

Looking now to the somewhat longer term, perhaps the mid- to late 1990's, we are continuing to examine the feasibility of use of satellite-based systems to support some of the air traffic control functions.

Let me just select one and assess its impact on system design. One proposal which has been made is to use satellite-based systems to provide either dependent or independent surveillance information to the air traffic control system.

As noted earlier, the majority of the surveillance processing is done in an external processor associated with the surveillance sensor. In the event that the satellite surveillance data were to be used by the future air traffic control system, the major impact of that change would be on the logic executed in the surveillance processor.

As in the case of the conversion to a surveillance system based solely on the DABS/ATCRBS system, which we looked at a moment ago, changes to the air traffic control computer program we think would be very minimal.

In the written testimony is a detailed layout of the development roadmap (figure 9). This shows not only the advanced computer transition, but also the automation programs being developed which would operate in that system.

I would like to take you now on a guided tour of this development roadmap for our future automation system, which shows the planned

time phasing for some of the major automation-related equipment and software systems.

The top part of this viewgraph is an artists concept that shows the type of growth in the number of controllers that can be expected as traffic continues to grow through the period 1980 to the year 2000. Superimposed on this graph is an indication of the potential for reduction in staffing we feel may be possible.

Mr. LLOYD. In looking at your chart, have you in any way projected the clear possibility that there will not be an increase as a result of the energy shortage? For instance, the problems we are experiencing just on general aviation fuel because of a shutdown of a refinery. Are we really going to expect that continued growth on that basis?

Mr. BLAKE. We believe we will. I think, as Mr. Bond indicated yesterday, the gasoline shortage for general aviation should be a fairly temporary matter, and as we showed at the beginning of this talk, we expect a fairly healthy growth, particularly in general aviation and air-taxi operations.

Mr. VOLKMER. Will the gentleman yield on that?

I'd like to ask you if you had contacted the refining companies in regard to their position for the future in refining for general aviation fuel, both for the kerosene type for the small jets and the gasoline type for your regular engines?

Mr. BLAKE. There was a gentleman here yesterday who has made that contact. I personally haven't. He believes that the fuel situation will improve.

Mr. VOLKMER. Would you be so kind as to have that gentleman furnish me with what companies he contacted, and their response, as to the future refining for general aviation; what their projections are in the company? I would appreciate it.

Mr. LLOYD. If I might add, Mr. Chairman, I would appreciate the same information being furnished to the committee, because I have an interest in the same theme as my colleague, Mr. Volkmer.

Mr. HARKIN. Do you see any problem with providing that?

Mr. ALBRECHT. No, Mr. Chairman.

Mr. LLOYD. I would like to know what you're doing since that refinery failed the last few weeks, and what you are doing about that? What is the Department of Energy doing about the immediate fuel flow problems? Then, going further down the line, what do you anticipate in your interface relationships with DOE, which is exactly what Mr. Volkmer asked for?

Thank you very much.

Mr. ALBRECHT. We have no problem with that, Mr. Lloyd. We will give you the basis for our estimates, as Mr. Bond indicated yesterday. [Material supplied follows:]

Congressman Volkmer requested that I submit the following information to the Subcommittee concerning the availability of aviation gasoline and jet fuel. Although the FAA has no authority to directly regulate the fuel availability for users of the National Airspace System, the agency has established a liaison with users and oil refiners to monitor general supply and price conditions for the aviation industry. Beginning in January of this year, a monthly aviation fuel report has been distributed by the agency to regional offices and various aviation organizations. The reports currently contain information on jet fuel and aviation gasoline prices and availability. The information is obtained by surveying fixed based operators (FBOs) at various airports in addition to direct contacts with

aviation fuel suppliers. The report identifies those airports which have fuel supply problems, and provides projections of 30, 60, and 90-day availability of aviation gasoline and jet fuel for general aviation and air carriers. In addition, the report lists fuel prices by region, production, stocks, import and export levels, air carrier fuel consumption statistics, and will eventually include information on aviation fuel refinery sales.

When aviation fuel problems arise, the FAA informally coordinates its activities with the Department of Energy (DOE), which has the primary responsibility in this area. DOE will then seek out alternative suppliers to meet the demands of aviation users.

With regard to the specific situation concerning the availability of aviation gasoline, there are several characteristics which adversely impact on the supply of aviation gasoline. First, aviation gasoline is in direct competition with unleaded automobile gasoline. Second, aviation gasoline is a blended fuel which is more difficult to refine than other products. Finally, aviation gasoline represents a very small percentage of refinery products; therefore, a refiner has little incentive to convert to aviation gasoline production.

In addition to these fuel characteristics which limit the supply of aviation gasoline generally, a fire at the Phillips Petroleum Refinery at Borger, Texas, has complicated the current aviation gasoline situation. Phillips is a major supplier of aviation gasoline, especially 100/130 octane low lead, to the Midwest states and to some areas of the Southeast. After stopping distribution completely for several days in late January, Phillips resumed shipment to distributors at 35 percent of amounts previously contracted. Resumption of full allocation is, at best, several months away, and is subject to the completion of agreements between Phillips and other petroleum producers.

Two companies, in addition to Phillips, have been immediately affected by the refinery fire at Borger. Texaco had numerous exchange agreements with Phillips in the middle U.S. As a result of the Borger fire, Texaco began producing aviation gasoline at its Amarillo refinery. They plan on producing aviation gasoline for 60 days, for the benefit of their dealers in Texas only. This is being done at the expense of unleaded automotive gasoline and may cause problems should stocks of unleaded automotive gasoline fall below the critical level in the area.

Phillips and Texaco are also negotiating an exchange agreement for aviation gasoline supplies from the Port Arthur Texaco refinery. This agreement has yet to be completed and would only be a near term solution. Conoco was also affected at a few of its outlets in the southwest. Their allocations dropped to 40 percent at the beginning of February, but have since been increased to 100 percent for aviation gas customers. Other suppliers have maintained their allocations relatively constant; however, increased demands are being placed on these suppliers because of the overall shortage.

We anticipate that general aviation, particularly local and personal flying, will decline somewhat during the first few months of 1980. However, we anticipate that the effect will be temporary.

Individuals with whom we have been in contact regarding general aviation fuels are as follows: Mr. Keith J. Bauer, Department of Energy; Mr. Walter V. Paulhus, Manager, General Aviation, Texaco; and Mr. S. V. Drum, General Manager of Aviation, Chevron.

Mr. Paulhus reports that Texaco is planning an additional 25 percent production of aviation gasoline beginning in 1980. Mr. Drum of Chevron, reports that a 3 percent increase is expected in aviation gasoline production in the near future.

Mr. BLAKE. You will note on this graph that we show a transition period in the late eighties and early nineties, and this period, we believe, represents a general timespan during which we believe the transition to the advanced computer system will be needed. Below this graph, the time phasing of the major automation improvements discussed earlier is shown.

The first line indicates the time period in which we believe new hardware systems will become available for implementation. In each case, the estimated date at which the implementation of the new capability could be started if the decision for implementation is made is located at the left end of the legend.

The dates assume, of course, successful development programs and a future management decision to implement the function. Implementation decisions have only been made on the items marked with an asterisk on this diagram.

We expect that DABS, with its integral data link will begin operation at some field sites in 1983; ETABS and TIPS should be ready for implementation during the mideighties; and the advanced computer system implementation is planned for the late 1980 time period.

Another system which is currently being evaluated is the cockpit display of traffic information and its possible use in equipped aircraft to allow the pilot to assume some additional separation responsibilities.

Should this prove desirable, we believe the time period for implementation of such a device would be the late eighties or nineties. The use of satellites to support additional air traffic control functions is under a continuing investigation and we believe the cost of satellite-based services will continue to decrease, and it may be feasible and cost-effective in the midnineties time period to consider using satellite-based systems to support additional functions.

The second line addresses system improvements which are largely related to reducing the risk of flight. These are the safety items. They include conflict alert, terminal and en route minimum safe altitude warnings, conflict resolutions, and the Automatic Traffic Advisory and Resolution Service.

We anticipate that the first three will have been implemented by 1982, and that the ATARS service will start shortly after the introduction of DABS into the surveillance system. We also anticipate an increasing use of data link with time to support air traffic control and weather services.

Data link is shown on the safety line because we anticipate that the initial use of the data link will be tied to ATARS, BCAS and weather safety services. Introduction of weather products from the national Doppler weather radar system into the control facilities is expected to start during the late 1980 time period.

Mr. HARKIN. Excuse me, Mr. Blake, if I might interrupt at this point.

On the safety line, I was wondering why you don't have the BCAS.

Mr. BLAKE. BCAS is an independent airborne system. I was only listing here those particular items which affect the computer system that we're buying. Now, BCAS does, in fact, interface with the data processor out at the DABS site, but not directly with the computer at the ATC facility.

Yes, it is a safety item. It isn't listed because it doesn't interface directly with the en route computer system.

Mr. HARKIN. It's not a fully independent system.

Mr. BLAKE. It's not fully independent at all. Its interface, though, is with the computer at the DABS site, which in turn, interfaces with this system.

Mr. HARKIN. Oh, I see. BCAS interfaces with DABS.

Mr. BLAKE. Right.

Mr. HARKIN. Go ahead. I think I understand.

Mr. BLAKE. It's a pretty complex subject.

As you will notice, the safety items are well to the left of our diagram. That's a reflection of the priority that we have placed on getting safety improvements into the system first. The next group has to do with performance.

These include en route metering, which we plan to have in place by 1982; extension of this function to include terminal flow management, which we plan to be able to implement by 1987; and an integrated flow management system which includes enhancements to these systems and integration with our national flow control capability in the 1990 time period.

We expect that there will be later improvements to the flow management system beyond the ones I mentioned, and the integrated system will make extensive use of the DABS data link, starting about the mid-80 time period.

Much has been done to improve system productivity, and benefits have already been achieved through the implementation of flight data processing and radar data processing functions in the ARTS and NAS. We believe that significant further gains can be made in the productivity area.

Electronic tabular displays of flight plan information and a similar system for the terminal area called terminal information processing system are expected to improve productivity by providing improved displays of processed flight plan information at the radar and procedural controller positions.

With the introduction of the advanced computer into the en route facilities, we foresee the automation of much of the flow planning function. This will include the processing and coordination required to determine optimum fuel profiles for direct flights, and for automation of the clearance generation and delivery functions. The latter process is expected to automatically generate conflict-free clearances and present them to the controller on his electronic tabular display.

Although we have not yet defined enhancement packages for these basic capabilities, we fully expect that further productivity gains can be made and programs beyond those currently under way will be defined as the program proceeds.

While I have outlined for you the general flow of our development program in the automation area for the next 10- to 15-year time period, there are still a number of decisions which must be made regarding the implementation of some of the capabilities. I would like to indicate the general time periods in which these decisions should be addressed.

First, while not directly related to the automation function, we expect to be able to define the role of the global positioning system for civil air navigation by the end of calendar year 1982. Our development work to date has indicated that the utility of that system for civil navigation is very closely related to the accuracy which can be made available for the civil users. Our studies and experimentation will define the services which can be based on GPS as a function of the accuracy available and the relative cost of using the system.

The selection of the computer architecture for the advanced computer system will be made at the completion of the concept phase of the development program. This is currently scheduled for 1983.

Development work has been started on the next generation severe weather detection and display system. The radar sensor portion of this effort is a joint FAA, NOAA and USAF program.

We anticipate being able to make the decision on incorporation of the weather processing and display of severe weather data on our center controller's displays in the 1985 time period.

Another closely related decision is the continuing role of primary radar as a part of our surveillance system. We presently are examining the extent to which surveillance requirements can be met solely by the DABS-ATCRBS system. This study is addressing the question of continued joint use of radar for air traffic control and air defense, as well as examination of backup systems and procedures in the case that we have either ground interrogator or airborne transponder failures. We expect to be in a position to define the future role of primary radar by the mid-1980 time period.

As we indicated previously, the introduction of the advanced computer system will allow us to proceed with the implementation of higher levels of automated assistance to the controller. It will, of course, be necessary to define the role of the controller for each step up the automation ladder.

Closely tied to this program is the need to define any changes in the distribution of separation responsibilities between the pilot and the controller for those aircraft equipped with a cockpit display of traffic information.

The implementation of the advanced computer will also permit provision of terminal approach capabilities in the centers and will make feasible the consolidation of such facilities. This offers the advantages of much higher reliability in the automation available to the controller and also has some possible manpower savings resulting from consolidation.

Although the time period for such decisions is undefined, it would seem appropriate to examine this question as soon as the advanced computer system becomes available.

We also believe that the early 1990 time period is the appropriate time to again examine the potential future use of satellite-based systems as they may relate to improvements in our communications and surveillance capabilities.

Many of the programs that I have just outlined are already under way. Our automation goals (figure 10) which set the basis for the advanced computer requirement are to provide a system that meets the demand for air traffic control service, avoids constraints on system growth, and achieves the benefits of improved system performance and productivity, and supports establishment of an optimum fuel, conflict-free, national flow control system. This translates into a requirement for a computer architecture which can expand to have a substantially greater processing capability. Our initial studies indicate a need for an order-of-magnitude increase in processing capability, also improved reliability and availability, fail operational capabilities, and the ability to accommodate the type of functions envisioned in programs like AERA.

This viewgraph (figure 11) provides an overview of the program which contains five major areas of activity. These are, first, identifica-

tion of key management decisions and decision alternatives; second, development and selection of technical and procurement tools; third, the preparation and approval of requirements and procurement plans associated with the acquisition process; fourth, definition of functional and operational requirements; and, lastly, functional evaluation and supporting technology studies.

This viewgraph and the ones that follow (figs. 12-15) show a number of the specific tasks to be conducted in each area. I won't go through them in detail, but I would like to highlight some of the key activities in each area.

Under key management decisions (fig. 12), the decision to proceed with the advanced computer program, the establishment of program priority, and the assignment of personnel and resources to develop the system requirement statement and program plan has been taken.

The next management decision point will be reached when the system requirement statement and program plan are ready for approval. This will also include approval of procurement, transition, development, evaluation, and acceptance strategies.

Thereafter, at each stage of the procurement process, concept evaluation, design selection, development awards and production release, management review of the program and approval to proceed will be required. The management approval process will also cover implementation, training and staffing standards plans.

The technical and procurement tools (fig. 13) activity includes review, selection, and implementation of appropriate system standards, management tools, and technical evaluation concepts and methods preparatory to awards for the concept definition studies. These standard, tools and methods are then used throughout the program cycle, and at a later phase of the program, they are used to develop implementation and associated funding plans.

The evaluation process covered by this activity includes the development of test and evaluation plans and procedures, and the establishment of system support and system test facilities.

Preparation of the development and management decision roadmap and coordination of the program with the users, the Congress, the Office of Management and Budget, and other similar large Government procurement programs is also carried out under this activity.

The initial step in the acquisition process (fig. 14) is the development of a system requirement statement clearly stating the mission need and problems, with identification of alternative ways of meeting the needs and projected benefits expected to result from the system improvement.

Mr. HARKIN. When can we expect the system requirement statement?

Mr. BLAKE. The draft will be available by December of this year.

Mr. HARKIN. How does that coordinate with the concept awards of the TSARC-1?

Mr. BLAKE. The concept award, the TSARC-1, is based on the mission need statement which does exist.

Mr. HARKIN. So you don't need the system requirement statement for that.

Mr. BLAKE. You don't need it for the initial TSARC, which we hope to have this coming April. We will have perhaps an update on that

TSARC after the system requirement statement is available. I will come to some of this in a moment.

A number of sources are being used to define both the near- and long-term air traffic control system improvements which in turn set the requirements for the new computer systems.

The benefits determination is a particularly difficult assignment, as many of the major benefits accrue from achieving productivity gains from higher levels of automation, and not simply from replacing the computer system. However, evolution to the higher levels of automation is contingent on replacement of the current systems with computers of significantly higher capacity and improvements in system reliability.

Once the system requirement statement has been approved, the acquisition process provides for reviews, revisions, if necessary, and approval for continuing the program in four steps: Concept, design, development, and production contract award times.

The next activity is a review of the operational and supplementary functions, identification of system interfaces, and definition of the projected environment (fig. 15). Transition restraints and alternatives will be examined in establishing the transition plan and maintenance concepts will be defined and evaluated to establish a maintenance plan.

Definition of the controller and pilot roles as the level of automation increases is an important task in this area, and will affect the design both of the future automation improvements and the future controller station equipment. The introduction of new hardware and software capabilities, and the transition from the use of current equipment, will require establishment of training programs for technician and controller staffs and scheduling of the flow of personnel through the training pipeline.

The life expectancy of the 9020 system will be established during the early phase of the program, and we hope to complete that this year. Later studies will address the life expectancy of the terminal systems, and this will include determination of the most likely time at which each facility will reach saturation and an examination of alternatives for offloading these facilities to extend their life until a replacement system can be implemented.

The program addresses evolution alternatives and constraints, it defines the transition plan through replacement of the current computers and the future evolution of the system to accommodate higher levels of automation after the transition to the advanced computer has been achieved (fig. 16).

The technology program focuses heavily on the impact of various long-term system options on system architecture and software design.

Automation studies address the questions of man-machine interface, role of the controller in a more automated environment, and reliability techniques needed for automated decisionmaking.

The options to be defined and examined include air traffic control options, such as provision of major airport approach and departure control from en route facilities, centralized flight data processing, automated flow management strategies, real-time Doppler weather radar information processing and display, and surveillance options, including transition to a DABS-only system.

Studies, evaluations and comparisons of available software operating systems and higher order languages will be conducted to provide the information necessary to evaluate proposed concepts and designs and ultimately to select the final software design approach. Similarly, computer architectures will be studied and analyzed to assist in developing evaluation criteria to be used in the final computer architecture design selection.

Activities relating to the development and test of "very reliable" software will be reviewed to assist in establishing requirements for software development and validation testing. A related activity is the development of maintenance strategies for reliable software for the candidate computer architectures.

Changing now to the general topic of program acquisition process (fig. 17), the advanced computer development program has been established as a "major system acquisition" within FAA, and is being managed under the system acquisition management process internally (FAA Order 1810.1A), and the major system acquisition and review and approval process, managed by the Office of the Secretary, DOT Order 4200.14A which implement OMB Circular A-109 procedures.

I would like to touch briefly on the key points of each of these, and then indicate some of the special management steps which have been taken in view of the importance of the program.

The system acquisition management process, (fig. 18) defines the procedures for establishing requirements for major development programs, evaluating options, conducting development programs, and developing transition and implementation plans. This process, of course, dovetails with the FAA planning and budgeting process.

The initial stage of each program is the establishment of a systems requirement study group (fig. 19), which establishes a formal requirement for development. The group defines the mission requirement, analyzes alternative courses of action for meeting the requirement assesses potential benefits, and prepares the system requirement statement.

These actions must be approved by TSARC in accordance with the departmental implementation of OMB Circular A-109. The group here is composed of representatives from the appropriate offices and maintains an internal tracking system on the status of all associated tasks.

In accordance with FAA Order 1810.1A, the Airway Facilities Service was designated as the office of principal interest for formation of a system requirement study group to prepare the system requirement statement.

Now, once the system requirement statement has been approved by the Administrator, an engineering and development program plan is prepared, and an acquisition paper is submitted to the Office of the Secretary for approval, (fig. 20). Following this approval, the E. & D. organization conducts the development, test and evaluation activities required to generate the technical data package needed for specification and procurement of the production system. A parallel effort during this time period is the development of a transition plan.

Upon completion of the development process, an acquisition authorization is approved internally, an implementation plan prepared,

and a second acquisition paper is developed by the operational services and submitted to the Office of the Secretary to obtain approval for procurement and implementation.

The various papers and reports that are developed as a part of this process are shown here. As we will see on the next several Vugraphs, it has been necessary to modify this process somewhat to achieve compliance with A-109, and two additional updates of the acquisition paper are required.

OMB Circular A-109 (fig. 21) covering procedures for accomplishing major system acquisition increases the number of the secretarial level approvals to four; requires the evaluation of industry-proposed concepts for meeting the requirements; requires competition as long as possible in the development and implementation process; requires broad-based industry participation; requires designation of a program manager and the establishment of an acquisition executive.

The DOT order 4200.14A implementing the A-109 procedures is shown here (fig. 22). It requires secretarial level approval before initiating each of the four stages of development and implementation set forth in OMB Circular A-109 and which are summarized here. In addition, it establishes the Deputy Secretary as the acquisition executive.

I would like to return now to the A-109 process and identify where we are in that process. The next two Vugraphs that I will use are taken from the OMB guidance on A-109 implementation.

The A-109 process is seen as a repetitive loop that continually examines mission requirements and current system performance in order to identify and establish requirements for unmet or partially met needs (fig. 23). FAA/DOT, assisted periodically by outside committees and industry, has conducted continuing assessment of system operation, and made definitive recommendations for system improvements.

As we noted earlier, the groups were all unanimous in their recommendations for an evolutionary approach to improving the air traffic control system and then going to higher levels of automation in ATC. The inputs from these studies and the internally generated mission requirement statement resulted in definition of the program we looked at a few minutes ago.

We are currently performing the functions set forth in the top part of the diagram and have, in fact, prepared the acquisition paper needed to proceed to TSARC-1 to obtain approval for the remainder of the program definition work and the concept phase procurements.

This viewgraph—again, taken from the A-109 Circular—highlights the decision points and further emphasizes the desirability of maintaining competition at least up to the start of full-scale development (fig. 24). Some flexibility is shown in continuing competition beyond that point. This is particularly significant for the procurement of our advanced computer system, as development of a second full prototype system by a second contractor would substantially increase the development costs (fig. 25).

Our approach to contracting for the advanced computer system (fig. 26) follows the competitive procurement approach set forth in the preceding viewgraph. Our current acquisition strategy is to award

perhaps as many as five contracts for the conceptual phase, reduce the number of contractors somewhat for the design and critical subsystem demonstration phase, and subsequently reduce the number to one or two for full-scale development.

At the completion of that phase, one contractor would proceed with the fabrication of the production system. This approach eliminates the time lost between phases by retaining some of the same contractors throughout the entire program sequence with a reduction in the number of contractors occurring at the end of each phase.

Another aspect of the recommended acquisition approach was designed to minimize the program duration, as shown. Since an FAA evaluation activity, acquisition paper update, and TSARC approval cycle is required at the conclusion of each phase before we can proceed to the next phase, there would normally be a hiatus of several months to a year's duration while these events took place. Hence, contractors would probably be unable to keep their program teams intact during these breaks in the program.

Therefore, we believe that it would be preferable to let most or all of the contractors that worked on a particular phase continue on into the design part of the next phase while the FAA evaluates the work done and selects the best concepts and designs for further developments.

Due to the importance of the program to FAA and the need to address a number of management and system issues associated with the evolution of the air traffic control system, two special groups were established to initiate the program (fig. 27). The first was a management steering group, jointly led by the Associate Administrators for Air Traffic and Airway Facilities and Engineering and Development.

This group provides a management forum for resolution of policy, management, and transition planning issues associated with the ATC evolution. A requirements development and review team was established under the direction of the Deputy Associate Administrator for Engineering and Development and the Chief of the Program Management Staff who reports to the Associate Administrator for Air Traffic and Airway Facilities.

This team was created to establish and maintain program tasks, manpower, and funding requirements; review and approve the system requirement statement; raise and resolve technical issues; and evaluate alternative acquisition, transition, and implementation plan strategies.

The requirements development and review team, comprised mainly of Engineering and Development and Air Traffic and Airway Facilities personnel at the service, office, and division level, defined the program tasks shown earlier and established manpower and contracting resource requirements for the program.

This data has subsequently been refined for the first phase of the program. Actual day-to-day management of the Air Traffic and Airway Facilities and Engineering and Development tasks is being carried out by a program manager in each of the areas with coordination of these front-end activities being provided by the requirements and development review team.

At the time that the system requirement statement is completed and we are ready to proceed to procurement of concepts—which will be

coming up shortly—a single E. & D. program manager will be selected for the total program. At the conclusion of the development process for the advanced computer system, we expect the program management to shift from E. & D. to the Air Traffic and Airway Facilities group for the production and implementation phase. It may be the same program manager.

Figure 28 provides an overview of the major program areas to be accomplished during each phase of the program with a much more detailed breakout provided of the initial phase. It also identifies the responsible office for each of the tasks.

During the requirements definition phase, Air Traffic and Airway Facilities has the lead responsibility for determination of requirements, development of an acquisition paper, program management plan, program funding estimates, and cost-benefit studies.

The Logistic Service is responsible for development of the procurement strategy. Engineering and Development will provide long-range requirements, conduct supporting technology studies, develop concept evaluation criteria, and prepare the specification for design concepts. The Office of Aviation System Plans will take on the responsibility of conducting detailed cost-benefit studies supporting the acquisition.

During the concepts phase, the Logistics Service will conduct the solicitation of design concepts. Engineering and development will develop the request for proposals and the engineering and development program plan, and manage the concept contracts. They will also manage the competitive design, critical demonstration, and prototype phases.

After the full-scale development and prototype development and test phase is complete, the program manager responsibility will shift from E. & D. to Air Traffic and Airway Facilities, who will manage the production phase of the contracts.

The major milestones for the advanced computer program are shown in figure 29. As noted earlier, we are in the process of preparing for the first TSARC review of this program. The acquisition paper has been prepared, covering both program definition and concept phases.

The first TSARC is being held somewhat in advance of the time that A-109 process requires it due to the significant level of activity associated with the program definition and startup phase. Hence, it is quite possible that a TSARC-1 update will be required at the time the system requirement statement and the procurement documentation have been completed.

The scheduled dates for availability of the system requirement statement and request for proposal packages are March 1981 and December 1981, respectively. Contract awards are anticipated by June 1982.

The TSARC dates for the design, full-scale development, and production phases are anticipated to be April 1983, August 1985, and November 1987, respectively. Based on this schedule, we believe that the first system can be installed in November 1988 and become operational in 1989.

The remaining systems would be installed and made operational over about a 4-year time period. Although we are in the program definition phase, preliminary estimates have been developed for the initial phase of the program. The costs through completion of the

front-end program definition and concept phase contracts are estimated to be in the \$20 to \$25 million range, depending somewhat on the actual number of concept contracts awarded.

During the next year, we will be working out new funding requirements for the later phases of this program and will be in a position to report on it during the coming year.

In summary, the computer systems in use in the en route and terminal facilities we believe can continue to meet our current and near-term future requirements (fig. 30). We expect that some of the en route computer systems, however, will reach their capacity limits in the late 1980 time period, due primarily to growth in air traffic and the increasing demand for air traffic control services.

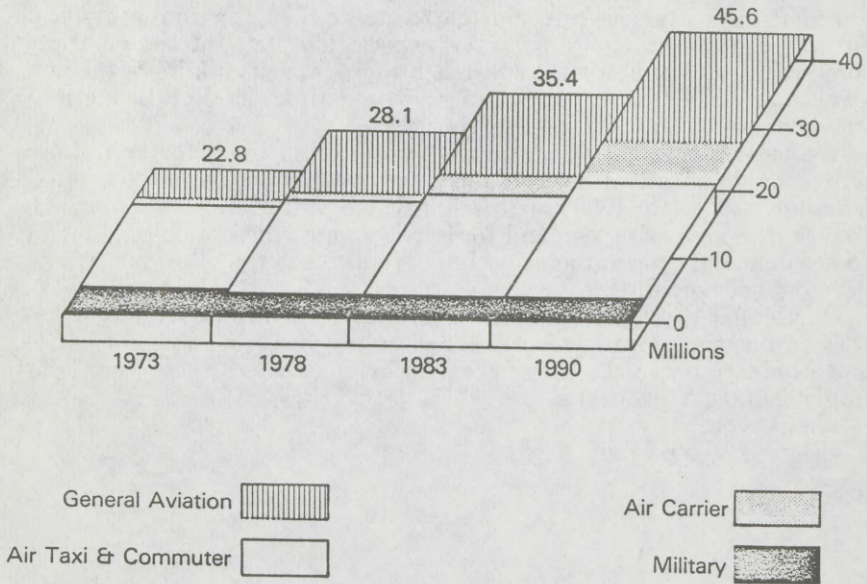
We believe that the program that we have outlined for you today will provide an advanced computer system that can be implemented starting in the late 1980 time period which will allow us to continue to meet the increasing demand for services and which can be expanded to accommodate the automation improvements as they flow out of our development pipeline.

Our longer range automation program is keyed to provide the further automation improvements needed to improve system performance and productivity in the time period following the advanced computer implementation program.

Thank you.

[Figures 1-30 follow:]

**IFR Aircraft Handled by
FAA Air Route Traffic Control Centers,
Fiscal Years 1973 - 1990**



	FY 1978 Status (Growth)	FY 1978 — 90 Forecast (Total Growth)
General Aviation	19%	120%
Air Taxi	19%	205%
Air Carrier	5%	28%
Military	0%	0%
Total	8%	62%

Source: Detailed forecast of "IFR Aircraft Handled"
(Report No: FAA-AVP 79-1)

FIGURE 1

Average Day IFR Handles For All Centers

<u>Center</u>	<u>1979</u>	<u>1990</u>	<u>% Growth</u>	<u>Equipment*</u>
Chicago	5884	9625	64	D/E
Cleveland	5564	9288	67	D/E
New York	5132	7466	46	D/E
Atlanta	4756	6893	45	D/C
Washington	4532	7140	58	D/E
Indianapolis	4452	7323	64	D/C
Ft. Worth	4425	7236	64	D/E
Houston	4142	6688	61	A/C
Miami	3975	5764	45	A/C
Los Angeles	3951	5362	36	D/C
Jacksonville	3918	5293	35	D/C
Memphis	3904	6197	59	A/C
Kansas City	3871	5707	47	D/C
Minneapolis	3622	5792	60	A/C
Oakland	3233	4784	48	A/C
Boston	2885	4205	46	A/C
Albuquerque	2822	4000	42	A/C
Seattle	2707	4529	67	A/C
Denver	2655	4027	52	A/C
Salt Lake City	1860	2679	44	A/C

*

Central Computer Complex

D/E - 9020D

D/C - 9020D

A/C - 9020A

Display Channel Processor

9020E

Raytheon Computer

Display Processor

Raytheon Computer

Display Processor

Source: Detailed forecast of
"IFR Aircraft Handled"
(Report No: FAA-AVP-79-1)

FIGURE 2

**IFR Handled — Busy Hour — Average Day and Peak Day
(No Constraints)**

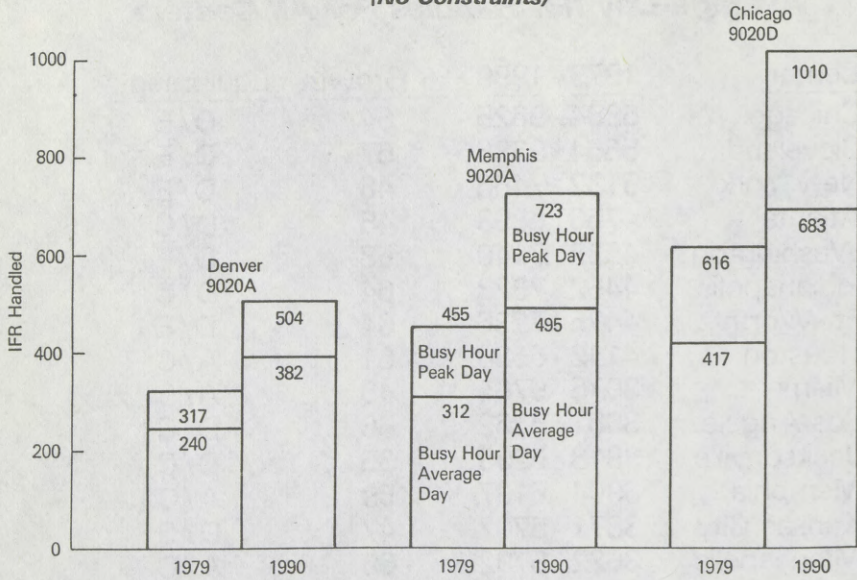


FIGURE 3

**Historical and Forecasted Operations at FAA Towered
Airports by User Category**

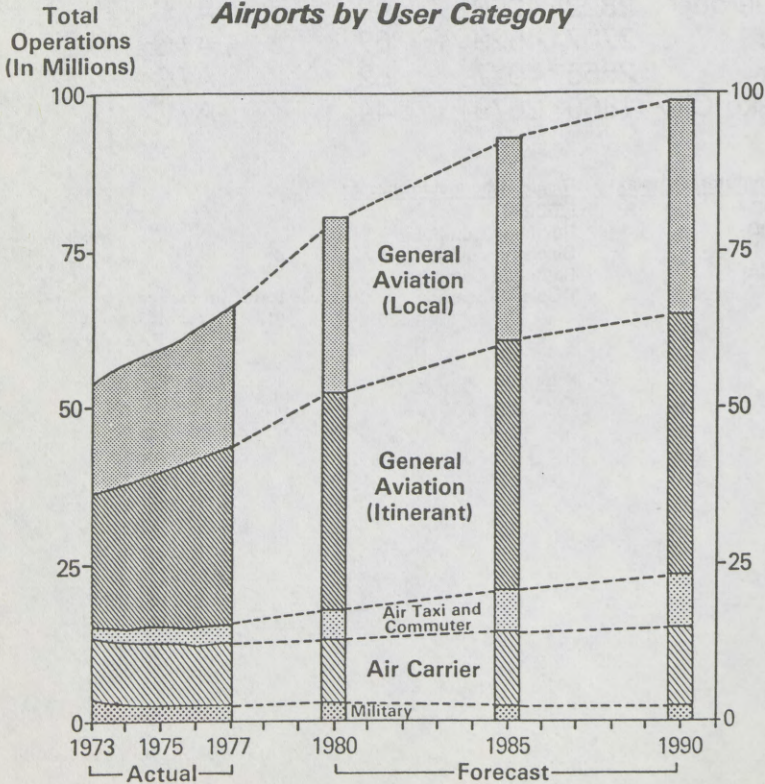


FIGURE 4

Source: FAA-AVP-79-12

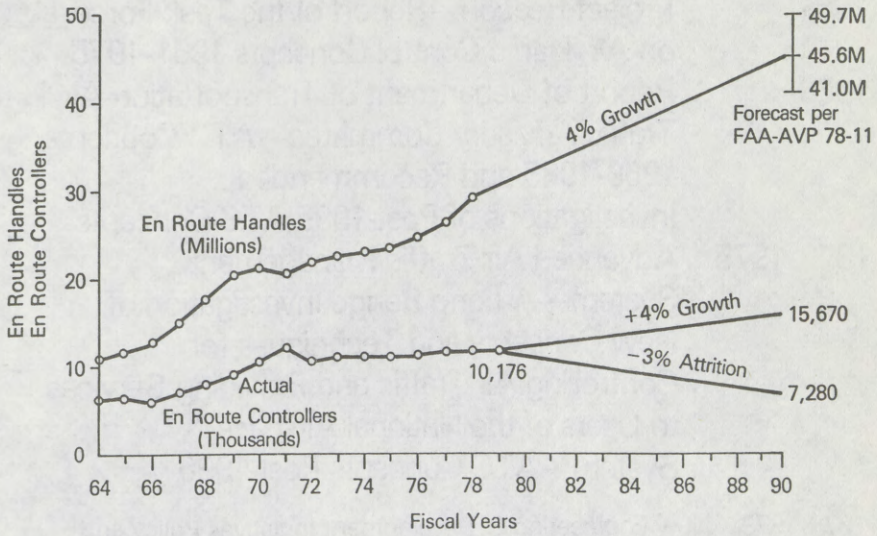
Productivity

FIGURE 5

Industry and User Studies of ATC

- | | |
|-----------|---|
| 1961 | Project Beacon—Report of the Task Force on Air Traffic Control Concepts 1961-1975 |
| 1969 | Report of Department of Transportation Air Traffic Advisory Committee—ATC Concepts 1969-1985 and Recommended Investigations of Post-1985 ATC Concepts |
| 1972-1975 | Advanced Air Traffic Management System—A Long Range Investigation of New Concepts and Techniques for Controlling Air Traffic and Providing Services to Users of the National Airspace System—ATC Concepts Post-1990 |
| 1978-1979 | <p>New Engineering & Development Initiatives Policy and Technology Choices-ATC Concept For the 1980's. Over 260 Experts Representing the Aviation Community Recommended:</p> <ul style="list-style-type: none"> ● Continued Evolutionary Development of the ATC System ● ATC Clearance Generation Should Continue to be a Ground System Function ● ATC Clearance Execution Should Continue to be an Airborne Function ● Additional Application of Automation to ATC Will Increase Safety, Improve Productivity and Reduce Fuel Costs ● Automated Clearance Generation is Acceptable to the User Community ● Some Form of Cockpit Responsibility for Separation ● ATC Computer Replacement Needed |

FIGURE 6

FAA Actions

- A Scenario for the National Airspace System Near the Turn of the Century
- Long Range Concept for Air Traffic Service
- Advanced En Route Automation Program

FIGURE 7

Automation Program Elements

9020 ERA

- En Route Minimum Safe Altitude Warning
- En Route Conflict Resolution
- En Route Metering
- Terminal Flow Management

Transition - 1988-1992

- Electronic Tabular Displays

Advanced Computer Era (AERA)

- Integrated Flow Management System
- Automated Planning
- Conflict Free Clearances

Design Choices

- ATC Automation
- Pilot-Controller Separation Responsibilities
- Alternative Surveillance, Communication Systems

FIGURE 8

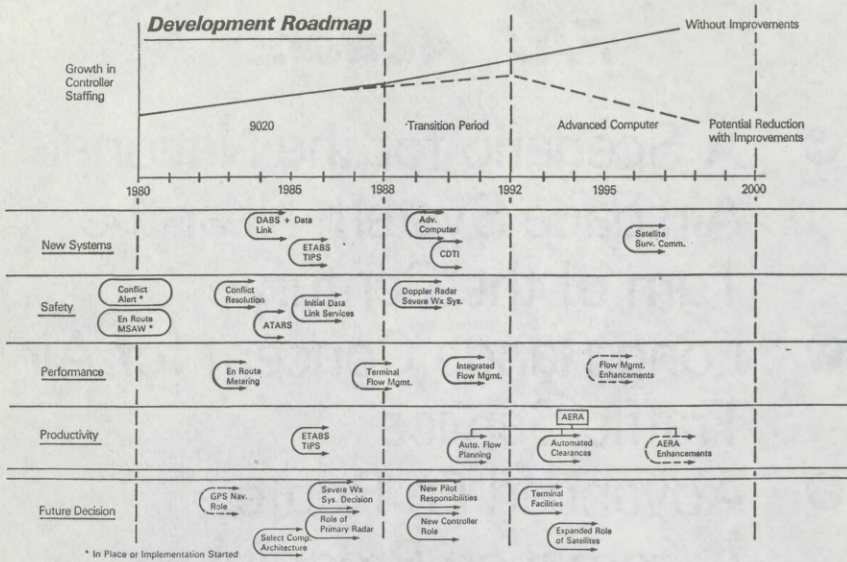


FIGURE 9

Automation Goals

- Meet the Demands for ATC Service
- Avoid Constraints on System Growth
- Achieve the Associated Benefits from Increased Automation

Advanced Computer Requirements

- Order of Magnitude Increase in Computer Capacity
- Improved Reliability and Availability
- Fail Operational Performance
- Accommodate Long-Term ATC System Evolution

FIGURE 10

Planning Overview

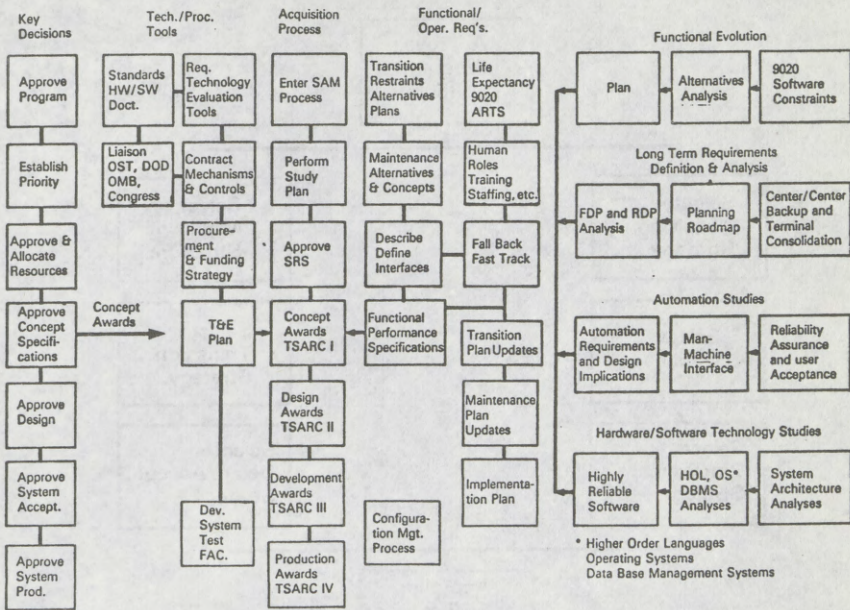


FIGURE 11

Key Management Decisions

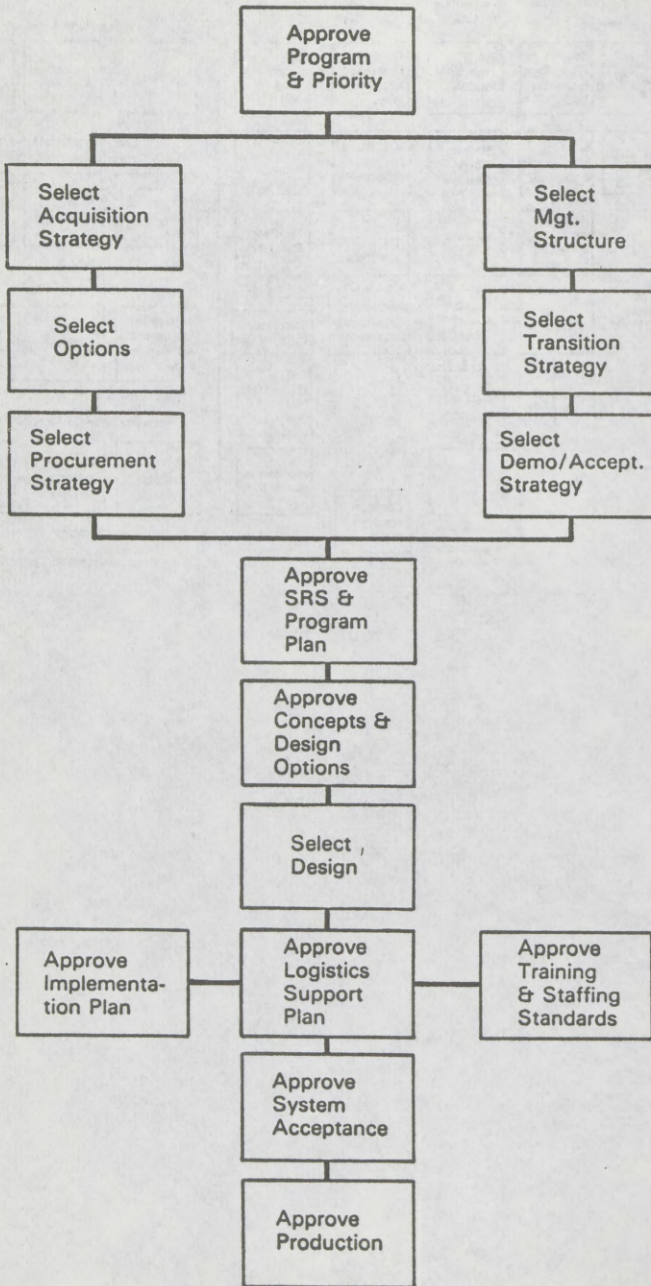


FIGURE 12

Technical/Procurement Tools

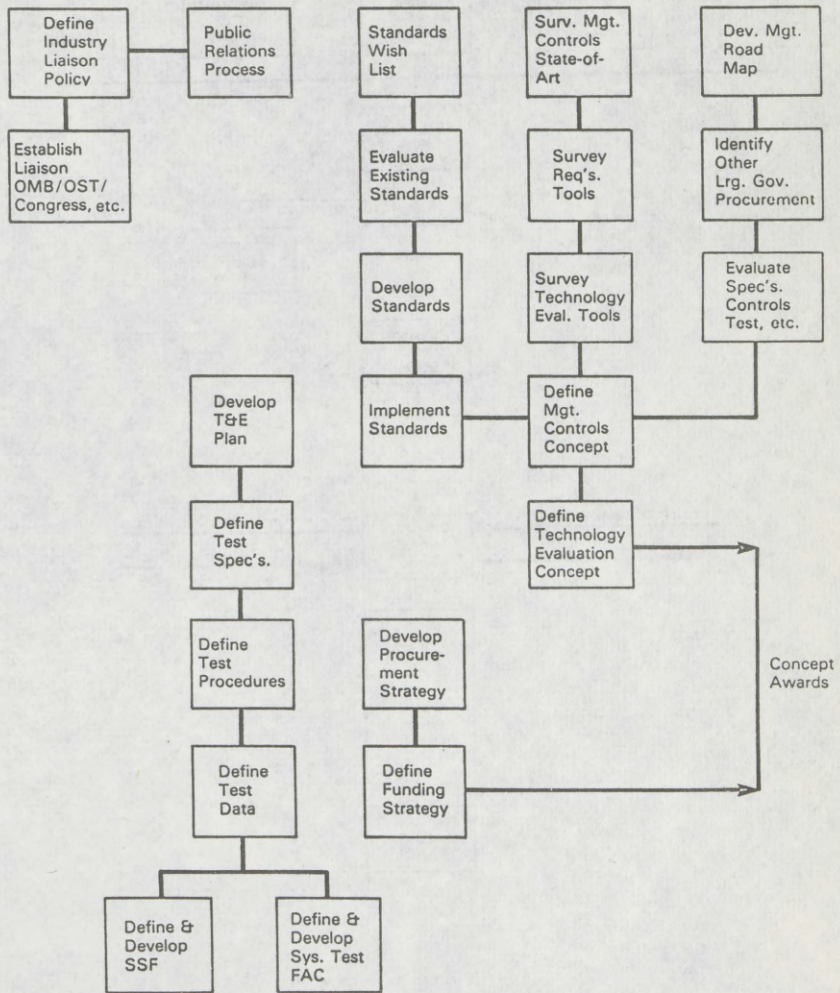


FIGURE 13

Acquisition Overview

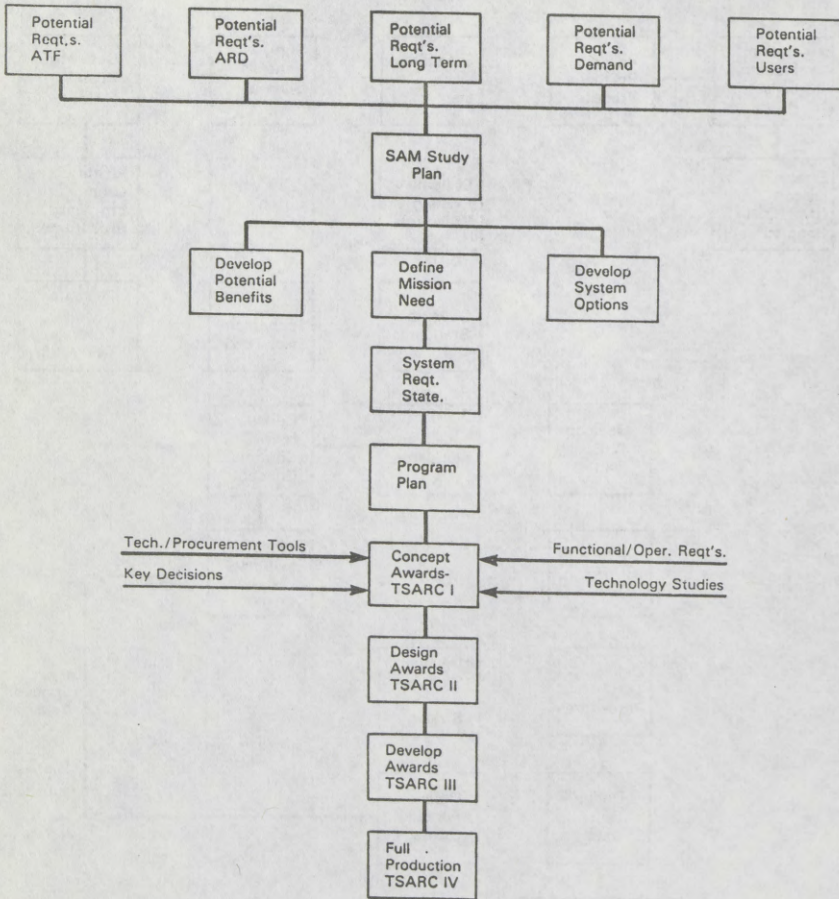


FIGURE 14

Functional/Operational Requirements & Specifications

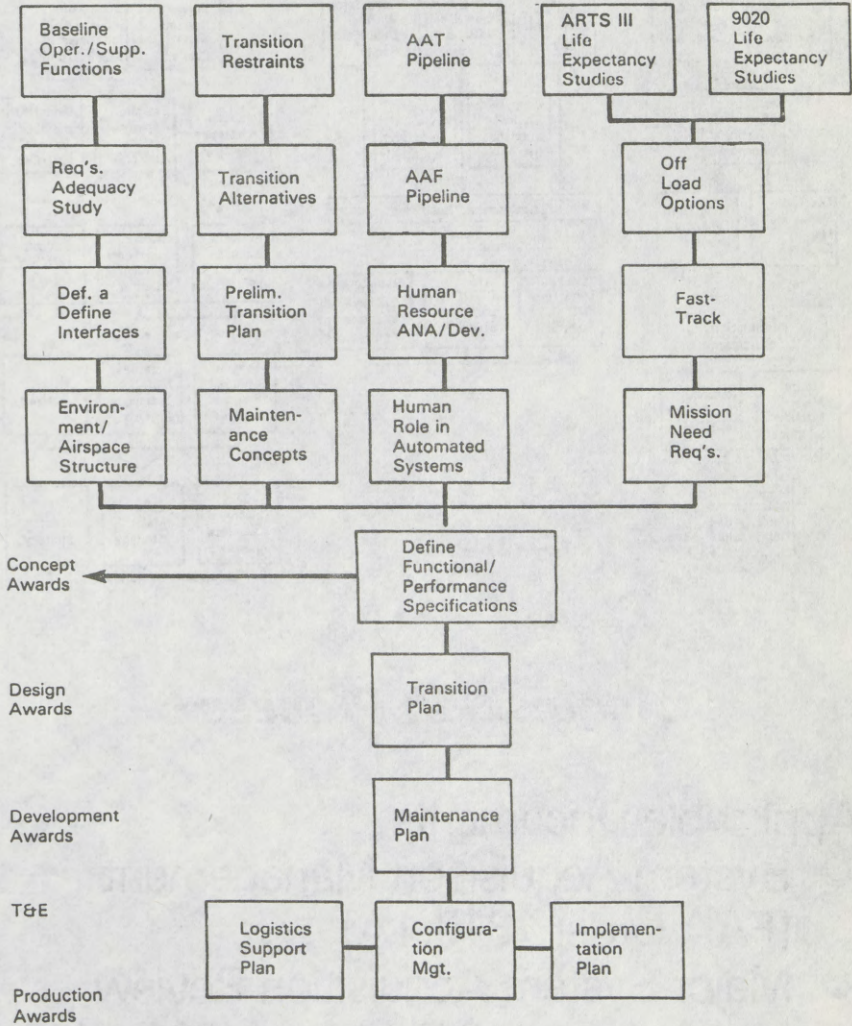


FIGURE 15

Technology Support Overview

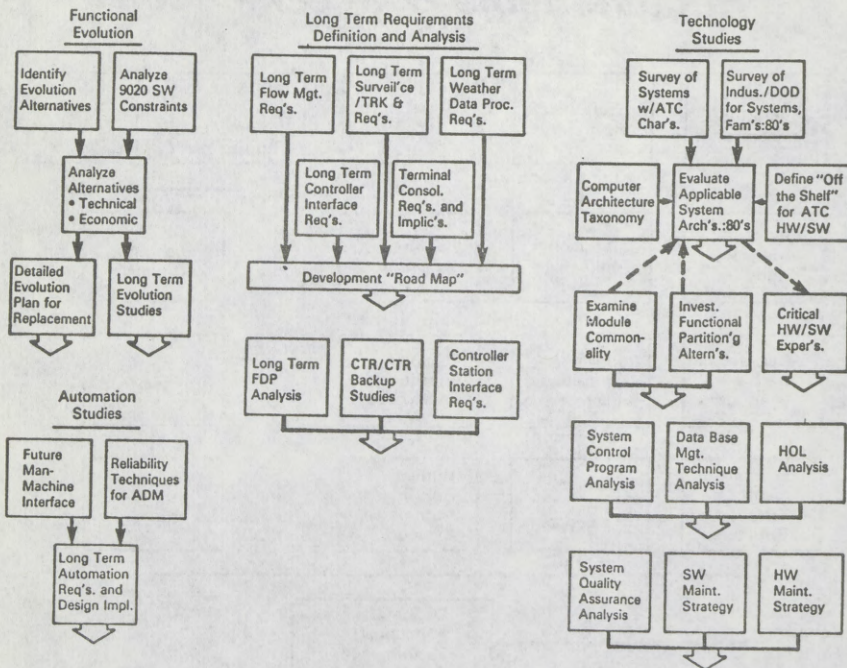


FIGURE 16

Acquisition Process

Applicable Documents

- System Acquisition Management (FAA Order 1810.1A)
- Major System Acquisition Review and Approval (DOT Order 4200.14A)
- Major System Acquisitions (OMB Circular A-109)

FIGURE 17

Overview of Process

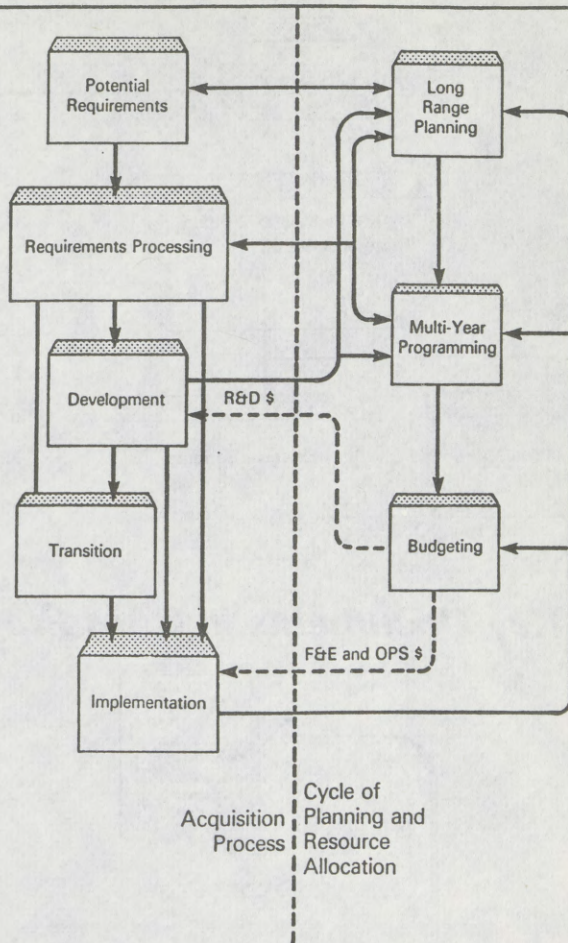


FIGURE 18

System Requirements Development

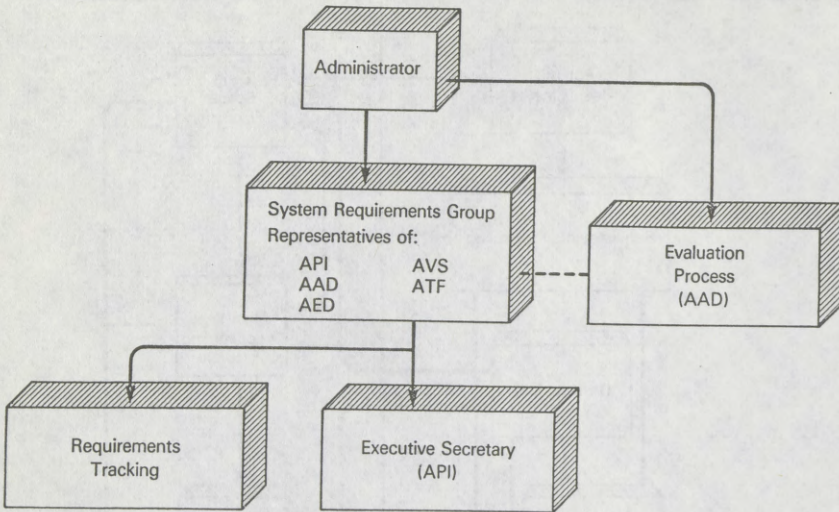


FIGURE 19

Key Documents in SAM Process

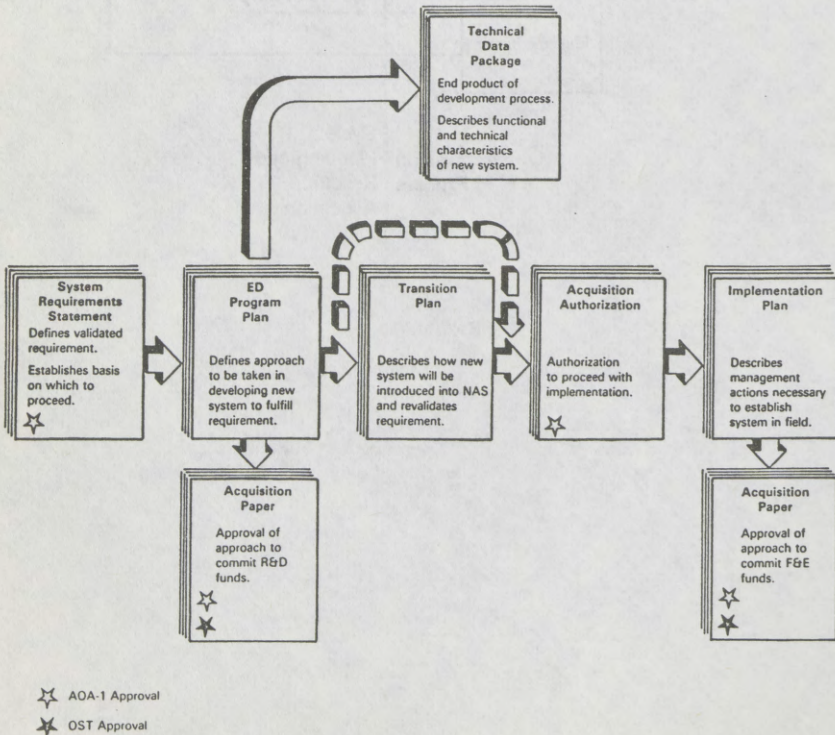


FIGURE 20

***Major System Acquisition
(OMB Circular No. A-109)***

- Four Key Decisions for Agency Head (Cabinet Level)
 - Approve Mission Need
 - Approve Design Concept(s)
 - Approve Development and Limited Production
 - Approve Full Production
- Requires:
 - Evaluation of Industry Proposed Concepts
 - Competition as Long as Possible
 - Broad-Based Industry Participation
 - Designation of Program Manager
 - Establishment of Acquisition Executive

FIGURE 21

***Major Systems Acquisition Review
and Approval (DOT 4200.14A)***

- Department Implementation of A-109
- Key Decision Points
 - TSARC 1 - Concurrence in Identification of Mission Need
 - TSARC 2 - Selection of Competitive System Design and Approval for Test/Demonstration
 - TSARC 3 - Commitment to Full-scale Development and Limited Production
 - TSARC 4 - Commitment to Full Production
- Deputy Secretary is Acquisition Executive
 - Integrates and Unifies Management Process
 - Monitors Implementation Vis-A-Vis Policies

FIGURE 22

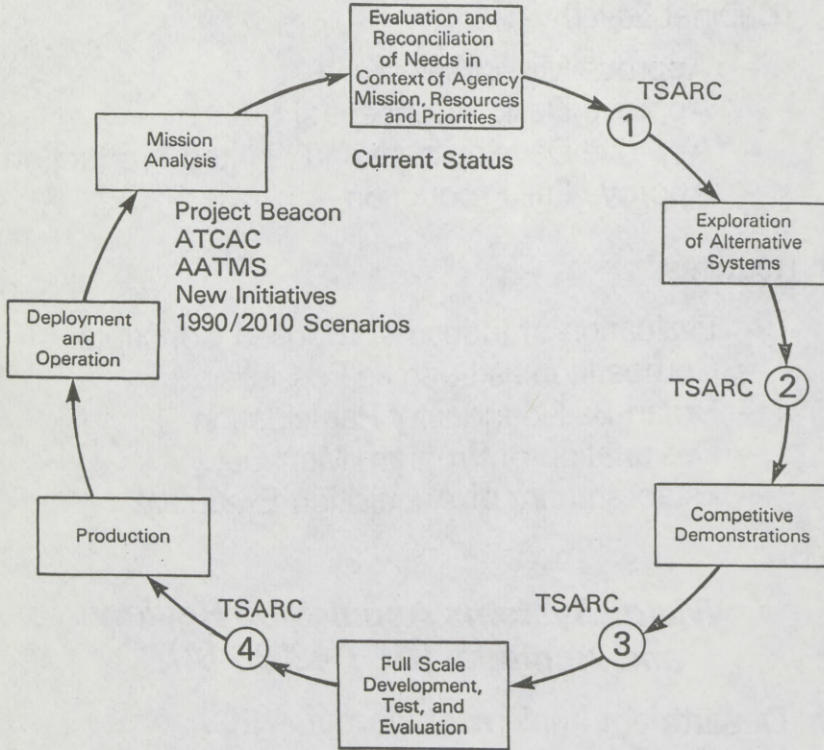
A - 109***Major System Acquisition Cycle***

FIGURE 23

Major System Acquisition Process

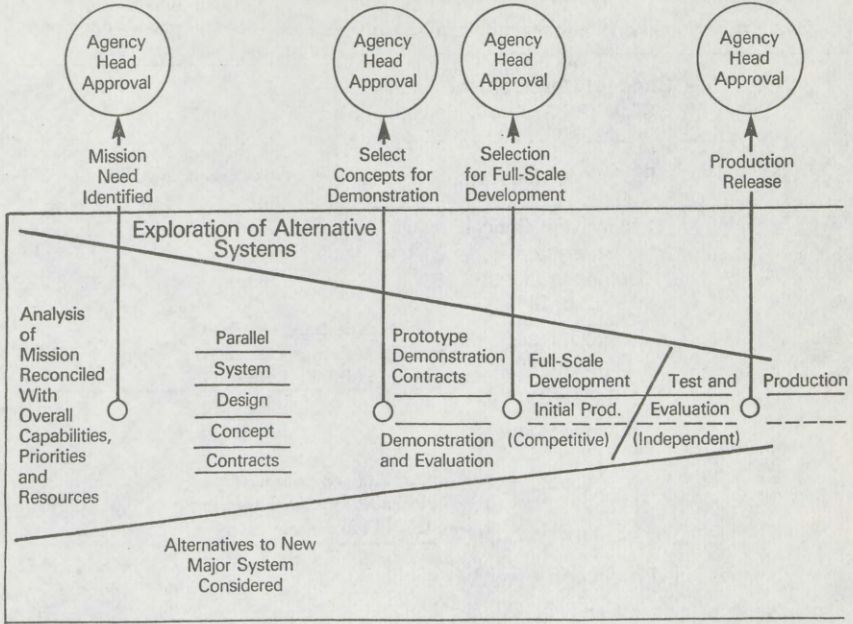


FIGURE 24

FAA Implementation of A - 109

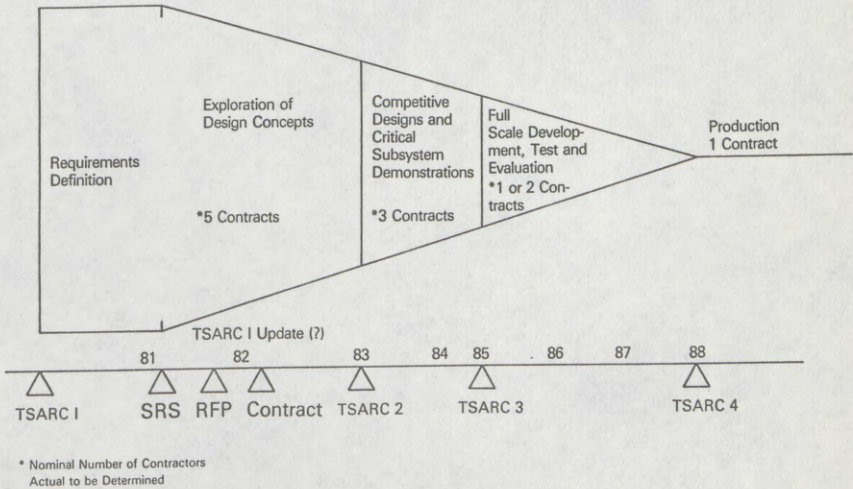


FIGURE 25

System Acquisition Process

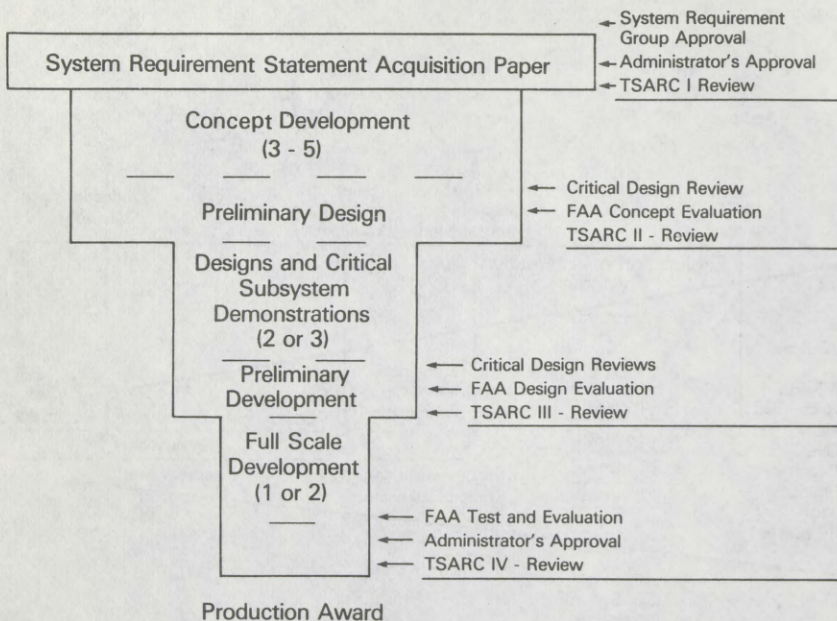


FIGURE 26

Program Management Structure Evolution

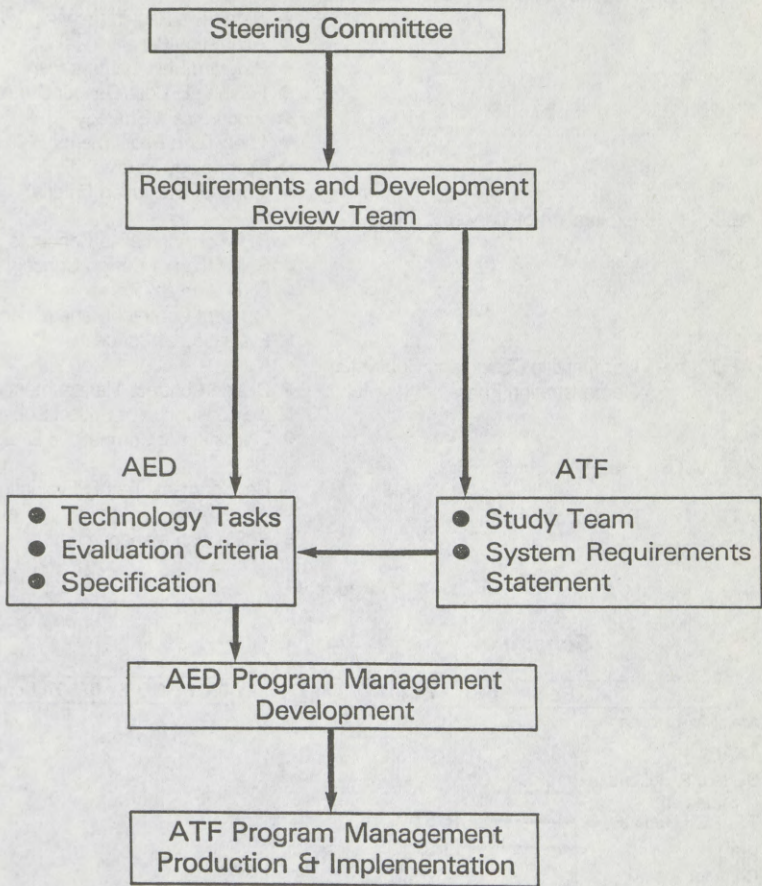


FIGURE 27

Responsibilities

ATF/AED	Requirements Definition Phase	● Determine Requirements ● Acquisition Paper ● Program Management Plan ● Funding & Cost/Benefit Studies ● Procurement Strategy ● Long Term Requirements ● Technology Studies ● Concept Evaluation Criteria
AED	Exploration of Concepts Phase	● RFP For Alternative Concepts ● Solicitation of Design Concepts ● E&D Program Plan ● Concept Contract Management ● Evaluation of Concepts
AED	Competitive Design and Subsystem Demonstration Phase	● Design Contract Management ● Demonstration of Critical Subsystems ● Evaluation of Competitive Designs
AED/ATF	Prototype Phase	● Development, Test & Evaluation
ATF	Production Phase	● Production Management

FIGURE 28

Schedule

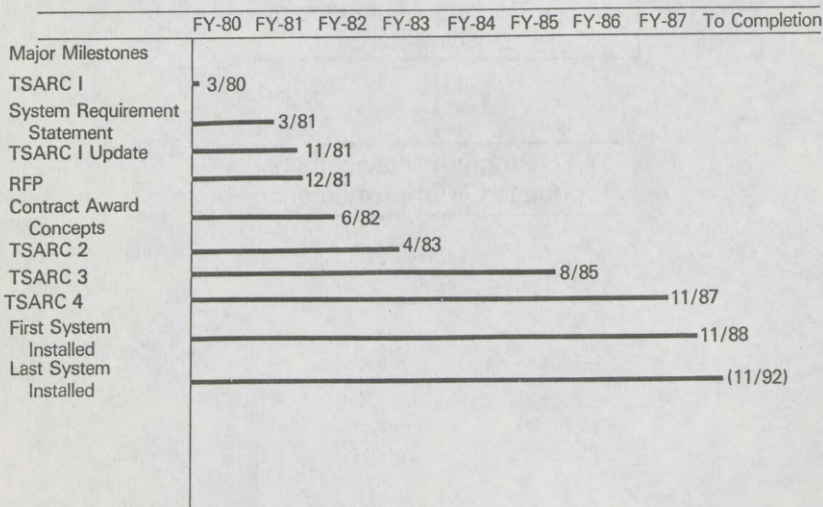


FIGURE 29

Summary

1. Growth in Aviation, Especially Commuters and Business Jets Will Continue to Impose Growth in Demand For ATC Service
2. The Existing ATC Computers Will Not Support Current Functions Beyond the Late 1980's
3. Additional Traffic Density Will Require Either Reduction in Sector Size With Concomitant Coordination and Staffing Needs or Use of Automation
4. Higher Levels of ATC Automation Are Needed But Cannot be Accommodated by the Existing ATC Computers
5. Order of Magnitude Increase in Computer Capability Needed to Accommodate the Changes
6. The Advanced ATC Computers Will be Designed to Accommodate Growth in Demand, Changes in Technology and Further Automation of the ATC Process
7. Advanced Computer Program Definition Completed

FIGURE 30

Mr. HARKIN. Thank you very much, Mr. Blake.

Would I be correct in saying that all of this that you've just walked us through demonstrates the FAA does indeed have a long-range plan, it's laid out, and it's being implemented?

Mr. BLAKE. Yes, we have a plan for the automation of our system.

Mr. HARKIN. The updating of the computer system?

Mr. BLAKE. That's correct.

Mr. HARKIN. And that this plan is being implemented right now, and that what you've just demonstrated for us—all these little boxes and flow charts and stuff, which I would never be able to remember in a million years—are all being managed at FAA?

Mr. BLAKE. That's right.

Mr. HARKIN. Who is the FAA manager of all of this? I suppose Mr. Bond, but I mean under him. Who is really in charge of this long-range management concept?

Mr. ALBRECHT. Well, I have to divide that answer into two parts, Mr. Chairman. At the current time, there are two kinds of activities progressing. One is the development of the system requirement statement which is the job of the Associate Administrator for Air Traffic and Airway Facilities.

Mr. HARKIN. When is that going to be ready?

Mr. ALBRECHT. By the end of this year, December 1980.

Mr. HARKIN. By the end of this year. But the chart said by March 1981, and you say by the end of this year.

Mr. ALBRECHT. The draft will be out in December. The work will be completed by then.

The technology studies, the development of a specification for the concept contracts, the business of getting our technical planning organized so we can put our arms around this job, is basically my re-

sponsibility. So the Associate Administrator for Air Traffic and Airway Facilities and I are working very closely together.

We expect in the near future, probably within the next few months, to establish what is regarded as a more formal program office with a single individual who can be identified and be very visible as responsible for the entire program.

Mr. HARKIN. You don't have such a person, actually.

Mr. ALBRECHT. No, it's a little early. We are moving in that direction. We want to get some work underway in terms of developing the system requirement a little further to make sure we can do a fairly good job of assessing the kind of technology studies that need to be done so we can better scope the program in terms of how we spend our resources. We are getting there.

Mr. HARKIN. On page 3 you mention, "In examining the capabilities of our computer systems, we have found that they have adequate capacity to meet our current and near-term future needs. As we look further into the future, however, we believe that the continued growth in traffic will cause some of our en route systems," and so forth.

Am I correct in saying that your "near-term future needs" means between now through 1986, 1987, 1988? Somewhere in there?

Mr. BLAKE. Yes, that's correct. The transition period of some of the older computers—the slower ones, the 9020As that we listed on one of the viewgraphs—will be candidates for early replacement, and those are the ones that will be replaced starting in the 1987–88 time period.

Mr. HARKIN. Okay. So you start in 1987 or 1988 and complete in the early 1990s, 1992 is your target date.

Mr. BLAKE. That's right. We have, as I noted earlier, three different capability systems in our facilities. Some of the earlier ones were the original computers that were somewhat slower than the later ones, and three of those will be candidates for early replacement.

Mr. HARKIN. Two questions. One, do you feel that that starting time of 1988 is soon enough? The next question would be, is it possible to move that date up, or is it just technically not possible to move that date up? Just from a technical standpoint, from the hardware side, is it just not possible?

Mr. ALBRECHT. Some of our initial estimates on how long it would take to provide such a system—when we could begin acquisition—indicated some later dates, beyond 1987 and 1988, and we reexamined the program to compress the time schedule where we thought we could in order to come up with a system as soon as possible.

Now, you ask "is this soon enough?" Again, the Air Traffic and Airway Facilities people say, guardedly, yes. We are doing everything we can to add to the capability of the 9020 complexes at this time, anticipating growth that will take place between now and 1987.

The real answer depends on a detailed examination of the traffic growth and the requirements at each center, which is now being done.

Mr. HARKIN. On pages 15 through 17 you are talking about the GPS system. You say on page 15—at the bottom—that you "expect to be able to define the role of GPS for civil air navigation by the end of calendar year 1982." You say that "our studies and experimentation will define the services which can be based on GPS as a function of the accuracy available and the relative cost. . . ."

Then on page 17 you say "We also believe that the early 1990 time period is an appropriate time to again examine the potential future use of satellite based systems. . . ."

Mr. BLAKE. There are two different subjects here. The first one is the use of GPS for civil navigation, and we have worked as a part of an overall inter-governmental working group led by the Office of Management and Budget to develop a national plan for navigation, and that plan specifies that we should have conducted sufficient research and development work to be able to define the role of GPS in the civil navigation system by the end of 1982.

Mr. HARKIN. Let me stop you right there. I just noticed an ad in the paper this morning by Rockwell. They now have their fifth satellite in orbit, and they now have enough to really start getting this kind of data. Now, are you working with them? Are you tracking this? Do you have some kind of agreement to get that kind of information about accuracy, cost and everything else?

Mr. BLAKE. Well, we have more than that. The group I referred to is a joint DOT-DOD working group. We also are participating with DOD and actually flying in their aircraft taking data on their equipment at the Yuma range, and will be receiving avionics from the military to test in our own aircraft at different airports around the country.

Mr. HARKIN. Will that take 3 years for you to get that kind of information? You say by the calendar year 1982. That's 3 years from now.

Mr. BLAKE. Well, I think it's all tied to the projected implementation dates. If adequate funding is available, we expect the GPS will be operational in the 1986-87 time period. So there is no need to reach a final decision before that time. We are just now getting our equipment from DOD to start our own tests, so we believe this is a reasonable date considering when that system will be available.

Mr. HARKIN. You say operational by 1986?

Mr. BLAKE. 1986-87 time period.

Mr. HARKIN. Then why do you say "the early 1990 time period is an appropriate time to again examine the potential future use?" It would seem to me that by 1986 or 1987 you would have that completely defined.

Mr. BLAKE. The reference is to possibly basing additional services, such as communications and surveillance on satellite systems. We are continuing to work that problem out not only with DOD but with the NASA-Langley folks, to see not only what possibilities exist for exploiting GPS further, but what other satellite systems and technology may come along in the same time period.

Mr. ALBRECHT. That early 1990's timeframe did not refer to GPS, Mr. Chairman. It referred to other systems that could come along.

Mr. HARKIN. I understand.

Mr. Lloyd?

Mr. LLOYD. Thank you, Mr. Chairman.

I note that in your statement you were talking about WWMCCS system, and obviously, you have coordinated with them, because when I walked out of here I went out and checked to see where we were on WWMCCS. We have some very serious deficiencies, as I'm sure you are aware, in that program.

I don't know if they're applicable to your application, but I do know that before you go any further, I would expect you to clarify your position. Obviously, the WWMCCS system is based on the Honeywell computer, which has some very severe limitations, and it would appear to me that before you got into that, you would really clarify what you want. Just in application, and I'm sure you already know this, its methodology—just to give you a brief description of how it works—is like a deck of cards, only they're face down, and in order to find any specific chunk of information, you have to go through the deck.

Well, you know, obviously, the average timeframe is 26, whatever that multiple is, because you have to assume that sometimes you have to go to the end, sometimes you get it on the first card.

There are other computer programmers and computer presentations which are like a deck face up, spread out, so that you need only make one turn to pull the card out. It would appear to me that that application would be far more applicable to what you are trying to do than the presentation that you have.

I'd be glad to hear if you have any response to that. I would also remind you that another committee here is having a review of the total WWMCCS program within the next couple of weeks, Mr. Chairman, and I would suggest that maybe you might like to be at that presentation—or any member here—to take a look, since this is what you are talking about. We would then have the program director, Mr. Dinneen, and all of the people there. We'd get two for the price of one.

At that point, it would appear to me that we could review exactly where we are on this thing.

Mr. BLAKE. We're familiar with the WWMCCS system and coordinating on that program.

Mr. ALBRECHT. Let me go a little bit further, Mr. Lloyd. We have asked DOD—for example, we have worked with Jerry Dinneen and his people to try to find computer data processing applications of this magnitude and with similar requirements. We are looking for good examples. There aren't too many around.

What we are talking about—perhaps in this case—may be a million lines of code, a fairly substantial system, and we are looking for ways in which that kind of a program has been managed successfully; where there were not major overruns and not major schedule slippages.

I think we are up to speed, but we certainly can accept any suggestions you may have in areas we may not have covered.

Mr. LLOYD. I am not suggesting, because I'm not an expert at this. I only know that in cross indexing or in crossfiling with another committee, we have reviewed it for several years. As a matter of fact, there is serious consideration of mandating going another way because of the problems that have been presented. But those problems may not be applicable to your specific situation. I think we need a clarification on that, because, under the circumstances, knowing as little as I know—and I emphasize the word "little"—were I to be involved at this point, I would vote against any moneys being spent by you in this program. I may be wrong, but I think we should really review where it is we are going, because if, indeed, your application has similarities then, indeed, you are going to have similar problems.

Mr. BLAKE. I think there are some similarities between the systems, but there are also a great number of differences. We are really talking,

in a replacement system at the time we switch to a new computer, of doing the same functions that would be in that computer on the day we switch, and we think we know very well how to do this

Mr. LLOYD. Well, are you considering the Honeywell machine?

Mr. BLAKE. We have not picked any particular machine.

Mr. LLOYD. Well, when you say WWMCCS, that's what you're saying. You don't just get software. Software must match with hardware. That software was matched with that hardware, so the answer is, if indeed you say WWMCCS to me, you've got to be talking Honeywell.

Mr. BLAKE. I merely said that we were "familiar" with the WWMCCS program. We were not specifically considering implementing the WWMCCS system. Quite to the contrary. The A-109 process is one in which you go out with your mission need and functional requirements and ask all of industry to bid on it.

Mr. LLOYD. I am very familiar with the A-109 process. I get it on the other side with the Department of Defense. We call it TSARC here, we call it DSARC there, but it's the same approach.

Mr. HARKIN. Mr. Goldwater?

Mr. GOLDWATER. Thank you, Mr. Chairman.

Mr. Chairman, last November and again last December, two other House subcommittees held hearings on the question of the current computer systems used by the FAA. There was great concern about the outages and undercapacity of today's existing system. The chairman and I testified at these hearings. We indicated that if we're going to address ourselves to the needs of the air traffic control system, we shouldn't just go out and buy new computers today without assuring that there are significant improvements in terms of controller productivity plus flexibility, safety, and fuel savings for controlled aircraft.

We stuck our necks out in a way, and we generally support the basic approach and attitude of the FAA. My main worry, and I think it's been reflected in the hearings that we've had, is whether we are going to have the money available to do the kind of thing you're advocating.

Listening to the testimony today—and I don't know whether you did this for effect or not—going through, step by step, the processes you have to do before you can proceed to the next step, I can't help but wonder how you get anything done in the first place.

This all brings an anecdote to mind:

It is said in the Bible that God created Heaven and Earth in 6 days, and on the 7th day he rested. Then he created Adam, the first man. Adam got kind of lonely, so he asked God for a companion, and God responded by saying "Well, Adam, do you have a systems requirement statement and an approved acquisition plan?"

I am absolutely amazed. I guess I understand now why there's so much complaint by industry, Congress and the users that FAA isn't responding to problems. They are spending half their time shuffling papers and devising all kinds of schemes and charts on how not to get something done.

Now I recognize that you are probably under constraints, and rules, and regulations which you didn't create—but perhaps you had a hand

in it. The point is that this R. & D. and acquisition plan is so complicated; OMB's, DOT's, and your own rules have bogged this process down to the point that it may fall under the weight of the paper. I'm sure that private industry is nowhere near this complicated.

I don't really know what the answer is. I'm sure that Congress can probably help, but then again, they may just further complicate the thing. But it seems to me this process has got to be accelerated somehow.

Mr. ALBRECHT. I think we concur with that, Mr. Goldwater. In a sense, we do it to ourselves; the rules and regulations that we do have to meet in order to get something done basically come from some parts of the Government. But I would like to object a little bit to your comment that we spend a lot of time trying to find ways of not doing anything.

We are doing our damndest to try to see where we can legally avoid some of the time-consuming requirements and still be responsive to the directives, and I think we've done that. We've compressed the schedule considerably over what it normally would be.

The concept of establishing up to five contractors initially and keeping that set of contractors throughout the program, narrowing it down as we go, is intended to prevent procurement delays.

We are not swift enough in terms of our own internal procurement actions. I submit neither is DOD nor many other Government agencies. We are aware of that and we're working on it as a single point where we can perhaps make some improvements.

One area where I think we can show some foresight in the program is avoiding the kind of technical risk where you become dependent upon one source or one contractor for solutions, and if it doesn't work out, then you're in trouble. Then you go back to "go" again.

Well, in this program, we will pursue multiple approaches so that it will have, if you will, continuous backup, technical development capabilities, and avoid that kind of a start-over program.

I think we are aware of your concern. We have the same concern, and, believe me, we are open to suggestions.

Mr. GOLDWATER. The Aviation Daily attributed a quote to you, Mr. Albrecht. You labeled this computer replacement program "of extreme urgency." I think that's what you said. However, the total amount to be spent on this problem from 1981 to 1985 is only \$93 million. Several people who have some expertise in these areas make the prediction that three or four, or maybe five times that amount is needed. If that's true, I am wondering how this matches up with your sense of urgency?

Mr. ALBRECHT. Well, I think this perhaps goes back to the discussion we had yesterday, Mr. Goldwater. We, for several reasons, are currently reassessing the program development costs—total cost—and we will submit to you very shortly some figures that indicate our very current thinking in this area.

Without giving specific numbers, which I can't do right now, I think you will see that these kinds of concerns are reflected in those numbers.

Mr. GOLDWATER. Well, yesterday I made a request for you to fill in some blanks on that budget. I assume part of that information will reflect the increased urgency of this replacement.

Mr. ALBRECHT. That's correct. It will also reflect our current assessment of what it takes to meet the kind of schedule commitments we've made, our current assessment of the impact of A-109.

Mr. GOLDWATER. And the costs.

Mr. ALBRECHT. Yes.

Mr. GOLDWATER. Each descending year.

Mr. ALBRECHT. Exactly as the form laid out for us.

Mr. GOLDWATER. Thank you.

Mr. HARKIN. Mr. Volkmer?

Mr. VOLKMER. Most of this work on your advanced computer for air traffic control is in the development stage. Is that going to be done all in-house? That is, other than working with private industry, do you contemplate contracting out to various research groups? What are your plans?

Mr. BLAKE. If you remember the development roadmap I showed you, the advanced computer line, we are planning to start out with five contractors. You know, if there are five good proposals and we have the money to fund it. And all of the development work will then be done by contractors.

The Government part of it is to prepare the specifications.

Mr. VOLKMER. That's right. And monitor and review it, and then come back and make new proposals back to them. That part of it, will that all be in-house.

Mr. BLAKE. Most of it will be, yes; with some support contractor assistance.

Mr. VOLKMER. Support contractors in what area?

Mr. BLAKE. Well, in several of the areas shown. Particularly the technology tasks that I showed at the end, we will have support contractors helping us to establish evaluation criteria, providing the information from which we will develop the evaluation criteria to be utilized.

Mr. VOLKMER. In other words, they'll be working with your five contractors.

Mr. BLAKE. No; they'll be working directly for us on an exclusion clause. They cannot help us on evaluation criteria at the same time as they would be working on the program.

Mr. ALBRECHT. To answer what I think is your question, Mr. Volkmer, we are going to manage the program. We are going to direct it overall technically. We are not going to abdicate that responsibility.

Where we need support from a systems support contractor that has no hardware interest, we will get it.

Mr. VOLKMER. What will be their function? That's what I'm trying to get at.

Mr. ALBRECHT. This is a reasonably complicated program and there are areas where technical expertise outside of the FAA can be usefully applied, and where it is, we use it.

Mr. VOLKMER. In other words, where you do not have the ability to do it in-house.

Mr. ALBRECHT. Where we don't have, on a full-time basis, the specific technical expertise in a given area. It is much more efficient for us to get it on the outside.

Mr. VOLKMER. All right. This expertise will be in what areas? Give me one example.

Mr. ALBRECHT. Well, an example, a case in point, might be looking at how one would approach some of the total automation functions, how one would set up a model to totally automate a sector. In this particular problem area, we have used the services of Mitre Corp. very successfully.

Mr. VOLKMER. And then they set it up to provide you with a model, and then you make your evaluation of that.

Mr. ALBRECHT. That's right.

Mr. VOLKMER. Your evaluation, of course, is based a lot upon what they recommend with the model.

Mr. ALBRECHT. It is based upon our independent opinion of the work they have done.

Mr. VOLKMER. You are using them for ideas then, that's what you're doing, is that correct?

Mr. ALBRECHT. We use a lot of people for ideas.

Mr. VOLKMER. Oh, OK. I don't have any more comments.

Thank you, Mr. Chairman.

Mr. HARKIN. Thank you, Mr. Volkmer.

Mr. HARKIN. Mr. Goldwater?

Mr. GOLDWATER. I'd be interested in getting a feel for what earlier air traffic control computer systems have cost in the research and development phase, in order to estimate what the next generation might cost. I wonder if you could provide for us the total cost of research and development for the current generation of en route air traffic control computers. If you could, convert this into 1980 dollars.

Mr. ALBRECHT. We certainly could do that for the record, Mr. Goldwater. I can't give you those numbers right now.

Mr. GOLDWATER. I would also like to know the total cost of research and development for the current ARTS-3 computers in 1980 dollars. I think that would give us a better feel perhaps for what we are embarking on right now with this new generation of ATC computers.

[Material supplied in a letter from Mr. Bond to Mr. Harkin, April 28, 1980. See Appendix.]

Mr. GOLDWATER. Another thing I wanted to ask you about was Doppler radar severe weather system. Mr. Blake said it would be ready for service sometime in 1988. It seems to me that kind of improvement would be excellent, especially for general aviation. Have you budgeted enough money in the budget—in your proposals—so that it would be ready by 1988?

Mr. ALBRECHT. As I'm sure you know, that is a joint effort between ourselves and the Defense Department and the National Weather Service. We are jointly manning a system program office at the current time addressing the development of that particular radar. And some of the funding decisions in terms of how that program will be supported are fairly recent, so to the extent they impact any previous submissions, they will be corrected in the new numbers we give you.

Mr. HARKIN. Thank you very much.

I just have one last question. In all of this plan that you've just outlined for us, the target dates, the time of implementing the procurement of these computers, ending date of 1992, I guess is what you have listed, I don't think I have ever seen target dates yet that didn't slip or slide a little bit.

I am wondering if, perhaps, you ought not to move up that target date a little bit to 1990, knowing full well that it is going to slip a little bit. Second, assuming that you don't move it up, you stick exactly where you are, do you feel that the amount of money that has been requested for the 5-year ADAP program is sufficient to keep you on track for this program?

Mr. ALBRECHT. Well, to answer your first question, first, I think there is probably somebody's law around that says whatever your schedule is, you are going to at least meet that or exceed it, so to the extent we firmly believe that we can meet the initial implementation date of 1987, I'd be very reluctant to change it. We are going to fight very hard to make sure we meet that date.

In other programs, if you're late, you get fired or you get your wrists slapped, but in this case, we are meeting an operational requirement that also is running along that we don't control, so we are deadly serious about doing everything we can to meet that date.

I am not saying we are not going to have problems, that we're not going to have to reevaluate, but as of right now, that's our best forecast and we are going to stick with it.

In terms of total—do we have enough money, have we asked for enough money, again, without trying to be devious, Mr. Chairman, I think the answer to that will be reflected in the submission we will give you very, very shortly that reassesses the impact of factors on the program since we made that last submission.

Mr. VOLKMER. Mr. Chairman?

Could I ask if FAA would furnish me with how much Mitre has done so far on this?

Mr. BLAKE. Well, it depends on which part of the program you are talking about. If it's the advanced computer program, we maintain a level of about five to seven people in direct support for the first part of the program.

Mr. VOLKMER. From Mitre?

Mr. BLAKE. From Mitre.

Mr. VOLKMER. Do you have a contract with them?

Mr. BLAKE. Yes.

Mr. VOLKMER. How long have they been on board on this program?

Mr. BLAKE. This program's been running about 2 years.

Mr. VOLKMER. Is that an ongoing contract or is it annually reviewed?

Mr. BLAKE. It's reviewed and renewed annually.

Mr. VOLKMER. Could I have copies of the contract you had with them when you started the program?

[Witnesses nod in the affirmative.] (Contracts transmitted by Bond to Harkin letter, April 28, 1980 and forwarded to Mr. Volkmer.)

Mr. VOLKMER. I would appreciate your furnishing it to me.

Mr. HARKIN. Thank you.

The next witness today is Mr. David Israel, WWMCCS System Engineer in the Defense Communications Agency of the Department of Defense.

Mr. Israel, we have your prepared statement. Without objection, it will be made a part of the record in its entirety. As I instruct every witness, you may proceed as you so desire. You may either read it, summarize it, extemporize, whatever you want.

Mr. ISRAEL. Yes, sir; it's a fairly short statement and I would like to read it for you.

**STATEMENT OF DAVID ISRAEL, WWMCCS SYSTEM ENGINEER,
DEFENSE COMMUNICATIONS AGENCY**

Mr. ISRAEL. I am especially pleased to have this opportunity to make a few remarks about FAA's R. & D. program and on the modernization of its en route and terminal computer systems.

It was some 30 years ago this month when I was a graduate student at MIT that I wrote a master's thesis suggesting that the then-new digital computers could be applied to civil air traffic control. It has given me great pleasure to see how far this idea has been carried forward.

Since that time, I have been engaged in various parts of the civil sector and Government in the engineering of electronic systems. This has included 5 years at the FAA, where I was the first Director of the Office of Systems Engineering Management and, later, the Deputy Associate Administrator for Engineering and Development. Over that period, from 1970-75, I directed FAA's R. & D. programs.

Hence, I have very little hesitation in making several observations and suggestions to you. I do this, however, as an interested private citizen, and not as an employee or representative of the Defense Department.

Mr. HARKIN. But you are employed by the Defense Department.

Mr. ISRAEL. I am employed by the Defense Department. The title is WWMCCS System Engineer. WWMCCS is World-Wide Military Command Control System. It is that network of sensors, communications and computers at some 24 command centers around the country which constitutes, the information and force management system that permits the President, the Secretary of Defense and the Joint Chiefs of Staff to exercise control of our strategic and tactical forces.

I serve as the architect of that system, making recommendations of what should be done to improve its capabilities. My organization has recently become part of the Defense Communications Agency. I also consider that I work for Dr. Van Trees and Dr. Dinneen in OSD.

This would be an appropriate place to point out that while the FAA's computer replacement problem is large and difficult, it certainly isn't unique or the biggest such problem in the Government. The Defense Department is today involved in considering the replacement and modernization of some 35 computers at the 24 command centers which are part of WWMCCS. As you heard earlier, concerns have been expressed with respect to the Honeywell computers. In fact, that is one of the responsibilities I have and am addressing in my current position: the architecture and the plans for proceeding with the modernization of the WWMCCS ADP and the Honeywell computers.

My remarks today will be in two parts, First I would like to make a few generalizations about FAA's R. & D. program, its relation to its customers and the level and source of funding. Then I have prepared some recommendations—actually 10 specific suggestions—for your consideration for the computer modernization problem.

My first generalization is that the customer isn't always right about what is needed. That problem, I find in my experience, is multiplied with the FAA because it has many customers of its R. & D. program.

First, the customers include the users of the system as well as the operators of the system. These are two entirely different sorts of customers. The operators, in turn, represent the controllers and the flight service station specialists. They have unique needs and unique viewpoints.

The other customer is the user, and the users represent the civil, the military, the commercial air fleets, the private and general aviation pilots. And there we have a dichotomy again. In some cases, you have the owners as opposed to the pilots, each, again, with different views.

So the FAA has a very unique situation. It has a large number of different customers; each one has a different viewpoint, and each one is for or against various R. & D. activities for different reasons.

One generalization is that this diverse group of customers is generally not convinced that more R. & D. by FAA is good, although they might admit that this is so in the safety area.

I won't go into the detailed reasons; but as you can imagine, these include such considerations as job security, cost of operating an aircraft in the air space, and so forth. In any event, the net result is that almost every part of the FAA's R. & D. program has some customer who is against it. It is very disconcerting—I remember my reaction when I was in the FAA—to find out that there was always someone lined up against some part of your R. & D. program. I think this translates to you as an apparent across-the-board lack of support by the customers. When the customer doesn't support a program, I am sure Congress wonders why it should provide financial support.

The customers have prevailed and the FAA's R. & D. budget has been constrained. Fortunately, I might add parenthetically, this attitude towards R. & D. doesn't exist in the Defense Department. R. & D. there is an important product and the customers want it and they want more as soon as we can give it to them.

So my plea is that you shouldn't give too much weight to the customers' opinions in judging and funding the R. & D. program. ACT customers aren't necessarily the best judges of the necessary R. & D. efforts. Self-interest should not be confused with national interest.

My second concern has to do with the level of funding of the R. & D. program. Simply put, it is short today and grossly inadequate as we look forward to an era of fuller automation. There are many serious questions to be addressed and tested here, and none of this is inexpensive.

One problem I gave particular attention to when I was in the FAA was the question, Are there limits to the amount of traffic that a controller will assume responsibility for, and what sets the limits? If we could provide him complete automation, would he take say, 100 aircraft under his control? What is behind this? I believe it has to do with his feeling of responsibility and his feeling of safety, and his feeling of safety is related to the automation and the backup and the backup of the backup. He does not want to be left alone with 100 aircraft under his control over some checkpoint and all calling in at once.

To understand this problem takes tests and evaluation and a lot of it. It's very expensive. It takes computer programming and, certainly, this testing and evaluation requires far more funding than exists at present. But where will the money come from?

As I noted, there is great reluctance on all sides to increase the total R. & D. budget and there is, in fact, opposition to almost every individual item. I think there are two answers.

First, a number of the current R. & D. activities should be transferred immediately to a SPO, and the SPO should not be funded from R. & D. funds. Not funded with R. & D. money.

The second is that the way FAA funds the R. & D. program should be changed. Having traveled through various parts of the Government, I find that we don't fund things the same way in all departments. I think the first thing I would do is to take the staffing for the in-house personnel in the FAA and not fund them under the R. & D. line. I see this done in other agencies of the Government.

In any event, I recommend that FAA and Congress investigate this as a means of making the current R. & D. funding go further. But these solutions, this way of handling the money or accounting for it differently, should not divert attention from the fact that FAA's R. & D. budget is inadequate to the needs of the system which is now heavily, if not totally, dependent upon current and future technology. Our controllers are dependent upon that technology, and it's expensive, and the costs of operating air traffic control systems are going to continue to increase.

The tendency to make that staffing line curve down, to show that we are going to save controllers, is one we have to fight off. It probably won't happen. The costs of operating our national air traffic system are very high and it is going to continue to be more expensive.

Let me make 10 suggestions concerning the computer modernization problem.

First of all is the need to recognize the size of the task. Essential to the success of a computer modernization will be a full and proper recognition of the size of the task. It is going to be very expensive. Depending on how one wants to do the accounting, it will cost between \$1 and \$2 billion over the next 10 or 15 years.

It is a task of enormous proportions in money, people and time. It may be as large a task as the FAA has ever handled. Not only must the FAA recognize the size and complexity of this task and effort, but it must avoid that inevitable tendency to underestimate and oversell, and also must recognize that we've had an almost unbroken series of previously unsatisfactory experiences in such enterprises in the Government because we underestimate and oversell.

There is no reason to be optimistic about this problem. That is the fundamental note I want to sound today. Money will be difficult to obtain, but even worse is the problem of qualified technical people. Technical managers in this area are very scarce. There is a heavy demand by commercial projects, and by DOD projects, and there is going to be great competition for good people. So the task is extremely large and one should not be very optimistic about being able to handle it.

The second is to establish a dedicated project organization. Once the size of the task and the related experience are fully appreciated,

then you have to establish a strong, full-time, dedicated team to direct and manage and execute the enterprise. I repeat, a dedicated, full-time team to direct, manage and execute the effort.

Let me describe some aspects of such a team, which I would call a Special Program Office of SPO. First, it would be full time and dedicated to the task. It wouldn't be a committee, and hence it wouldn't be distracted by other activities.

Second, it would be manned by the best people available from all of FAA's services.

Third, it would have real authority and control over the money. It would have a strong support contractor, and it would report directly to the FAA Administrator.

It will not be easy to establish this SPO. The conventional organization will fight against the loss of responsibility and authority that would be required to put this together and to have it to report at the right level. It will take at least a year—if we start today—to get that SPO established. You have to write a charter; you have to recruit a director; you have to find a staff; you have to find the office space; you have to find the secretaries; you'll have to pass papers up and down the Department of Transportation until you're blue in the face. I believe that an immediate and strong effort by the Administrator is the only way that that SPO would get established in a reasonable time.

Until then, I discount everything that's happening as just marching in place, with very little progress being made. Committees don't make very much progress in these matters.

If we're serious, I say set up the SPO now.

The third point I would make is that we must band together and fight off all those who want to explore new ATC concepts. The way we control traffic today has evolved from flight strips to flight strips and radar/beacon data to computerized assistance for the controller. The key word is "evolution." In this sense I would not consider this modernization to be a major system acquisition as in the A-109; I would consider this an upgrading and evolution of capability.

I believe we can see how it's going to proceed. I believe it's been validated by numerous studies, and I feel very comfortable with the present basic concepts. The nature of ATC is sound and valid.

I make this point to highlight the fact that we are surrounded by well-meaning technologists and managers, albeit ATC neophytes. They surround us in the Department of Transportation, the Office of Management and Budget, the Office of Technology Assessment. They are all around, and they would like to review the conceptual basis for air traffic control just one more time before proceeding. These are the people who want to do just one more study of transferring ATC to the cockpit, or transferring it to satellites or someplace else.

I believe this is, again, the human tendency to put off the difficult funding decisions by conducting just one more study to see if we can't find a simpler problem. I think we have to fight that off and get started.

The fourth point would be to define the problem and objectives. The first task of the SPO should be to review and identify the problem and desired objectives and to put them in some order of priority. This will not be easy, because there are many tough items on this list.

I have a list of the following items or concerns, you have when you think about the future, not necessarily in order of priority:

- (a) Improve equipment reliability and availability;
- (b) Provide capacity to handle traffic peaks and growth;
- (c) Provide capacity to handle new functions, such as more automation and data link;
- (d) Reduce maintenance costs;
- (e) Improve logistic support and reduce logistic support costs;
- (f) Untangle or unbundle the software to permit easier modification and growth;
- (g) Improve man-machine interface;
- (h) Improve console reliability;
- (i) Improve standardization—both the hardware and the software—between en route and terminal systems.

In fact, are we more concerned about capacity in the en route or terminal system? The important starting point then, in my mind, is the very careful delineation and prioritization of these objectives.

That is because of my fifth point, which is, don't try to solve everything now. If we try to do everything on the list, I predict failure. This job is a very big, and our management capabilities—despite the experience we've had—are very limited. This will not be the last major upgrade of ATC automation. In 15 years, there will probably be a committee sitting here concerned again, with modernization. The comment will be as follows: "Something has happened operationally. Something has happened to technology. How come we didn't foresee this 15 years ago? Here we are needing to upgrade the ADP and hardware and software again." We cannot be omniscient. We should plan as best we can, but I believe in the back of our minds, we must assume another major upgrade beginning around the year 2000.

We should plan how to best accommodate such an upgrade and minimize its impact. Certainly, we should not be overwhelmed by that problem and let it unduly influence what we do now, but there will be major upgrades in the future, even though we can't predict them with clarity today, and our planning should take that into account.

Sixth, we should avoid trying to do too much. We need to carve out quickly a program which meets the essential needs and that is within our realistic capabilities. The essential items should come first; the desirable will have to be considered but they must also be understood as a possible enemy.

Again, it's this problem of overestimating what we can do. We must avoid overselling in product, time, and money. We must stress this over and over. It is the heart of the problem with most of our system acquisitions.

The seventh item is to avoid overcontemplation of the problem. FAA must avoid the tendency to contemplate the problem, its size, and complexity to a point where it is mesmerized into inaction. We ought to get going now. I believe the major design or architectural alternatives are limited; they are already known. The need is not so much to refine them, but to get along with the very difficult job of selecting among them.

I'm really not even sure the FAA needs to go back to "go" with the A-109. This is a system evolution or upgrading. I am concerned with

what I understand to be a proposal to prepare a specification and go through a source selection to achieve a concept definition phase with five contractors. FAA has a reasonably strong in-house staff and an experienced and respected support contractor.

I would doubt the need to educate, say, 15 to 20 people from each of the 5 contractors in the basic concepts of ATC and the present NAS configuration before we get started. I believe the FAA could save several years without inhibiting competition in any way.

Set up the SPO, give them the job, and get started with the hard choices.

The eighth point would be to give the SPO a broad charter. As I predicted earlier, the FAA organization will fight against a SPO, and one normal tactic of bureaucrats would be to limit the scope and responsibility of the organization. I believe the SPO should have a very broad charter. It should not only be responsible for computer modernization, but it should also look at new and improved means of computer program production and test and how the FAA adapts and maintains its computer programs at sites.

There are many FAA programmers at each of the NAS en route and terminal facilities. I believe that his modernization provides an opportunity to rethink and reimplement those test, evaluation, adaptation, and certification functions. I think this, too, should be the responsibility of the SPO.

The ninth point would be to pursue the nonelegant upgrade as insurance. In a billion dollar program, we should consider a few million, if not a few tens of million, for insurance. I am personally concerned that the equipment reliability—and this is a very difficult problem to approach objectively—may be today or may become worse than the FAA cares to concede. This problem may exist in the main frames or the display consoles.

If this does become a real problem again, I am sure it is a real problem today—or if traffic grows very quickly, then the FAA, I believe, should have in its hip pocket a fully detailed, thoroughly investigative plan for what I would call a “quick and dirty upgrade” by a NAS-compatible computer without any computer reprogramming at all.

We should do more than think about this. We should perhaps even lease one of these machines and do the necessary engineering for reliability then and test out this proposal. I think the SPO should be charged to look into the magnitude of such a fallback effort very quickly, as a matter of priority and as a matter of insurance.

My 10th point would be to give some parallel attention to the future of the surveillance system. Related to the computer modernization, and perhaps equally necessary for the future success of air traffic control, would be an upgrading and modernization of the surveillance system which feeds data to our controllers and computers.

Our attention to the ADP modernization problem should not be permitted to detract from attention in that area. There are very serious problems in the surveillance area, but also some very unique opportunities.

For example, I believe that within 10 to 15 years we should phase out the use of primary radar. All aircraft under ATC surveillance and control should be required to carry a beacon, and that beacon and the beacon transponder should be DABS. We ought to push this very hard.

In fact, I think one should even consider establishing a surveillance program management office. That would be a good idea to get that moving.

Well, those are my 10 sugestions. I thank you for the opportunity to present them. I hope I have been helpful to the committee, but more important, I hope that you will be helpful to the FAA. It faces a very major problem and it certainly needs money, guidance and support.

Mr. HARKIN. Thank you very much, Mr. Israel.

[The prepared statement of Mr. Israel follows:]

STATEMENT OF

DAVID ISRAEL

WWMCCS SYSTEM ENGINEER
DEFENSE COMMUNICATIONS AGENCY
WASHINGTON, D.C.

ON

FEBRUARY 20, 1980

BEFORE

SUBCOMMITTEE ON TRANSPORTATION, AVIATION, AND COMMUNICATIONS
OF THE

HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

I am especially pleased to have this opportunity to make a few remarks about FAA's R&D program and on the modernization of its enroute and terminal computer systems. It was just 30 years ago this month, as a graduate student at MIT, that I began work on my Master's thesis which was the first suggestion that the then-new digital computers could be applied to air traffic control. In the interim, I've been engaged in various parts of the civil sector and government in the engineering of large electronic systems. This included five years at the FAA, where I was the first Director of the Office of Systems Engineering Management and later the Deputy Associate Administrator for Engineering and Development. Over that period, from 1970-1975, I directed FAA's R&D programs. Hence, I have no hesitation in making several observations and suggestions to you. I do this as an interested private citizen and not as an employee or representative of the Defense Department.

This might be an appropriate point to note that while FAA's computer replacement problem is very large and difficult, it is far from being unique or the biggest such problem in the government. The Defense Department is facing the similar problem of modernizing some 34 computers at 25 command centers which form a major element of the Worldwide Military Command and Control System (WWMCCS), the information and force management system for the President, Secretary of Defense, and JCS. It is one of the problems I'm addressing in my current position.

My remarks today are in two parts. First I would like to make a few generalizations about FAA's R&D program -- its relation to its customers and the level and source of funding -- and then I would like to make some recommendations for the computer modernization problem. These latter I have organized into ten specific suggestions.

My first generalization is that the customer isn't always right about what is needed. The problem is multiplied with the FAA since the customers of its R&D program are multi-fold. There are the users of the system as well as the operators. The operators represent the controllers and FSS specialists. They have unique needs and viewpoints. The users are the commercial, military, and civil aircraft fleets. In the commercial segment, there are both owners and pilots, each with different views.

There are, then, a large number of different customers, each has different viewpoints, and each is for or against certain R&D activities for various reasons. This diverse group of customers is not necessarily convinced that more FAA R&D is good, except perhaps in the safety area. I won't go into the reasons, which include such aspects as job security and cost of operating in the air space, but the net result, in my observation, is that almost every single part of the FAA's R&D program has some customer against it. This apparent across-the-board lack of support by the customers clearly influences Congress. The negative attitude of the customers has generally prevailed and FAA's R&D budget has been constrained. I'm happy to say that the attitude towards R&D in the Defense Department is quite different; R&D there is highly valued and desired by the customers.

My plea is that you shouldn't give much weight to the customer's opinion in judging and funding the R&D programs. The ATC customers are not necessarily the best judges of the necessary R&D programs. Self-interest should not be confused with national interest.

My second general concern has to do with the level of funding of the R&D program. Simply put: it is very short today and grossly inadequate as we look forward to an era of fuller automation. There are many serious questions to be addressed and tested here. One which I gave some attention to while I was in the FAA was: Are there limits to the amount of traffic for which a controller will assume responsibility and what sets such limits? The problem here relates to his confidence in the system and the backups to it. This is obvious, but there is much test and evaluation which needs to be pursued to better assess and support decisions on how to achieve greater system capacity without ever increasing numbers of controllers. This test and evaluation requires far greater funding than at present.

Where will the money come from? There is great reluctance on all sides to increases in the total R&D budget and, as noted above, opposition to most individual items. My answer is two-fold:

First, a number of the current F&D activities should be transferred to a SPO which I will describe shortly. The SPO should not, repeat not, be funded with R&D money.

Second, the way that FAA funds the R&D program should be changed. In other parts of the government, the in-house staff are separately funded and are not included under the line R&D activities.

I recommend that the FAA and Congress investigate this as a means of making current F&D funding go further. In any case, these proposed solutions should not divert attention from the fact that FAA's R&D budget is inadequate to the needs of a system now heavily dependent on current and future technology!

Next, let me briefly make ten recommendations concerning the computer modernization problem.

1. Recognize the Size of the Task

Essential to the eventual success of FAA computer modernization will be a full and proper recognition of the size of the task. This will be an expensive effort, involving between one and two billion dollars over the next 10-15 years, depending on how one does the accounting. It is a task of very large proportions -- in money, people and time. It may be as large a task as the FAA has ever handled. Not only must FAA recognize the size and complexity of the effort, avoiding the inevitable tendency to underestimate and oversell, but the almost unbroken series of previous unsatisfactory experiences in such enterprises throughout the government must be fully appreciated. There is little reason to be optimistic. Money will be difficult to obtain; talented technical managers in this area are scarce, to begin with, and in heavy demand by commercial projects.

2. Establish a Dedicated Project Organization

Once the size of the task and related experience are fully appreciated, then the next step will be to establish a strong, full-time,

dedicated team to direct, manage and execute the enterprise. Let me describe some aspects of this team, which we can call a Special Programs Office or SPO:

- a. it will be full-time and dedicated to the task, not distracted by other duties
- b. it will be manned by the best people available from all of FAA's Services
- c. it will have real authority and money
- d. it will have a strong support contractor, and
- e. it will report directly to the FAA administrator.

It will be difficult to establish this SPO. The conventional organization will fight against the loss of responsibility and authority. I predict it will take at least a year to get such a SPO into operation: a charter must be written, a director recruited, staff selected, office space found, etc. etc. An immediate strong effort by the Administrator is the only way the SPO will get established in a reasonable time; until then, I discount the progress to be made by coordinating committees, etc. If we're serious, set up the SPO.

3. Fight Off Those Who Want To Explore New ATC Concepts

The way we control traffic today has evolved slowly from flight strips alone to flight strips and radar/beacon data to computer assistance to the controller. Today we can see the further evolution -- I stress evolution -- of this controller-oriented system over the next 15-20 years, and I believe this has been validated by numerous studies, etc. I feel very comfortable that the present basic concepts and nature of ATC are sound and valid.

I make this point to highlight the fact that we are surrounded by generally well-meaning technologists or managers ATC neophytes in the Department of Transportation, Office of Management and Budget, Office of Technology Assessment and other organizations who would like to review the conceptual basis for ATC before proceeding. These are the people who want to do just one more study of transferring ATC to the cockpit or doing it by satellites, etc.

The human tendency to put off the difficult funding decisions by conducting another study to see if we can't find a simpler problem must be fought off. We need to get started.

4. Define the Problem and the Objectives

A first task of the SPO should be to review and identify the problem and desired objectives, putting them in some order of priority. This will not be easy, for some of the entries on the list must include the following:

- a. improve equipment reliability and availability
- b. provide capacity to handle traffic peaks and growth
- c. provide capacity to handle new functions, such as more automation, data link etc.
- d. reduce maintenance costs
- e. improve logistic support and costs
- f. untangle or unbundle the software to permit easier future modification and growth
- g. improve man-machine interface
- h. improve console reliability

i. increase standardization -- both hardware and software -- between enroute and terminal systems

Are we, for example, more concerned about capacity in the enroute or terminal system? In any case, the starting point must be a careful delineation and prioritization of these objectives!

5. Don't Try to Solve Everything Now

If we try to do everything on such a list, I predict failure. The job is too big and beyond our capabilities. But, this will not be the last major upgrade of ATC automation. In 15 years, operational considerations and the impact of new technology will introduce new problems and possibilities which we can't clearly foresee at this time. We cannot be omniscient. We should plan as best we can, but we should probably assume another major upgrade beginning in the 2000. Of course we should plan now on how to best accommodate such an upgrade and minimize its impact. But, we should not become overwhelmed by that problem and let it unduly influence what we must do now. There will be more major upgrades in the future even though we can't predict them with clarity. Let's plan on this.

6. Avoid Trying to Do Too Much

We must quickly carve out a program which meets the essential needs and which is within our realistic capabilities. Essential comes first; desirable must be considered but must also be understood as a possible enemy.

Again, the need to avoid over-estimating what we can do and avoid overselling -- in product, time, and money -- must be stressed over and over.

7. Avoid Over-Contemplation of the Problem

The FAA must avoid the tendency to contemplate the problem, its size and complexity to a point where it is mesmerized into inaction. Get going now! I believe that the major design or architectural alternatives are limited and already known; the need is not so much to refine them, but to get along with the difficult job of selection among them.

I'm not sure that FAA needs to go back to "GO" with respect to A109. I am concerned about what I understand to be a proposal to prepare a specification and go through a source selection to achieve a concept definition phase with five contractors. The FAA has a reasonably strong in-house staff and an experienced and respected support contractor. I doubt the need to educate, say, 15-20 people from each of five contractors in the basic concepts of ATC and the present NAS configuration. I believe the FAA can save several years without inhibiting competition.

Set up the SPO, give them the job, and get started with the hard choices.

8. Give the SPO A Broad Charter

It can be predicted that the FAA organization will fight against a SPO, and one tactic will be to limit the scope and responsibility of the SPO.

The SPO should have a broad charter. It should not only be responsible for the computer modernization, but also look at

new and improved means of computer program production and test and how the FAA adapts and maintains the programs at sites. There are many programmers at each of the NAS and ATC facilities. I believe that the modernization provides an opportunity to rethink and re-implement these test, evaluation, adaptation, and certification functions. The SPO should do this.

9. Pursue the Non-Elegant Upgrade as Insurance

In a billion dollar program, we should consider a few million, if not a few tens of millions, for insurance. I am concerned that equipment reliability -- which is a very difficult problem to approach objectively -- may be or may become worse than the FAA cares to concede. This may be in the main frames or the display consoles. If this becomes a real problem -- and again, I'm not sure it is -- or if traffic grows very quickly, then the FAA should have in its hip-pocket a fully detailed and thoroughly investigated plan for a quick and dirty upgrade to a NAS-compatible machine with no computer reprogramming. The design, engineering, and test of this proposal should be carried out.

The SPO should be charged to look into the magnitude of such a fall-back effort as a matter of priority.

10. Give Parallel Attention to the Future of the Surveillance System

Related to the computer modernization, and perhaps equally necessary for the future success of ATC, is upgrading and improvement of the surveillance system which feeds data to the controllers and computers. Our attention to the ADP modernization problem should not be permitted to detract

from attention there. There are some serious problems and unique opportunities in the surveillance area. For example, within 10-15 years we should phase out the use of primary radar for enroute control. All aircraft under ATC surveillance and control should be required to carry a beacon, and that transponder should be DABS. We should push this very hard. In fact, a surveillance program management office would probably also be a good idea.

Those are my ten suggestions. I thank you for this opportunity to present them. I hope I have been helpful to this Committee; but more important, I hope that this Committee can be helpful to FAA. It faces a major problem. It needs money, guidance, and support.

Mr. Lloyd?

Mr. LLOYD. Thank you very much, Mr. Chairman.

I presume, Mr. Israel, you heard my reservation with regards to WWMCCS. Do you concur or disagree with me, or am I being unduly alarmed? What kind of response would you have to that?

Mr. ISRAEL. The WWMCCS computer, chosen in the early 1970's will need to be upgraded and replaced at about the same time period that the FAA computers will need to be replaced. The WWMCCS computer is probably a little older in history, and certainly not as up to date as the FAA computers, but it will have to be modernized. That's a very difficult modernization program, somewhat different than the FAA's. The FAA has 20 centers all doing the same thing. We have 25 centers all doing different things. We have much more software.

While the Honeywell computer is not deemed as adequate to continue more than another 5 to 7 years, it would be a mistake to pull it out tomorrow and try to replace it. It should be done in a more relaxed time frame so that we can get the operators and the software and everything else in tune with it. So, in short, the Honeywell machine will need to be replaced. On the other hand, I do not believe that the performance of the Honeywell machine is inhibiting or is a key factor in the performance of WWMCCS today.

Mr. LLOYD. I'm not competent to make the transfer to the application here, when Mr. Blake alluded to the interest in WWMCCS. While I want him to do that, whether that system is adequate or not, the first thing that needs to be done is somebody's got to review the field as you have already said. I certainly concur with your remarks. I also agree with you that, if we stand around and do it by committee, without assigning somebody to get on with the program, we're not going to get anywhere.

You know, in the field of computers the proliferation at the present moment is just tremendous. We can anticipate major changes. I was just talking to people from Lawrence Livermore Laboratories, and they seem to have a system that they think is the answer to the most technical questions and, indeed, if they are correct, it's a generation step ahead of anything we know now. It's here today, as they say. I don't know that it's so, you understand. I'm only repeating what I hear.

I think one of the major problems that we have to solve is just who gets to play with the ball. Are we going to continue—as I presume the FAA does—that all the final, fine-tuning, control factors will rest with the controller? Or are we going to allow a greater range of information to the pilot so that he can make the judgment? Who really controls? Do you think that's a valid question to the FAA?

Mr. ISRAEL. I'm not overwhelmed with the idea of turning air traffic control over to the pilots, even those in the cockpits of 747s with large displays. I am all for giving them information, but I believe that the way to chaos is to turn over ATC to the pilots.

I believe there must be centralized control of the air traffic from the ground. I believe everyone should participate in the system. It makes me unpopular with general aviation, but I think you should be required to have a transponder to fly in the system; the FAA ought to turn off the primary radars except in the terminal areas.

As far as the first part of your question is concerned, and touching on something you said earlier, there is nothing in the Honeywell machines that the FAA wants or needs. As we proceed forward in the Department of Defense with modernization of the WWMCCS-ADP, we are thinking of some of the same architectural solutions that they are thinking about, and there has been in the past—and there certainly will be in the future—an exchange of information.

Mr. Lloyd.

Have they adequately communicated with you, in your opinion, or are you adequately communicating with them, so that the single entity out there, which is called the taxpayer, is not buying two systems, or can get the benefit of what you are doing for Defense into FAA, or they can get the benefit of what FAA is doing back into Defense?

Mr. ISRAEL. It happens both formally and informally. The formal channels I'll leave alone. Informally, there are technical managers who move back and forth between the agencies; we all know each other; the contractors visit us all; we all like to keep abreast of our professional and technical specialties.

Mr. LLOYD. Do you consider it adequate?

Mr. ISRAEL. Oh, very. There's no problem.

Mr. LLOYD. I know that we have to do this, and you will note in my comments, in no way am I advocating that you use IBM or DEC or whomever it might be. I don't know, frankly. I only know that I don't want to commit the errors that we got into in the initial phases of WWMCCS. At no time am I finding fault with Minneapolis-Honeywell, because they did what they were told to do. I don't think they had the system to make it go, but it was mandated. And at that point, if that's the vehicle, you've got to go forward and do it.

Mr. ISRAEL. It was a fully competitive contract and procurement.

Mr. LLOYD. Well, that's what they say. I happen to have a different opinion. I reviewed it very carefully and I think there was a great mandating into Minneapolis-Honeywell. That's my opinion, and I'm not imposing that upon you. I just think it was a lousy way to have handled it at the time, and I don't want a repeat of those kinds of problems.

But all in all, from what you're telling me, we really are having that kind of communication we have talked about. We really are reviewing the hardware. I know they are just as smart—probably way smarter than I am—I just want to make sure that FAA understands the problems of the software program. As you well know, the days of a computer dedicated to one small problem has long since disappeared, and the answer to the whole thing is a computer that can adequately handle the software which actually addresses the problem. I just want to make sure we are going down that track.

Are those reasonable concerns, or am I being too shallow?

Mr. ISRAEL. I think the exchange of information as it exists in various formal and informal ways is really more than adequate. I would say my principal concern, if I had to summarize with respect to what the FAA is doing, relates to management in getting on with it.

Mrs. LLOYD. Thank you very much, Mr. Chairman, for the extra time.

Mr. HARKIN. Mr. Goldwater?

Mr. GOLDWATER. Dave, it's nice to see you again.

Mr. ISRAEL. Thank you.

Mr. GOLDWATER. After all those years of discussions on air traffic control and the FAA. You certainly have left your imprint over the years. I have to say my experience with you has been very positive. One thing can be said about Dave Israel, he always has a point of view on a specific topic involving aviation. I think that point of view has evoked a great deal of discussion as well as controversy. For example, your statement here—on page 4—that we should not give much weight to customers' points of view is a very typical David Israel approach to problem-solving. I think it is indicative of the end result of many, many years of collision avoidance work at the FAA under your direction. Today, we are still working on it after at least the 10 years that I have been familiar with those programs. We still don't have a collision-avoidance system.

I can understand your concerns about involving too much opinion in the evolution of technology and its application. Getting too much input perhaps would confuse the issue, as well as cause delay. Nevertheless, it seems to me that this is the American way for Government to function, and that is to provide the necessary services to meet the needs of customers or people who have to use those services. If you give them what you think they need, you might wind up—as Ford did—with an Edsel, with no market and few customers. So I happen to disagree with you when you say you shouldn't listen to customers. If the customers aren't going to use the system—if they aren't going to cooperate with that system, then why build it in the first place?

Do you have any comments on that?

Mr. ISRAEL. Well, I didn't say not to listen to the customer. You can't avoid listening to the customers. Another customer is the American public, the people who are traveling and who would like a fast, efficient, economic air transportation system.

My problem is—well, there's a tendency to generalize, and I must try to avoid that. The general aviation pilot is concerned about the cost of operating in the air space. Generally speaking, at least when I was there, the general aviation representatives would be very pleased if the FAA R. & D. would fold up and go away. All we could do was generate solutions that would cost them money.

Now, I'm not sure we want to debate collision avoidance systems here. I think one of the finest decisions I ever made—and a correct one—is that we should not invest in the so-called ACAS solutions, the independent airborne collision avoidance systems. I think the users were playing the game. When push came to shove, I don't think the customers would have wanted it because it was too expensive.

I think the BCAS as it has evolved—it has taken a long time—is the way to go.

Mr. GOLDWATER. But I think that you have to admit that today's BCAS concept is a combination of the ACAS and Syncro-DABS and IPC and DABS. So maybe the evolutionary process was not all bad, because it appears that we have arrived at some kind of consensus—at least broader than it was in those early days—that BCAS tends to offer the best of all worlds.

Mr. ISRAEL. Well—

Mr. GOLDWATER. If we had followed your original suggestions we may not have wound up at this point.

Mr. ISRAEL. I'm really not sure what point we've ended up with today.

Mr. GOLDWATER. Well, ground based or independent, depending on the type of airspace. In dense airspace BCAS is tied into the ground, but out of dense airspace, there is an independent capability. Now that seemed to achieve the goals of a variety of users. If we hadn't listened to all those users, we would have wound up with a concept that didn't truly meet all the needs of the customers.

Mr. ISRAEL. I'm really not convinced that we have the right solution. I think we have a solution by committee. Unless the FAA has decided whether it's going to go with an active or passive system, then we're still trying to keep everyone happy as the price of success. It means that you make no progress.

Mr. GOLDWATER. But the concept has both; so everyone is happy—supposedly.

Mr. ISRAEL. If we ever get the system.

Mr. GOLDWATER. True.

Well, I think your observations are making a contribution. I think you address some of the concerns I had with previous testimony; that somehow we get bogged down in a lot of paperwork and a lot of committees and a lot of endless kinds of activities. And what you are suggesting as an alternative is some kind of centralized, narrowly focused management concept that could, in fact, eliminate a lot of the unnecessary—

Mr. ISRAEL. Yes, sir. I think if you are serious, you should give the responsibility to someone and get on with it.

Mr. GOLDWATER. This has concerned me for some time now. Often when the FAA sets out to do something, various functions of that effort seem to split up within the FAA. They have liaison individuals who attend the meetings, but belong to separate organizations. They are segregated into separate kinds of functions. No function seems to be really coordinated with the other. What you are saying here is for the FAA to establish one management team that would do all those functions and therefore could better coordinate the project.

Mr. ISRAEL. Yes; I would say I am saying that. I think that is what our experience over the years has shown in the Army, Navy, Air Force, DOD procurements, NASA, and other places. In fact, I think that's what A-109 says: to establish a project manager early and put him in charge. So I am not proposing anything strikingly new.

Mr. GOLDWATER. Last November and December, two other committees held hearings on the air traffic control computer outages of the current system. I'm curious to know what your opinion is of this outage problem, and whether you think the current system will handle the traffic for up to 10 years until this new system is installed?

Mr. ISRAEL. I don't have any independent knowledge and I haven't even followed those hearings, unfortunately. But it's very hard for the FAA to handle a problem like that. It may be that someone outside the FAA has to look at the computer reliability situation.

There are labor problems and public image problems. It's very difficult to address objectively, I'm afraid, by the organization that's responsible for operating the system.

Mr. GOLDWATER. Shouldn't they have the expertise to do that?

Mr. ISRAEL. Well, I don't think it takes any high level of expertise that isn't available. I am just suggesting it's a very hard problem for the FAA to handle. Critical self-analysis. Very delicate labor problems are tied into it.

Mr. GOLDWATER. But technically, or equipmentwise, do you feel the equipment is adequate to handle the job for the next 10 years?

Mr. ISRAEL. I have some sort of a gut feeling that they are having more reliability problems than they should have.

Mr. GOLDWATER. On equipment?

Mr. ISRAEL. On equipment.

Mr. GOLDWATER. And you say this is further complicated because of other problems, such as labor?

Mr. ISRAEL. I am saying how the FAA handles that problem is a very touchy matter. The image you present to the public, the image you present to the controllers, it's a very delicate matter, I'm afraid.

Mr. GOLDWATER. One of the things we really didn't get testimony on from witnesses so far is the research and development costs of other large computer systems. I think this would give us an idea of what FAA's system may cost. I think you are familiar with these kinds of costs, and I'm wondering if you have a feel for what we're up against as far as total R. & D. costs for FAA's proposed new ATC computer system.

Mr. ISRAEL. I would have to think some more about it. It is complicated by the problem I alluded to; namely, the real breakthrough—and I'm not sure it's the breakthrough that should be scheduled for this modernization—has to be in greater automation: getting a control position to handle more aircraft than it's handling today.

That's a very difficult problem in terms of the right match between the controller and the computer and the software and the design—the human factors design—of the console; this affects the reliability he places both in the console and the system. And all of that doesn't succumb to paper studies. It requires setting up test facilities and trying it out with the software and the hardware.

I could look at some numbers, but it seems to me that in support of this modernization program, one ought to be planning to spend 20 percent or more of the \$1 to \$2 billion in system engineering and development.

Mr. GOLDWATER. I think your statement used the words "grossly inadequate" with respect to FAA's funding projections of \$93 million over the next 5 years.

Mr. ISRAEL. I would think that might be enough for the second year, or maybe the third year.

Again, my message is that this is a big problem. The other message is, don't try to bite off more than you can chew. A very delicate choice to be made there. And the other message is, stop contemplating it and get on with it.

Mr. GOLDWATER. What is your opinion of the GPS satellite system in relation to air traffic control?

Mr. ISRAEL. Strictly personal opinion: I wish it would go away. There's no role.

Mr. HARKIN. What was that last part?

Mr. ISRAEL. It is a very complicated subject to address in a short answer, but I believe that the role of the GPS in the civil system will end up being very much smaller than the proponents of the system hope.

Mr. GOLDWATER. A smaller portion of it?

Mr. ISRAEL. I don't believe that things have changed in the last 5 years. When I looked at this 5 years ago, I was not overwhelmed for the need for the GPS system to carry out any essential air traffic control functions.

I think there were some cases in mountainous regions where perhaps loran—if you really needed to return to some precise spot, is not adequate. In any case, let me make it clear, if we could start over fresh, we would leave out primary radar and we would leave out a lot of other things, and GPS would have a role. But I am saying that in view of the tremendous investment, the sunk costs both in airways facilities and in aircraft—I doubt in my lifetime to see GPS make a significant impact on the air traffic system if it is fully funded and pushed forward by the Department of Defense.

Mr. GOLDWATER. Do you think it's something we ought to continue to pursue and explore?

Mr. ISRAEL. I'd watch it. Watch how the Defense Department gets it implemented and how it works, but I don't know what I'd do differently. We've still got to upgrade the VOR's and DME's and ILS's and MLS's. You can't count only on GPS. I don't know who's going to buy GPS airborne equipment immediately to fill some essential civil need. There may be some air carriers that would—but it seems to me in recent years they haven't been anxious to go out and buy additional equipment.

I realize this is—in your mind—another one of those outspoken or contrary views I have.

Mr. GOLDWATER. Well, I'll be honest, I have no point of view on GPS myself.

Mr. HARKIN. If I could interject here.

You said a moment ago that they aren't rushing out to buy the equipment, but from the standpoint of a multiplicity of different systems we have, it would seem to me that GPS answers all the problems and needs with just one system that these other systems might involve.

It's a system that's adaptable, not only for air, but for a lot of other things. Besides that, in the future, because of the traffic increase, because of the need to save fuel, we're going to have to go to better areawide navigation. We aren't going to keep funneling airplanes down the highways in the sky with an MLS system and limited approaches to airports; we are now going to have to open up the airways—just open up the whole air space—for areawide-type navigation.

It seems to me that GPS addresses that problem quite well. So you said they may not rush out to buy the equipment, but they might if they see that it will fit into a system that will, in fact, save them fuel, save them time, be safer, even provide collision-avoidance information.

Why wouldn't they buy that equipment?

Mr. ISRAEL. Well, I don't believe that the exploitation of the area navigation is dependent upon GPS. The exploitation of area navigation, in my mind, relates in part to the capabilities of the ground

environment and the ground system, and its ability and the ability of the controllers to handle increased amounts of traffic that isn't channelized along certain routes. It's a very difficult problem.

I believe you can achieve area navigation in other ways. Five years ago, we were looking into various ways to do this. It can be done.

Mr. HARKIN. Did you ever try? Do you fly?

Mr. ISRAEL. No.

Mr. HARKIN. Have you ever tried to fly using the new area navigation that we have on GA planes now and file point-to-point? You can't get it. Controllers can't handle it. They won't give it to you. They still want to funnel you along those highways.

Mr. ISRAEL. That's my point. I think that's not going to change if you had the GPS.

Mr. HARKIN. What is the reason?

Mr. ISRAEL. The controller problem has to be solved. The problem of how a controller can accommodate traffic that is not channelized or has a greater of variety of routes is the fundamental problem.

Mr. HARKIN. The thing is, though, if you have a system that can keep track of all airplanes at all times in a real-time environment, updating that information, then you've solved the problem of the controllers needing that kind of information for areawide navigation. It seems to me that GPS does that.

Mr. ISRAEL. GPS is not—unless it's changed—in my knowledge, a system that's going to tell you where everyone is. It will tell anyone where he is very precisely.

Mr. HARKIN. That's right.

Mr. ISRAEL. There are two answers. First, if you want to invest in more airborne equipment, let's make everyone carry a transponder, preferably DABS. That's got to be first on your priority list of carrying airborne equipment to make the system better, safer and more capacity.

The second point is, I certainly don't question GPS as a very neat, elegant, and efficient navigation system. However, there are many neat, elegant solutions to problems, but we can't achieve that solution, and I believe GPS in the civil area may be one of them.

Any time I try, or the people working with me have tried, to figure out how we were going to get people to invest and switch over to GPS, it turns to be a very long-term process. And the difficulty is that the promise of it then interferes with necessary programs that people would like to avoid, namely, transistorizing—at least 5 years ago—the VOR's and DME's and upgrading them.

So I have no problem with GPS in the long term. It may eventually take over, but I expect to see for a 100 years, perhaps, transponders, and VOR's and DME's.

Mr. GOLDWATER. Mr. Chairman, I don't have any further questions. I just want to thank Dave for coming today. He always makes a significant contribution to the discussions. And certainly, Dave, when you were the Director of the Office of Systems Engineering Management and Deputy Associate Administrator for Engineering and Development at the FAA, your operation was always at the center of the storm. I think a lot of good thought came out of that and, hopefully, a system that works. Your contribution to aviation has been significant. I know that I for one—even though we've had a number

of contrary opinions—enjoy the give-and-take. I appreciate the fact that here is one person who definitely has opinions on how to do things and opinion on what is needed.

That's refreshing, since oftentimes you get no opinion from people or you get both sides of the question. So I think we are very fortunate to have Dave Israel here today to make these suggestions. I think some of them are very good. In fact, his attitude is also important. I would like to see that same kind of attitude more in Government—that things can be done without making them complicated; that there is a fairly simple, straightforward way of doing things without creating all kinds of committees.

Mr. HARKIN. Thank you.

Mr. Israel, I only have one other question. A general question. You talk about the need to set up the SPO, a dedicated project organization with FAA, right?

Mr. ISRAEL. Right.

Mr. HARKIN. Why do you need that? Why do you have to set up a special thing? Why can't we just do it with the existing organization? Is there some inherent instability or lack of coordination?

Mr. ISRAEL. It is quite independent of the FAA, sir. It is the fact that if you have an important job, you ought to do it with full-time, dedicated people. If it's important enough, they ought to report to the most important man in the organization.

I see this happening all the time in NATO. NATO does business by committee and little ever gets done. Committees meet occasionally. Afterward, people go back and do their normal jobs. A half hour before the coordinating committee or the liaison committee, they try to get up to speed, get together and try to figure out a way they can put off the decision until another meeting.

You want a full-time set of experienced people assigned to do this. That's how we got the Polaris built. That's how they built the U-2. That's how you get anything done. You don't figure out how many people you can give the job to, how far down you can give the responsibility. You figure how far up and decrease the number of people who can say "no" between him and the Administrator.

Mr. HARKIN. Do you think that this project, this updating of the computer modernization program is important enough to set up something like this? Are you saying that if it's that important we should do that?

Mr. ISRAEL. This is as important a job that I think the FAA is going to handle in its history. It did once have a SPO and it handled the original implementation of the 9020's. The FAA got rid of it as soon as it decently could—got rid of the SPO.

Mr. HARKIN. Under what Administrator was that?

Mr. ISRAEL. Oh, it started back probably under Halaby, extending through to Schaffer. Well, it was gone by the time of Butterfield. I think it's recognized in the A-109 that you should put one person in charge of enterprises of this sort and give them the resource. The tendency otherwise is to draw charts.

Mr. GOLDWATER. Has FAA ever done this?

Mr. ISRAEL. Yes, FAA's had SPO's. There are various types of SPO's. For NAS. Various types of SPO's. The other characteristic of an SPO is that it is very hard for the conventional organization to

think up that solution, as I pointed out, because there really isn't anyone who feels that he wants to give up that part of the responsibility.

Mr. HARKIN. Can you draw that from existing personnel in FAA to set up this SPO?

Mr. ISRAEL. It ought to be the best people from Engineering and Development, Airways Facilities, Flight Standards, et cetera.

It seems to me the future of the air traffic control system is now entirely based on automation. We've gone past the point of no return, and modernizing that automation is essential to the efficient operation and growth of the ATC system, and that must be among the most important things that the FAA has to do, or else that system will collapse.

Mr. HARKIN. It will collapse with all those charts and boxes. That was an amazing presentation I saw this morning, just amazing.

Thank you very much, Mr. Israel. I would concur wholeheartedly in what my colleague has said about your statement. Although I have not had the involvement with you, I can see that you do have some definite ideas, and it is my intention to take your recommendations—if you don't mind—and send them down to FAA to have them comment on them. I'm going to see why they don't think they would be good ideas.

Mr. ISRAEL. My friends will never speak to me again. [Laughter.]

Mr. HARKIN. I'll take your name off them, all right?

Thank you.

Our next witness today is Peter F. McCloskey, president of Electronics Industries Association. Without objection, your prepared statement will be made a part of the record in its entirety. Again, please proceed in any manner you so desire: read it, summarize it, comment on it; whatever you'd like to do.

STATEMENT OF PETER F. McCLOSKEY, PRESIDENT, ELECTRONIC INDUSTRIES ASSOCIATION, ACCOMPANIED BY PAUL SCALLY, REPRESENTATIVE OF THE AIR TRAFFIC CONTROL COMMITTEE, EIA

Mr. McCLOSKEY. Mr. Chairman and members of the committee, my name is Pete McCloskey. I am the president of the Electronics Industries Association. Accompanying me is a representative of our Air Traffic Control Committee, Paul Scally.

The association is over 50 years old and has a current membership of 340 companies. These companies engage in research and development, manufacture and support of electronic components, equipment and systems for Government, industrial, and consumer applications. It is the major trade association of the electronics industries.

Our Air Traffic Control Committee represents the interests of those of our members who are directly involved in providing hardware and software for use in the air traffic control system administered by the FAA. It is in behalf of those companies that we appear before you today.

We wholly support the need to modernize and upgrade the air traffic control system that it will be capable of handling the greater air traffic expected in the 1990's and beyond in the safest manner possible with a minimum of delay.

The industry is proud of its role in helping to provide the best air traffic control system in the world today. We must recognize, however, that this system, designed and developed in the early 1960's, operating through the 1970's and 1980's, requires full utilization of the latest technology so as to assure the safe movement of air traffic in the 1990's.

It is essential that the FAA and the Department of Transportation expedite the modernization of the system with advanced technology, hardware, and software that will continue to insure the safety of air travel.

Recently, our Air Traffic Control Committee developed a number of recommendations for improving the system and the means for developing and acquiring its critical components.

I would like to offer this document for the record, and I have it here.

Mr. HARKIN. Fine. Without objection, it will be made a part of the record.

[Material to be supplied follows:]

ELECTRONIC INDUSTRIES ASSOCIATION
Air Traffic Control Committee*

Issues and Recommendations
for
Congressional Action

- FAA ATC System Program Plan
- FAA Research Level of Effort
- FAA Acquisition Process
- FAA Coordinated ATC Control System Development
- FAA Microwave Landing System

*These issues and recommendations were formulated by the Air Traffic Control Committee of the Government and Communications Divisions of The Electronic Industries Association. This Committee represents the interests of the concerned companies who provide equipment, systems and services to the Federal Aviation Administration in support of the nation's air transportation service.

ELECTRONIC INDUSTRIES ASSOCIATION
2001 I Street, N.W., Washington, D. C. 20006
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Subject/Issue: FAA ATC SYSTEM PROGRAM PLAN

The Federal Aviation Administration should publish a ten-year plan which describes the existing ATC system, planned installation of new equipments, planned equipment/system developments and planned research goals. This plan should be updated annually. Periodic industry and user input and review are a necessary part of developing the plan and its annual updating to ensure that the FAA, industry and users have an opportunity to exchange information on the latest technology availability and system requirements. Such a plan is needed by:

(a) the industry which supplies ATC equipment so they can accomplish the research and development, and production planning necessary to provide the latest technology; (b) the system users so they can plan equipment purchases and operations which are compatible with the future ATC characteristics; and (c) the airplane designers so they can design and build aircraft for maximum safety and efficiency in the expected future ATC system. The FAA published such a plan in the early 1970's but it was discontinued. Industry and users demonstrated that the effort was important by suggesting improvements for the plan and by heavy participation in the associated user conference. Since the plan was dropped, industry has repeatedly requested its reinstitution with no success.

Although the plan was developed in compliance with Section 312 of the Federal Aviation Act of 1958, there are presently arguments that such a plan, needed as it is, may legally require Congressional action to approve its development.

Action Recommended

Congress should direct the FAA to develop a long-range (10 year) plan. Congress should maintain annual oversight on the updating of this plan to assure that (1) users and industry have visibility of the FAA long-range goal system planning and (2) the FAA maintains configuration control over ATC system evolution and (3) the published long-range "goal system" configuration is compatible with forecasts of:

- user requirements
- energy, efficiency, environmental and safety criteria
- technology advancements in aircraft, airborne systems and other subsystem elements in the Air Traffic Control System

Subject/Issue: FAA RESEARCH LEVEL OF EFFORT

The level of expenditures in the FAA for research and development is small compared to the total Administration budget. It is particularly small in view of the high technology nature of air transportation and the Air Traffic Control system. It is also small when considering concerns for safety and environmental quality. It is even smaller than it appears considering the overhead of government employees and facilities normally dedicated to research and development. Most of the present R&D budget is for special and development programs attuned to near-term problems. Often inventive ideas are tested against today's airplane capabilities and operations rather than those expected in the future. There is little available for the applied "research," i.e., investigations to uncover and test new concepts and technologies from which promising innovative advancements for the future ATC system are selected and developed. The quality of the future ATC systems depends on today's research.

The limited funding of research and development, particularly exploratory research, leads to updating the ATC system with some new sub-systems incorporating recent technology (e.g., solid state) but basically resulting in "doing business in the same old way." Operational problems are perpetuated when funds are insufficient to examine the system as a whole. Available and potential advancements in aircraft and airborne systems are not exploited because the ATC system evaluation is not sensitive to potential user contributions.

Action Recommend

Congress should appropriate on the order of 10 percent (i.e., approximately \$300 million) of the FAA's total annual budget to research and development. Oversight should be maintained to assure these funds are expended to utilize the high technology resources of U.S. industry and do not go to increasing government work force, facilities or other overhead commitments.

Subject/Issue: FAA ACQUISITION PROCESS

The process by which FAA establishes operational requirements for hardware systems, develops technical specifications and then procures the services and supplies has long been a subject of heated discussion among FAA contractors and bidders. While safety improvements in the system are best incorporated on an evolutionary basis, FAA's management of the acquisition process takes so long that inflation wrecks the outdated budget, inefficient systems continue in operation long beyond their effective life, operational and maintenance personnel requirements and payroll costs keep increasing and personnel effectiveness is severely hampered. Finally, procurement delays force capable employees into doing little or no effective work for too long with the resultant demoralizing effects.

Even the companies that compete for new business with the FAA are most unhappy with the acquisition cycle for solicited programs. One particular company has three important programs pending awards; one is now into the 17th month since issuance of the RFP on 30 June 1978, a second RFP was released in March 1979 proposed on in April, but as yet, none of the bidders have received any technical or management inquiries on their proposals, the third program although valued at only \$1M is already 13 months into the procurement cycle which began with release of the RFP on 22 September 1978.

It appears the FAA management does not fully appreciate the financial investments made by industry to identify a program, organize a technical team to develop appropriate understandings and solutions, submit proposals and then maintain teams to respond to questions and then be ready to proceed on the award at a much later date. Considering the excessive time and dollar investments necessary to do business with the FAA, and the inability to bid on other programs concurrently, this company and others are seriously considering whether to respond to future requirements of the FAA.

Of additional concern is that the FAA has not been successful in implementing improvements to the acquisition process which were recommended in various contracted studies under previous Administrators. Further, Congress and industry have criticized the FAA on their procurement of major equipments and systems. Specifically, these criticisms have centered on:

1. The inordinate amount of time involved in deliberations and decision on competing technical solutions to operational problems.
2. The delays in the actual procurement process from coordination of technical requirements through the actual solicitation, evaluation and award.
3. Frequent contractor problems in design, development and delivery of equipment and systems.

A conclusion that frequently comes to mind is that the FAA lacks a feeling of urgency in all of the many actions leading up to and through the procurement process.

Action Recommended

Congress should direct the FAA to develop a more efficient procurement process so as to provide safety and system productivity related equipment into the field within a minimum amount of time and to minimize the time from delivery of operational requirements documentation to issuance of the procurement request and the resulting contract. Further, Congress should direct the FAA to provide a report showing the minimum, maximum and average time from receipt of Procurement Requests (PRs) to contract award on Facilities and Equipment procurements of approximately a million dollars or more and Engineering and Development procurements over \$250,000. This report should be on a quarterly basis and reflect actions to continually improve the total process to overcome the problems listed above.

Subject/Issue: FAA COORDINATED ATC CONTROL SYSTEM DEVELOPMENT

Control is the ATC action that directs the flight of individual aircraft and determines where an aircraft will be at any given time. Control in the Air Traffic Control System is as separate a function as communication or surveillance. As control is automated, it becomes necessary to define and analyze it rigorously as a system.

The FAA currently has several "control subsystem" development efforts. These include Metering and Spacing, Local Flow Management, En Route Metering, Automated En Route Air Traffic Control, and the control functions embodied in the Area Navigation operational concepts. These efforts lack coordination, especially since no "goal system" has been defined toward which these subsystems should be evolving. Thus, each may be optimized in itself, yet not lend itself to evolving into an optimized system.

Action Recommended

Congress should direct that the FAA establish a "Control Technology Office" to act as the focal point for control philosophy and for implementation to assure acquisition of the control system using the best control technology. There is presently no focal point responsible for development, validation and implementation of control philosophy.

Subject/Issue: FAA MICROWAVE LANDING SYSTEM

The FAA is contributing to a future problem in the ability of the U.S. industry to compete with foreign industry to supply the FAA needs. An example of this is the absence of any FAA implementation of the Microwave Landing System (MLS). As a result, American industry is not designing and producing production MLS ground and airborne hardware. The MLS as developed by the FAA and selected by ICAO as the International Standard landing system, needs to be implemented by the FAA promptly. This development was at considerable expense and is considered by many to be the key factor in aircraft fuel conservation and reduced noise pollution through the uniqueness of the curved approach capability of MLS. Through continued delay by the FAA in initiating MLS production and procurement, they are not only denying the aviation community the benefits of its operational and economic advantages, but are creating a potentially serious problem for U.S. manufacturers.

At the present time, the Japanese, Australians, British and even the Russians are producing MLS systems with the support of their respective governments. Due to the lack of firm FAA policy for implementing MLS, American industry is neither designing nor producing the ground or airborne equipment. At such time as the market does develop for U.S. Domestic and International sales, American industry will be at a serious competitive disadvantage with the foreign producers.

A plan for implementing MLS was developed by the Radio Technical Commission for Aeronautics Special Committee 125. This 1977 report was considered to be an excellent implementing guideline prepared by an impartial cross section of aviation representatives from the U.S. and foreign countries.

As pointed out in this report, MLS is a more cost effective landing system than the present day ILS. This is especially true with regard to the low cost simplified installation criteria for MLS over ILS. As such it is an ideal landing system for use by the Commuter airlines at their smaller terminals where no landing aids are presently available. At a time when commuter airlines are expanding and the CAB and FAA are exercising increasing surveillance over these smaller airlines to insure their safety and operational reliability, they are being deprived of the increased safety and operational advantages that could be obtained if MLS was available for their use.

ACTION RECOMMENDED

FAA should initiate promptly a significant MLS procurement and installation program in order to encourage U.S. manufacturers to initiate final development and production of such systems.

Mr. McCLOSKEY. Estimate of the cost to develop, produce, and field the new computer replacement system ranges from several hundred million dollars up to \$2 billion. Design and development costs beginning in fiscal years 1981 and 1982 and lasting through full-scale development and testing will take years. Additional funding must be provided to assure adequate competition during the concept design, verification, development, and full-scale testing phases in order to provide for the most cost-effective and operationally effective system.

Historically, the annual level of R. & D. funding is grossly inadequate—if continued at present levels—to accomplish this task. So as to maintain, and not preempt, the orderly research and development program for other critical elements of the system, we feel that specific authorization should be granted to utilize the moneys available in the Airport and Airway Development Act trust fund as the best means of funding this R. & D. program of modernization. These funds should be identified and authorized by Congress for this specific purpose. These funds should be over and above the planned FAA R. & D. budget. Money for this purpose is currently available in the trust fund.

Therefore, we recommend that Congress pass legislation authorizing approximately \$100 million of the trust fund to be allocated specifically for the necessary R. & D. for the modernization program.

Mr. GOLDWATER. Is that \$100 million for 1 year or for 5 years?

Mr. McCLOSKEY. No; that's over a period of years. That's a multi-year commitment of funds outside of the normal research and development budget that the FAA currently has.

Mr. HARKIN. What you are saying, then, is that we provide specific authorization for this computer modernization program; specifically authorize a certain set sum of money, separate and apart from, or over and above the authorization for other R. & D. in FAA.

Mr. McCLOSKEY. That's right, sir.

Mr. HARKIN. So you are not saying we ought to authorize \$185 million this year, it might be \$130, \$140, or however much it may take.

Mr. McCLOSKEY. I identify with Mr. Israel's remarks, that if you're going to spend up to approximately \$2 billion, a percentage of that is intelligently spent on research and development to make sure you do the job in the best way.

SCOTT CROSSFIELD. How much each year?

Mr. McCLOSKEY. I think each year is a building process until you finally come to your system specification, so that it would be very hard to say how much in the first year, and that's why you have to say it on a multiyear basis.

For many years now the FAA, DOT, and OMB have routinely accepted a figure of \$50–\$75 million for the annual level of effort for research and development by the FAA. The rates of inflation over the past several years have reduced this level of effort to a grossly inadequate R. & D. capability.

In addition, the annual cost of R. & D. personnel salaries, which are included in these R. & D. figures, have risen and further deflated the R. & D. effort. The cost of operating and maintaining R. & D. facilities has similarly reduced the actual funds available for R. & D. work. Even the originally agreed-upon level of \$90 million for fiscal year 1981—which was reduced by the administration to \$85 million—is not

sufficient to provide a reasonable R. & D. program to enhance the level of safety in the national air traffic control system.

We recommend that Congress look into the desirability of increasing the future authorization and appropriations to at least 5 percent of the annual FAA budget to support their research and development. By way of comparison, over 10 percent of the DOD annual budget is allocated for research and development. These funds would rightly be appropriated from the Airport and Airways Trust Fund, which is projected to have a \$3.661 billion uncommitted balance by the end of fiscal 1981.

We believe that an investigation of FAA records would show that in recent years there is a gradual, but definite reduction in the number of companies responding to their RFP's. We believe that this indication of the increasing reluctance of some companies to do business with the FAA is largely due to the time-consuming delays they encounter in the FAA acquisition cycle.

As a result of these delays, a number of companies are questioning the assignments of their resources to do the requisite, very extensive, and costly, pre-RFP proposal and pricing efforts involved in FAA R. & D. procurement. Further, these delays make it almost impossible to retain the proposal/contract team for work on the eventual contract.

Obviously, industry cannot afford to place key employees on overhead for any extended periods of time while waiting for FAA and DOT action. Particularly, when a division of a company capable of providing FAA with high technology systems and services finds itself in a situation with comparable opportunities between FAA and other Federal and commercial organizations, the typical FAA-DOT delay experience can be the deciding factor in favor of these qualified companies pursuing other than FAA R. & D. programs.

Mr. Chairman, we recommend that this subcommittee investigate the additional administrative workload imposed on the FAA by the DOT in the award of R. & D. contracts and the procurement of systems, equipment, and services.

Perhaps more realistic dollar thresholds for procurements required DOT approval should be established than those set forth in DOT orders. Too much time is involved in the preparation of acquisition and source selection documents for the Office of the Secretary and the Transportation System Acquisition Review Council.

In some instances, procurements have been delayed for months while FAA waits to get on the schedule of DOT's TSARC to obtain approval for a program which DOT has already approved in its budget. Further, considerable additional time is involved in obtaining the DOT's source selection official's determination of qualified companies with which to negotiate and more time is lost in waiting for the SSO to select the company or companies who receive the actual awards.

We further recommend that consideration be given to increasing the number of skilled procurement specialists in order to expedite the procurement process.

Some years ago, the FAA, in an effort to gain support from the community of users, operators, and suppliers, annually published a 10-

year plan and conducted annual briefings on the FAA R. & D. and F. & E. programs. The providing of such planning information to industry made it possible for industry to better direct its resources to support FAA's needs.

The oncoming generation of transport aircraft will incorporate systems that have been in development for 10 to 15 years. The policy summary and 10-year plan were invaluable to designers of ground systems and airborne systems elements of the national aviation system. Regrettably, the publication of the 10-year planning document was canceled.

We recommend that FAA formally reestablish and publish the 10-year plan, and organize a 1- or 2-day conference and provide industry and users with such data prior to the forum so as to provide the best possible interchange of planning data.

The FAA has been working on the computer replacement program since August of 1978. We believe it is timely now to organize a more effective management team to accomplish the desired modernization goals.

When FAA started on the present en route terminal and automation systems, a System Program Office was established to manage the FAA and the contracted industry resources. We in the industry felt this system worked extremely well and wholeheartedly recommend FAA organize such an office for this project.

The program Director should report to the Deputy Administrator so as to assure proper response and assistance in the resolution of major problems. Implicit in this recommendation is the requirement that the SPO be an integrated organization with contracting personnel assigned, along with engineering and development and air traffic and airways facilities representatives.

In conclusion, we believe that the U.S. air traffic control system is recognized as the best in the world. We in EIA are dedicated to assuring that the FAA continue to have the safest air traffic control system despite increasing levels of usage. To do this, we, the Congress, the industry, and the FAA must act collectively, in a prompt and unambiguous manner, to insure the application of our best resources toward this goal.

Thank you, Mr. Chairman.

Mr. HARKIN. Thank you very much, Mr. McCloskey.

I take it, then, that you obviously agree with many of the statements made by Mr. Israel.

Mr. McCLOSKEY. Yes; we do.

Mr. HARKIN. One thing, let me find the right page. Oh, here it is, page 4. You want the subcommittee to investigate "the additional administrative workload imposed on FAA * * * too much time is involved in the preparation of acquisition and source selection * * * procurements have been delayed for months * * * further, considerable additional time is involved in obtaining the * * * source selection official's determination of qualified companies * * *."

Can you give us some examples of that? If you could give us some examples of that, then we can really go to work.

Mr. McCLOSKEY. We would be happy to provide you with some examples.

Mr. HARKIN. That just might, in fact, get us in a position to really work with FAA in setting up this SPO—as you call it—for this computer modernization program.

I must say that I am very responsive to your remarks, as I was to Mr. Israel's, and I feel it is something that this subcommittee really ought to get into with the FAA on this whole computer modernization program.

You recommended that we pass legislation authorizing \$100 million specifically for this program, just talking about this next fiscal year.

Mr. McCLOSKEY. I wouldn't—no, the next several years. The passing of it this year, yes.

Mr. HARKIN. Passing it this year, but for 5 years.

Mr. McCLOSKEY. Right.

Mr. HARKIN. Has your industry ever taken a position, or do you feel you would rather not take a position, on the problem of the annual authorizations that we are now discussing with FAA? As you know, this subcommittee and this committee has, over the last 4 years, sought to obtain the annual authorizations. We have passed, both in committee and in the full House, but it was not acted upon in the Senate. Those years, however, were during years that the ADAP cycle was up. This year the ADAP cycle is up. We are now involved in that process again of whether or not we ought to have annual authorization.

I was just wondering, have you taken a position on that or not?

Mr. McCLOSKEY. I don't believe we've taken an official position; no. I think we recognize the conflicting demands in a program of this type. And in a program like this, we recognize that it is an ongoing commitment and a major program.

I don't think we ought to be deluded by the fact that it's an evolutionary program. I do think it's evolutionary and I do think it's a replacement program, but the magnitude of the task is immense, and it's going to require a considerable effort over an extended period of time before we are able to even be in a position to award the contracts for implementation of the replacement program.

Mr. Scally points out that an annual look by the committee is a very desirable idea, so how you balance the oversight with the requirement is really left best to you and the FAA.

Mr. HARKIN. I really don't have any more questions.

Mr. Lloyd is not here. He wanted to have a question asked for the record. If you are not prepared to answer it today, perhaps you could submit it in writing.

His question was this: In your Issues and Recommendations paper, you spoke of the Microwave Landing System and the need to get MLS installed, particularly to help commuter airlines. This issue was not discussed today. Why not, and what are your views?

If you want to address that now, fine; if you want to submit in writing, fine.

Mr. McCLOSKEY. We would be happy to submit an answer for the record.

Briefly, though, we thought it was probably in the jurisdiction of the Public Works and Transportation Committee, rather than this particular committee, but we will submit a fuller answer for the record.

[Material to be supplied follows:]

We believe MLS is an issue that is probably more appropriate to discuss with the Aviation Subcommittee of the Public Works and Transportation Committee since MLS has completed its development cycle and is ready for operational implementation. We think it is most inconsistent for the FAA not to request funds for production quantities of MLS in the FY 1981 budget submission while they do request production funds (\$20M) for DABS (Direct Address Beacon Systems). FAA has been testing MLS since 1973. From September 1977 through April 1978 the FAA installed and performed operational demonstration flights on MLS at thirteen airport locations around the world to demonstrate to ICAO delegates the proven capability of MLS prior to its selection as the International Standard at the ICAO meeting in Montreal in April 1978. Since that time there has been no planning by the operational people at FAA to provide for the implementation and utilization of this improved landing system in the ATC System. On the other hand, DABS testing at NAFEC has just recently gotten underway and will probably continue for another year or longer; yet the FAA has requested funds for a production buy of DABS in the FY 1981 budget but none for MLS.

Our member companies have commercial interests such as State Aviation Departments and offshore oil drilling companies wanting to buy MLS equipment as well as many inquiries from commuter airlines most eager to utilize the Microwave Landing System. However, until the FAA approves MLS for certification and operation and procures systems for implementation to show their intent to make it an operational system, nothing can or will move forward.

As recently as February 14, 1980 the National Transportation Safety Board Chairman James King, appearing before the House Ways and Means Oversight Subcommittee hearings on Commuter Airline Safety, said, "The Safety Board is deeply concerned that at present, there is a significant gap between the facilities and equipment available at airports serving certificated air carriers and those serving commuters." King listed the four major areas where there is a gap as: (1) precision approach facilities, such as instrument landing systems, microwave landing systems and visual approach slope indicators; (2) terminal radar services; (3) airport crash, fire, and rescue services, and (4) weather information. King said only 33 percent of the airports used exclusively by commuters and general aviation aircraft have precision approaches while 67 percent of large air carrier airports have precision approach facilities. "Past accident history has led the board to believe that such precision approach equipment is a prerequisite for safe commuter operations," King said, pointing out that about 25 percent of fatal commuter accidents occur during the final approach of the flight.

We recommend that Congress appropriate and dedicate \$20M in FY 1981 for the procurement of 50 MLS for operational implementation as soon as possible. Further the FAA should be directed to procure at least 50 MLS each year over the next five years.

Mr. HARKIN. Now that I have you here, how do you feel about the MLS, especially the time-reference scanning beam system that we are now going to—do you have any second thoughts about it? Fully in support of it?

Mr. McCLOSKEY. I am a general aviation pilot. I like the concept of having available a lot of fields with instrument approaches. If that's the way that we can achieve it, then I think we ought to have it.

Mr. HARKIN. I guess I'm talking about something else. There were two paths we were going down on the MLS. One was the doppler system, one was the time-reference scanner.

Mr. McCLOSKEY. I am not in a position to comment on that, one way or the other.

Mr. HARKIN. I was greatly involved in that debate at one time. I am waiting to see the outcome.

Thank you very, very much, Mr. McCloskey.

Mr. McCLOSKEY. Thank you.

Mr. HARKIN. Tomorrow, the subcommittee will meet at 2 p.m. in 2318, rather than at 8 a.m. The time has been changed to 2 p.m. tomorrow.

The subcommittee will stand adjourned until that time.

[Whereupon, at 11:58 a.m., the hearing was adjourned.]

H.R. 6721

1981 FAA R. & D. AUTHORIZATION

THURSDAY, FEBRUARY 21, 1980

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

The subcommittee met, pursuant to notice, at 2 p.m., Thursday, in room 2318, Rayburn House Office Building, Hon. Tom Harkin (chairman of the subcommittee) presiding.

Mr. HARKIN. The Subcommittee on Transportation, Aviation and Communications will come to order.

Today, we will complete the series of hearings regarding the FAA's fiscal year 1981 R. & D. budget.

Our first witness today is Dr. Gerald Dinneen, Assistant Secretary of Defense for Communications, Command, Control and Intelligence. Dr. Dinneen was head of Lincoln Labs and also served as an adviser to Dr. McLucas when he was FAA Administrator. Dr. Dinneen brings considerable experience on civil aviation matters to this hearing.

Dr. Dinneen, we want to welcome you to the committee. I understand you are accompanied by Col. Stephen W. Gilbert, Office of Under Secretary of Defense for Research and Engineering.

Without objection, your entire statement will be made a part of the record. You can proceed in any manner you so desire.

Dr. DINNEEN. Thank you, Mr. Chairman.

I appreciate this opportunity to participate in your review of the Federal Aviation Administration's fiscal year 1981 budget. With your permission—as you suggested—we will put the full statement in the record, and I will make a few brief remarks here to summarize the high points. Then I have a short film I want to show, and I think the whole thing will take 10 or 15 minutes, and I will be prepared to answer your questions.

STATEMENT BY DR. GERALD P. DINNEEN, ASSISTANT SECRETARY OF DEFENSE, COMMUNICATIONS, COMMAND, CONTROL AND INTELLIGENCE, ACCOMPANIED BY COL. STEPHEN W. GILBERT, OFFICE OF THE UNDER SECRETARY OF DEFENSE, RESEARCH AND ENGINEERING, DOD

Dr. DINNEEN. What I want to do today is to give you a brief update on the status and plans for the Defense Department's NAVSTAR global positioning system.

In both my prepared statement and for my summary remarks, I have assumed that the subcommittee is familiar with the basic NAVSTAR system concept, and I have therefore confined the discussion to the current status of the program.

And our plans for acquisition and deployment. If you have any questions about it, we will be glad to go into more detail.

Mr. HARKIN. I think the subcommittee is quite well briefed on the NAVSTAR system.

Dr. DINNEEN. Good. First, I would like to mention those activities within the Federal Government to develop a Federal radionavigation system plan that combines in one document the information needed to assess the direction in which the total Federal Government—both military and civilian—should go in providing a reliable radionavigation service.

This plan, the Federal radionavigation plan, represents a close tie between my Department—the Defense Department—and the Department of Transportation, including the FAA. And that close tie resulted from a joint Department of Defense/Department of Transportation Memorandum of Agreement on radionavigation system planning, which was signed in April 1979.

Among other things, this interagency agreement called for joint development and annual publication of such a plan as part of the budget process. And I would hope that this plan would be helpful to your committee.

The close coordination between the various agencies involved in the development of this plan has stimulated what I believe to be a new awareness of the need for continued efforts of this type. I also believe that the activity has stimulated a growing awareness, not only in the Federal Aviation Administration, but in the entire civil user community, of the potential importance of DOD's NAVSTAR global positioning system for applications in the air, on land, and at sea.

The Federal radionavigation plan should bring this focus even more into perspective.

The first edition of the plan has yet to be published. It was actually called for by the Congress in October of 1979. We were not able to meet that date, and the OMB has discussed this with the Congress, and I'll talk later about the reasons for that delay, because they are directly related to the NAVSTAR global positioning system.

However, before I discuss these factors—the delay—I would like to show a short film which I think clearly demonstrates the military utility of NAVSTAR.

I understand this is not going to be pertinent to your interest in the civil uses, but I wanted you to have this background on how we plan to use it and the importance of NAVSTAR for military uses.

The film was taken at the Army's Yuma Proving Grounds in Arizona, which is the primary test site for NAVSTAR. Several types of NAVSTAR user equipment are represented and, very importantly, the demonstrations that you will see employ actual satellite signals to determine the three-dimensional position of the user vehicle.

I was out there about a month ago and witnessed many of these demonstrations myself. The film does not have a voice track. I will try to make some comments as we go through to highlight the points.

We can actually stop the film at any time that you have any questions. It will run about 5 minutes.

Mr. HARKINS. These tests were run using the four satellites?

Dr. DINNEEN. That's correct; we were using all four satellites, but one of the satellites had a clock failure, so we are using an oscillator rather than the full clock. But we are using all four satellites. The tests were all conducted prior to the launch of the fifth satellite which occurred—I think, as you know—on February 9.

The tests were conducted at Yuma. There was a 2-hour period. When I was out there, it was between 6 a.m. and 8 a.m. when those four satellites could be observed from Yuma, so it was only that 2-hour period when the tests could be conducted, but we used all four satellites.

[Film is shown.]

Mr. HARKIN. I assume this is all unclassified.

Dr. DINNEEN. Yes; this is all unclassified.

What we are demonstrating here is an instrument approach to a remote site by a UH-1 helicopter, using only the NAVSTAR GPS steering information. The coordinates of the desired touchdown point were provided to the pilot, and he inserted that into his onboard computer. Then the pilot, using only a steering display which told him to go up or down or left or right, permitted an instrument approach without the use of any ground-based aids. Combat helicopter operations, of course, frequently require approaches such as this to remote landing sites under poor weather conditions to land assault troops.

Now we are turning to a C-141, and we are demonstrating the same approach capability with that C-141; namely, insert into that display on the C-141 the coordinates of the position and then by receiving the signals from the satellites, the C-141 was able to guide itself to a particular touchdown point. This could have been a landing approach or a parachute drop.

Dr. DINNEEN. This was an approach only. The aircraft did not actually land in this particular case.

Mr. HARKIN. Can you give me any idea of what the accuracy of that approach was? Did he hit the threshold?

Dr. DINNEEN. In the case of the helicopter or the C-141, it was 10 to 16 meters.

Joe TYMCZYSZYN. Too wide for the runway.

Dr. DINNEEN. Well, yes, in the case of a C-141 you would bring it in close enough so he could get under the weather. This would not be a completely blind landing.

Mr. HARKIN. Can you tell me more about the accuracy of the system, though? Is this 16-meter accuracy of the C-141, could that be less?

Dr. DINNEEN. I can't give you much more detail than that on the accuracy that we would expect for the military uses, because I would be getting into classified material. I can say that 16 meters in three dimensions, is roughly what we could expect. We could go into more detail on this in a separate session.

What you see here is a manpack receiver, which in production, we hope will only weigh about 12 pounds. The person carrying it would go out in the field, be hidden from the helicopter, but he could radio

his position which was determined by his manpack receiver to the helicopter; the helicopter would put this position into the computer, and he would also then use the guidance information coming from the satellite in order to make a rendezvous with the person who was hidden. You will see a little red flag down there which is not visible to the helicopter pilot, but is useful to allow observers to see how accurately the helicopter performs the rendezvous.

This next demonstration, and we're going through this very quickly, is an armored personnel carrier. We drive the vehicle into the desert, as you can see and hide it in a depression where it could not be seen by an F-4 pilot. In a combat situation, a forward air controller, for example would see this happening and using a laser range finder to get the coordinates, send them back to the F-4 who would enter them into his onboard equipment and would make an approach.

You now see the F-4 making the approach. The film shows that he will fly right over that APC which is hidden from his view.

We are showing here an F-4 again because another military application is for deliveries of high-drag weapons such as free-falling bombs. You will see some bombs and you can see again the flag there which marks the point at which he was aiming.

Again, the F-4 will now fly in low where he doesn't see the target, but knowing the position of the target from the coordinates given to him by forward air control, they are entered into his onboard equipment and he will use the GPS to give him the coordinates and to guide the aircraft. He can then make these kinds of approaches. He can also fly in low and then pop up at the right time and make the drop.

The F-4 pilots who have done this have been extremely impressed. They were, most of them, rather skeptical at first. There was a 4-G maneuver that he made, and the point there was that the computer—the GPS computer on board—has to, of course, be able to operate in this high-G dynamic environment.

In a sense, to repeat what I said earlier, for that 2-hour period at Yuma where we had these four satellites in view, and with these user equipments—I think there are something like 40 user equipments that now exist—we actually had an operational capability although it was very limited in time, the 2 hours, and limited in place, at Yuma, Ariz. But it is a very good illustration of what we can have when we have the full system.

I think that finishes the film.

As I said, the purpose of this was to give you a very brief indication of some of the very important military applications that we have now been able to demonstrate using the actual satellites and using test equipment, some of it militarized on jeeps, in aircraft which can undertake the high-G loads, also man-pack.

There have been nearly 700 individual tests which have established the statistical performance of the system, and are convincing evidence that NAVSTAR is a sound concept, and the system will provide a very significant improvement in our ability to react rapidly on a global scale.

I will now discuss the status of the global positioning system program and the availability of NAVSTAR for civil and international use.

These two factors have affected the Federal radionavigation plan and are of interest, I believe, to this subcommittee, since they also affect NAVSTAR's potential civil utility.

There is a restructuring of the NAVSTAR program currently in progress as a result of the fiscal year 1981 budget decisions. In mid-1979, the services unanimously recommended to the Defense Systems Acquisition Review Council a program plan that would achieve a system initial operational capability by 1986. This is defined as 18 satellites on orbit. This is three rings of six each to provide an initial global three-dimensional capability.

As then structured, the initial capability was to be expanded by 1987 to the full 20-satellite deployment supported by a dedicated master control station. In addition, the plan called for initial production of user equipment beginning in 1983.

As a comment, the equipment that we used in the earlier tests was, of course, experimental equipment, not production equipment. We would complete the transition to a full deployment of NAVSTAR equipment by the mid-1990's.

The DOD inputs to the Federal radionavigation plan were based on this program which was approved by the Secretary of Defense in August of 1979. During the ensuing months, as we prepared for the fiscal year 1981 budget submission, we found it necessary to reduce program funding over the 5-year period for this program beginning in fiscal year 1981. Our initial assessment of the impact of these reductions was a slip in the initial 18-satellite capability date from 1986 to about 1989 or 1990, and a limit—at least initially—of 18 satellites.

However, since the major reductions occurred in the 1982-85 time frame, it was decided that a range of alternatives should be developed as part of the fiscal year 1982 budget process. This effort is still in progress, but we expect a recommendation and decision within the next few weeks on how to proceed.

I can only give you general information on the range of alternatives, but I will do that at this time. All the alternatives limit the system to 18 satellites, although expansion into the full 24-satellite deployment at some later date is possible.

One alternative retains all of the planned system improvements such as increased radiated signal power—which does require a major redesign of the current satellite—and this alternative would result in initial 18-satellite capability in about 1990 and would, of course, significantly affect our plans for phase in and phase out of user equipment and of other navigation systems.

Another alternative is to defer some of the items which would require major redesign of the satellite. This would allow diversion of development funding for procurement of operational satellites, essentially the same as those currently on orbit. Under this option, the 18-satellite capability could be achieved by late 1987, rather than 1990—the other option. And our user equipment transition plans would remain essentially the same as they were before the fiscal year 1981 budget decision.

As I said, a decision is anticipated within the next month and, based on this decision, we plan to modify the Federal radionavigation plan accordingly.

The other factor that I would like to talk about now which has affected the plan is that of the availability of NAVSTAR for civil and international use.

We have long recognized the need for some form of denial or degraded capability to preclude the full potential of NAVSTAR being used against us by our enemies. Originally, our concern was only with the accuracy of the so-called precise signals transmitted by each of the satellites. However, our testing has shown that even the coarse acquisition signal, which is used to acquire the precise signal more easily, is of sufficient accuracy to cause concern.

As a result, we have examined several techniques to not only deny the use of the precise signal, but to degrade the accuracy available from the coarse acquisition signal as well. We have worked very closely with the various agencies involved to arrive at what we believe to be an equitable balance between national security and national utility in determining the level of accuracy that should be established.

Our position is that NAVSTAR should be made available for civil use at an accuracy level that is consistent with national security. Consistent with the accuracy level we originally equated with the coarse signal, we have concluded that an accuracy of approximately 200 meters—50 percent confidence level—would not seriously jeopardize national security in the mid-1980's.

This figure was selected since it represents a threshold level of accuracy for potentially widespread civil aviation and maritime use.

I want to emphasize that the balance between national security and national utility and the resulting position on civil availability have been subject to considerable attention within the Department of Defense. We have developed, but not fully tested or evaluated, several techniques to implement this capability in the operational system employment. Further, we are still evaluating the operational procedures needed to provide adequate control and security of these techniques in all levels of conflict.

We view this as a major issue remaining related to the development and acquisition and operation of the NAVSTAR system. We also recognize that the outcome will have some impact on future civil use of NAVSTAR. For this reason, we will insure that you and other interested parties are kept fully informed of our progress.

It is our concern that a clear statement of policy and the ability to implement that policy must go hand in hand. Given our current situation with both the restructuring of the NAVSTAR program and the remaining work to be done on the civil availability issue, we have been forced to delay finalizing the first Federal radionavigation plan.

Mr. Chairman, those are the summary remarks that I wanted to make, and I will be pleased now to answer any questions that you or the committee may have.

[The prepared statement of Dr. Dinneen follows:]

THE DEPARTMENT OF DEFENSE

STATEMENT

BY

HONORABLE GERALD P. DINNEEN

ASSISTANT SECRETARY OF DEFENSE

COMMUNICATIONS, COMMAND, CONTROL AND INTELLIGENCE

BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND COMMUNICATIONS

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

96th CONGRESS, SECOND SESSION

21 FEBRUARY 1980

FOR OFFICIAL USE ONLY UNTIL RELEASED BY THE SUBCOMMITTEE
ON TRANSPORTATION, AVIATION AND COMMUNICATIONS, COMMITTEE
ON SCIENCE AND TECHNOLOGY, UNITED STATES HOUSE OF
REPRESENTATIVES

INTRODUCTION

This statement is in response to a request by the Chairman, Subcommittee on Transportation, Aviation and Communications for testimony on the latest status and plans for the NAVSTAR Global Positioning System. This is in support of the Subcommittee's review of the Federal Aviation Administration FY 1981 budget, recognizing the potential role of NAVSTAR in the future plans for civil aviation and air traffic control.

STATEMENT

Mr. Chairman and Members of the Subcommittee:

Since the Subcommittee last reviewed the status of the NAVSTAR Global Positioning System, a great deal of progress has been made toward realizing the operational deployment and application of this major new capability. In June 1979, the Defense Systems Acquisition Review Council reviewed the results of over five years of work and expenditures of over \$350 million dollars aimed at validating the NAVSTAR system concept. The work involved developing all system segments -- satellites, ground control station and user equipment -- and extensive testing to establish a qualitative and quantitative measure of system and equipment performance. It also included a variety of realistic demonstrations of the system's military utility on land, at sea and in the air.

Based on this review and the recommendations of the Defense Systems Acquisition Review Council, the Secretary of Defense on August 24, 1979 approved the transition from Concept Validation to Full-Scale Engineering Development of the NAVSTAR system. Shortly thereafter, work was begun to develop operational NAVSTAR user equipment leading toward initial production in the 1983-1984 time-frame. To ensure availability of satellites for continued testing of this equipment, four

additional satellites were ordered to provide reasonable assurance of maintaining the five satellite constellation for NAVSTAR-related testing until deployment of the operational satellites. Finally, we are also nearing completion of a competitive predesign effort for the operational master control segment.

A major emphasis during the past year was to improve the management and coordination within the Federal government of radionavigation system planning, development, acquisition and operation. The Department of Defense has actively participated with the Department of Transportation -- including its modal organizations: the Federal Aviation Administration and the U.S. Coast Guard -- the Department of Commerce, the State Department, and the National Aeronautics and Space Administration on an interagency working group co-chaired by the Office of Management and Budget and the National Telecommunications and Information Administration. An important result of this involvement was the signing of a joint Memorandum of Agreement between the Departments of Transportation and Defense. This agreement, among other things, delineates the individual and joint responsibilities of the two departments in planning and coordinating of activities related to radionavigation systems commonly used by both the military and civilian communities. This, in turn, has led to strong ties between the Department of Transportation Navigation Council, the Department of Defense Positioning and Navigation Executive Committee and their corresponding working groups. I

am pleased to note the active participation and close working relationships this activity has fostered with the Department of Transportation and specifically with the Federal Aviation Administration and the U.S. Coast Guard. This spirit of improved coordination has also been demonstrated by the permanent assignment of a Department of Transportation representative within our NAVSTAR Joint Program Office in Los Angeles.

One of the joint responsibilities of the DOT/DOD set forth in the Memorandum of Agreement is the preparation and annual updating of a Federal Radionavigation Plan. Although publication of the first edition of this plan has been temporarily delayed, its development has brought a new awareness of the importance of improved coordination among the various Federal agencies involved, and the need for a precisely defined set of requirements against which radionavigation systems and system mixes can be evaluated. I believe that this plan, as it evolves and forms the foundation for future radionavigation system development and acquisition, will be of significant benefit to the users, to industry, to the developers and providers of radionavigation services, and to the Congress.

By recognizing the potential role of NAVSTAR in the future mix of military and civilian radionavigation systems, the draft Federal Radionavigation Plan formalizes a deliberate and structured process to evaluate NAVSTAR's overall utility

for civil use. The original draft was based on the NAVSTAR program approved last August by the Secretary of Defense. It was also predicated on an assessment by the Department of Defense of the national security implications of the level of civil and international access to the unprecedented global positioning accuracy of the NAVSTAR system.

Since the draft plan was submitted to the Office of Management and Budget for inclusion in their Report to the President on Radionavigation System Planning, both the NAVSTAR program itself and our assessment of the feasibility of denying the use of the high accuracy of NAVSTAR to our adversaries have been subjected to considerable scrutiny. Recognizing the importance of these considerations to the Subcommittee's review of the Federal Aviation Administration's program, I will explain why, at least in part, publication of the Federal Radionavigation Plan has been delayed.

NAVSTAR GPS PROGRAM SCHEDULE

Along with the Secretary of Defense approval to proceed into Full-Scale Engineering Development of NAVSTAR came a challenge to reduce the projected overall system cost to make it more affordable. Thus, it was recognized that the estimated cost for development, acquisition and operation of the system, including procurement and installation of about 19,000 sets of

military user equipment -- approximately \$8.5 billion through the year 2000 -- constituted a major national commitment. It was also recognized, however, that a significant portion of this investment -- at least 25 percent of it -- could be offset by judicious phase-out or reduced use by the Department of Defense of other, less capable systems and equipments. Further, it was recognized that the improved capabilities that NAVSTAR could provide to nearly every facet of military application would far exceed the basic system cost in terms of equivalent force effectiveness.

It was within this framework that the Military Services unanimously recommended to the Defense Systems Acquisition Review Council (which subsequently recommended to the Secretary of Defense) a program plan that would achieve a system Initial Operational Capability (IOC) -- defined as 18 satellites on-orbit to provide an initial, global three-dimensional capability -- by 1986. As then structured, this capability would be expanded by 1987 to the full, 24-satellite deployment and we would have been well on our way in the 10-year transition to full use of the NAVSTAR system. It was also within this framework that the Air Force, acting as Executive Service for the NAVSTAR program and charged with finding the resources to develop and acquire the space and ground control segments as well as their fair share of user equipment development and acquisition, found it impossible in the FY 1981 through FY 1985 time-frame to fund the acquisition program

within the minimum level of the Budget they had recommended. The result which evolved during the initial stages of our FY 1981 budget process, was to slip the 18-satellite and 24-satellite system capability dates to 1987 and 1988, respectively. Under this plan, nearly everything else, including the system specifications, user equipment development and acquisition, and the planned satellite block-change, remained the same. We were forced, however, to defer construction of a dedicated master control station facility in favor of a modification to existing facilities at Vandenberg Air Force Base, California.

As the FY 1981 budget preparation neared completion, it became necessary to reduce planned outyear expenditures on NAVSTAR even further in order to fund other high-priority efforts. Our initial evaluation of these additional funding constraints was that the system Initial Operational Capability of 18-satellites could not be achieved until the late 1980's. However, since the primary reductions were confined to the FY 1982 to 1985 time-frame, it was decided that a completely restructured program would be developed in the next few months as we prepare for the FY 1982 budget submission. This restructuring process is currently in progress within the Services and we expect a recommendation within the next few weeks.

Since we are still in the process of restructuring the program, I can only provide general information at this time that may be useful for the Subcommittee's consideration.

- o All restructuring alternatives currently under consideration limit the system to 18-satellites. This is a significant departure from our earlier plans in which expansion to the full, 24-satellite deployment followed by about a year the initial 18-satellite capability. Although this action may, at first, appear to represent a major reduction in capability, the fact is that an 18-satellite system is still a formidable capability, particularly for its intended defense purposes. It is also important to note that this action does not preclude expansion of the system to 24 satellites at some later date.

- o One of the restructuring alternatives being considered retains essentially all of the planned system improvements that were included in the program recommended last year by the Defense Systems Acquisition Review Council. Among these improvements was a major block change to the current satellite design which, among other things, would increase the radiated navigation signal power. To remain within the baseline funding profile established during the FY 1981 budget preparation and to acknowledge the fact that such a block change would take at least three-years to complete, the system Initial Operational Capability could not be achieved until 1990.

o Another alternative is to defer some of the satellite modifications -- such as increased navigation signal power -- that would require a major block change and use essentially the current satellite design for the initial operational deployment. This would reduce near term development cost and schedule constraints which, in turn, would allow diversion of funds associated with the block change to funds for procurement of the operational satellites. Under this alternative an 18 satellite deployment could be achieved by late 1987. Service plans for development and acquisition of user equipment would remain virtually unchanged.

I believe that within the next month a decision will be made on the restructured baseline program and its schedule. It is clear, however, that this exercise has caused us to hold up on publishing the first edition of the Federal Radionavigation Plan.

NAVSTAR AVAILABILITY

Turning now to a second area that I am sure is of interest to this Subcommittee, I would like to review our position with respect to civil availability of NAVSTAR. During even the formative stages of system development, the need for some form of denial or degraded capability was recognized to preclude the full potential of NAVSTAR being used militarily against the United States or its allies. Originally our

concern was limited to the so-called "Precise" signals transmitted by each of the satellites. It was thought that the "Coarse/Acquisition" signal -- which is used as an aid to acquire the "Precise" signal and can be used for navigation -- would not be of sufficient accuracy to be militarily useful. However, tests performed with actual hardware have demonstrated that the "Coarse/Acquisition" signal accuracy is much better than we anticipated. Although it does not offer the jamming signal margins of the Precise signal, it could provide improved capabilities to an adversary.

As a result, we have carefully examined several techniques to not only deny the use of the Precise signal but to degrade the accuracy available from the Coarse/Acquisition signal as well. In establishing a level to which the system accuracy should be degraded, we asked the Organization of the Joint Chiefs of Staff to study the national security implications of such a global capability and to recommend an appropriate course of action. In addition, we worked closely with the Department of Transportation, the Federal Aviation Administration, the U.S. Coast Guard, NASA and other agencies of the Federal government to establish a range of capabilities versus specific requirements for navigation service. In so doing, we have attempted to achieve an equitable balance between national security and national utility of the NAVSTAR system.

Our position is that NAVSTAR should be made available for civil use at an accuracy level that is consistent with national security. Consistent with the accuracy level we originally equated to the "Coarse" signal, we have concluded that an accuracy of approximately 200 meters (50 percent confidence level) would not seriously jeopardize national security in the mid-1980's. This figure, somewhat more accurate than the level originally recommended by the Joint Chiefs of Staff study, was selected since it represents a threshold level of accuracy for potentially widespread civil aviation and maritime use.

I want to emphasize that the balance between national security and national utility and the resulting position on civil availability have been subject to considerable attention within the Department of Defense. We have developed, but not fully tested or evaluated several techniques to implement this capability in the operational system deployment. Further, we are still evaluating the operational procedures needed to provide adequate control and security of these techniques in all levels of conflict. We view this as the major issue remaining related to the development, acquisition and operation of the NAVSTAR system. We also recognize that the outcome may have some impact on future civil use of NAVSTAR. For this reason we will ensure that you and other interested parties are kept fully informed of our progress. It is our concern that a clear statement of policy and the ability to implement that

policy must go hand-in-hand. Given our current situation with both the restructuring of the NAVSTAR program and the remaining work to be done to address the civil availability issue, we have been forced to delay finalizing the first Federal Radionavigation Plan.

OTHER COMMENTS

This completes my remarks regarding the NAVSTAR program except to say that the results of nearly 700 individual tests, using both simulated and actual satellite signals, conducted on a wide variety of host vehicles, have conclusively demonstrated that the NAVSTAR concept is sound. Nearly every day I am made aware of yet another important military application of this emerging new capability and I am convinced that NAVSTAR will revolutionize the art and science of positioning and navigation. We welcome the continued interest of this Subcommittee and the spirit of cooperation that has characterized our work with the other Federal agencies involved.

Mr. HARKIN. Thank you very much, Dr. Dinneen.

Was this restructuring or reprogramming basically because of budgetary considerations more than anything else?

Dr. DINNEEN. Yes; it was primarily a budget consideration. When we were reviewing our fiscal year 1981 budget, a question was asked—as it is asked about all programs—is it possible to restructure, rephase this program so we can continue this program perhaps at a slower pace or something. That was one of the decisions.

Mr. HARKIN. Can you talk about how high up on the list of priorities this is in the Department of Defense from a military aspect in terms of warfare, in terms of just the navigation and communications aspect of it? What is the DOD's position on this?

Dr. DINNEEN. If I could just take a moment to put it in context, the NAVSTAR system is a support system, as are communications systems and other systems which collect information, rather than a weapon system as such.

In order to gain financial support for that kind of system, one has to develop a constituency among the people who are developing the major service programs. The way we have been attempting to do that, of course, is by demonstrations such as the one that you observed here.

Prior to those demonstrations, quite frankly, there were some who said "well, we have navigation systems now," and they looked at the overall cost of NAVSTAR, which is going to be very large, perhaps between now and the year 2000, we will expend somewhere between \$6 and \$8 billion on the system, including the satellites and the control segment and the user equipment.

I think, at the present moment, the support for NAVSTAR is quite strong, because we have demonstrated through these tests capabilities that will make a big difference in our defense capabilities. So I think the support is strong.

Now, obviously, it isn't the highest priority item in the budget or it wouldn't have taken any cut at all, but it survived when a lot of other things fell out, and support is strong and growing.

At what level would you say the decision was made to pursue the program? The highest levels?

Dr. DINNEEN. Oh, this was made at the highest level. This was an issue that was discussed at the highest level.

Mr. HARKIN. I want to shift my emphasis a little bit.

Yesterday at our hearings, Dave Israel, who is always very frank, forthright, makes some interesting comments, talked about NAVSTAR for civil use. He said he was expressing his own views. I want to make that clear. He was expressing his own personal views, not DOD's.

He said I can almost remember his voice—he wished that NAVSTAR would just go away as far as civil use was concerned. I wonder if you heard about that statement and I wonder if you would care to comment on it at all.

Dr. DINNEEN. Well, coming over in the car somebody told me that at the hearing he made some comment about NAVSTAR. That was about the extent of my knowledge until now.

I had seen Dave's statement—yesterday in preparing for this hearing, somebody showed me the statement that he made as an individual, not as a Defense witness—and this was primarily, of course, on the

FAA work, so I guess this other thing must have come up in the question period.

Mr. HARKIN. Question, yes.

Dr. DINNEEN. I don't know how to comment on it. I would be surprised that anybody who had seriously thought about NAVSTAR would make such a statement.

Mr. HARKIN. I think that's what I said to him.

Dr. DINNEEN. I certainly don't subscribe to his view. I think NAVSTAR—as I have indicated here—is very important for military, and it can have extremely important civil uses.

Mr. HARKIN. In all fairness to Dave, I think what he was saying was that there may be other ways to solve the problems we are having in navigation in the civil end without going to this tremendous expenditure for the NAVSTAR system. Maybe that's what he was saying; that there were less expensive, less sophisticated ways of doing it, I think was really the point he was making.

Following on that, speaking for the DOD, do you feel that there would be a national role for NAVSTAR above that which is being pursued by the Department of Defense?

The second part of my question is, do you see an international role for NAVSTAR?

Dr. DINNEEN. The answer is yes to both. When you say "above that being pursued by the Department of Defense," I assume you mean above what we are doing for military applications, because it is our mission, of course, to develop NAVSTAR for our needs.

Mr. HARKIN. I don't mean "above it," but apart from it, yes.

Dr. DINNEEN. As you know, there have been other navigation systems that were developed by the Defense Department and then found widespread civil use. TRANSIT is an example, and some of the other systems—LORAN and so on. And I'm sure NAVSTAR will follow that same path.

As I indicated in my statement and also in my remarks, the one thing that we have to do is to decide on a proper balance between the needs to protect the very high accuracy signal so it's not used against us, and then provide a sufficiently accurate signal so it's very useful, and I think we can do that, and we've made—I think—rather good strides working with the Department of Transportation in our joint planning. We have come quite far with them.

Now, in addition to the second part of your question, I think there are other uses. NASA, and we have been talking to NASA about that, and there are probably uses in some of the ocean activities, and so on.

Mr. HARKIN. We lose one ship a day in the ocean someplace in the world. One ship a day. It doesn't take long before that adds up to a few billion dollars. Certainly, some of those go down for reasons other than navigation, but the great bulk are navigation problems, they run into something because they are 2 to 3 miles off course.

Dr. DINNEEN. Oh, I'm sure, and in that case, the kind of accuracies that we're talking about are adequate, the 200 meters are so clearly better than what they have now.

Mr. HARKIN. Absolutely.

Dr. DINNEEN. If I could be permitted one other comment along these lines, I understand the argument about sophistication and high costs

and so on, but NAVSTAR is one of those systems that provides a capability that we simply cannot provide in any other way. There's no other way that we can get that kind of global navigation with any systems that I can imagine.

That is, of course, crucial. In many ways crucial to the Defense Department, and often important to the civil users as the example you just mentioned with the ships at sea.

You also asked about international. I think it is easy to make the extrapolation from domestic civil users to international civil users, but, of course, we are also working very closely with our NATO allies, and, in fact, we have NATO officers resident in our program office—in fact, a number representing many of the countries so that we will have joint programs.

Mr. HARKIN. A little bit on the technical aspect of it.

I was told a couple of different things I want you to comment on. I understand the need, of course, for the military to protect its accuracy and to protect that signal. Now, the signals that you get through the use of NAVSTAR give you height, altitude, and distances in the x and y axes as well as time. So you've got a full three-dimensional aspect. I understand all that.

For most civilian uses, you don't need height or the time. So can you block out one of those signals? Can you say, OK, we'll keep the height for the military, but can you keep that signal from being used, let's say, by the civilian users. Obviously, ships don't need the height, right? Most aircraft don't need the height because we have other ways: barometric altimeters, approach aids, whatever. So you could protect your accuracy that way.

Dr. DINNEEN. Let me make my comment, then Colonel Gilbert can give you more technical details if you need it.

I think the answer is that that is not feasible. We kind of compute all those things from the signal that's being received from the four satellites, and if you have only three satellites, you get a degradation, but a degradation of all of the coordinates. You get basically the same signal from all satellites, and then on the basis of the computation in this little computer that's carried with the thing, you figure out your position and latitude and longitude and altitude. There isn't a separate signal for altitude which you can work out.

That's my understanding. Do you want to comment further on that, Steve?

Colonel GILBERT. Perhaps I could fill in briefly. The four satellites that a user looks at to get his position need to be in good geometry to determine the whole solution—three-dimensional positioning and time. Generally they look at three satellites on the horizon about equally spaced around you, and one directly overhead. The one directly overhead gives the user good altitude information; the three on the horizon give him good horizontal position, and it's a geometry question.

So what you are suggesting is that you would just have to turn the satellite off overhead and you wouldn't get altitude information, but for a user several hundred miles from here, he'll be looking at that particular satellite to get horizontal position.

The inherent solution requires four satellites unless you put other information into the user equipment, such as altitude.

Mr. HARKIN. Again, I am trying to figure out how you can correlate this with civilian use.

Dr. DINNEEN. I understand the point of your question, which is to try to strike that balance in a way which protects the national security but also provides the information that is most needed by the civil users.

Mr. HARKIN. Yes, that's right.

Dr. DINNEEN. And you are saying if, in fact, they don't need altitude—I'm not sure that's true. I think you may find some civil users who want the altitude, even degraded. That, in fact, is the process we are going through right now, and that is one of the reasons—as I indicated earlier—why that plan is being held up. We are looking at various ways to do this to strike that balance.

Mr. HARKIN. From my standpoint, when I look at NAVSTAR, I see it as a navigation system that would be useful in so many different situations. I see all the civilian and military aspects too.

Dr. DINNEEN. Sure.

Mr. HARKIN. I am saying if we just go down the military road, then I am wondering if DOD itself would recommend that they spend that much money on that navigation system that was useful only for the military. Or, since it is going to cost so much money, that we have to have joint civilian/military use of it. And if it is just going to be a military system, is it, in fact, going to be built?

Dr. DINNEEN. I would like to comment on the last part of that. I feel quite confident at this point that we are going to go ahead with the system even if it were only military.

Mr. HARKIN. I don't share your confidence. I'm sorry. I have done a lot of talking to a lot of people about it and I don't think that's necessarily true.

Dr. DINNEEN. You know as well as I do that we've had budget problems, but my feeling right now, on the basis of the tests we have been able to conduct, the demonstrations that we've made, the recognition of what a difference it will make in our military capability is such that we will proceed with the system, and I feel fairly confident of that.

Obviously, we still have to have money authorized and appropriated and so on, but my feeling of confidence in the system is much stronger this year than it would have been last year. But I also share with you the feeling that this is a system which, even at degraded accuracy—and you know, this is a time-phased thing, as we said, it can have a tremendous impact on civil users.

You raise another question which is an interesting question. I really find it hard to give you a good answer on it. How you would go about this kind of joint funding program.

Mr. HARKIN. What would the military—do you think—feel about a system similar to a COMSAT to raise the money that's needed for a NAVSTAR system, which would be an independent organization similar to the COMSAT that would simply provide a portion to the military? Would the military be interested in using a system like that?

Dr. DINNEEN. If the policy that we've stated were followed, namely, that the system that were developed, that only the high-accuracy only was provided to the U.S. military and perhaps NATO, and not to those

who might use it against us, then it would be just a question of what's the best way of acquiring the system.

But I think the thing that we would be concerned about is that we would want this extremely important capability transferred to those who might use it against us.

Mr. HARKIN. Could it be done within that kind of framework of an independent agency, let's say, running it? Using it for other purposes, obviously. They would sell time or something to the ship owners and to the maritime fleet. You could even use it for trucking operations, railroads could use it, surveyors. All kinds of things. All the civilian airlines.

Would there be a way of doing that and then having the military "buy into it" let's say?

Dr. DINNEEN. I'll be frank with you. It is my opinion, and I haven't thought this one out very much.

Let me give you my judgment at this point, but assure you that I will think more seriously about it.

I guess my initial reaction is that that would be very difficult. I would give you a couple of reasons.

If, in fact, we accept the principle that we are going to provide the high-accuracy signal only to the military and not to the other users, there has to be a fairly strong control of the system by the military. I mean, we have to control the ground stations; we have to be sure that we control the satellites; the satellites have to have certain military characteristics which would not be required for civil users. So, for example, a COMSAT-like organization were going to do this, they would try to provide that service at the lowest cost possible, because that's how they would get it through; therefore, they would perhaps not want to provide in the satellite hardness and that sort of thing which we need.

They also would obviously have to control the satellites—their position and so on—for the civil users. Unless you could work out all the things about how it would be transferred, but it's hard for me to see how you would get an international group to buy into an organization which had this kind of a restriction on the use by the military.

There's another question of how you'd charge for this service. I suppose you could ask for some kind of copyright on the user terminals, but once the satellites are up there and emitting the signal and somebody gets a terminal, they can build their own, and they don't have to do anything to receive the signal.

Mr. HARKIN. Can't you change the signal code?

Dr. DINNEEN. Oh, yes. That's the kind of thing we want to do. I suppose it would be like cable television or something. You'd have to buy the code for that week.

Mr. HARKIN. Yes, that's right.

Dr. DINNEEN. But that would also perhaps make the thing more complex. I know this sort of thing has been thought about. I haven't personally looked at it very seriously, though.

Mr. HARKIN. To sum up my feeling, I can see the importance for the military. I can see it, being an ex-Navy pilot myself, I can see great things in there. But I can also see the amount of money that is going to take. A lot of money. And if the past is any indication, it is going to take even more than we think it's going to cost right now.

So if we are going to put that much national resources into it and since it has so many civilian applications, ought we not be looking at it in both ways, military and civilian areas, rather than just strictly military areas?

Obviously, there are those things that you have to spend money for from a taxpayer's standpoint that are strictly military, whether it's a new fighter plane or a new ship or something that has absolutely no civilian spinoff or use, but on something like this, which does, and which costs so much money, then you have to ask the question: should we somehow be going down that road where we have both the civilian and the military use of it?

Dr. DINNEEN. The answer is yes, we should, and yes, we are, and how to do it. If, in fact, my judgment is correct that the support for this system for its military application remains strong, then the issue is going to be how to engage the other parts of the Government in doing the user equipment development and so on to make those uses at the accuracy that we can make available and that will be time phased.

Since we have a program well underway at this point and we've committed ourselves to these satellites which also have other payloads on them and so on, but turning that around now into a different kind of management arrangement, I think would tend to delay the system. I would tend to feel that we should not go in that direction unless we run into very serious problems in support.

As I said, I think the support is growing, plus we'll continue to work with our counterparts in the civil agencies to insure that it's made use of, just as we have in the past on other navigation systems.

Mr. HARKIN. I rather doubt we can afford to have two systems.

Dr. DINNEEN. I am not suggesting two.

Mr. HARKIN. I'm just saying I don't think we can afford to have a civilian and a military system.

Dr. DINNEEN. Oh, no. I don't think so either.

Mr. HARKIN. OMEGA is internationally controlled. How much does the military use OMEGA?

Dr. DINNEEN. We still use it. The Navy uses it, but I'm not sure I know how much.

Colonel GILBERT. No in great numbers, but the Navy does use it.

Dr. DINNEEN. Colonel Gilbert says not a great deal, but I really don't know how much.

Mr. HARKIN. Do you feel the Soviet Union might go ahead and put up their own NAVSTAR system?

Colonel GILBERT. I certainly think that's a very good possibility.

Dr. DINNEEN. Yes, I think that.

Mr. HARKIN. Which makes you wonder, if they do it, then everybody's got all this accuracy, and what's the point in hiding it, I guess. That would bother me very much. I don't know if they are or not, and I've heard some rumblings that they were thinking of doing it, but I don't know any more than that.

Dr. Dinneen, you've had extensive experience with advisory groups. You were a member of Dr. McLucas' advisory group when he was FAA Administrator. Do you just want to make a couple of comments on whether or not such a group could be beneficial to the FAA?

Dr. DINNEEN. I served on a very large number of advisory groups before I came into the Government. Since I've been in the Government,

I've had a lot of advisory groups giving me advice. I think the opinion sort of varies with whether you are giving advice or taking it.

I can only speak for the Defense Department, but on balance, I think the advisory groups that we have—and we have a large number of them—do, in fact, benefit us and we gain from it. Our experience is good. They are helpful and have been helpful to us.

Mr. HARKIN. Another question off the subject of NAVSTAR.

You were Director of the Lincoln Labs until about a couple of years ago. In fact, you were Director of Lincoln Labs when I first got involved in the MLS program.

During that time, Lincoln Labs developed the DABS and the ATARS system for the FAA. Now that you have left that job, I wonder if you have any thoughts that you would like to share with us today on DABS, ATARS, and how they have progressed.

Dr. DINNEEN. I don't recognize ATARS.

Mr. HARKIN. Oh, IPC.

Dr. DINNEEN. Oh, the Intermittent Positive Control.

Mr. HARKIN. Yes.

Dr. DINNEEN. Well, when I left the lab to come down here, of course, I kind of disqualified myself from following their activities in any detail, so my comments on DABS and the Intermittent Positive Control would be based on my experience back there up until 1977.

I thought DABS was a very good system. I thought it was a system that evolved from the current beacon system. It had the advantage of—as you know—cutting down on the interference from a lot of others. I flew while I was up there in a number of the experiments in the Intermittent Positive Control; was very impressed with what that could do. At that time, the FAA, of course, was pursuing this system, and I thought they were both systems that offered great potential.

Mr. HARKIN. The last thing. Do you think we made the right decision, looking back now, to go ahead with the TRSB—the time reference—rather than doppler?

Dr. DINNEEN. I thought so at the time, and I haven't seen anything to make me change.

Mr. HARKIN. We continue to get reports on some of the problems with TRSB, but I guess we made the decision and we are going ahead with it, so that's that.

Would you care to comment on the support and coordination that you have with the Federal Aviation Administration and how they are serving the Defense Department where its interests are affected, such as with DABS, MLS, and the coordination and support that you get from FAA. Is it good?

Dr. DINNEEN. Yes. I've worked with Mr. Albrecht and others there on a number of those programs. I think the support we are getting is generally satisfactory. In the DABS we have some joint programs, and in the MLS, as you are aware, I guess last year or the year before there was some money transferred from the FAA for the MLS thing, \$6 million or so, and we are pursuing that.

I think generally the coordination is good. I have no problem.

Mr. HARKIN. Very good.

Well, thank you very much, Dr. Dinneen and Colonel Gilbert. Thank you very much for being here today.

We now have a second set of witnesses who will testify regarding helicopter operations and development. I understand that all three have statements.

We have Robert Richardson, executive director of the Helicopter Association of America, Richard Stutz, chairman of the Helicopter Association of America's Heliports and Airways Action Group, and Glen Gilbert, president of Glen A. Gilbert and Associates, Incorporated, a consultant to the Helicopter Association of America.

I understand, as I said, that all three of you do have prepared statements, is that correct?

Mr. RICHARDS. Yes, Mr. Chairman, we each have a summary statement.

Mr. HARKIN. Without objection, all three of those statements will be made a part of the record in their entirety, and again, since you are all together, I would just leave it up to you on how you would like to proceed.

Mr. RICHARDSON. Thank you, Mr. Chairman and committee staff members. I'd like to lead off, and inasmuch as our collective statements lead one into the other, unless you have any strenuous objection, we'd like to hold the questions until the three of us are through. Is that OK?

Mr. HARKIN. Fine. That'll be fine.

Mr. RICHARDSON. Thank you.

STATEMENT OF ROBERT A. RICHARDSON, EXECUTIVE DIRECTOR, HELICOPTER ASSOCIATION OF AMERICA, ACCOMPANIED BY RICHARD G. STUTZ, CHAIRMAN, HELIPORTS AND AIRWAYS ACTION GROUP, HAA, AND GLEN A. GILBERT, PRESIDENT, GLEN A. GILBERT & ASSOCIATES, INC., CONSULTANT TO HAA

Mr. RICHARDSON. The Helicopter Association of America is an international, independent organization of just over 400 member companies who own and operate helicopters.

The Nation's helicopter fleet has increased from less than 3,000 helicopters in 1970 to about 7,000 vehicles today. In 1979, this industry employed about 75,000 people. We manufactured over 950 aircraft in 1979, and the industry gross revenue was well over \$1 billion.

It is the fastest growth element of the aviation industry at a compound growth rate of 15 percent per annum, and by 1990, we estimate that there will be some 20,000 helicopters in the national air space.

Mr. HARKIN. Can I just interrupt you right there?

Three thousand helicopters in 1970, 7,000 today. I was just wondering how many of those are built abroad. Do you have any idea what percent we're talking about?

Mr. RICHARDSON. I think that it might well be, with the penetration that the European manufacturers are making, it could be 20 to 25 percent.

Mr. HARKIN. Is that growing? I mean, is the competition from abroad increasing?

Mr. RICHARDSON. Yes, it is. It is growing.

We project that by 1990, we will manufacture 2,000 aircraft that year, and the industry gross revenue will be over \$3 billion.

Now, here is one example of how helicopter transportation can provide unique benefits to our economy with major contributions to both conserving and developing energy. In September 26, 1979, a twin turbine, modern-technology helicopter challenged a fixed-wing business jet to a competition to move six people more efficiently from downtown Knoxville, Tennessee, to the World Conference Center in Atlanta, both using automobiles for connecting transportation when required.

Using city center heliports, the helicopter system transported the six passengers in 1 hour and 10 minutes, using 560 pounds of fuel at an average speed of 130 miles per hour. This was clearly more efficient than the airplane system, which transported the six passengers in 2 hours, using 1,210 pounds of fuel at an average speed of only 88 miles per hour. At the same time, the helicopter transportation bypassed the second busiest airport in the country.

This is a prime example of heliports as reliever airports, relieving both air and ground congestion.

Mr. HARKIN. Excuse me. That's a great example. Now, are you talking about from the time they left downtown Knoxville to the time passengers back to the conference center in Atlanta.

Mr. RICHARDSON. Well, they left the conference center in Atlanta, actually. They flew to downtown Knoxville and brought these six passengers back to the conference center in Atlanta.

Mr. HARKIN. And they flew by business jet?

Mr. RICHARDSON. And the other group flew by helicopter and the helicopter came out a clear winner on that one.

Mr. HARKIN. The jet must have had to hold over Atlanta for a while. This was Friday afternoon?

Mr. RICHARDSON. As a matter of fact, it wasn't. It was in midweek, as I recall.

Mr. HARKIN. That's startling. OK.

Mr. RICHARDSON. Today, the helicopter industry is at a critical point in its development. The capabilities of our advanced technology helicopters and the contributions that they make to the national transportation system are not known to the national, State and local levels of government. As a result, the growth of our industry and its contribution to the general public is severely limited to day by the lack of public-use heliports, connected by discrete helicopter airways in convenient places to serve the traveling public.

Compared to conventional airports and airways, these helicopter facilities are simple and small in both land-use and airspace utilization.

The Airport and Airways Development Act of 1970—which we commonly refer to as ADAP—contained no specific provisions for heliports and helicopter airways. Furthermore, none of the proposed ADAP renewal bills contained such provisions in 1979, in spite of the spectacular growth of the industry.

On August 14, 1979, the HAA formed the Heliports and Airways Action Group—better known as HAAG—to run a comprehensive campaign to convince the Congress that not only provisions for heliport and discrete helicopter airways grants and funding should be made in the Airport and Airway Improvement Act of 1979, but also specific heliports and helicopter airways planning should be directed.

The HAAG was also charged with identifying and taking actions with other Federal and State and local government agencies to bring about the implementation of a national heliport and airways system.

Otherwise, the benefits of the helicopter transportation system to the national transportation system may never be realized.

In our testimony to the Senate Subcommittee on Aviation on September 13, 1979, and to the House Subcommittee on Aviation on September 25, 1979, we proposed the planning and funding to meet our requirements shown as follows:

The Secretary is directed to prepare and publish, within 1 year after the date of enactment * * * and thereafter to review and revise as necessary, a national public-use heliport and helicopter airway system plan for the development of this transportation element in the United States.

The plan shall set forth, for at least a 10-year period, the type and estimated cost of heliport and helicopter airways development considered by the Secretary to be necessary to provide the systems to be adequate to anticipate and meet the needs of civil aeronautics and to meet the public safety needs of the Nation's cities.

The Secretary may authorize a State to receive a block-grant from funds apportioned only upon finding that the State airport system plan includes provisions for public use heliport systems within the State plan.

Not less than \$50 million shall be granted for public heliports in each fiscal year.

Not less than \$50 million shall be authorized to be appropriated for establishing discrete helicopter airways navigation facilities in each fiscal year.

A total of not less than \$75 million shall be appropriated for heliports, helicopter airways and helicopter transportation systems, research and development, and an additional \$25 million shall be appropriated for associated noise abatement R. & D. programs, with an additional \$25 million appropriated for research and engineering and development of the NAVSTAR global positioning system for civil use.

Now that I've covered the background and major planning and funding issues or our proposal to the Congress, Mr. Stutz and Mr. Gilbert will give you details on this \$125 million in research and development and demonstration funding that we have requested.

Mr. Stutz.

Mr. STUTZ. Thank you, Bob.

The first viewgraph I have here is a plot showing the rapid expansion of the civil helicopter fleet which I am showing here for background while I make my initial remarks.

Bob Richardson has just testified that today we have no all-weather heliports, and only one helicopter airway, which is experimental, and that we project 20,000 civil helicopters in the national airspace by 1990.

Unless something is done, these helicopters will either have nowhere to go or seriously interfere with airplane traffic.

We also need a noise descriptor appropriate to helicopter and heliport operations, acceptable to the public, rather than applying the airplane/airport criteria not suitable, certainly for downtown metropolitan areas where our heliports will be.

In addition, helicopter internal noise levels acceptable to the public are not adequately known. More than \$50 million of Government money has already been spent on airplane noise abatement R. & D. to bring it to the present level of technology, but little has been spent on helicopters. Consequently, the HAA requests that research and develop-

ment be conducted in both all-weather heliports and airways and helicopter noise abatement.

I would like to expand on the detailed requirements of these R. & D. efforts.

The objectives of the heliports and helicopter airways R. & D. program proposed is to develop and demonstrate the heliport construction criteria required, and the navigation, communications and air traffic control equipment and procedures required to operate helicopters into and out of metropolitan and other areas in all weather conditions.

The next viewgraph shows the itemized funding the HAA requests for this heliports and airways R. & D. effort:

First, heliport design criteria would develop all-weather design criteria in the following areas: planning criteria for site locations, including, specifically, interface with other modes of public and private transportation; construction criteria for elevated, ground-level and floating sites in remote, offshore and city center environments; heliport lighting, marking, safety refueling, firefighting and security design criteria for varying environments; noise level and noise abatement design criteria for various heliport environments.

Heliport site plans would develop specific site locations for primary and secondary all-weather public-use heliports for each of the Nation's 25 largest cities and 10 other selected locations, and prepare detailed heliport development plans for each site.

Heliport terminal guidance would develop terminal guidance equipment and procedures. This would include a steep approach, curved flight path microwave landing system designed to minimize noise and airspace required appropriate to helicopter performance, not airplane performance.

Heliport automatic weather would develop remote automatic weather recording and reporting systems appropriate to heliports.

Helicopter airway navigation would develop navigation equipment and procedures appropriate to the low altitude, narrow-corridor helicopter capabilities. It would include special configurations of Vortac, loran-C, ground and airborne radar permitting airways 500 feet above ground level 2-miles wide, and nonprecision approaches.

This is not possible now due to the line-of-sight restrictions of the existing systems.

Heliport airway communications would develop reliable communications between the helicopter and air traffic control en route and down to the heliport surface. This is not possible now due to line-of-sight limitations of the existing VHF equipment.

Heliport and airway air traffic control would develop low altitude, high accuracy metering and spacing systems that would permit helicopters to operate safely in increasing numbers in metropolitan and other congested areas like the Gulf of Mexico.

Helicopter airways criteria would develop discrete helicopter airways design criteria using navigation, weather, communication and air traffic control equipment, and procedures described above. It would include design criteria for en route, approach, landing and departure from established public-use heliports and airports.

Heliport and helicopter airways demonstrations would provide for design, construction, and demonstration of up to four metropolitan all-weather heliport systems. Each system would consist of one or more heliports, interconnected by helicopter airways, and connected by helicopter airways to adjacent helicopter or airplane airways systems as appropriate.

These heliport/helicopter airways systems would use equipment and procedures developed above for construction, facilities, noise abatement, terminal guidance, navigation, communications, and air traffic control.

NAVSTAR GPS, which Glen Gilbert will be discussing later, would also be tested.

These demonstration heliports would not only demonstrate much-needed service, but also such appropriate types of heliports as rooftop, landsite, air rights, and water site.

The last item, discretionary funds, would provide a reserve for unanticipated R. & D. efforts.

Now, moving on to noise abatement, the objective of the helicopter noise abatement technology R. & D. program is to improve the acceptance of the helicopter by both the community and the passenger.

This viewgraph shows the itemized funding the HAA requests for helicopter noise abatement technology R. & D.

Under helicopter external noise, community acceptance criteria would develop acoustic criteria for helicopters which will allow operation in a variety of community environments while being environmentally acceptable to the communities.

Economic studies would provide economic studies of the effect of helicopter external noise reduction during en route, landing and takeoff for current and future helicopter designs. It would also provide an economic assessment of proposed noise rules on derived helicopter designs.

Enlarged acoustic data base would provide an enlarged data base, particularly for large helicopters, in order to verify the vehicle prediction model and establish reasonable limits for certification and future reductions in noise levels.

Component prediction models would develop prediction models for each of the components, such as main rotor, tail rotor, engines and transmissions associated with helicopter noise. It would also conduct component tests to verify the models.

Aeroacoustic mechanism research would conduct the wind tunnel and theoretical research necessary to define the analytically model mechanisms important in component acoustic radiation not included in the prediction models above.

Vehicle prediction model would develop a vehicle prediction model which accounts for component and component/airframe aerodynamic interactions during the various operational modes of landing, takeoff and en route, and allows the prediction of acoustic contours. It would also computerize this prediction program.

Development of quiet designs and operation models would develop noise abatement designs and operational procedures using data derived above. It would also conduct component, model and full-scale

tests to verify the noise abatement techniques developed above and establish the associated economic and performance tradeoffs.

Blade slap would develop the relationship between blade slap and the impact of noise exposure while subjects are conducting representative tasks.

Then under helicopter internal noise, the prediction model would develop and verify a component based prediction model for helicopter internal noise which includes; for example, the prediction of transmission induced structural vibration, its effect on the internal noise level, and the effect of interior treatments.

Data base would establish an internal noise data base in order to verify the prediction model and establish reasonable limits for certification and future reduction in noise levels.

Exposure and acceptance criteria would develop relationships between interior noise level and exposure duration and the impact of noise exposure, including annoyance, communications interference, and temporary threshold shift—in other words, loss of hearing. It would also develop recommended criteria for each as they relate to practical helicopter limits.

Finally, internal noise reduction methodology would conduct component and vehicle test programs to develop more efficient methods of reducing helicopter interior noise. This would include transmission design for reduced excitation and reduced resonant response; transmission isolation techniques, reduced structural response composites, and material damping research; and more efficient acoustic treatment approaches.

Now Glen Gilbert will provide you with the details of civil applications of NAVSTAR GPS R. & D.

Glen?

Mr. GILBERT. Mr. Chairman, gentlemen I have a paper that you have on the record, and I am going to summarize this as it is quite comprehensive and detailed. Obviously, if there are technicalities in this paper that any of the staff members would like to discuss with me or any of my associates at an appropriate time, we would be happy to go into those details.

For the purpose of this hearing, however, I would like to highlight this paper.

A fundamental goal for helicopter operations, as well as for civil aviation in general, is to have a high-accuracy-navigation system with global coverage, capable of providing area navigation without the need for point reference navigation aids. Signal coverage should be down to the surface without the constraints of line-of-sight limitations from ground-based navigation aids.

The navigation system should be capable of providing narrow, discrete helicopter routings to facilitate segregation of helicopters and conventional takeoff and landing or CTOL aircraft. Dick Stutz has just talked a little bit about that aspect in his presentation.

Similarly needed are discrete instrument approach and missed approach procedures onshore and offshore to heliports helipads, at conventional takeoff and landing airports, and points in space, as well as in remote areas.

Thus, it should be possible to operate helicopters without interference to or from airlines and other conventional aircraft, in many cases sharing the same landing areas, but not the same runway. The potential of helicopters cannot be achieved if they are to be handled in the air traffic control system as fixed-wing, conventional aircraft, particularly in high traffic density areas. For optimum IFR helicopter routings and approaches, an RNAV—area navigation system—of some sort is needed.

Mr. Chairman, I had the pleasure of being here Tuesday morning at the testimony that took place, and I noted with a considerable amount of interest that you were well aware what RNAV is all about. You asked some very penetrating questions.

The increasing use of civil IFR helicopter operations has focused sharp attention on the deficiencies of the present VOR/DME navigation system, including VOR/DMS RNAV. May I repeat that, sir?

The increasing use of civil IFR helicopter operations has focused sharp attention on the deficiencies of the present VOR/DME or VORTC navigation system, including VOR/DME RNAV.

These basically are the lack of precision navigation guidance, line-of-sight limitations for low altitude flight, and unavailability of stations offshore and in remote areas.

The present national navigation system permits precision instrument approaches only where an ILS or an MLS, or a PAR precision approach radar system, is installed.

There are about 13,000 aircraft landing facilities in the United States and its possessions, including nearly 3,500 heliports, of which about 300 are elevated, yet precision instrument approach facilities are available for less than 500 conventional airports, and none for heliports.

I might say, Mr. Chairman, that in the 35 years that we've had the ILS, we have this record to look at: 500 conventional airports served by ILS, no heliports. How many years will it take to have for the thousands of heliports and other areas that we want to use for helicopters served by ILS or MLS in the future? You name it.

The present navigation system limitations become even more pronounced when considering the growing need for precision or non-precision instrument approaches to virtually an infinite number of landing/take-off areas for IFR-capable helicopters and other VTOL's now being developed.

Dick, may I have that first slide?

Here is a list of 10 items that are also in the text and are what we consider from a helicopter operational point of view to be ideal navigation goals. Talking about some system that we want to look forward to, these goals basically outline the concept that we have.

Highly accurate three-dimensional navigation guidance; time-referenced navigation—that's make it possible to arrive at a particular point in space or on the surface at a desired time; accurate approach in landing guidance anywhere. Thousands and thousands—in fact, an infinite number of places may be involved in meeting helicopter requirements for instrument approach capability in the future.

Signal coverage down to surface without radio horizon limitations; imperviousness to atmospheric conditions for noninterrupted use;

nonsaturable capacity; service availability to all classes of airspace users on a worldwide basis; output capability to drive multifunction cockpit displays, amongst them possibly being a CDTI—cockpit display of traffic information.

Also, I noticed at your hearings on Tuesday, Mr. Chairman, that this subject was brought up. I personally feel that the sensors that are needed for a good CDTI are not available in the present system, but I believe they can be made available with a future system which I will talk about in 1 minute; namely, GPS.

No. 9, automatic position reporting in air-to-air separation assurance. "Air-to-air assurance" meaning some form of proximity warning or CAS.

And finally, a cost-effective system design for various classes of airspace users.

Those elements constitute an outline or a blueprint for an ideal navigation system to meet helicopter requirements as we see them, and I think these same goals will serve very well other segments of aviation, perhaps specifically and especially general aviation, but I can't speak for them at the moment.

What is the system that will meet these ideal navigation goals as we see it right now? Well, it's the NAVSTAR GPS.

That will be the subject which I will address now in some further detail.

I think I would like to skip down a little bit, if you are following the presentation, and just say I believe our approach here in considering GPS is to treat it as the basis for an advanced or fourth-generation ATC system, scheduled to be phased in as I will point out.

It should be clearly understood that the HAA proposed GPS funding—which I will outline in a moment—is over and above the FAA's base line R. & D. request for fiscal year 1981, as well as for the entire 5-year period, 1981 to 1985.

I would like to comment for a moment on the question of GPS accuracy, which was discussed earlier by Dr. Dinneen. At the moment, we will go along with the idea of having to have a degraded CA system accuracy in the order of 100 to 200 meters, which would be adequate or acceptable for en route navigation but it would not be acceptable for precision approaches. It might be acceptable for nonprecision approaches.

Now, how do we solve this question and still live with what the DOD says they need for national security in the way of making available only a degraded CA signal? The answer to this seems to lie in the application of differential GPS at selected locations.

This concept would not jeopardize national security as its enhanced GPS accuracy would be quite localized in coverage. Differential navigation has been used in the past with other navigation systems, such as Loran, Omega, and Transit. We could now look toward a differential concept for GPS.

Essentially, the differential concept for GPS involves fixed monitor receivers, which would be located in the geographic areas over which accuracy improvement is desired. The monitor receivers compute deviations in the measured position from a previously established true position. The amount of deviation is then used as a correction for the

nearby area of interest. This differential correction factor would then be broadcast to incoming aircraft. The resulting accuracy may be expected to be several orders of magnitude better than the raw degraded CA signals.

I have put quite a bit of illustrated material in the rest of this presentation which gives a concept of architecture for a GPS system for civil aviation, and that's pretty well self-explanatory as to what would be the elements involved there in setting up that kind of architecture.

Well, finally, what we'd like to do—the end product of the proposed HAA presentation—is to have the FAA conduct a GPS concept validation program which would have as its objective to reach a decision as to civil GPS application and implementation by the mid-1980's. This means the evaluation and validation process should be begun in fiscal year 1981.

If an advanced or fourth generation ATC system based on GPS emerges—as I think it will—past history shows that a transition period of 10 years or so will be required. Thus, we would be in the mid- to late 1990's for complete transition. However, use of the GPS system could be commenced by the mid- or later-1980's by airspace users most urgently needing its advantages, such as helicopter operators.

To carry out the proposed GPS concept validation program, a significant amount of R. & D. and test and evaluation hardware will be needed.

I would like to show some slides now on how we believe we can go ahead with implementing this test and evaluation concept validation program for fiscal years 1981 through 1985.

Here are seven specific funding proposals for FAA R. & D. civil aviation GPS concept validation beginning in the 5-year period commencing with fiscal year 1981. No. 1, the airborne GPS area navigation, 2-D, 3-D, 4-D; No. 2, the ground-based fixed differential GPS monitors, which I mentioned a moment ago that will give extremely good accuracy at specific points where you may need that kind of accuracy without interfering with the national security aspects of the GPS system; No. 3, airborne terminal guidance with differential GPS; No. 4, airborne separation assurance, that is proximity warning or CAS; No. 5, ground airborne data link communications; No. 6, ground-airborne surveillance; and No. 7, airborne multifunction displays.

Now this is broken down—as you can see in the first column—in fiscal year 1981 into different concepts of amounts totaling \$5 million for the year. When spread over the entire fiscal years 1981–85, 5-year period, our total budget proposal for concept validation by the FAA would be \$25 million.

Here's a summary of what we've said so far in terms of the HAA's proposal for augmented FAA R. & D. funding. Item 1, the heliports and discrete airways. Dick Stutz covered that briefly in an outline form, \$15 million 1981; \$60 million the other 4 years for a total of \$75 million. No. 2 is the helicopter noise abatement technology, \$5 million 1981; plus \$20 million for a total of \$25 million for the 5-year period; and No. 3, the GPS concept validation program which I just described briefly at \$5 million 1981; and \$5 million for each year thereafter for a total of \$25 million.

Thus, we are asking for an add-on to FAA's baseline R. & D. program for fiscal year 1981 in the amount of \$25 million, with the same

amount added on each year thereafter, for the total 5-year period, 1981-85 making a total of \$125 million added on to FAA's R. & D. program.

Thank you, Mr. Chairman.

Mr. HARKIN. Thank you, all three, very much. It was interesting testimony.

Just some general things before I get to the GPS.

The \$500 million ADAP money which you are talking about for public-use helicopter grants and discrete helicopter airways comes under the jurisdiction of Public Works, Aviation Subcommittee. We do a lot with them although we work only on the R. & D. portion.

In their ADAP hearings last year, Langhorne Bond was asked why ADAP money was not being spent on heliports. He answered that he'd love to make such grants. There's nothing in the present law which prevents it, but there simply were no applicants. FAA can't pass out money which nobody requests. So I would like to ask you, first, do you agree with Bond's statement, and, second, how would your proposal improve on this basic problem that no one's asking for it?

Mr. RICHARDSON. Let me take a crack at that. I think I have some information here that will help understand that.

As I indicated in my testimony, there's a lack of understanding among the leaders in certain jurisdictions, whether they be cities, whether they be countries, States, as to the contribution that the helicopter can make to transportation in this country. This is largely because we haven't really developed on instrument-capable multiengine kind of vehicle that has been able to make much of an impression or much of an impact, on transportation in this country, other than in obvious areas, such remote areas and offshore. The kinds of points of origin and points of destination where there really isn't any other alternative—any other practical alternative.

But we have now a new family of modern technology helicopters going into operation and which can provide the performance on an economic basis for significant growth, compared to previous helicopters that have been in existence. Some of these are designed from the first day of the drawing board for civil application. Heretofore, we have been relying on a military design vehicle, which hasn't proved to be too practical.

Fuel efficient aerodynamics and propulsion are being built in to this new generation of equipment. Higher payload, lower weight, fewer moving parts, lower maintenance, increased ride and comfort, lower noise, improved safety. These helicopters have been able to provide a rapidly growing service in the last several years, and we are on the threshold, as I indicated, of an increasing growth.

Heretofore, it's been principally in remote and offshore areas. Now, with increased aviation congestion through the national air space, not only in metropolitan areas, but in areas like the gulf, this growth cannot continue without heliports and airways systems.

We are going to set about through HAAG a concentrated campaign, if you will, of visiting certainly most of the 25 largest population centers in this country to educate the city fathers and those concerned with air transportation on what's happening in this industry.

The process for applying for ADAP funding has been very confusing to many city fathers and administrators, because there has never been anything in any of the ADAP bills—as I indicated in my testimony—which equated the heliport—it's always been airport. The word "heliport" has never even entered into any of this legislation.

We are making an effort in the formulation of the new ADAP legislation to see that the heliport is specifically mentioned and brought to the foreground.

The paperwork in applying for heliports involving Federal money is enormously complicated. Environmental impact studies and all of the machinations that one has to go through in the establishment of an airport, in many cases, has been almost overwhelming to people who have tried to tackle it. I think that now, largely through some of the efforts that we are undertaking at HAA and some of the other aviation organizations that work with us, we are going to see an increasing awareness of the availability of that funding, and we mean to go out and see that there are applications for Federal money for heliports.

Mr. STUTZ. I would like to add on to that, if I may, Mr. Chairman. Mr. HARKIN. Sure.

Mr. STUTZ. Just to tell you where we are at the moment.

At present, there are no public-use heliports under construction or being improved in the national air space. A planning grant funded plan for downtown Washington heliports is being reviewed now by the FAA, and funding for plans for New York City's 34th Street Heliport, and a downtown Boston heliport are being processed. They have been in process for several months.

New Orleans, a smaller city, is also being processed. However, these programs are moving very slowly, and as Bob Richardson pointed out, the HAA has started a campaign with the 25 largest cities, and we want to go to the State aviation departments as well to try to give them on a one-to-one basis the benefits of a helicopter transportation system to their city. This is part of our education process.

However, it is apparent from our contacts that we've made to date that the local and State governments are looking to the Federal Government for fostering and guidance, just as the Federal Government gave the airplane transportation system that kind of fostering in the 1930's, and they built airports and airways far ahead—as you may know—of the then-existing activity, and that's why we have the great transportation system we have today.

It's that same kind of fostering, now that we feel that we have a mature, civil helicopter industry, that we are looking for today from the Federal Government, from the Congress.

Mr. HARKIN. In light of an increasing need for rapid transportation of people from one metropolitan area to the other, butting heads with the need to conserve fuel, it seems to me that some people are making the case that helicopters might be the wrong way to go and that STOL aircraft—short takeoff and landing aircraft—can carry greater numbers of people and would operate more efficiently in terms of passenger seat per mile of fuel used than would helicopters.

Would you care to comment on that?

Mr. RICHARDSON. Yes, sir. Having been the president of a STOL airline that operated right here in the Washington-Baltimore area in

1969, and which operated between the now Baltimore-Washington International Airport, Washington National Airport and Dulles, we were bound by airports, albeit, we did have STOL runways—in the case of National Airport—on a taxiway. A couple of taxiways were outfitted for STOL landing, and at Dulles, we had a special STOL runway that was laid out right in front of the tower. We were able, (using some of the early RNAV equipment which was just beginning to be perfected), to make RNAV approaches to Washington National, which interestingly enough, Ransome Airlines with their DHC-7s is beginning to get into that right now. This very moment they are working with the FAA. We were doing it with the STOL planes—the STOL planes that we had at our disposal—10 years ago. But—

Mr. HARKIN. Excuse me for interrupting.

What I am asking you is this: Do you feel that in the future that helicopters can compete with STOL aircraft in terms of the amount of passengers that can be moved in a certain amount of time with a certain amount of fuel? Can they compete?

Mr. RICHARDSON. I think they can, because one of the big problems in getting people—the reason I was trying to develop some of this background is that people just didn't ride this thing because they couldn't get close enough to the inner city. They had to be bound by airports. The attempt to get STOLports close to the center of population in cities like Baltimore, Philadelphia, New York, all the way up the Northeast corridor clear to Boston, proved to be impossible. You need a piece of ground or an over-water bridging of piers or whatever you are going to do, 150–200 feet wide, and at least 1500, and more likely, 2,000 feet long. If we can't get clearance for heliports which, in some instances would only require an area, say, for a very, very minimum facility of a couple of hundred feet square, the capability of getting a STOLport close to the city center was proved to be unachievable. And the whole Northeast corridor STOL concept just simply died, despite enormous studies and I'm sure large sums of money that were spent on studying the whole thing, simply because they just couldn't get the handy STOLports.

And if we can get the public-use heliports, the helicopter, in my judgment, can be competitive.

Mr. HARKIN. Last fall the FAA provided testimony that they were conducting their "Helicopter Operations Development Program to improve the efficiency of helicopter operations."

How do you see this program? How does the helicopter operations development program of FAA fit into your requirements that you've outlined in all of this?

Mr. STUTZ. I think I can probably answer that, Mr. Chairman.

At our industry request, the FAA initiated that helicopter program in 1978. It's a 5 year, \$12-million-plus program scheduled to be completed in 1983, and was limited to looking at basic problems confronting helicopter all-weather operations in the national airspace, and to identify solutions for the desired improved efficiency in these helicopter operations.

Now, the HAA believes that the FAA has pursued this program with real interest, with the enthusiastic support of Administrator Bond, and our industry. But at the joint HAA/FAA helicopter workshop in

October of last year, we briefed the FAA's helicopter program team on this proposal we are presenting today.

We believe that we needed this larger R. & D. effort than what they have presently planned for construction and demonstration of these new facilities not covered by the scope of their program to proceed with a major expansion of the helicopter transportation system.

The helicopter operations development program was the place to put the effort. At that time, we asked the FAA to incorporate it in an expansion of this program. We also briefed Administrator Bond and Associate Administrator for Airports Aaronson and E&D Associate Administrator Albrecht on this same program.

However, it was simply not within the resources of the FAA to provide a program of this scope without special authorization by Congress.

Mr. HARKIN. Well, that's our problem. If any of you were at the hearings—I guess it was Tuesday—when we had Mr. Bond up, I kept trying to get out of them comments on the adequacy of their budget. They may not want to go against OMB in their on-record statements, but the fact is that the \$85 million they are requesting this year simply won't meet other programs, for example, the computer modernization program. If we can't even get that, how are we going to supplement it with something like this? That's our problem.

It would seem to me that we've got to do some grassroots work to get support for this kind of thing. I think you're doing that now. I think your association is now going out and doing that, which is very good. As you pointed out, I think Mr. Bond is very pro-helicopter. I think he has been very supportive of this, but I don't see any request in the budget for a more aggressive R. & D. program on this line. And I understand why.

Mr. GILBERT. May I add one comment? I was here Tuesday, as I mentioned a moment ago, and I definitely recall this question coming up. The question you raised: Is the FAA plan for R. & D. adequate? Obviously, at the rate they've proposed increases, it doesn't even keep up with inflation, so it can't be adequate even to maintain the current level of programs, let alone put on new ones.

Second, you also brought up the point that by the end of 1981—at the present rate of expenditure and user taxes—over \$5 billion will have accumulated in the trust fund, uncommitted.

Mr. HARKIN. That's right.

Mr. GILBERT. I think I can speak for my colleagues here, the helicopter industry has paid in money during the last 10 years without really getting anything out of the trust fund specifically for helicopters, not like general aviation's reliever airports, or airline airports or runways, or any of that sort of thing. Now why can't we get some of this trust fund money to do the kind of program we're proposing? But it will obviously have to be your initiative and the Congress here to do that. Certainly, we are not asking for anyone to pay more user taxes, and we're not asking for general revenue funds.

Mr. HARKIN. I'm sure you know that with the NASA portion of our budget, last year this subcommittee was very instrumental inaugurating the budget for rotorcraft last year and again this year. We haven't in the FAA. As I say, we're fighting just to get some augmentation in their basic program. Perhaps we'll have to take a much closer

look in our markup sessions on your proposal. I can assure you that we will.

Would you make any comments on NASA's program, how it's shaping up, especially in regards to the helicopter noise abatement technology program? Have you talked with NASA about this?

Mr. GILBERT. Mr. Chairman, I can perhaps comment on this as a leadoff on the answer to your question.

I served on the National Research Council with a committee to develop NASA's 10-year advanced rotorcraft technology program. I am very well acquainted with it. I also have been very closely involved with programs of Ames and Lewis and Langley Research Centers.

The HAA as an association supported that \$5 million add-on that you initiated in this committee. We supported going down the line through the conference committee to keep it in, and we felt that was a very, very important thing to do, to get this 10-year advanced rotor technology program underway. So fiscal year 1981 marks the initiative, thanks to your first step in getting that \$5 million authorization in.

Now what we need to do—and I may say, in general, the helicopter industry in general, is in agreement—I would like to see the 10-year program continue with this initiative that was started with \$5 million. And in 1982, 1983, right on down through the whole 10-year period. If it is continued more or less by NASA as the 10-year rotorcraft program has been developed with the support of the National Research Council and industry and so on, then we would expect some extremely useful outputs during the next 10 years for rotorcraft development.

Mr. HARKIN. I want to ask just one question on GPS. You heard our previous witness, the Department of Defense, and some of the questions I addressed to them. Obviously, we didn't even talk about the helicopter operations with DOD, but that is one area of the civil use of NAVSTAR that would be better than anything else we have. As you point out, VOR's and the problem with line of sight.

I am concerned now about the accuracy. They talked about 200 or 400 meters, I believe. You stated that that might be all right for en route. I don't even know if that's all right for en route. If you're talking about flying at 500 feet, I'd get worried about an accuracy that was off 200 meters.

Mr. GILBERT. One hundred to two hundred meters is what we've been advised. I think Dr. Dinneen said they are thinking in terms of about 200-meter accuracy.

Mr. HARKIN. I would think it would have to be better than that. If we're talking about using helicopters in all-weather conditions, in a busy eastern part of the United States, with a lot of them flying around, where you're making approaches to heliports, it would seem to me you would have to have a much more accurate signal than that.

Mr. GILBERT. Well, believe me, sir, from a helicopter industry point of view, we would be very happy to have available the P signals, the high accuracy degree of inputs, in the order of 10 meters and three-dimensions, which is more or less what the P-signal accuracy is reported to be. We would love it, and maybe we'll get it in 5 years as things go along and other developments take place and the national

security interests are not such a determining factor. But I think our position right now is, we would like to see something go ahead to apply or to work on the concept validation of GPS for civil use, get it started and get things going in terms of principle, because we know we're going to have to wait 5 years or—maybe 6—before the initial operation capability is at least in place. As so said earlier, maybe 1986, 1987.

So during the next 6 years—5 or 6 years—we would like to see a concept validation program underway by the FAA, specifically along the lines we've outlined. If, during that period of time, the DOD says "Well, look, we're going to improve this accuracy; we're going to give you the P-signal accuracy," you wouldn't find anybody unhappy about that.

Mr. HARKIN. I understand that, but I am just saying that if NAVSTAR proceeds as a strictly military system with some civilian application where the signal was degraded to the type of accuracy we heard about earlier today, I can't see that it's going to do a heck of a lot for helicopter operations. Maybe I'm wrong. Maybe there's something about that I don't understand.

Mr. GILBERT. The Northeast corridor operation which is strictly helicopter discrete routing using VOR/DME navigation is 4 miles wide, 2 miles each side of the center line. That contrasts to 8 miles wide or 4 miles each side of the center line of a standard airway. At least we're cutting it down a little bit with the current kind of area navigation available. But the VOR/DME RNAV is not very accurate as you get farther away from the station; you get bigger angular divergence and you have more of an error factor built in, the farther from a VOR station.

Anyway, if we can go to 300 to 600 feet for en route navigation, each side of the center line, that still is many times better than what we've got today.

Mr. STUTZ. I might just add something, too, Mr. Chairman, that whereas now we have nothing offshore or in remote areas like Alaska, that this 200-meter accuracy would give us a capability there that just doesn't exist in any way today for those kind of helicopter operations.

I think it is fair to say, as a helicopter operator, that we probably have more to gain than anybody else from the GPS system because of the nature of our operations: worldwide, remote, offshore, that kind of thing. That's one reason why we are supporting it here today.

Mr. HARKIN. You are not too concerned about the use of height information, are you? Or are you?

Mr. STUTZ. Oh, yes. Definitely. We would use all three dimensions. We are concerned about height because of the kind of approaches that we want to make, steep approaches, and we need the height signal.

Mr. GILBERT. The height signal with the degraded CA is obviously going to be more than you would want to have as an error in making an instrument approach. You wouldn't want to have your altitude off 300 feet, let's say, or something like that.

On the other hand, at high altitudes, which is probably not the case so much with helicopters, but as you know, we have to have

2,000-foot separation above 29,000 feet, and certainly GPS right then and there ought to be able to reduce that to 1,000 feet. That's one little thing where you might find immediate use from the vertical capability of GPS.

On the other hand, getting down to the helicopter operation again, when we can couple the 3-D inputs with a barometric altimeter, which has been contemplated in a number of design concepts, there are ways that we can really take advantage of that vertical capability, even if it's not quite as accurate as we'd like to have it at the moment.

Mr. HARKIN. Well, it seems that the growth that we're experiencing in the helicopter industry is either about to or is already bumping up against the air space, the navigation facilities, the heliports, landing facilities, and everything else that we have. I guess what you are saying is that your industry concern is that there is a demand there and you've had tremendous growth. Even though there are not many heliports or very many helicopter airways, you are saying that we ought to be paying attention to the other side of it as the demand for helicopters increases.

Is there anything else any of you would like to bring up?

Mr. RICHARDSON. Mr. Chairman, that last point that you made is extremely perceptive.

Men must have sat down—as Dick alluded to—perhaps in the late 1920's or early 1930's—maybe I'm a little off in my time frame—and had the same perception of the air transport industry, airplanes, and places to land them. And somebody got the thing going, and Dick articulated it, a system of airports and airways were put into place.

It must have looked, perhaps in some people's minds, absurd to think of large sums of money to lay down runways and the ground side complexes. Perhaps equally difficult to understand in our trying to come to grips today with helicopters, heliports and helicopter airways. I think that's a good way to close in trying to think about what we are trying to tell you.

We are at "square one." We haven't gotten out of the starting gate yet.

Mr. HARKIN. OK. Thank you all very much. I appreciate your testimony.

[The prepared statements of Mr. Richardson, Mr. Stutz, and Mr. Gilbert follow:]

Statements to the Subcommittee on
Transportation, Aviation and Communications
Of the
Committee on Science and Technology
U.S. House of Representatives

February 21, 1980

By

Robert A. Richardson
Executive Director, Helicopter Association of America

Richard G. Stutz
Chairman, Heliports & Airways Action Group, HAA

Glen A. Gilbert
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Heliports and Discrete
Helicopter Airways Requirements
In The National Airspace

Statement to the Subcommittee on Transportation, Aviation
and Communications of the Committee on Science and
Technology, U.S. House of Representatives

by

Robert A. Richardson
Executive Director, Helicopter Association
of America

February 21, 1980

The Helicopter Association of America, HAA, is an international independent organization of several hundred member companies who own and operate helicopters. Our services are for hire, corporate and private transportation and for public service. Our members operate in the fields of agriculture, airlines, air-taxi, construction, executive transport, law enforcement, energy exploration, rescue, logging, and many other commercial and civil applications.

The purpose of the HAA is to represent and promote the helicopter interests of our members to government, business and industry, the news media and the public.

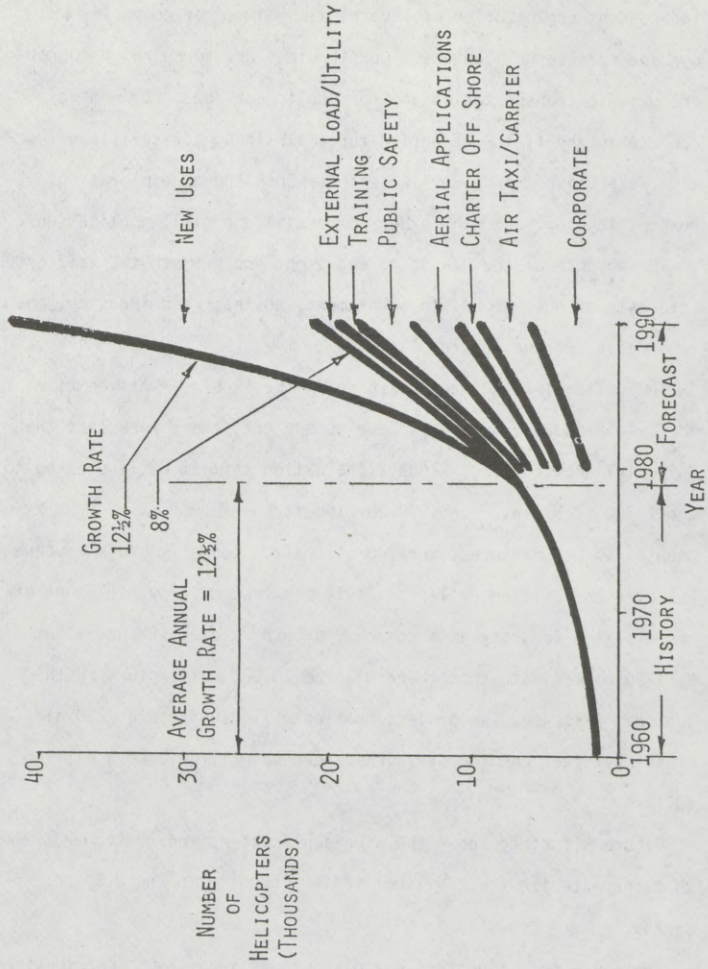
The helicopter industry was born in the 1940's -- at the time of the 1970 Airport and Airways Development Act, there were less than 3000 civil helicopters. Today, the nation's fleet has increased to about 7000 vehicles. In 1979 our industry employed about 75,000 people. We manufactured over 900 aircraft. Industry gross revenue was over one billion dollars. It is the fastest growth element of the aviation industry at a compound growth rate of 15% per annum. By 1990 we estimate that there will be 20,000 helicopters in the National Airspace. We project that we will manufacture 2000 aircraft that year and industry gross revenue will be over 3 billion dollars.

Figure 1 further shows the wide applications and phenomenal growth that characterize the civil helicopter industry in the U.S. and Canada.

These are some important examples of our industry's contributions to the nations commerce and welfare.

FIGURE 1

THE HELICOPTER INDUSTRY IN THE U.S. AND CANADA IS GROWING AT 3 TIMES THE GROWTH RATE OF GENERAL AVIATION AND IS THE FASTEST GROWING SEGMENT OF CIVIL AVIATION



A helicopter transportation system, unprecedented or unequalled in the world, has been exploding in the Gulf of Mexico. Each day over 7000 people are moved to energy production sites in these versatile machines. A single Louisiana based helicopter operator transports more people daily than the most active of all U.S. commuter airlines and owns more aircraft than almost all of the world's largest air carriers.

The nation's public safety organizations recognize the tasks that can be accomplished -- and only by -- helicopters. Daily, laws are enforced, crime is suppressed, apprehensions are made with helicopters. Daily, lives are being saved and hospital emergency rooms are accepting trauma patients delivered by helicopters. Daily fires are fought and people are evacuated by helicopters.

- During the "Blizzard of '79" the only aircraft taking off and landing at Baltimore-Washington International Airport were helicopters.
- At Three Mile Island only helicopters were capable of furnishing emergency support.
- During the height of tropical storm David, helicopters were pressed quickly into service for evacuation and rescue purposes.

Here are some other examples of how helicopter transportation is providing unique benefits to our economy, with major contributions to both conserving and developing energy. New York City, the only city today that has its act together on helicopter transportation, tells us that, for every corporate headquarters that is located in the city near the financial community, 500 urban

workers are employed. 68 corporations stay in town by flying to 60th Street Heliport alone. Digital Equipment Corporation, a large, fast growing computer manufacturer in Massachusetts, has dispersed their several plants to sites that afford living space for their workers and that reduce their workers' commuting needs. RCA has the same system in New Jersey as does United Coal Companies in their coal exploration in the Appalachians. Helicopter transportation permits them to maintain cost effective supervision and control as well as technical support among these plants and their central offices.

On September 26, 1979, a twin turbine modern technology helicopter challenged a fixed wing business jet to a competition to move 6 people more efficiently from downtown Knoxville, Tennessee, to the World Conference Center in Atlanta, both using automobiles for connecting transportation when required. Using city center heliports the helicopter system transported the 6 passengers in 1 hour 10 minutes using 560 lbs. of fuel at an average speed of 130 miles per hour. This was clearly more efficient than the airplane system which transported the 6 passengers in 2 hours using 1,210 lbs. of fuel at an average speed of only 88 miles per hour. At the same time, the helicopter transportation bypassed the second busiest airport in the country. This is a prime example of heliports as reliever airports, relieving both air and ground congestion.

This activity emphasizes reality -- helicopters are not toys -- helicopters are true working machines that serve not only the nation's people transportation requirements but also the nation's most basic needs - food supply, energy development, forestry, construction, public safety and many others. However, the HAA is vitally concerned today because the helicopter industry is at a critical point in its

development. The capabilities of our advanced technology helicopters and the contributions they can make to the National Transportation System are not known to the national state and local levels of government. As a result, the growth of our industry and its contribution to the general public is severely limited today by the lack of public-use heliports connected by discrete helicopter airways in convenient places to serve the traveling public. Compared to conventional airports and airways these helicopter facilities are small in both land use and air-space, and simple.

Legislation to date has not helped because it has reflected a general perception that the helicopter has been -- at best -- a highly specialized piece of military equipment with minimal civil application, and -- at worst -- a segment of the nation's transportation system so insignificant as to not warrant any particular attention.

Specifically the Airport and Airways Development Act of 1970, ADAP, contained no specific provisions for heliports and helicopter airways. Furthermore, none of the proposed ADAP renewal bills contained such provisions in 1979 in spite of the spectacular growth of our industry. Let me detail some of the serious problems that have arisen as a result of this lack of legislative action.

- Heliports - Through 1978 helicopter operators have paid into the Aviation Trust Fund nearly \$40 million through the fuel tax. Not a cent of this money has been used to construct heliport facilities or to provide related equipment. Among the 25 largest cities only 11 have public-use heliports, only four of these are recognized in the National Airport System Plan, and none of these are equipped for all weather operations. The only discrete helicopter airway in the United States runs from Washington, D.C., to Boston, Mass.

On December 28, 1979, a twin turbine modern technology helicopter flew from New York City's Wall Street Heliport to Washington in one hour and eleven minutes and from Wall Street Heliport to Boston in just over 59 minutes. These were both new world's speed records. However, the helicopter in each case could serve only the airports because neither city has a public-use heliport. We project that this airway, the Northeast Helicopter Corridor, will be servicing at least 500 twin engine fully all-weather capable helicopters by 1990 and hundreds of smaller helicopters. The helicopter operators obviously need a system to serve all the other regions of the United States where the demand for helicopter transportation is now fast growing.

- Airways - In 1978, a helicopter flying from Wilmington, Delaware, to Bridgeport, Connecticut, under IFR conditions would probably have been routed a total of 225 miles via airplane airways to cover this 165 mile distance, a 35% penalty in fuel and time. Today our one helicopter airway permits almost direct flights from Wilmington to Bridgeport. However, instrument approaches to the New York City area can only be made with non-precision approaches to and departures from the five Manhattan Island heliports in uncontrolled airspace. There is inadequate radio communications. In 1978, there were more than 90,000 operations there and New York City estimates that it reached 125,000 in 1979. This is one third that of LaGuardia which is in a terminal control area, and the helicopter traffic is increasing much faster. The helicopter operators need a much improved airway in the Northeast Corridor with positive air traffic control in congested areas as well as similar new airways in all the regions of the United States.

- Navigation - The line-of-sight airplane navigation system helicopter operators are forced to use in the Northeast Corridor requires them to fly at altitudes frequently higher than most efficient for helicopter operations in terms of fuel consumption, mission time, and separation from airplanes. In remote areas such as Alaska, where helicopter transportation is vital, and offshore, there is no appropriate navigation system at all. The operators need a nationwide low altitude system that will permit them to provide their unique transportation services in congested, remote and offshore environments regardless of the weather. This is why we are vigorous supporters of civil application of the NAVSTAR Satellite Navigation System. Mr. Gilbert will testify in behalf of this requirement shortly.

- Heliports and Helicopter Airways Planning - An important reason why so little has been done to develop and implement the helicopter transportation system is that there is no federal guidance or direction for its consideration in the Airport and Airways Development Act of 1970. Furthermore, nine years later there is still no such direction or guidance in either the Administration's proposed Airport and Airway Improvement Act of 1979, H.R. 3745, or the Senate's proposed Airway and Airways Development Act of 1979, S-1648. No state's aviation plan contains any direction or guidance either nor does PART 152 either existing or proposed. In fact, the words heliport or helicopter airways don't even appear in these documents. Although we are told that airports includes heliports, we find that city and state planners don't know this and with the exception of New York have not seriously considered helicopter transportation.

On August 14, 1979, the HAA formed the Heliports and Airways Action Group (HAAG) to run a comprehensive campaign to convince the Congress that not only provisions for heliport and discrete helicopter airways grants and funding should be made in the Airport and Airway Improvement Act of 1979, but also specific heliports and helicopter airways planning should be directed. The HAAG was also charged with identifying and taking actions with other federal and state and local government agencies to bring about the implementation of a national heliport and airways system. Otherwise the benefits of the helicopter transportation system to the National Transportation System may never be realized. In our testimony to the Senate Subcommittee on Aviation, September 13, 1979, and to the House Subcommittee on Aviation, September 25, 1979, we proposed the planning and funding to meet our requirements shown in Table I.

In the first item of the chart we have asked the Congress to direct the Secretary of Transportation to include public-use heliports and associated helicopter airways in the National Airport System Plan. No such specific direction exists in either the present ADAP Law or any of the four new proposals.

We believe that the FAA Airport Aid Program, PART 152, should address the second item in Table I, plans for local public-use heliports by providing specific direction that sponsors of airport development and planning must consider appropriate heliports, or at least provisions for space and zoning for such heliports to qualify for federal funding. Our comments to the FAA on the recent NPRM on PART 152 have reflected this. We also proposed a Public-Use Heliport Development Assistance Office to expedite the planning and acquisition of funds for sponsors.

SUMMARY

IIAA Positions On
 Airport and Airway Improvement Act of 1979

PLANNING

* Public-Use Heliports/ Discrete Helicopter Airways	By Secretary of Transportation	In National Airport System Plan
* Local Public-Use Heliports	By State/Local Governments	As Part of Requirements for Federal Airport Grants
* Heliport/Helicopter Noise Description and Abatement	By Secretary of Transportation	In Noise Description Systems Development and Abatement Plans

FUNDING (\$ Years)

* Public-Use Heliport Grants	\$250 M
* Discrete Helicopter Airways	\$250 M
* Heliports/Discrete Helicopter Airways R&D and Demonstration	\$ 75 M
* Heliport/Helicopter Noise Abatement R&D	\$ 25 M
* Civil Application of NAVSTAR GPS R&D	\$ 25 M
Total	\$625 M

TABLE I

In HR 3745 the Administration proposed that the Secretary of Transportation be directed to establish within a year a single descriptor for measuring noise at all airports and a single procedure for calculating and depicting this descriptor. This included heliports regardless of their location and environment. We testified, as shown in Item 3 of Table I, that an appropriate separate descriptor for heliports be established when sufficient R&D had been accomplished.

The \$500,000,000 that we proposed in Table I for heliports and discrete helicopter airways grants and implementation represents about 9 percent of the totals proposed by the Administration for airport grants and airway improvement. Helicopters will account for about 3-5 percent of the aircraft population by 1985, however, 9 percent of funds is not out of line when consideration is given to the facts that;

- (1) Airports and fixed-wing airways already exist and their funding requirements are for improvement - not for start-up.
- (2) Public-use heliport systems do not now exist except in New York City and discrete helicopter airways do not now exist except in the Northeast Corridor. Funding is needed to start-up these systems and the required funding levels, are, therefore, higher than "improvement levels."

A well developed public-use heliport system can be expected to cost in the neighborhood of \$7,000,000 to \$20,000,000, \$3-7 million per site, for a large city. Our proposed \$250,000,000 would, therefore, marginally cover our nation's 25 largest cities at an average of \$10M per city. We also propose \$250M for the intra city and intercity airways connecting this system of heliports. This is the smallest system we can envision that could possibly convince the required

city government sponsors of public-use heliports that they would be part of a national helicopter transportation system required to meet their need. The U.S. Conference of Mayors concurred in this concept.

This is just like the situation that emerging DC-3 airplane transportation was back in the 1930's. If Congress had not funded airports and airways far ahead of the then immediate activity level, the national airplane transportation system we have today would not exist.

Now that I have covered the background, major planning and funding issues of our proposal to the Congress, Mr. Stutz and Mr. Gilbert will give you details on the \$125M in R&D and demonstration funding we have requested, the last 3 Items of Table I.

I provided a markup of HR3745 ADAP Renewal that I believe would implement our proposal in my written testimony to the House Aviation Subcommittee September 25, 1979. I have provided you today with another format for this same markup in which all helicopter related items are collected into a single section.

THANK YOU!

Mr. Stutz

HAA Proposal For Heliports/Airways Section 1979 ADAP

SEC. ____ . PUBLIC-USE HELIPORTS AND HELICOPTER AIRWAYS

(a) DECLARATION OF POLICY.

The Congress hereby finds and declares -

That technological advances and United States industry demands are resulting in a rapid expansion of helicopter uses and inventories.

That existing infrastructure needed to insure the orderly growth and contribution of helicopters to the nation's transportation system are inadequate to meet the current and projected growth.

That a "heliport" means an airport which is used or intended to be used for the landing and take off of helicopters.

(b) NATIONAL PUBLIC-USE HELIPORT AND HELICOPTER AIRWAYS PLAN.

The Secretary is directed to prepare and publish, within one year after the date of enactment of this title, and thereafter to review and revise as necessary, a national public-use heliport and helicopter airways system plan for the development of this transportation element in the United States. The plan shall set forth, for at least a ten-year period, the type and estimated cost of heliport and helicopter airways development considered by the Secretary to be necessary to provide the systems to be adequate to anticipate and meet the needs of civil aeronautics and to meet the public safety needs of the nation's cities.

(b) STATE PUBLIC-USE HELIPORT PLANS.

The Secretary may authorize a state to receive a block-grant from funds apportioned under section _____ of this title only upon finding that the State airport system plan includes provisions for public-use heliport systems within the State plan.

(d) PUBLIC-USE HELIPORT GRANTS; OBLIGATIONAL AUTHORITY -

Of the sums listed under Sec. _____, Airport Improvement Program, of this title, not less than \$50,000,000 shall be granted for public-use heliports in each fiscal year.

(e) HELICOPTER AIRWAYS FACILITIES AND EQUIPMENT -

Of the sums listed under Sec. _____, Airway Facilities and Equipment, of this title, not less than \$50,000,000 shall be authorized to be appropriated for establishing discrete helicopter airways navigation facilities in each fiscal year.

(f) RESEARCH, ENGINEERING AND DEVELOPMENT, AND DEMONSTRATIONS. -

Of the sums listed under Sec. _____, Research, Engineering and Development, and Demonstrations, of this title, a total of not less than \$75,000,000 shall be appropriated for heliports, helicopter airways and helicopter transportation systems, and an additional \$25,000,000 shall be appropriated for associated noise abatement programs, and an additional \$25,000,000 shall be appropriated for

research and engineering and development of the Navstar Global Positioning System for civil use.

(g) NOISE EXPOSURE DESCRIPTIVE SYSTEM

The Secretary shall establish for heliports noise exposure description systems similar to those described in Sec. _____ only after sufficient research has been conducted to account for the unique characteristics of the helicopter family.

Research and Development
Requirements for Heliports
And Discrete Helicopter Airways
And Helicopter Noise Abatement Technology

Statement to the Subcommittee
On Transportation, Aviation and
Communications of the Committee
On Science and Technology, U.S.
House of Representatives

By
Richard G. Stutz
Chairman, Heliports and Airways Action Group
Helicopter Association of America

February 21, 1980

Mr. Richardson has just testified that, today, we have no all weather heliports and only one helicopter airway, which is experimental. He also testified that we need a noise descriptor appropriate to helicopter/heliport operations, acceptable to the public, rather than applying the airplane/airport criteria not suitable for downtown metropolitan areas. In addition, helicopter internal noise levels acceptable to the public are not adequately known. More than 50 million dollars of government money has already been spent on airplane noise abatement R&D to bring it to the present level of technology. Consequently, the Helicopter Association of America (HAA) requests that research and development be conducted in each of these areas. These are listed in HAA's complete heliports/airways proposal, Table I. I would like to expand on the detail requirements of these R&D efforts.

The objective of the heliports and helicopter airways R&D program proposed is as follows: Develop and demonstrate the heliport construction criteria required and navigation communications and air traffic control equipment and procedures required to operate helicopters into and out of metropolitan areas in all weather conditions.

Table II shows the itemized funding the HAA requests for this effort. It is broken down for (1), 1981; (2), 1982 through 1985; and (3), total.

In Table II, Item 1, Heliport Design Criteria would develop all weather design criteria in the following areas:

- Planning criteria for site locations including, specifically, interface with other modes of public and private transportation.
- Construction criteria for elevated, ground level and floating sites in remote, offshore, and city center environments.

SUMMARYHAA Positions On
Airport and Airway Improvement Act of 1979PLANNING

* Public-Use Heliports/ Discrete Helicopter Airways	By Secretary of Transportation	In National Airport System Plan
* Local Public-Use Heliports	By State/Local Governments	As Part of Requirements for Federal Airport Grants
* Heliport/Helicopter Noise Description and Abatement	By Secretary of Transportation	In Noise Description Systems Development and Abatement Plans

FUNDING (5 Years)

* Public-Use Heliport Grants	\$250 M
* Discrete Helicopter Airways	\$250 M
* Heliports/Discrete Helicopter Airways R&D and Demonstration	\$ 75 M
* Heliport/Helicopter Noise Abatement R&D	\$ 25 M
* Civil Application of NAVSTAR GPS R&D	\$ 25 M
Total	\$625 M

TABLE I

HAA PROPOSAL FOR HELIPORTS AND DISCRETE HELICOPTER AIRWAYS

R&D AND DEMONSTRATION FUNDING 1981-85

(THOUSANDS OF DOLLARS)

ITEM	1981	1982-85	TOTAL
1. Heliport Design Criteria	600	2,400	3,000
2. Heliport Site Plans	1,000	4,000	5,000
3. Heliport Terminal Guidance	800	3,200	4,000
4. Heliport Automatic Weather	1,000	4,000	5,000
5. Helicopter Airway Navigation	1,200	4,800	6,000
6. Heliport/Airway Communications	600	2,400	3,000
7. Helicopter/Airway Air Traffic Control	1,200	4,800	6,000
8. Helicopter Airways Criteria	800	3,200	4,000
9. Heliport/Helicopter Airways Demonstrations	7,400	29,600	37,000
10. Discretionary Funds	400	1,600	2,000
TOTAL:	<u>15,000</u>	<u>60,000</u>	<u>75,000</u>

TABLE II

- Heliport lighting, marking, safety refueling, firefighting and security design criteria for varying environments.
- Noise level and noise abatement design criteria for various heliport environments.

Item 2, Heliport Site Plans would develop:

- Specific site locations for primary and secondary all-weather public-use heliports for each of the nation's twenty-five largest cities and prepare detailed heliport development plans for each site. Development plans will include time phased plans for all development activities up to the operational opening of each site.
- Specific site locations and prepare detailed heliport development plans for all-weather, public-use, heliports in at least ten other locations not included in the nation's twenty-five largest metropolitan areas.

Item 3, Heliport Terminal Guidance would develop terminal guidance equipment and procedures. This would include steep approach curved flight path microwave landing system (MLS) designed to minimize noise and airspace required appropriate to helicopter performance.

Item 4, Heliport Automatic Weather would develop remote automatic weather recording and reporting systems appropriate to helistops as well as heliports.

Item 5, Helicopter Airway Navigation would develop navigation equipment and procedures appropriate to the low altitude narrow corridor helicopter capabilities. It would include special configurations of VORTAC, LORAN-C, ground and airborne radar permitting airways 500 feet above ground level two miles wide, and non precision approaches. This is not possible now due to line-of-sight restrictions of existing systems.

Item 6, Helicopter Airways Communications would develop reliable communications between the helicopter and Air Traffic Control enroute and down to the heliport surface. This is not possible now due to line-of-sight limitations of the existing VHF system.

Item 7, Helicopter/Airway Air Traffic Control would develop low altitude high accuracy metering and spacing systems that would permit helicopters to operate safely in increasing numbers in metropolitan/other congested areas.

Item 8, Helicopter Airways Criteria would develop discrete helicopter airways design criteria using navigation, weather, communication, and air traffic control equipment and procedures developed above. It would include design criteria for enroute, approach, landing, and departure from established public-use heliports and airports.

Item 9, Helicopter/Heliport Airways Demonstrations would provide for design, construction and demonstration of four metropolitan all-weather heliport systems. Each system would consist of 1 or heliports interconnected by helicopter airways and connected by helicopter airways to adjacent helicopter or airplane airway systems. These heliport/heliport airway systems would use equipment and procedures developed above for construction, facilities, noise abatement, terminal guidance, navigation, communications and air traffic control. GPS discussed later would be tested.

The HAA proposes that the site priority for the construction of these demonstration systems be as follows:

1. Washington, D.C.
2. Boston, MA
3. Los Angeles, CA
4. Chicago, IL

Choice of these sites would not only provide most needed service but also demonstrate such appropriate types of heliports as:

1. Roof Top
2. Land Site
3. Air Rights
4. Water Site

Item 9 Discretionary Funds would provide a reserve for unanticipated R&D efforts.

The objective of the helicopter noise abatement technology R&D program is to improve the acceptance of the helicopter by both the community and the passenger.

Table III shows the itemized funding the HAA requests for helicopter noise abatement technology R&D. This is broken down for (1), 1981; (2), 1982 through 1985; and (3), total.

In Table III under 1, Helicopter External Noise:

Item 1 (a) Community Acceptance Criteria would develop acoustic criteria for helicopters which will allow operation in a variety of community environments while being environmentally acceptable to the communities.

Item 1 (b) Economic Studies would provide economic studies of the effect of helicopter external noise reduction during enroute, landing and take-off for current and future helicopter designs. It would also provide an economic assessment of proposed noise rules on derived helicopter designs and their normal product improvement cycle.

Item 1 (c) Enlarged Acoustic Data Base would provide an enlarged acoustic data base, particularly for large helicopters, in order to verify the vehicle prediction model and establish reasonable limits for certification and future reductions in noise levels.

HAA PROPOSAL FOR HELICOPTER NOISE ABATEMENT TECHNOLOGY R&D
(THOUSANDS OF DOLLARS)

ITEM	1981	1982-85	TOTAL
1. <u>Helicopter External Noise</u>			
a. Community Acceptance Criteria	240	960	1,200
b. Economics Studies	200	800	1,000
c. Enlarged Acoustic Data Base	60	240	300
d. Component Prediction Models	600	2,400	3,000
e. Aeroacoustic Mechanism Research	700	2,800	3,500
f. Vehicle Prediction Model	200	800	1,000
g. Quiet Designs and Operational Models	900	3,600	4,500
h. Blade Slap	100	400	500
2. <u>Helicopter Internal Noise</u>			
a. Prediction Model	280	1,120	1,400
b. Data Base	40	160	200
c. Exposure and Acceptance Criteria	80	320	400
d. Noise Reduction Methodology	1,600	6,400	8,000
TOTAL	<u>5,000</u>	<u>20,000</u>	<u>25,000</u>

TABLE III

- Item 1 (d) Component Prediction Models would develop prediction models for each of the components such as main rotor, tail rotor, engines and transmission associated with helicopter noise. It would also conduct component tests to verify the accuracy of the level and directionality of the component prediction models developed for landings, take-off and enroute flight.
- Item 1 (e) Aeroacoustic Mechanism Research would conduct the wind tunnel and theoretical research necessary to define and analytically model mechanisms important in component acoustic radiation not included in the prediction models above. It would also incorporate this R&D data into prediction models and re-verify..
- Item 1 (f) Vehicle Prediction Model would develop a vehicle prediction model which accounts for component/component/air-frame aerodynamic interactions during the various operational modes of landing, take-off and enroute and allows the prediction of acoustic contours. It would also computerize this prediction program.
- Item 1 (g) Development of Quiet Designs and Operation Models would develop noise abatement designs and operational procedures using data derived above. It would also conduct component, model and full scale tests to verify the noise abatement techniques developed above and establish the associated economic/performance trade-offs.
- Item 1 (h) Blade Slap would develop the relationship between blade slap and the impact of noise exposure while subjects are conducting representative tasks.

In Table III under 2, Helicopter Internal Noise:

- Item 2 (a) Prediction Model would develop and verify a component based prediction model for helicopter internal noise which includes the prediction of transmission induced structural vibration, its effect on the internal noise level, and the effect of interior treatments.
- Item 2 (b) Data Base would establish an internal noise data base in order to verify the prediction model and establish reasonable limits for certification and future reduction in noise levels.
- Item 2 (c) Exposure and Acceptance Criteria would develop relationships between interior noise level and exposure duration and the impact of noise exposure, including annoyance, communications interference, and temporary threshold shift. It would also develop recommended criteria for each as they relate to practical helicopter limits.
- Item 2 (d) Internal Noise Reduction Methodology would conduct component and vehicle test programs to develop more efficient methods of reducing helicopter interior noise. This would include:
- Transmission design for reduced excitation and reduced resonant response.
 - Transmission isolation techniques.
 - Reduced structural response composites and materials damping research.
 - More efficient acoustic treatment approaches.

Mr. Gilbert will now provide you with the details of the last item in Table I, Civil Applications of NAVSTAR GPS R&D.

Research and Development Requirements
For
Helicopter Navigation
And
Advanced Air Traffic Control Systems

Statement to the Subcommittee on
Transportation, Aviation and Communications
Of the
Committee on Science and Technology
U. S. House of Representatives

by

Glen A. Gilbert
President
Glen A. Gilbert & Associates, Inc.

February 21, 1980

A fundamental goal for helicopter operations (as well as for civil aviation in general), is to have a high accuracy navigation system with global coverage, capable of providing area navigation without the need for point reference navigation aids. Signal coverage should be down to the surface without the constraints of line-of-sight limitations from ground based navigation aids.

The navigation system should be capable of providing narrow, discrete helicopter routings to facilitate segregation of helicopters and conventional take-off and landing (CTOL) aircraft. Similarly needed are discrete instrument approach and missed approach procedures on-shore and off-shore to heliports, helipads at CTOL airports and points-in-space, as well as in remote areas.

Thus, it should be possible to operate helicopters without interference to or from airlines and other conventional aircraft, in many cases sharing the same landing areas, but not the same runway. The potential of helicopters cannot be achieved if they are to be handled in the Air Traffic Control (ATC) system as fixed-wing, conventional aircraft, particularly in high traffic density areas. For optimum IFR helicopter routings and approaches, an RNAV (area navigation) system of some sort is needed.

The increasing use of civil IFR helicopter operations has focused sharp attention on the deficiencies of the present VOR/DME (VORTAC) navigation system, including VOR/DME RNAV. These basically are the lack of precision navigation guidance, line-of-sight limitations for low altitude flight, and unavailability of stations off-shore and in remote areas.

The present national navigation system permits "precision" instrument approaches only where an ILS (future MLS) or PAR (Precision Approach Radar) system is installed. There are about 13,000 aircraft landing facilities in the United States and its possessions, including nearly 3,500 heliports, of which about 300 are elevated, yet precision instrument approach facilities are available for less than 500 conventional airports, and none for heliports.

The present navigation system limitations become even more pronounced

when considering the growing need for precision or non-precision instrument approaches to virtually an infinite number of landing/take-off areas for IFR-capable helicopters and other VTOL's now being developed.

Ideal Navigation Goals

The ideal helicopter navigation and positioning concept would be one which would have all of the following capabilities in an integrated system:

1. Highly accurate three-dimensional (lateral, longitudinal, vertical) area navigation guidance.
2. Four-dimensional (4-D) guidance adding time referenced navigational capability to 3-D guidance with extremely high time positioning accuracy.
3. Sufficiently accurate approach and landing guidance by the airborne RNAV system so that minimums approaching "precision" instrument approaches could be achieved to any pilot-selected point on the surface, or in space, without the need necessarily to have an electronic landing aid at that location.
4. Ability to function without line-of-sight (radio horizon) limitations.
5. Imperviousness to atmospheric conditions for non-interrupted operations.
6. Non-saturable capacity.
7. Service availability to all classes of airspace users on a worldwide basis.
8. System outputs capable of inputting standard displays such as the CDI (Course Deviation Indicator) and HSI (Horizontal Situation Indicator), as well as advanced multi-function cockpit displays, including displays of navigational and traffic situation information.
9. Data link capability to transmit x-y-z (lateral, horizontal, vertical) position coordinates for automatic position reporting and air-to-air separation assurance.
10. Cost effectiveness with the system design such that it can have various levels of sophistication and thus will be affordable to all classes of airspace users.

It is considered that the DOD Navstar Global Positioning System (GPS)

offers the most likely potential for meeting the foregoing goals. It is for this reason that the Helicopter Association of America supports a dynamic civil aviation "concept validation" of GPS by the FAA for the five year period beginning in FY 1981, and urges a \$25 million (1979 dollars) add-on to the FAA's R&D authorization for this period for this purpose.

Objectives of Testimony

The basic objectives of this testimony are to bring to the attention of this Subcommittee an approach which is considered to be feasible and effective in guiding the FAA into a GPS program for helicopter navigation and advanced air traffic control systems (which also would be capable of serving all of the civil aviation community); as well as to provide this Subcommittee with a convincing justification to authorize the FAA sufficient R&D funding to carry out such a program. It should be clearly understood that this presentation calls for funding over and above (in addition to) the FAA's baseline R&D request for FY 1981 as well as for the entire five year period FY 1981-85. Details of the HAA proposed GPS add-on R&D funding for the FAA are shown in Figure 15.

GPS Accuracy

I will not cover any detailed technical aspects of the Navstar Global Positioning System as these have been presented before this Subcommittee by other witnesses. I would like to discuss first what many consider to be a key factor in deciding if GPS would be useful to civil aviation, and that is the question of the accuracy of the signals which would be available to civil users on a clear access/coarse acquisition (C/A) basis.

Obviously, we would like to have the precision (P) signal accuracy available. But we understand that military security may preclude this, at least in the foreseeable future. However, there seems to be no question but what civil users could be permitted to receive C/A accuracies in the order of 100-200 meters, which would be acceptable for enroute navigation. It might suffice for "non-precision" approaches with somewhat high minimums. But such

accuracy would not be acceptable for minimums somewhat comparable to "precision" approaches.

The solution to this problem appears to lie in the application of "differential GPS" at selected locations. This concept would not jeopardize national security as its enhanced GPS accuracy would be quite localized in coverage.

The concept of differential navigation has been in use for many years. LORAN, OMEGA and TRANSIT navigation systems have all been implemented in a differential mode at one time or another. In the case of differential GPS, fixed-monitor receivers would be located in the geographic areas over which accuracy improvement is desired. The monitor receivers compute deviations in the measured position from a previously established (through geodetic survey for example) position (true position). The amount of deviation is then used as a correction for the nearby area of interest. This differential correction factor could then be broadcast to incoming aircraft. The resulting accuracy may be expected to be several orders of magnitude better than the raw, presumably degraded, C/A inputs.

In the illustrative presentation which follows, considerable emphasis is placed on the use of fixed GPS differential monitors in the proposed GPS civil aviation application architecture. Research and Development activities with regard to the differential GPS approach should be focused on concept validation hardware. The technology available for the civil GPS receiver will, in all likelihood, be directly transferable to the design of the monitor station. R&D efforts must be undertaken to develop the correction algorithms (both for the aircraft and the monitor) and a means of disseminating the correction data. Direct broadcast to inbound and outbound aircraft must be investigated to ascertain line-of-sight limitations, coverage requirements, and whether a voice or data link be incorporated. The former requires pilot intervention while the latter entails aircraft hardware modifications.

Concept Validation Program

The end product of the proposed FAA GPS concept validation program

would be to reach a decision as to civil application and implementation by the mid 1980's. This means the validation/evaluation process should be begun in FY 1981.

If an Advanced or Fourth Generation ATC system based on GPS emerges, as I think it will, past history shows that a transition period of ten years or so will be required. Thus, we would be in the mid to late 1990's for complete transition. However, use of the GPS system could be commenced by the mid 1980's by airspace users most urgently needing its advantages, such as helicopter operators.

To carry out the proposed GPS concept validation program, a significant amount of R&D and T&E (Test and Evaluation) hardware will be needed. Figures 1 through 10 which follow illustrate the GPS system architecture which I believe should be used by the FAA as a guide in developing the program.

In particular, Figures 1 and 2 show the GPS multifunction system concept and multifunction GPS avionics, respectively. Figures 3 and 4 portray the 4-D RNAV functions and 4-D avionics as one of the subsystems of the GPS multifunction concept. The terminal guidance subsystem functions and avionics are illustrated in Figures 5 and 6. Air Traffic Control functions and collision avoidance (separation assurance) proposed avionics configuration are covered in Figures 7 and 8. Figure 9 illustrates data link (digital communications) applications, and finally Figure 10 conceptually conveys two basic ways to achieve the GPS core element, i. e. 4-D area navigation.

Figures 11 and 12 show the many potential benefits on the Air Traffic Control System (in its broadest sense) which can result from GPS implementation. T&E hardware objectives are outlined in Figures 13 and 14, including the "bottom line" called for under "TARGET" in Figure 14.

Finally, Figure 15 sets forth the proposed HAA add-on funding breakdown for the recommended FAA R&D GPS concept validation program.

EVOLUTIONARY MULTIFUNCTION SYSTEM

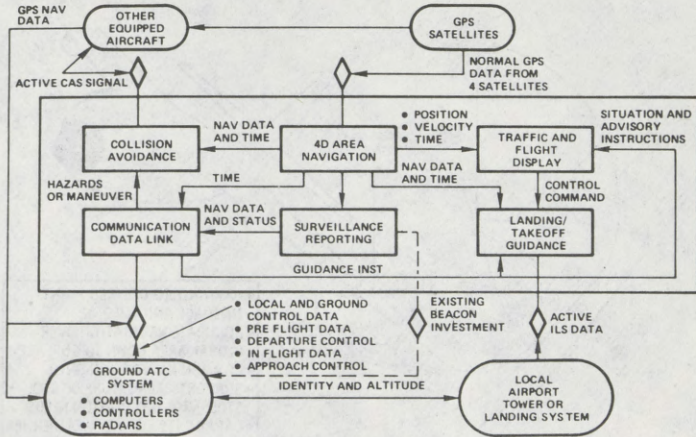


Figure 1

INNOVATIVE MULTIFUNCTION GPS AVIONICS

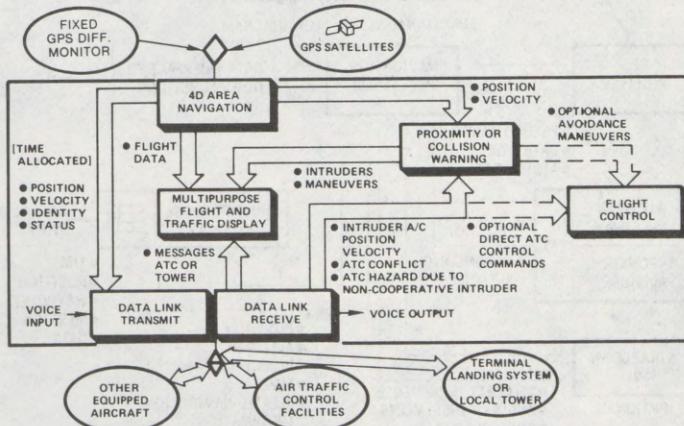


Figure 2

4D AREA NAVIGATION FUNCTION

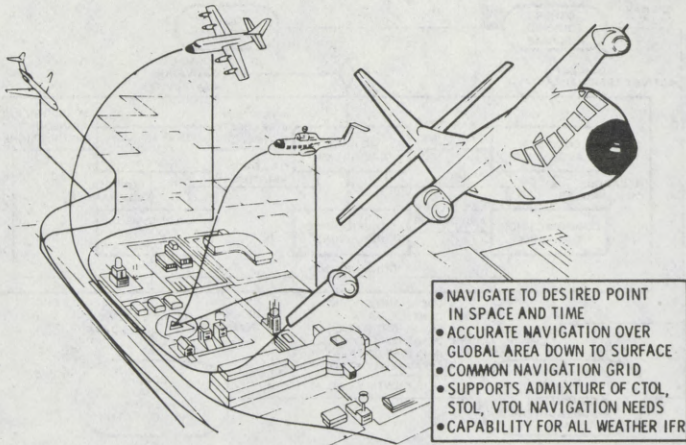


Figure 3

4D AREA NAVIGATION AVIONICS CONFIGURATION

FUNCTIONAL SIGNAL FLOW DIAGRAM

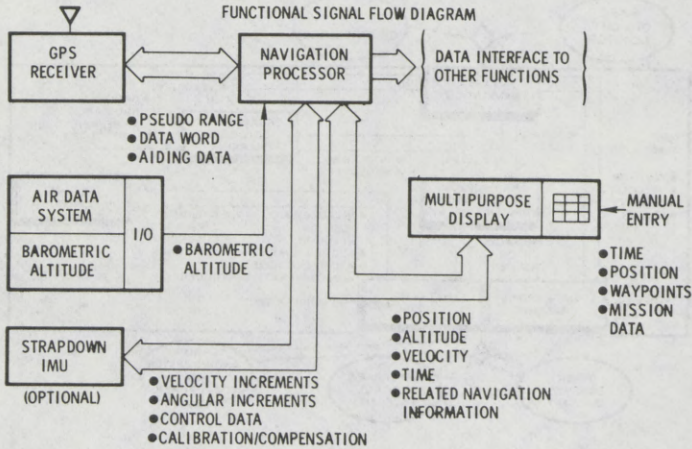


Figure 4

TERMINAL GUIDANCE FUNCTION

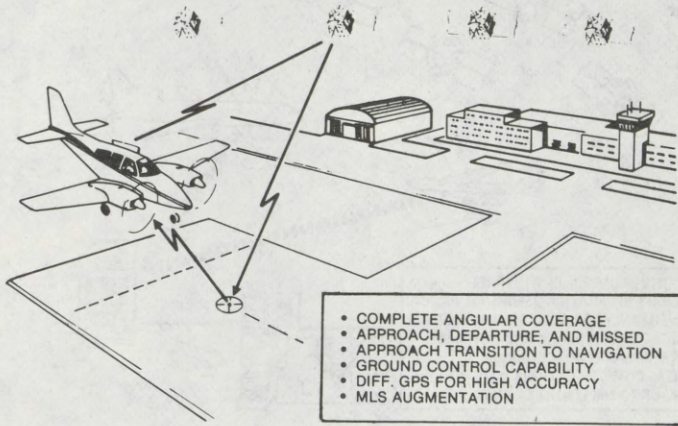


Figure 5

INNOVATIVE TERMINAL GUIDANCE AVIONICS

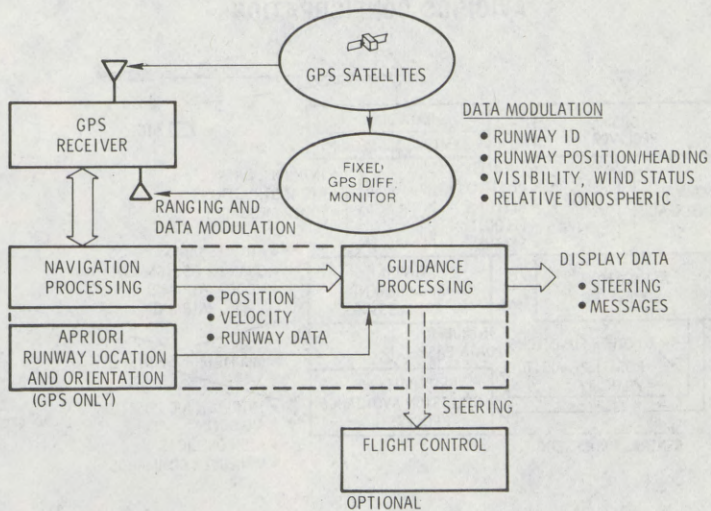


Figure 6

AIR TRAFFIC CONTROL FUNCTIONS

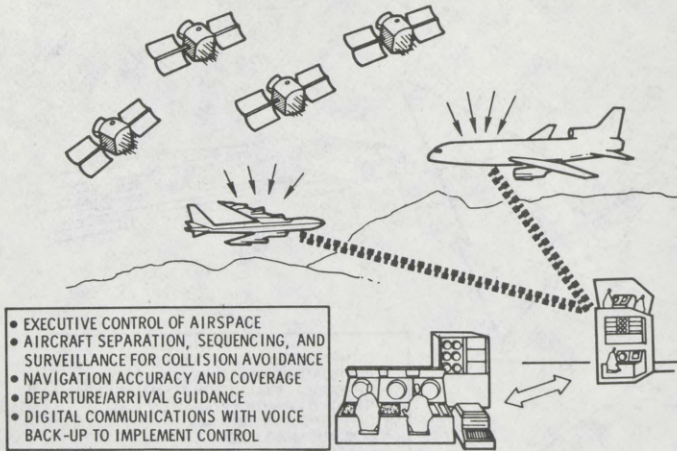


Figure 7

INNOVATIVE COLLISION AVOIDANCE AVIONICS CONFIGURATION

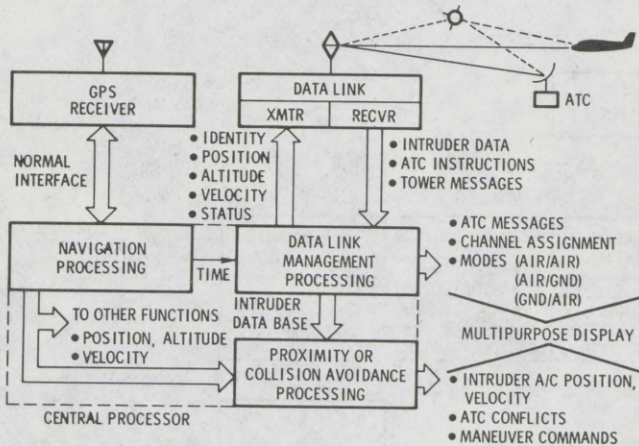


Figure 8

MAJOR DATA LINK OPTIONS

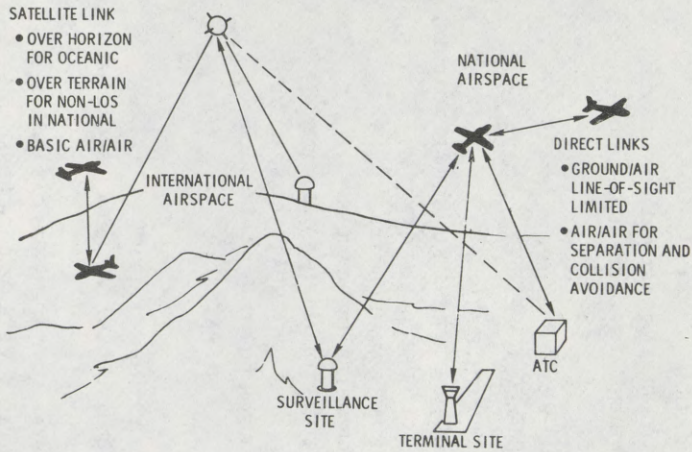


Figure 9

USING THE GPS CORE ELEMENT

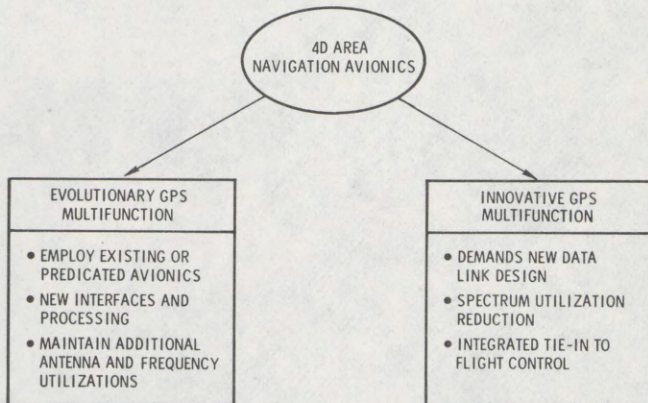


Figure 10

POTENTIAL GPS ATC IMPACT

MORE EFFICIENT AIRSPACE UTILIZATION

- TWO, THREE OR FOUR DIMENSIONAL AREA NAVIGATION
- REDUCED ROUTE WIDTHS/APPROACH/DEPARTURE
- DISCRETE ROUTINGS
- AIR TO AIR SEPARATION ASSURANCE
- BEST WEATHER/TIME/FUEL ROUTINGS

MORE EFFICIENT AIRPORT/HELIPORT UTILIZATION

- ALL RUNWAYS AVAILABLE FOR INSTRUMENT APPROACHES
- MORE CLOSELY SPACED PARALLEL RUNWAYS
- ALL-WEATHER HELIPORT AVAILABILITY
- REMOTE AREA HELICOPTER APPROACHES
- MAXIMIZE CTOL/STOL/VTOL AIRPORT CAPACITY
- PILOT MONITORED APPROACH/DEPARTURE SPACING
- SURFACE GUIDANCE FOR PILOTS
- PRECISION METERING AND SPACING

INCREASED SAFETY

- PILOT AWARENESS OF OTHER TRAFFIC
- PILOT READOUT CONTINUOUSLY OF TRACK DISPLACEMENT AND POSITION ALONG TRACK
- NON-PRECISION INSTRUMENT APPROACH CAPABILITY TO VIRTUALLY UNLIMITED NUMBER OF LOCATIONS

Figure 11

POTENTIAL GPS ATC IMPACT

- PRECISION APPROACH POTENTIAL WITH DIFFERENTIAL GPS
- PILOT ABILITY TO FOLLOW ACCURATELY DISCRETE ROUTINGS FOR SEGREGATION OF DIFFERENT CLASSES OF AIRCRAFT
- PILOT ABILITY FOR INDEPENDENT LANDING, AIRPORT SURFACE GUIDANCE AND TAKEOFF MONITORING
- INDEPENDENT ALTITUDE MONITORING WITH 3D/4D RNAV
- PILOT ABILITY TO HAVE HIGHLY ACCURATE VELOCITY MEASUREMENT (VERTICAL, HORIZONTAL, LATERAL)
- PILOT ABILITY TO HAVE REDUNDANCY/BACKUP OF GROUND ATC

INCREASED CONTROLLER PRODUCTIVITY

- REDUCTION IN CONTROLLER WORKLOAD INVOLVED IN COMMUNICATIONS, VECTORING, PATH STRETCHING, HOLDING, ALTITUDE INSTRUCTIONS, SEPARATION ASSURANCE
- ISSUANCE OF TRAFFIC ADVISORIES BY CONTROLLER MINIMIZED DUE TO PILOT ABILITY TO MONITOR OTHER TRAFFIC
- REDUCTION OF CONTROLLER SECTOR COORDINATION WORKLOAD
- REDUCTION IN CONTROLLER WORKLOAD BY DELEGATING TO PILOT SEPARATION FROM OTHER TRAFFIC INTRAIL/CROSSING/PASSING/MERGING
- AS A RESULT OF ABOVE, CONTROLLER ROLE SHIFTS MORE TO STRATEGIC TRAFFIC MANAGER RATHER THAN CURRENT HIGH WORKLOAD, MAN INTENSIVE GROUND BASED CENTRALIZED ATC SYSTEM

Figure 12

HARDWARE OBJECTIVES

TO PROVIDE:	GPS INTEGRATED, MULTIFUNCTION DEMONSTRATION OPERATIONAL HARDWARE, BOTH GROUND AND AIRBORNE, FOR TEST AND EVALUATION IN THE DEVELOPMENT OF AN ADVANCED (FOURTH GENERATION) AIR TRAFFIC CONTROL SYSTEM
TO INCLUDE:	AREA NAVIGATION • 2-D • 3-D • 4-D FIXED DIFFERENTIAL GPS MONITORS APPROACH AND LANDING / MISSED APPROACH / DEPARTURE AIRBORNE GUIDANCE • RAW GPS INPUTS • DIFFERENTIAL GPS INPUTS SEPARATION ASSURANCE (PROXIMITY / CAS) COMMUNICATIONS (DATA LINK) • DOWN LINK • UP LINK SURVEILLANCE MULTIFUNCTION DISPLAYS

Figure 13

HARDWARE OBJECTIVES

TO ACCOMPLISH:

GPS COST BENEFITS/ANALYSIS AND OBJECTIVELY DERIVED, REAL WORLD DATA BASE FOR DECISIONS ON GPS CIVIL AVIATION APPLICATION.

FUNDING:

MINIMUM \$25 MILLION ADDITIONAL R & D TO FAA FOR FY 1981 - 1985. BEGINNING FY 1981, INCREASE FAA R&D REQUEST FOR \$5 MILLION AND ADD \$5 MILLION EACH FISCAL YEAR THEREAFTER THROUGH FY 1985 (ALL AMOUNTS IN 1979 DOLLARS)

TARGET:

BY FY 1986, DEFINITION OF NEXT GENERATION (ADVANCED) ATC SYSTEM AND ROLE OF GPS, WITH INITIATION OF IMPLEMENTATION BY OR BEFORE END OF THAT FISCAL YEAR. ALSO BY END OF FY 1986, HAVE TIME-PHASE PLAN FOR PHASE-OUT OF APPROPRIATE ELEMENTS OF THE CURRENT (UPGRADED THIRD GENERATION) ATC SYSTEM

Figure 14

HAA FUNDING PROPOSAL FOR FAA R&D CIVIL AVIATION GPS CONCEPT VALIDATION FY 1981-85

(In Thousands of Dollars)

ITEM	1981	1982-85	TOTAL
1. AIRBORNE GPS AREA NAVIGATION (2-D, 3-D, 4-D)	400	1,600	2,000
2. GROUND BASED FIXED DIFFERENTIAL GPS MONITORS	1,500	6,000	7,500
3. AIRBORNE TERMINAL GUIDANCE WITH DIFFERENTIAL GPS	500	2,000	2,500
4. AIRBORNE SEPARATION ASSURANCE (PROXIMITY/CAS)	600	2,400	3,000
5. GROUND/AIRBORNE DATA LINK COMMUNICATIONS	750	3,000	3,750
6. GROUND/AIRBORNE SURVEILLANCE	750	3,000	3,750
7. AIRBORNE MULTIFUNCTION DISPLAYS	500	2,000	2,500
TOTAL	5,000	20,000	25,000

Figure 15

SUMMARY OF HAA PROPOSAL FOR AUGMENTED FAA R&D FUNDING
(Thousands of Dollars)

ITEM	1981	1982-85	TOTAL
1. HELIPORTS AND DISCRETE AIRWAYS	15,000	60,000	75,000
2. HELICOPTER NOISE ABATEMENT TECHNOLOGY	5,000	20,000	25,000
3. GPS CONCEPT VALIDATION	5,000	20,000	25,000
TOTAL	25,000	100,000	125,000

Figure 16

Mr. HARKIN. Our next witness is Walter Jensen, who is the vice president of the Air Transport Association of America.

Mr. Jensen, I understand that you have a prepared statement. Please proceed to make your comments. If you would like to prepare a statement, we would be more than happy to keep the record open to receive such a statement.

Mr. JENSEN. Thank you, Mr. Chairman.

Normally, as in the past, I would have had a prepared statement. This year, we are following the FAA presentation, and we thought we could make a much more meaningful input to the committee if we waited to hear the testimony of the FAA and their proposals, and then submit it in a prepared statement, which we are now doing and will have available to you next week, if that would be permissible.

With that in mind, I would just make a very short statement here and, of course, make myself available for any questions you might have.

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

Mr. JENSEN. In view of what we've heard so far in the hearings and in our analysis of the FAA's budget submission, we feel that there is a need, as FAA has already indicated to you, for more money for the R. & D. effort for FAA for fiscal year 1981.

The growth factors in aviation that were cited by the FAA people day before yesterday have us as concerned as it has them concerned. It will require a strengthened R. & D. effort, and as you have pointed out, the budget submission won't increase the effort; in fact, it won't even keep up in view of inflation factors.

Our impression at this point, which we will include in our prepared statement, indicates that we can identify justified projects that would increase the FAA budget by approximately \$20 million over the \$85 million that FAA requested.

In our statement that we will have ready for you next week, we will identify the various elements of the FAA R. & D. programs that we think need strengthening by budget support, and we will also identify a couple that we think are missing from that effort that need some support.

For example, on items that we didn't find—at least so far in their budget submission, Glen Gilbert just mentioned the need for 1,000-foot vertical separation above 29,000 feet. We have long sought that and we found nothing so far in the FAA budget in R. & D. to do the work necessary to convince themselves as to how to proceed with implementing 1,000-foot vertical. Therefore, we think some money in the R. & D. effort to do that would be well warranted on the basis of decreased fuel use and improved efficiency.

We also didn't find anything on improved airport surface traffic control; the information for controllers to deal with airplanes taxiing and on the active runway and on the ramp areas. FAA has an effort that has been identified, but we didn't see the money for it, and we think there should be some money for that to improve and replace the airport surface detection equipment radar, that's the radar that has

been in use for many years, but it needs much improvement and replacement.

Other items that we will identify are some increased funding for DABS; increased funding for BCAS, the collision avoidance system; the computer replacement system; severe weather detection. I am just picking out some of the things we've identified. Navigation investigations including GPS, OMEGA, LORAN-C, wake vortex advisory system, and so forth.

As I say, those seem, at the moment, to add up to a need of approximately \$20 million over the budget request.

Mr. HARKIN. By \$20 million additional, above the \$85?

Mr. JENSEN. Yes; \$105 million, roughly.

Mr. Chairman, that is all I have to say right now to give you just an insight into what you can expect, but I am available for any question you might have.

Mr. HARKIN. Are there any areas you think ought to be cut out?

Mr. JENSEN. We haven't identified any at this point, but we're looking, because we always want to keep this budget as lean as it can be to get the job done, and if we find any, we will certainly put them in our statement.

Mr. HARKIN. We were just discussing other testimony that was held in another subcommittee concerning BCAS, and the question was asked by the chairman of another subcommittee as to why the air carriers don't just go ahead and take the initiative and install BCAS—why are we waiting for FAA?

Mr. JENSEN. I'd like to answer that. I'm glad you brought it up.

In our opinion not only do the airlines feel, but we think that the FAA feels, and the potential manufacturers of BCAS equipment feel, that the time is not yet ripe for anyone to put an order in to purchase some equipment and a manufacturer to build it.

The reasoning is that the FAA is just now engaging in their test program of the BCAS at NAFEC and that data is needed before purchases are made. They estimate that that job will be done—I think they said October, we think that they might be a little optimistic. But between October and the end of the year, the information as to the final form of BCAS, the way it ought to be built, will be available and that would be the time to place the orders and start building.

Now, we are not sitting still with just that. We have worked with Aeronautical Radio's Airlines Electronic Engineering Committee. This is an arm of the airline family, Aeronautical Radio, I think you are familiar with them. And within the AEEC, a specification for the BCAS has been drawn up and agreed to, the forum factor and the various things that will facilitate putting it in airline aircraft when the final details are in. So that's all ready to go so that when the FAA data is in, we will be able to proceed.

Second, we are having the wiring put in the new aircraft that are being purchased. This is in the contracts for the 757's and the 767's to anticipate BCAS and DABS and to have the airplanes wired accordingly, so that we will be all ready to go when the right time comes.

Mr. HARKIN. Sounds good to me.

Thank you again, Walt. Thank you for your testimony and, as I said, we'll keep the record open for the prepared statement.

[The prepared statement of Mr. Jensen follows:]

Statement of Walter A. Jensen
Vice President - Operations and Engineering
Air Transport Association of America
Before the House Committee on Science and Technology
Subcommittee on Transportation, Aviation and Communications
February 28, 1980

The Views of the Scheduled Airlines

on the FAA FY-1981

Research, Engineering and Development Program

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. We appreciate the opportunity to comment on the FAA FY-1981 Research, Engineering and Development (R, E&D) program.

Last year, this Committee highlighted the Aircraft Separation Assurance program area -- one of FAA's most important safety-related research efforts -- and our testimony focused on this area. The importance of the Separation Assurance program has not diminished, but today I would like to change the focus and emphasize programs that are promising in terms of improved capacity and efficiency, as well as safety.

Rapid escalation in the price of fuel over the past several years makes delay ever more costly. Increased costs

being experienced by airlines due to unnecessary delay are passed along to the traveling public, and to shippers, thereby increasing inflationary pressures in our economy.

In 1978 the average price paid by an airline for a gallon of fuel over the course of the entire year was approximately \$.39; in 1979 the price increased to \$.58; in 1980 the average price over the course of the year is expected to be \$.95. By the end of the year airlines expect to be paying approximately \$1.10 per gallon of jet fuel. The industry will consume about 11.2 billion gallons of fuel this year at a total cost of \$10.6 billion. During 1980 fuel costs will constitute about 30% of total operating cost.

Costs of delay in airline operations are particularly onerous because they are entirely nonproductive and waste expensive, nonrenewable fuel resources. While it is true that some causes of delay are unavoidable, other causes of delay are directly related to lack of adequate airport and ATC system capacity. Something can be done about this latter category of delay, and this is the problem we are concerned about today.

To gain some appreciation for the scope of the delay problem and its associated costs, let us consider the estimated cost of airline delays for CY-1977 and compare them with the level of delays that we estimate were experienced during CY-1979.

FAA contracted for a study of airline delays and related costs using data collected by three major carriers,

American, Eastern and United Air Lines. These data served as a basis for estimating total delays and costs experienced by the entire industry. The three airlines operate approximately 31% of all airline flights. The study showed that in 1977 airline delay costs totaled approximately \$800.5 million and about 682 million gallons of fuel were wasted. Complete data for 1979 is not yet available from the same three airlines, but sufficient information is at hand to estimate that the total cost of airline delays during 1979 approximated \$1 billion and fuel waste totaled about 784 million gallons.

FAA forecasts^{1/} for increased aviation activity in future years makes the potential scope of the delay problem even more worrisome. FAA's most recent forecasts predict the following:

- From 1979 to 1991 the airline aircraft fleet will increase from 2,623 to 3,164 aircraft, an increase of 20.6%;
- The total active general aviation aircraft fleet will increase from 193,000 aircraft in 1979 to 303,800 aircraft in 1991, up 57.4%;
- The number of general aviation turboprop and turbojet aircraft, which frequently compete for the same airport and airway capacity with airline aircraft, will increase from 5,900 in 1979 to 14,100 in 1991, up 139%;

^{1/} FAA Aviation Forecasts, Fiscal Years 1980 - 1991
(September 1979)

- The number of instrument operations at airports with FAA air traffic control service will increase 77% from 1979 to 1991, although the number of air carrier instrument operations at these airports will increase only 25%. (General aviation growth in instrument operations is expected to total approximately 119%.)

Superimposing even a modest part of the projected traffic growth upon the level of delays and the cost of delays being experienced by airlines in 1979 paints a gloomy picture for the 1991 scenario unless significant improvements are made. It can clearly be seen that most of the growth in numbers of operations will come from general aviation activity rather than from airline activity. Unless significant improvements can be made in the next decade in the ability of our airports and airways system to more efficiently handle the forecast demand, avoidable delays and unnecessary waste of fuel will escalate significantly.

Increases in airport and airway capacity, beyond capacity derived from additional runways or new airports, are dependent in part upon introduction of new technology. It is apparent that a substantial Research, Engineering and Development effort will be required for FAA to be in a position to make the needed decisions. FAA is making an effort to develop a consensus on the direction this effort should take. FAA's New Engineering and Development Initiatives project -- still under way -- is serving as

a vehicle for development of a broad consensus on the future architecture of the ATC system; the R, E&D work necessary for final decisions on system architecture is stated in general terms. The views of the participants in the process and the FAA's initial response to the users' recommendations both highlight a substantial amount of R, E&D work that will have to be completed to enable FAA to introduce capacity related items such as further automation of the ATC system; to implement the Separation Assurance program; to replace the aging enroute and terminal computer systems; and to accomplish these objectives without compromising safety.

The potential costs of implementing the improved ATC system of the 1990 era will be substantial. The largest single expenditure will involve replacement of the computer systems at enroute centers and later at terminal control facilities. The replacement of these systems could involve expenditures of \$1.5 billion or more. In order to plan intelligently for this massive investment and to avoid mistakes that may be perpetuated throughout the life span of any new computer system, FAA will have to spend substantial amounts of money over the next five - seven years to insure that the automated functions to be performed in the new system are properly defined; that the system architecture is designed to accomplish those tasks and still be flexible enough to permit future modifications or additions; that important human factors questions concerning the proper role of the controller and the pilot in a highly automated

ATC system have been satisfactorily answered; and that complex problems of planning for an evolutionary transition from the current system to the new system are completed.

Adequate funding for completion of research work related to the computer replacement program must be authorized and then appropriated in order to insure that the replacement program does not lag. Mr. Neal Blake of FAA has outlined the complex process which FAA believes must precede purchase of the replacement computer system; Administrator Bond advised that a late 1988 target date for the first replacement computer is based on a schedule that is not financially constrained. Our understanding of the program leads us to believe that FAA has included adequate funds in the FY-1981 budget request to support the 1981 part of the replacement program schedule outlined by Mr. Blake, but that massive shortfalls will become evident in the FY-1983 and subsequent year requests. This deficiency warrants the future concern of this Committee and of the entire aviation community.

Mr. Chairman, the airlines believe the FAA FY-1981 budget request for \$85 million is inadequate to meet the capacity needs as we see them. An unrealistically low ceiling on the FAA R, E&D budget in the guise of fighting inflation is false economy and a poor investment. The long term effects of inadequate investment now in FAA R, E&D programs intended to improve efficiency of FAA operations, to increase system capacity, and to reduce delays will not

only be highly burdensome, but will further delay implementation of vitally needed improvements. These effects will appear as increases in FAA Operating and Maintenance costs, increases in the cost of transportation purchased by airline customers, and increases in operating costs experienced by other users. An adequate FAA Research, Engineering and Development budget authorization is one of a number of steps required to avoid a long term worsening of the delay problem. Last year FAA requested \$75.0 million for R, E&D activities and this amount was subsequently appropriated. Meanwhile, the economy has experienced an inflation rate of approximately 13% during the past year, and the FAA sponsored New Engineering and Development Initiatives Study has highlighted the need for an ambitious FAA R, E&D program. The airlines do not believe FAA can adequately meet the challenges it should be addressing with an R, E&D budget of less than \$110 million, a total of about \$25 million more than has been requested by the agency.

I would now like to highlight those areas of the FAA budget request which in our opinion require this additional funding, above the FAA budget request, in order to insure that safety, efficiency, and capacity goals are met in coming years:

Discrete Address Beacon System (DABS)/Data Link/
Automated Traffic Advisory and Resolution Service (ATARS)

FAA progress with DABS development work during CY-1980 should be sufficient to permit

completion of a technical data package for a single-site sensor -- a document prepared by the Research and Development Service for handoff to the Airway Facility Service for implementation. Completion of this document should permit FAA to initiate the procurement process with prospective vendors.

However, some DABS-related R&D programs will still require funding for several additional fiscal years at a high level, and must not be slighted. One of these programs involves completing development of the software package for the Automated Traffic Advisory and Resolution Service (ATARS), which utilizes DABS as its communications link. ATARS is the service intended to backup the primary ATC system, within coverage of the Discrete Address Beacon System.

A second part of the DABS program requiring substantial continuing work is the hardware/software automation package for the air-ground data link service. The data link is intended to provide a number of operational services, including Air Traffic Information Service (ATIS), transmission of enroute and altitude clearances, provision of runway visual range and other essential current weather information and forecasts, and minimum safe altitude messages. Much work remains to be done in defining the message content and format and means to accumulate all the appropriate information and display it to flight crews. The initial data link

capability should be ready to implement at about the same time the basic DABS surveillance service is first implemented. Due to the work remaining to be accomplished, we believe a likely target date should be late 1983.

In our view, timely completion of the DABS/Data Link/ATARS work will require approximately \$4 million in FY-1981 above the FAA request for support of these programs.

Beacon Collision Avoidance System (BCAS)

The DABS/ATARS System will provide Aircraft Separation Assurance as a backup to the primary Air Traffic Control system in 90 terminal areas, and at 30 enroute sites, assuming the multi-year procurement program proceeds as presently planned by FAA. A backup Separation Assurance capability is required for areas not served by the DABS installations. Such service is to be provided by the system currently identified as Active BCAS. Development of the Active BCAS appears to be progressing on schedule. FAA is investigating extension of BCAS capability by development of a "full BCAS" which is to be capable of providing backup separation assurance in high density terminal areas as well as lower density areas, and of providing the information to operate a Cockpit Display of Traffic Information (CDTI), should such a display prove acceptable and advantageous.

In addition, a low cost Active BCAS study has just been launched by FAA and a contractor in order to develop a more affordable hardware capability. This is an important adjunct to the basic program and should be funded through the flight demonstration stage.

The foregoing BCAS development programs are vital to the FAA Separation Assurance program. In order to avoid unnecessary delays in these programs, we believe FY-1981 funding of about \$3.5 million in addition to the FAA request is required.

Automated Enroute Air Traffic System (AERA)

Slow progress is being made by FAA and its contractor -- due to lack of funding -- in the development of automated decision-making capability for the provision of enroute air traffic control services. This program should proceed separately and in addition to the FAA computer replacement program; however, it is an essential input to the computer replacement program. AERA capability could be brought to a demonstration status much sooner than currently planned by increasing the level of R&D funding.

The airlines recommend provision of at least \$2 million in addition to the FAA request for FY-1981 support of this program.

Tower Automated Ground System (TAGS)

An important element of the FAA's Airport Surface Traffic Control Program which remains in the early development stage, primarily due to lack of funds, is the Tower Automated Ground System. The TAGS capability will supplement the ASDE-III surveillance capability by providing alphanumeric identification of surface traffic on the ground controller's display. The technique involves use of secondary radar returns from the aircraft to three sites on the airport surface; hence the term tri-lateration is used in defining the system. Although initially the capability may only be needed at our busiest airports, the airlines believe that development of TAGS must proceed without delay. There are important potential capacity benefits, but even more significant are potential safety benefits at our busiest airports. Separation of aircraft on the ground during poor visibility conditions remains a high priority need, and we have had several recent reminders of the possibility for human error.

We understand that no funding is requested for TAGS in FAA's FY-1981 budget request. The airlines urge that at least \$1 million in FY-1981 be authorized to progress the development of the TAGS capability. The program will require support over a period of two or three years.

Next Generation, Ground Based Radar for Severe Weather
Detection (NEXRAD)

National Oceanic and Atmospheric Administration (NOAA) and FAA have established a joint project office to develop and manage the testing of a new generation ground-based weather radar system for detection of hazardous weather and display of the weather radar information in designated Air Traffic Control Facilities. Substantial funding, shared by FAA, NOAA and USAF, will be necessary in FY-1981 to get the project under way. Sufficient funds should be made available to permit development of the hardware specification, followed by test bed installations at the NOAA Severe Storms Laboratory in Norman, Oklahoma and at the FAA, Atlantic City facility (NAFEC). Installations at both locations will permit NOAA and FAA to proceed more rapidly with testing and evaluation of the new radar capability.

The airlines recommend a FY-1981 augmentation of \$2 million in addition to the FAA request for this purpose.

Microwave Landing System (MLS) Demonstrations and
Applications

Microwave Landing System capability shows promise for solving problems related to airside airport capacity where precise, flexible aircraft approach and missed approach navigation capability

is required. For example, simultaneous use of closely spaced parallel runway and triple parallel runway configurations may require MLS capability for missed approach guidance as well as precise guidance to the runway during the approach phase of flight. In addition, provision of precision MLS guidance for segmented or curved approaches at locations where visual guidance is currently required for completion of the approach should provide a safety improvement. The FAA System Test and Evaluation Program for MLS should include use by wide body air carrier aircraft, as well as demonstration of suitability for use by smaller aircraft under daily operating conditions. The present FAA FY-1981 budget request for the MLS System Test and Evaluation Program (STEP) only includes funding sufficient for demonstration of the "small community" MLS capability.

The airlines believe that the FAA FY-1981 request for MLS programs should be augmented by an additional \$2.5 million to accomplish this high priority work.

Airport Capacity/Runway Configuration Studies

FAA R&D investigations indicate that capacity at up to 11 busy airports could be improved significantly by adding a short runway parallel to existing runways and establishing an independent arrival stream for

smaller aircraft. To date only one airport specific study incorporating this concept has been undertaken -- at Denver. We recommend that studies for other locations be completed. In addition, the IFR system requirements for other runway configurations promising airport capacity increases should be investigated. Such configurations include: more closely spaced parallel runways, triple parallels and converging runways. These studies should be undertaken on an urgent basis so that timely decisions can be made on the need for funding of additional runway construction and other long lead-time facilities.

The airlines recommend that \$2 million be added to the FAA FY-1981 budget request for the conduct of such studies.

Head-Up Display (HUD), Cockpit Display of Traffic Information (CDTI), Cockpit Alerting and Warning Systems, and Related Human Factors Investigations

FAA and NASA are involved in studies of the value of alternative head-up displays with emphasis on their potential advantages and disadvantages as an aid to approach under Category I and better visibility conditions. There is a need to compare these displays with advanced electronic displays located on the instrument panel.

Neither FAA nor NASA has yet funded this important additional head-up display work, which should

be allocated approximately \$1 million above FAA's request for FY-1981 HUD work.

FAA and NASA will also investigate the value and crew workload implications of a CDTI. While the airlines have reservations and concerns about the CDTI concept, we believe that an evaluation should be conducted in a thorough and unbiased manner.

Funding of approximately \$300,000 in addition to the FAA FY-1981 request for CDTI research appears necessary.

The human factors aspects of head-up displays and CDTI will comprise an important part of the FAA and NASA studies. Another program with significant human factors aspects is FAA's investigation of cockpit alerting and warning systems. This program requires about \$1.2 million in addition to the FAA FY-1981 request in order to carry on the examination of all aspects of cockpit alerting and warning systems.

Thus, the airlines recommend that an additional \$2.5 million be provided for FAA in FY-1981 to continue the three programs at an adequate level.

Oceanic Computer and Display System (OCADS)

Oceanic control sectors in certain of the FAA Enroute Centers are still controlling traffic using procedural means -- flight progress strips and strategic planning. The process is antiquated and inefficient,

particularly where there are a large number of crossing routes that are difficult for the controller to visualize without a suitable situation display. A limited amount of work was done by FAA some years ago in the Oakland Air Route Traffic Control Center using a Cathode Ray Tube Display of aircraft position based on flight plan data, updated by pilot position reports. This program should be reinstated, in order to develop a display for use by oceanic air traffic controllers which is capable of utilizing flight plan data and/or dependent surveillance inputs generated aboard the aircraft.

A modest funding increase of \$500,000 in FY-1981 should enable rejuvenation of this program, with further future funding required for completion.

Reduced Vertical Separation Above FL 290

The airlines have been pressing FAA for a number of years to specify the requirements for adoption of 1,000' vertical separation above FL 290. The users participating in the E&D Initiatives program supported this recommendation. Such a reduction would open up additional cruising altitudes for turbojet aircraft, resulting in additional enroute altitude availability with consequent reduced fuel consumption. Airlines estimate that fuel consumption reductions of 65 million gallons per year could be realized if

reduced vertical separation above FL 290 were available (about .6% of total fuel consumed). At the 1980 average price of \$.95/gallon the potential operating cost reductions total about \$61.7 million annually. Although the airlines believe FAA already has sufficient data to make decisions necessary to implement such a change, agreement has not been reached among all the parties having an interest in the problem. Therefore, we urge that FAA immediately undertake any data collection or studies that may be necessary to complete action on this proposal.

The airlines believe a \$1 million addition to the FY-1981 R, E&D budget request should provide adequate funding for this purpose.

Metering and Spacing (M and S)

The FAA metering and spacing program should not be allowed to lapse at this time merely because the problem has proven so complex at multiple runway major airports. A demonstration program of the automated spacing function -- turn on and final approach -- should be conducted to verify the reductions in spacing that the early studies show should be possible when using the computer. The automated spacing function may enable a 15 - 20% gain in capacity for a particular runway -- an important addition if it can be realized in practice.

The automated M and S capability could be added to some ARTS systems if the demonstrations prove successful.

About \$500,000 should be added to the FAA request in FY-1981 for M and S programs.

Navigation Investigations (GPS, Omega, Loran C)

FAA has been investigating possible civil use of the military Global Positioning System (GPS), as well as more widespread use of Omega and Loran C. We recommend that these studies be accelerated modestly, and that about \$1 million be added to the FAA request for this purpose.

Wake Vortex Advisory System (WVAS) and Vortex Detection and Alleviation

The prototype WVAS installed at Chicago O'Hare has not been accepted for operational implementation. The system apparently requires additional research and development work. In addition, more basic research needs to be done on both ground and airborne vortex sensors. FAA and NASA work on measures to reduce the intensity of vortices generated at the source also needs to be vigorously pressed.

The wake vortex programs deserve an additional \$1.5 million in the FAA FY-1981 authorization. Airlines regard resolution of the vortex problem as one of the most pressing research needs.

Airport Programs

The airlines recommend that FAA augment their airport paving R&D program by means of selected demonstration projects. We also recommend completion of the National Runway Friction Measuring Program, which is intended to provide runway friction and surface condition data on runways at certificated airports that are served by an ILS and used by turbojet aircraft. The program is close to completion.

An additional \$1 million should be made available for these airport related programs.

SUMMARY

Mr. Chairman, this concludes my recommendations on FAA, R, E&D programs that the airlines believe warrant funding augmentation during FY-1981. In summary, we believe FAA's R, E&D budget should be increased a minimum of \$25 million -- to a total of at least \$110 million -- for FY-1981. The breakdown of the areas requiring additional funding is as follows:

DABS/Data Link/ATARS	\$ 4.0 Million
BCAS	3.5
AERA	2.0
TAGS	1.0
NEXRAD	2.0
MLS	2.5
Airport Capacity Studies	2.0
HUD/CDTI/Warning Systems	2.5
OCADS	0.5
Vertical Separation	1.0
M&S	0.5
Navigation	1.0
Wake Vortex	1.5
Airport Projects	<u>1.0</u>
	\$25.0 Million

I turn now to questions you raised during your September, 1979 hearings on the desirability of an annual authorization process for that part of the FAA budget request dealing with Research, Engineering and Development work. I understand that the primary interest in seeking authority to reauthorize annually is to insure that FAA budgetary requests can be modified on a regular basis to meet the needs of all the users, rather than having the process tied to a five year cycle which is not responsive to changing needs and to the effects of inflation.

The airlines, too, want the authorization process to provide the flexibility to add necessary funds for programs like those we have just recommended for FY-1981.

We are uncertain how frequently the authorization process should be undertaken in order to assure the best result. A five year authorization may be inadequate due to the dynamic nature of the R, E&D requirements and the future effects of inflation. We are somewhat hesitant about the expediency of a reauthorization every year but laud you for your commitment to the annual program review, which is vital.

We leave final resolution of this question to your judgment and that of your colleagues, but suggest that you consider reauthorizing the program more frequently than every five years, but not as frequently as every year.

We do see another closely related need -- better FAA accountability for R, E&D program planning and for progress,

or lack of it, in adhering to the objectives set forth in the program. There is scant hope of meeting the challenges of future growth unless FAA is willing to state clearly its research objectives and then report with candor to the Congress and the interested public on both progress and problems encountered. In short, there is need for a reasonably detailed five year plan to guide the agency, the Congress and the users. We are pleased to see the progress FAA has made in correcting this deficiency. FAA testimony presented to this Committee on February 19 and 20, 1980 fills some of the information gaps but more needs to be done. Better definition of the programs should be presented by FAA and we appreciate the assistance the Committee has rendered in persuading the agency to be more forthright and specific. Please keep up the pressure.

Thank you, Mr. Chairman.

That concludes our hearings today. The subcommittee will stand adjourned until February 26 when we meet jointly with the Subcommittee on Space Science and Applications on the NASA fiscal year 1981 authorization.

[Whereupon, at 3:28 p.m., the subcommittee was adjourned.]

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591



JAN 20 1980

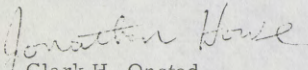
Honorable Tom Harkin
Chairman, Subcommittee on Transportation,
Aviation and Communications
Committee on Science and Technology
House of Representatives
Washington, D. C. 20515

Dear Mr. Chairman:

In response to your letter to Administrator Bond, dated December 18, 1979, we have enclosed up-to-date responses and recaps to the Findings and Recommendations as shown in excerpts from House Reports HR 95-95, HR 95-974 and HR 96-54.

Please let us know if we can be of further assistance.

Sincerely,


Clark H. Onstad
Chief Counsel

Enclosure

House Report No. 95-95 (Page 6) 3/18/77

Committee Action: The Committee on Science and Technology asked FAA to immediately reevaluate the AEROSAT funding mechanism and conduct an examination of the merits of the program through the AEROSAT Council. The Committee authorized an expenditure of \$1,500,000 for this feasibility study.

Answer:

Following Congressional direction, in FY-1978 the Federal Aviation Administration (FAA) proposed to its Aeronautical Satellite (AEROSAT) Program partners that the need for satellite communications for oceanic and low traffic density areas be reevaluated within a broadened forum of the international community. In addition, the FAA developed a study program with which to support such a study effort. Consequently, in latter FY-1978 the international "Committee to Review the Application of Satellite and Other Techniques to Civil Aviation" was formed with broad participation from the system user and provider communities. In early FY-1979 a study program was formally initiated under the direction of the Committee with significant support being provided by the FAA.

As of early FY-1980, a flight cost model (to evaluate flight costs, in particular fuel costs, for various alternative system configurations) has been developed and is being validated by the international community;

traffic forecasts have been developed and are being finalized; and present system description and analysis efforts (needed as a basis to develop alternative improvement options) of the geographic areas under study are well underway. Key future milestones are the development of "First Cut" improvement options which are presently scheduled to be completed by early fall of 1980, and the completion of the final report which is anticipated to be available in the spring of 1981.

The study of alternative funding mechanisms related to the provision of satellite communication services will be included as part of the overall aforementioned feasibility study program.

Subcommittee on Transportation, Aviation
and Communications
(Recommendations and Responses)

H.R. 95-95

Recommendation 1

National policy must clearly declare that maintenance of the United States' preeminence in aeronautics is absolutely vital to the national interest.

Response: At the time this recommendation was made (1976), the primary basis for the supporting findings was the relatively depressed state of the aeronautics industry. Following a peak year in 1968, industry shipments experienced a declining trend to the point that by 1976 the constant dollar value reached some 71 percent of the 1968 level. The trend, however, was reversed in 1977 and by 1979, the value of industry shipments (in constant dollars) exceeded the 1968 peak for the first time in a decade. The Commerce Department anticipates even further real growth in 1980, an increase of 15 percent over 1979.

Similarly, our aeronautics trade balance (excess of exports over imports) was experiencing a constant dollar decline in the year of the hearings. This trend too has been reversed. There was a modest 2 percent growth (in constant dollars) in 1979, and a further real growth of 22 percent is anticipated in 1980.

Thus, while the policy recommendation is valid, and we concur in it, the basis for the recommendation has changed.

Recommendations 2 and 3 deal with the development of a coordinated National Civil Aviation Research and Development Policy.

Recommendation 2

The Federal Government must recognize the direct relationship between well-planned, effective R&D and the future health of the aviation industry through creation of a National Civil Aviation R&D Policy.

Recommendation 3

Government-sponsored aeronautical research, development, and demonstration (RD&D) programs and activities must be totally restructured and reoriented into a new and comprehensive national effort that will:

(1) Be coordinated with other modes of transportation and given focus in the National Transportation Policy.

(2) Expand past practices of conducting only basic research and technology development into other areas of aeronautical development that are beyond the capacity of private enterprise.

(3) In close coordination with private enterprise, establish long-term stabilized goals and identify the Federal resources needed to fulfill these goals.

Response: The Federal Aviation Administration agrees with the need for a review of civil aviation research and development needs and an assessment of the best way to meet these needs. As a first step, FAA has initiated an internal review of the current state of civil aviation research and development. One of the factors that will be considered is the recommendation of the National Transportation Policy that:

"more Federal dollars should be available to support research of national importance for which benefits are expected to exceed costs. Efforts should concentrate on innovations with potential for assimilation into the transportation systems." (p. 326)

Recommendation 4

The United States Government can no longer ignore foreign government subsidies to their aircraft industries and air carrier operations. The United States must:

1. Substantially boost its efforts in the development of new technology.
2. Accelerate the conversion of new technology into operating hardware.
3. Reevaluate national policy toward the development of supersonic air transports.
4. Reevaluate national policy toward the export of American-developed technology.
5. Closely examine the national interest involved in joint-ventures between American manufacturers and foreign subsidized firms.
6. Reexamine present treaties involving agreements for the operation of international air carrier flights.

Response: At the time this recommendation was made, European manufacturers had taken the initiative in two areas: supersonic transport (Concorde) and short- to medium-range widebody transport aircraft (A300). U.S. airframe manufacturers indicated that they were having financial difficulties in launching new aircraft programs. Since then, however, the Concorde has not been successful because of increased fuel prices and other economic deficiencies. The A300 has not gained wide acceptance in the United States (only one airline, Eastern, has ordered any). Furthermore, U.S. manufacturers have responded to foreign competition with two totally new aircraft, the Boeing 757 and 767, a significantly modified version of an older aircraft (DC-9-80), and modified versions of current production widebodies (747SP, L1011-500).

Over the last five years, new orders for transport aircraft totalled some 1895 worldwide (excluding USSR markets). U.S. manufacturers received over 90 percent of these orders. Almost half of the new orders received by U.S. manufacturers during this period were from non-U.S. airlines.

We are still concerned about the role played by foreign governments in equipment purchase decisions, however, the record thus far has shown that the airlines involved generally tend to make their equipment decisions on the basis of market needs, price and aircraft performance.

Recommendation 5

Covered in previous comments.

Recommendation 6

The National Civil Aviation R&D Policy must recognize that the single most important ingredient needed to open the way for development of new generation aircraft is the ability of U.S. air carriers to purchase new equipment.

Response: Economic conditions and the status of the U.S. air carrier industry have both changed significantly since the recommendations were made in 1976. The major institutional change has been the economic deregulation of the certificated air carrier industry. This, accompanied by improved domestic economic conditions has led to three consecutive years of profitability, despite rapidly escalating fuel costs. As a result, there has been a resurgence of new aircraft orders.

In the two-year period 1975/1976, U.S. manufacturers received a total of 372 new air transport aircraft orders; only 63 were from U.S. carriers. In 1978/1979, new orders placed with U.S. manufacturers for air transport aircraft totalled 1064, of which 561 were from U.S. carriers. Equally important, during the 1978/1979 period, two new transport aircraft, the B-757 and B-767, and a new technology modification of an older version, the DC-9-80, were initiated.

Further support for U.S. commercial aircraft sales to non-U.S. carriers has been provided by the Export-Import Bank. During the first three quarters of Fiscal Year 1979 some \$1.2 billion has been authorized for the purchase of 100 U.S. manufactured aircraft with a total export value of \$2.5 billion. This is 70 percent greater than the total amount authorized for the preceding three years.

TRANSPORT AIRCRAFT ORDERS

Company and Model	Total Orders					
	1974	1975	1976	1977	1978	1979
Boeing						
747	29	20	14	42	83	79
737	47	35	39	38	146	76
727	95	50	114	134	131	112
707	17	9	4	14	6	1
757					40	0
767					84	51
Douglas						
DC-10	NA	14	16	29	43	34
DC-9	NA	27	25	51	66	49
Lockheed						
L-1011	28	0	5	5	30	33
A-300B	2	12	7	23	70	34

TRANSPORT AIRCRAFT ORDERS

Foreign Carrier Orders

	1974	1975	1976	1977	1978	1979
Company and Model						
Boeing						
747	26	20	12	38	56	71
737	44	34	32	20	112	62
727	43	25	18	38	51	47
707	17	2	4	4	0	1
757					19	0
767					4	41
Douglas						
DC-10	NA	14	12	18	26	24
DC-9	NA	22	12	37	29	21
Lockheed						
L-1011	23	0	2	2	10	29
A-300B	2	12	7	23	70	34*

*Through July 1, 1979, some EAL orders in these numbers.

TRANSPORT AIRCRAFT ORDERS

U.S. Carrier Orders

	1974	1975	1976	1977	1978	1979
Company and Model						
Boeing						
747	3	0	2	4	27	8
737	3	1	7	18	34	14
727	52	25	96	96	80	65
707		7	0	10	6	0
757					21	0
767					80	10
Douglas						
DC-10	NA	0	4	11	17	10
DC-9	NA	5	13	14	37	28
Lockheed						
L-1011	5	0	3	3	20	4

Number of Transport Aircraft Ordered Through Direct Loans^{1/}
Export Import Bank of the United States

	Number of Aircraft					10/1/78- 6/30/79
<u>Fiscal Year</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	
Company and Model						
Boeing						
747	14	18	5	-	4	10
737	52	26	10	3	14	34
727	37	14	15	10	7	11
	<u>103</u>	<u>58</u>	<u>30</u>	<u>13</u>	<u>25</u>	<u>55</u>
Douglas						
DC-10	15	18	10	1	-	10
DC-9	28	11	18	10	2	8
	<u>43</u>	<u>29</u>	<u>28</u>	<u>11</u>	<u>2</u>	<u>18</u>
Lockheed						
L-1011	8	7	-	3	-	-
L-100	1	-	1	-	-	3
	<u>9</u>	<u>7</u>	<u>1</u>	<u>3</u>	<u>-</u>	<u>3</u>
Unidentified	<u>1</u>	<u>6</u>	<u>3</u>	<u>-</u>	<u>-</u>	<u>24</u>
Total	156	100	62	27	27	100

^{1/} Excludes orders for used aircraft where identified.

Source: Export Import Bank of the United States.

Export Value and Authorized Amounts^{1/}
Direct Loans for Transport Aircraft Orders
Export Import Bank of the United States

Fiscal Year	Export Value (millions of U.S. dollars)					Authorized Amounts (millions of U.S. dollars)					
	1974	1975	1976	1977	1978	10/1/78- 6/30/79	1974	1975	1976	1977	10/1/78- 6/30/79
Boeing											
747	503.1	971.7	225.9	-	191.0	528.8	196.1	313.9	79.2	-	272.8
737	353.2	206.1	89.7	32.6	158.4	409.6	154.5	71.1	41.5	13.2	257.2
727	360.3	103.6	153.2	117.5	91.5	173.1	141.2	33.9	51.9	54.8	77.2
	<u>1,216.6</u>	<u>1,281.4</u>	<u>468.8</u>	<u>150.1</u>	<u>441.0</u>	<u>1,111.5</u>	<u>491.8</u>	<u>418.9</u>	<u>172.6</u>	<u>68.0</u>	<u>607.2</u>
Douglas											
DC-10	430.4	455.9	328.6	32.0	-	530.6	163.4	150.9	127.2	9.6	212.9
DC-9	201.9	56.4	136.4	87.7	18.5	99.2	81.9	20.5	50.2	36.1	49.1
	<u>632.3</u>	<u>512.3</u>	<u>465.0</u>	<u>119.7</u>	<u>18.5</u>	<u>629.8</u>	<u>245.3</u>	<u>171.4</u>	<u>177.4</u>	<u>45.7</u>	<u>262.0</u>
Lockheed											
L-1011	146.6	72.0	-	59.0	-	-	62.6	28.8	-	23.6	-
L-100	8.3	-	12.3	-	-	39.5	3.3	-	4.9	-	23.7
	<u>154.9</u>	<u>72.0</u>	<u>12.3</u>	<u>59.0</u>	<u>-</u>	<u>39.5</u>	<u>65.9</u>	<u>28.8</u>	<u>4.9</u>	<u>23.6</u>	<u>23.7</u>
identified	<u>11.0</u>	<u>48.0</u>	<u>37.6</u>	<u>-</u>	<u>-</u>	<u>723.5</u>	<u>5.0</u>	<u>19.2</u>	<u>11.3</u>	<u>-</u>	<u>306.2</u>
total	<u>2,014.8</u>	<u>1,913.7</u>	<u>983.7</u>	<u>328.8</u>	<u>459.5</u>	<u>2,504.3</u>	<u>808.0</u>	<u>638.3</u>	<u>366.2</u>	<u>137.2</u>	<u>1,199.1</u>

^{1/} Excludes orders for used aircraft where identified.

Source: Export Import Bank of the United States.

Findings 7, 8, 9, 10 and 11

Recommendations

Covered in previous comments.

Recommendation 12

It is clearly in the national interest for the U.S. to build an environmentally acceptable, fuel efficient and economically viable supersonic air transport aircraft. Government action in the near term should be aimed at accelerating the technology availability date for such a project and at reducing barriers to development by the private sector.

Response: Any development of a second-generation SST will cost \$4-6 billion. Such a program, especially considering the associated risks, is beyond any single corporation, and possibly any conglomerate of corporations. Some form of national financial assistance will be necessary. Although many questions of available technology remain, the biggest are those of noise and fuel efficiency. Until these can be overcome, no development program can be considered. NASA should continue its Supersonic Cruise Research program, seeking answers to these technology problems, so that a future option for a second-generation SST remains available to the United States.

Oversight Findings and Recommendations

FINDING 13

Recommendation

The Subcommittee heartily endorses the objectives of the NASA Aircraft Energy Efficiency program, but urges that its scope be expanded so that the results may be readily and quickly applied by industry without undue risks.

Response

This is a NASA program, and they have advised that they will respond directly to the Subcommittee's query.

Recommendation 14

The Subcommittee favors the early modernization of economic regulations and the streamlining of promulgation procedures which would permit appropriate competition and thereby enhance the development of new technology. This action should assure that quality service is provided to the public. Furthermore, it should be completed quickly to restore the stability that is necessary for investor confidence in U.S. airlines.

Response: This recommendation has been implemented through the promulgation of the Airline Deregulation Act of 1978. As previously pointed out, the airline industry has had three consecutive years of profitability since the Committee made its recommendations in 1976.

Recommendation 15

Civil aviation R&D policy must emphasize the need to develop and quickly apply new technology to aircraft and airports in response to requirements for reduced emissions and noise and more effective land use control.

Recommendation 16

FAA, EPA and other regulatory agencies must develop mechanisms to assure that regulatory standards are developed in time to permit the incorporation of the best available noise and emission suppression technology in future aircraft and engines.

Response: Since receiving statutory authority to regulate aircraft noise in 1968, the FAA has followed a deliberate program of imposing noise limits on all types of aircraft. These limits are first imposed on the designs of new models as a condition for type certification; the limits are then extended to production airplanes as a condition for the issuance of a U.S. standard airworthiness certificate; finally, if technology and economics permit, the limits are applied retroactively to all aircraft as a condition for operating in the U.S. Again, as the state-of-the-art permits, the imposed noise limits are made more stringent, and the cycle of applicability is repeated.

The initial noise standards of 1969 were revised in 1977. The more stringent ("Stage 3") noise standards provided the guidance to the manufacturers for the new generation aircraft such as the Boeing 757 and 767. The FAA and NASA will continue to work with the aviation industry to develop the technological basis for future rulemaking to assure that the generation of aircraft that follows the one that is forthcoming is even quieter and more fuel efficient.

95th Congress Report No. 95-974 - Committee Actions - NavigationActions

1. To support studies, including hardware analysis, of alternative system configurations of GPS for civilian application. One of these studies funded by FAA should be conducted by the Defense Department, and at least two other FAA funded studies should be conducted by independent, private contractors. These studies should be coordinated by the Office of Telecommunications Policy and the Office of Management and Budget.

2. To support cost analysis studies of various navigation system mixes, including NAVSTAR. These studies should be conducted by two or more independent contractors, under the auspices of the Office of Telecommunications Policy and the Office of Management and Budget.

These studies should be completed and presented with recommendations to the Committee by September 30, 1979.

Answer:Senate Report 95-938 (Page 14) 6/19/78

"The committee agrees with the Department that the House action of taking \$3 million of this appropriation and applying it to unbudgeted research on civilian application of NAVSTAR will result in delay or deferment of critical safety and productivity related to major ongoing budgeted programs. Therefore, the committee does not agree with the House report in this regard."

House Conference Report 95-1329 (Page 8) 6/29/78

"The conferees expect, however, that FAA will continue to pursue to the maximum extent feasible the potential application of NAVSTAR for civilian use."

Status of Studies and AnalysesTSC Cost Analysis

RSPA contract with SCI "Economic Analysis of Civil Navigation Systems" to be completed June 1982. This analysis is being done in coordination with the Office of Management and Budget.

Committee ActionsLanding Systems

The Committee, while supporting funding for the Microwave Landing System (MLS), believes that the FAA should provide the Committee with more data and information concerning the MLS development program in the future.

The MLS has been the subject of much controversy in the Congress, between the U.K. and the FAA, and in the International Civil Aviation Organization (ICAO).

The Committee believes that fulfilling its oversight responsibility on such a controversial matter requires an extra effort of cooperation from the FAA.

Therefore, the Committee has required the FAA to submit quarterly reports concerning progress of the MLS development program and to submit the update of the 1971 National Plan for development of the Microwave Landing System, by June 30, 1978.

The update shall include a program plan for the implementation of MLS and shall be coordinated with DOT, DOD, and NASA and State Department participation shall be sought. The implementation plan shall be submitted provided that ICAO has had an opportunity to select a system prior to that time.

Response:

On June 30, 1978, the FAA submitted the update to the 1971 National Plan for the development of the Microwave Landing System to Congress as requested. Also attached to the forwarding letter was the first of the Quarterly Status Reports that were requested. The FAA has continued to submit these reports on a quarterly basis. The update specifically addressed a Transition Plan rather than an Implementation Plan, as being developed at that time. A Transition Plan is currently being reviewed within the Executive Branch and, when it is approved, it will be published for public comment. An Implementation Plan will be prepared after the public comments are received and factored into a planning document.

Technical Advisory Committee

Covered in page 18.

- Topic Group 4 Safety and Flight Control, Chaired by
Dr. Roger J. Phaneuf, Consultant
- Topic Group 5 Non or Low-Capital Policies to Improve
Efficiency, Chaired by
Dr. George W. Douglas, President of
Southwest Econometrics

The following is a list of the Subcommittee recommendations and the manner by which FAA's engineering and development programs are addressing them.

Recommendation 1

- Accelerate efforts to systematically examine various new concepts and methods of air traffic control

FAA Programs

Automated Terminal Service (ATS)

The ATS system is designed to improve the ATC separation and advisory services and reduce the risk of midair collisions. The feasibility of providing an ATS was successfully demonstrated during FY-1979 at Miller Airpark, Toms River, New Jersey, with full public participation. This activity was redirected in FY-1980 to evaluate the feasibility of providing a low-cost, combined primary/secondary radar advisory system (automated tower) using the applicable technology and concepts derived from ATS and NASA's Pilot Advisory System. Feasibility test bed development was initiated in FY-1980 and will be continued in FY-1981. Feasibility testing will commence early in FY-1982.

Automated En Route ATC (AERA)

The objective of AERA is to demonstrate the feasibility of automating routine en route ATC processes. The approach is to design and refine an automated air traffic control system capable of detecting and resolving aircraft conflicts with no controller interaction. Also, a human interactive capability will be developed and extensions to multi-sector capability will be addressed. The system is to be applicable to en route ATC facilities.

UPDATE OF THE STATUS CONCERNING THE RECOMMENDATIONS OF
THE SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND WEATHER
"FUTURE NEEDS AND OPPORTUNITIES IN THE AIR TRAFFIC CONTROL
SYSTEM"

Background

During the FY-1979 Authorization hearings held by the House Subcommittee on Transportation, Aviation and Weather, the Subcommittee received formal testimony from expert witnesses and informal briefings from numerous others that examined the requirements and opportunities in the future air traffic control system. The results of these hearings were a set of recommendations that summarized the major issues and viewpoints of the various witnesses and the Congress. The FAA's response to those findings and recommendations in terms of programs and activities both current and planned were set forth in a paper submitted to the Subcommittee on September 18, 1978. This is an update of that paper.

Introduction

FAA is responding to the Subcommittee recommendations in a variety of ways. There are internal FAA engineering and development programs as well as several interagency cooperative efforts. In addition, five topic groups were established in March 1978 at the FAA's consultative conference on "New Engineering and Development Initiatives - Policy and Technology Choices" to grapple with, among other issues, the technology issues and recommendations contained in the report. The topic groups, composed of representatives from user organizations, industry and government were all chaired by experts outside of government.

The five topic groups are:

- | | |
|---------------|---|
| Topic Group 1 | Productivity and Automation - Chaired by
Mr. Robert Everett, President of MITRE
Corporation |
| Topic Group 2 | Airport Capacity, Chaired by Mr. Joseph Blatt,
Consultant |
| Topic Group 3 | Freedom of Airspace, Chaired by
Mr. Gil Quinby, Senior Vice-President of
NARCO Avionics |

AERA has been demonstrated as feasible by simulation of the Front Royal Sector in FY-1976. In FY-1980 development of the first phase of the AERA testbed was completed which encompassed the flight plan route conversion, flight profiles and conflict prediction functions as well as an initial display capability. During FY-1981 longitudinal flight progress monitoring and conflict resolution will be completed and development of an en route delay absorption algorithm will be prepared. In FY-1982 real-time data feeds will be integrated into the first phase development of the AERA testbed.

Alternative Separation Concepts

The objective of this effort is to provide a basis for the development of ATC systems for future ATC environments. The approach is to investigate the feasibility, costs, and benefits associated with various strategies for providing ATC service in future environments. Strategic and tactical approaches for both enroute and terminal airspace regions will be investigated as well as concepts that affect the relative roles of pilot and controller.

In FY-1979 the work resulted in a specific recommendation for an alternative separation concept but did not recommend a variety of alternatives. As a result, we are continuing the exploration of feasible alternatives during FY-1980. In FY-1981 assessment of a number of alternatives will be made by FAA and the user community. Additional efforts in feasibility assessment of these alternatives will also be conducted based upon results from the joint NASA/FAA CDTI effort.

Automated Traffic Advisory and Resolution Service (ATARS)

The objective of the ATARS system is to improve the safety of civil air travel by reducing the potential for near-miss encounters and midair collisions. In particular the system addresses the hazards caused by the ineffectiveness of "see and avoid" separation techniques, aircraft deviations due to equipment malfunction or pilot error, errors in the ATC system, and ATC system hardware or software failure.

The concept of ground-based collision avoidance utilizing the DABS surveillance and data link capability has been validated through single-site testing at Lincoln Laboratory. The Pilot Warning Indicator, an advisory service has received strong acceptance by pilots using "see and avoid" separation techniques. During FY-1979 traffic advisory service testing on a single-site basis was initiated and is continuing in FY-1980. In FY-1981 refinements to the ATARS algorithm will be tested using the ATC facilities at the National Aviation Facilities Experimental Center. The enhanced algorithm will be available to the operating services in June 1981.

New Initiatives User Groups

The topic groups have evaluated FAA's AERA program, active and passive BCAS and ATARS, and have reviewed ATS. A time-based ATC concept - 4D area navigation - has also been assessed.

- Examine capabilities and limitations of cockpit displays of traffic information.

FAA Programs

Cockpit Systems Engineering

The purpose of this program is to determine the information requirements for advanced aircraft operating in the evolving ATC system and to investigate concepts for the proper display and control of this information. Currently, the program is investigating the advantages and disadvantages of cockpit traffic displays and planning for broader studies of integrated display concepts.

The Cockpit Display of Traffic Information (CDTI) project is in the detailed planning stage with NASA. Facilities are being prepared and experimentation began in January 1979. An analytical study of cockpit information requirements has been initiated and a follow-on experimental program to study integrated cockpit system concepts is being planned.

Head-Up Displays (HUD)

The objective of this program is to determine the potential benefits of HUD as an approach and landing aid and as a technique for vertical guidance in reduced visibility conditions. The Head-Up Display activity is being performed by both FAA and NASA. This program ties in with human factors research and simulation experiments performed at NASA's Ames Research Center.

Human factors simulation activities are underway by NASA in examining the limitations on the field of view, the symbology clutter and other factors. Simulation of selected HUD concepts are being conducted and equipment is being selected for installation in an aircraft for test by the FAA. During FY-1979/1980 the HUD system is to be integrated in a flight test vehicle and initial system qualification tests are to be completed. In FY-1980 pilot evaluation and the flight tests are to be completed and final documentation prepared.

- Utilize TCV to explore distributed management concepts

FAA Comment - The TCV is being used to help evaluate the conceptual approach to changes in the distribution of ATC functional responsibilities as part of the joint NASA/FAA CDTI program. TCV will be evaluating the CDTI concept in hardware representative of an advanced transport aircraft.

The air traffic control system has been a "distributed management" system from its inception; both controllers and pilots have carefully defined roles and responsibilities in the system. We think the question, and it is an important question, is not whether FAA should move toward a "distributed management" system from the present system, but whether it would be beneficial for pilots to assume certain additional responsibilities now performed by the air traffic control system. Achievement of the best balance between tasks and responsibilities of pilot and controller has been considered in all improvements of the air traffic control system since its inception. However, the increase in automation, the potential changes in information required by pilots in a more automated system, the technical feasibility of providing information to the pilot on traffic of concern, and the possibility of achieving more productivity in the system by giving pilots certain responsibilities in IFR which they now exercise in VFR, have increased interest in the topic of the proper distribution of responsibility. In this regard, investigations in these areas are being addressed in the joint FAA/NASA CDTI program.

- Examine human factors problems related to distributed management concepts.

FAA Programs

Applied Human Factors

The objective of this program is to provide an FAA human factors research capability to conduct research to minimize the occurrences and consequences of human error, and to enhance flight crew performance.

Internal studies in the human factors area are underway by FAA. In FY-1979 the general aviation human factors laboratory was completed and cockpit workload studies using the Denver environment were completed. The general aviation cockpit laboratory is being further upgraded to support CDTI and advanced navigation investigation and this phase will be completed in FY-1980. A program agreement with NASA concerning full mission simulation is in the final stages of coordination. In FY-1980 a set of ATC system measures and experimental design criteria was developed which will allow objective assessment of the impact on system performance, changes or additions to the system, i.e., CDTI, advanced NAV systems, advanced automation concepts, terminal flow concepts, etc. Also in FY-1980 upgrading of the ATC Simulation Facility has been initiated to accommodate various individual engineering and development experimental programs requiring a future ATC system environment.

Cockpit Systems Engineering (previously described)

- Establish a formal mechanism for gaining user input.

FAA Programs

FAA established the New Initiatives Program as a first step in the process of user consultation and involvement in March 1978. Group 1 studied an ATC automation concept which provides greater opportunities for pilot involvement. This included the possibility of display in the cockpit of

traffic information. Participation was from the Air Line Pilots Association, NASA, FAA, and the MITRE Corporation. Group 3 conducted a study on "Electronic See and Avoid" (sometimes referred to as electronic VFR) which involved representatives of AOPA, the airlines, PATCO, Lincoln Laboratory, and FAA. Group 4 reviewed these efforts from a safety and human factors point of view.

In March 1979 the New Engineering and Development Initiatives -- Policy and Technology Choices - Consensus Views of User/Aviation Industry Representatives were published. The FAA has prepared and published a formal response to the aviation community which will be presented at the Consultative Planning Conference to be held on January 29/30, 1980. Copies of these two documents are attached for your information and review. User critique of FAA responses to their recommendations will then be used in helping to formulate E&D program modification and direction in various Engineering and Development programs.

In addition, on individual efforts such as the Human Factors work, CDTI, and HUD projects, informal user participation has been sought and is continuing.

Recommendation 2

- Thoroughly evaluate the potential of GPS for civil aviation use. Include:
 - looking to NASA for assistance, i. e., for space and airborne systems concepts.
 - formalizing a mechanism for gaining user input.
 - cost comparisons of various navigation systems in use or intended for use.
- FAA accelerate efforts in examining potential of developing low cost NAVSTAR/GPS avionics package relying on NASA where appropriate.

FAA Programs and Activities

Global Positioning System (GPS)

The objective of this program is to determine the potential role(s) of the DOD NAVSTAR/GPS system for civil aviation.

FAA has initiated an extensive program to define the potential future role of Global Positioning System (GPS) as an element of the civil aviation navigation system. This FAA NAVSTAR GPS program is a part of the Federal Radionavigation Plan that has been jointly prepared by DOT and DOD and concurred with by other concerned U. S. government agencies. We have defined the activities needed to address a number of institutional, cost, and technical problems, which must be resolved if GPS is to form a part of the future navigation system. These activities include a definition of the current capability and future civil aviation navigation requirements, an examination of the extent to which these requirements can be satisfied by GPS, a thorough and realistic cost analysis to determine the costs of the various navigation system mixes meeting the aviation requirement, and development of low-cost GPS user avionics for general aviation.

There are a number of activities associated with developing low-cost GPS user equipment, including the design of avionics specifically to meet the needs of the low-cost aviation user; an evaluation of the potential of using alternative satellite navigation signal structures for reducing cost; a forecast of future technology and its potential impact on receiver cost; design and evaluation of low-cost antenna systems; measurement and analysis of radio frequency interference to determine its effect on receiver operation; and costing of potential avionics designs.

Institutional Factors in GPS

Since GPS is being designed as a U. S. military position location system, a number of institutional problems must be addressed before such a system can become an integral part of the domestic and international civil navigation system. A few of the key issues are:

The availability of signals of adequate accuracy at all times, including times of stress, is perhaps the most important institutional factor. A preliminary evaluation of the GPS signals as they are currently proposed indicates that many of the civil requirements could probably be met with the clear acquisition (C/A) channel signal. Currently, the Department of Defense is studying the NAVSTAR GPS program and what might be made available for civil use. If the currently hoped-for accuracy of the clear/acquisition signal (100 meters 2drms) were available at all times, except for conflicts involving the immediate safety of the United States, then GPS becomes an attractive alternative for the future civil navigation system. We believe the civil user community will be very much interested in GPS if it can offer a better service than current systems at a lower user cost.

The suitability and international acceptability of a U.S. military system for international civil aviation use is an issue which also must still be resolved.

Technical Factors in GPS

While it is believed that avionics can be built for large air carrier aircraft that will perform satisfactorily, there is still a question on the feasibility of developing low cost user equipment that will operate satisfactorily with the GPS signal. Of particular concern is the ability to achieve the necessary accuracy for non-precision approaches using low-cost equipment, when the aircraft is in a maneuvering configuration at low altitudes in the terminal area. In this configuration, the aircraft is subject to the greatest amount of ground-generated radio frequency interference which is added to that generated locally on the aircraft. It is also in that environment that the aircraft is most subject to multipath problems.

Aircraft antennas become a consideration as it is necessary to obtain suitable signal-to-noise ratios even at very low satellite elevation angles, such as 5° above the horizon. This is necessary in order to track at least four satellites in good geometry throughout non-precision approaches.

Acquisition time becomes a consideration both on initial code acquisition and on airborne reacquisition after signal loss. It is also a consideration when it is necessary to receive ephemeris data when picking up a new satellite. This condition will occur whenever one of the satellites required to achieve a good position fix is just coming into view over the horizon.

A related issue currently under study is the effect of satellite failures on system accuracy, particularly as it might affect aircraft involved in non-precision approach operations.

Alternative signal formats have been examined to determine the potential for reducing avionics cost. Although some cost reduction appears achievable with a different signal format, the change offering the greatest gain seems to be the provision of additional power in the satellite utilizing the current signal format.

The human factors area must also be considered as the GPS system, by definition, is an area navigation system. Such a system represents an increase in pilot workload over the VOR system, particularly for single pilot IFR operations. It also increases the possibility for blunders in entering way-point information.

Use of GPS signals for more accurate aircraft height determination has been proposed as a method of reducing altitude separations above flight level 290. While this possibility is being investigated, questions relating to adequacy of the GPS signals to provide the increased accuracy on a continuing basis particularly when only the clear-acquisition (C/A) signal or a degraded C/A signal may be available to civil users, have yet to be fully answered. Analysis conducted to date tend to indicate that the signals are not adequate to perform this function. A further consideration is the problems that conversion from a pressure referenced altitude measurement system to an absolute or geometric referenced system may entail, particularly during the transition period.

An additional technical factor is that of undetected failures. It is possible, in a system as complex as the GPS receiver, to have failures which will not immediately be detected by the logic and may not be presented to the pilot. This affects the safety of operations -- particularly those conducted in close proximity to the ground.

Cost Factors in GPS

The most significant cost is that of the avionics for the majority of the general aviation users. This cost, more than any other cost, will determine the acceptability of the GPS system to the civil community. At the current time, industry estimates of the production costs of GPS avionics for general aviation range between \$3,600 and \$8,000. This

must be compared to the cost of the current VOR equipment, which is widely used by general aviation and is generally available at unit costs of \$900 to \$1,400.

Another area that must be considered is the distribution of operations and maintenance costs between the major system users. Most of the cost studies conducted to date have assumed that the Department of Defense would pay all of the operations and maintenance costs of the system. If, however, GPS becomes a part of the civil navigation system, the question of distributing the costs among civil and military users, and particularly those questions relating to international agreements on cost sharing, must be addressed. Current estimates indicate that the operations and maintenance costs approximates \$100 million per year. If the civil aviation community must absorb a good portion of the operations and maintenance costs, it will represent a significant increase over the operations and maintenance costs of the current civil navigation system. Since GPS, by definition, is an area navigation system, the cost of providing that capability must be considered and the transition costs of jointly operating two systems -- VORTAC and GPS -- for the lengthy transition period must also be considered in the cost studies.

GPS Program

The program includes activities to define future civil navigation requirements and to evaluate the performance of the GPS system in meeting these requirements. It includes use of GPS simulators to rapidly test receiver equipment, and flight tests to evaluate the performance of existing equipment and to determine the noise and radio frequency interference environment as it exists at a number of airports where non-precision approaches are currently being conducted.

A continuing cost analysis is being conducted on the various aviation navigation system alternatives. The FAA has completed a preliminary evaluation of several alternative navigation systems for civil air navigation. The results of this effort are reported in Report No. FAA-ASP-78-3 dated April 1978 with a supplement dated October 1979. The results of this study and that of a TSC radionavigation cost analysis done for the OMB Federal Radionavigation Systems Consolidation Working Group is that NAVSTAR GPS is the most expensive of the alternatives studied although the cost difference between the alternatives is small and depends upon several factors such as user equipment cost estimates and transition time. The FAA, with the USCG is

supporting the Office of the Secretary of Transportation and the Research and Special Programs Administration in cost analysis studies of various radionavigation system mixes applied not only to aviation, but also to maritime and land users.

A third major effort relates to design studies for a low-cost GPS receiver. This includes alternative design studies and evaluation, technology forecasts, antenna studies, radio frequency interference studies and measurements, and avionics receiver costing activities.

While much of the preceding material on institutional, technical, and cost factors raises questions, we believe that GPS may well play a significant role in future civil air navigation. In oceanic and low density traffic areas worldwide, we believe that there may indeed be an incentive for air carriers and commercial operators to carry such a system, since it offers a potential for the elimination of the need to carry systems such as INS, which currently have high maintenance costs. Hence, GPS may offer a cost-effective system for operations over as much as 90% of the earth's surface. Aircraft equipped with GPS will be able to utilize the systems within the CONUS airspace. Initially such use might be possible in the high altitude route structure providing a direct routing capability much like that available from the INS system today. This would require no changes to current ATC procedures. In the future, it might also provide the possibility of non-precision approaches; however, new charting and new waypoint systems will be needed which match the capabilities of the GPS system. GPS may also meet some special user requirements, such as in offshore oil exploration. Initially, the cost of receiver equipment appears to be comparable to that of existing OMEGA receivers. For the longer term, particularly if the low-cost user GPS avionics cost goals can be met, it may also become competitive to the cost of LORAN-C receiver equipment.

While we can foresee GPS in meeting these requirements, it is not yet clear whether GPS can meet the requirements for low cost user avionics, which represent the majority of the civil users within the continental United States. In our view, GPS should not be considered as a replacement for VORTAC until avionics are available in the \$2,500 or lower price range, and until we are sure that such avionics can provide an adequately high level of failure detection and safety.

FAA/NASA

A joint agreement, "Development of Advanced Technology for Satellite-Based Navigation for Civil Aviation," has been prepared in which the FAA and NASA will share responsibilities for:

- coordinating with DOD and its elements involved in NAVSTAR/GPS and other interested governmental agencies.
- developing plans for joint activities based on program needs and resources.
- experimental flight tests using both the FAA's and NASA's facilities to examine system performance in existing and proposed ATC environments.
- joint program reviews as warranted by the activities but at least on a semi-annual basis.

Additionally, the FAA and NASA sponsored a workshop on GPS for general aviation in October 1978. The objectives were to review GPS system and technology state-of-the-art, to identify user needs and requirements from all of the aviation user community, and to define R&D requirements based on the user's viewpoints.

New Initiatives User Groups

Groups 1 and 3 have examined GPS applications. The users have assessed GPS in terms of compatibility with automation concepts, freedom of airspace, availability of navigational coverage in off shore and other remote locations. GPS was also looked at as a non-precision approach aid for low activity airports. Additionally, Group 3 was concerned with the overall issue of low cost avionics and has formulated a position on GPS based on the availability of low cost avionics. (See Consensus Views of User/Aviation Industry document attached.)

- FAA work closely with NASA, DOD to examine feasibility of space-based ATC system.

FAA Comment - Crucial to the application of GPS in the Air Traffic Control System is the development of reliable and economical GPS user equipment. Towards this end, the FAA/NASA joint agreement on the "Development of Advanced Technology for Satellite-Based Navigation for Civil Aviation" and the FAA/DOD Space Panel are addressing this issue. Also, studies will be developed to evaluate and determine the feasibility of additional functions and services based on the use of GPS signals.

- DOT evaluate potential of GPS for use in other modes of civil transportation.

FAA Comment - Under the DOT and DOD Federal Radionavigation Plan, the use of GPS in other modes of civil transportation is being considered.

- DOT, FAA work closely with DOD, OSTP, NASA and others as appropriate to seek early formal Executive Branch policy decision on civil use of GPS.

FAA Comment - The Federal Radionavigation Plan has been evaluated by an interagency team that consists of representatives from the Department of Defense, Department of Commerce, Department of Transportation, on which an FAA member serves, NASA, the National Telecommunications and Information Administration (NTIA) and chaired by OMB. This Plan presents a program that will provide the information needed by the Executive Branch to determine the future civil and common user navigation system including the role of GPS.

Recommendation 3

- Subcommittee strongly supports FAA efforts to identify which controller functions can be automated and that FAA utilize NASA expertise and facilities in this effort.

FAA Programs

Automated En Route ATC (AERA)*
 Automated Terminal Service (ATS)*
 Automated Traffic Advisory and Resolution Service (ATARS)*
 Advanced Separation Concepts*

New Initiatives User Groups

Group 1 has reviewed a variety of control processes that could make the ATC system safer and more productive. They have also examined various hardware and software configuration options which could minimize disruptions that may be associated with transitioning to the more automated system. Some of the control processes which were considered are AERA, ATARS, 4-D area nav, ATS electronic "see and avoid" and delegating appropriate control responsibilities to the pilot. Among the concerns of increased automation expressed by the users is the need to provide increased attention to failure and recovery modes and human factors issues. Group 1 has examined these issues from the perspective of the control process and Group 4 from the perspective of backup to the surveillance system through increased cockpit capabilities. (See document on Consensus Views of User/Aviation Industry attached.)

- NASA study and identify which pilot functions can and should be automated. Conduct in coordination with FAA efforts of automating controller functions.

FAA Comment - A candidate NASA program augmentation for FY-1980 is being planned in cooperation with FAA which will:

- identify from the human factors viewpoint which functions can and should be automated,
- define with regard to the human operations the advantages and disadvantages of altering the responsibilities and roles of the ATC and aircrew, and
- identify from human factors considerations the advantages and disadvantages associated with cockpit integration and operation of currently available advanced technology hardware.

* Described earlier

FAA Programs

Advanced Computer Technology

The long range goal of this program is to develop a computer network for ARTS/NAS application and evolution which has very high availability, low maintenance costs, the capability for large increases in productivity, and which places minimal constraints on the growth and flexibility of the ATC system. The approach is to initially perform ATC computer requirements analyses for the 1990-2000 era followed by an investigation of future system configurations, technology alternatives, and design concepts. The high risk areas are to be identified which will influence the subsequent system development, test, evaluation and cost/benefit activities.

A planned approach to replace the NAS computing complex in the 1990's has been drafted, coordinated and tentatively approved by FAA. A requirements definition and analysis of costs to operate and maintain the current automation equipment is continuing. In FY-1980 assessment of potential benefits for increasing the level of automation in the current system has been initiated. In FY-1981 a cost/benefit analysis of upgrading en route automation facilities will be initiated.

Advanced Sensor Technology

This program is to develop and evaluate new sensors using the latest technology.

During FY-1980, the development of the Global Positioning System Test and Evaluation Equipment was continued. This equipment, which includes an engineering model of a low-cost GPS receiver, will be installed in a general aviation aircraft in FY-1981 and utilized to determine the applicability of the Global Positioning System in the National Airspace System, particularly for general aviation. The results of this effort will include an Engineering Requirements specification for a minimum performance, low-cost general aviation GPS navigation receiver.

In FY-1980 the FAA also initiated investigation of applicability of new developments, such as space-based radar and infrared detection systems, to ATC surveillance requirements. FAA will continue to monitor these developments in FY-1981 and will initiate studies to evaluate the feasibility of using this technology as an alternative to ground-based surveillance systems.

Recommendation 4

- Meaningful user involvement in the process of defining the future ATC system.

FAA Comment - The FAA began an effort in March 1978 called "New Engineering and Development Initiatives - Policy and Technology Choices" which established and sought user inputs to help FAA structure and define program requirements in current and future ATC scenarios. Approximately 250 individuals representing some 60 organizations across a wide spectrum of the aviation and user communities participated in this consultative process. The document on Consensus Views of User/Aviation Industry representatives was made available to the FAA in March 1979. The FAA response document was prepared in December 1979 and made available to the User/Aviation Industry at the Consultative Planning Conference held January 29/30, 1980. Recommendations of the users are becoming a significant input to Engineering and Development programs. There will continue to be follow-on consultation with users on specific issues of Engineering and Development programs.

Recommendation 5

- Under the guidance of a reformed TAC, FAA and NASA conduct indepth study of the potential of combining new satellite, computer and avionics technology that would serve as the heart of the future ATC system. Study to include recommendations that could be implemented in the 1990's.
- In considering alternatives of the future, reformed TAC should assume that by 1990:

- airborne collision avoidance capability widely deployed.
- most aircraft equipped with 3-D precision positioning and navigational devices.
- most aircraft equipped with electronic cockpit traffic information displays and flight directors.
- ground-based computers could receive and file flight plans, assign flight profiles, and manage traffic flow from takeoff to touch-down.

We have had the benefit of the Advanced Air Traffic Management Systems (AATMS) and the Air Traffic Control Advisory Committee (ATCAC) studies and the inputs of the users in the New Initiatives efforts. Incidentally, we plan to continue the process developed for the New Initiatives effort as a means of bringing more highly talented viewpoints into our program formulation so it shouldn't be viewed as a one-shot consultative effort. We also have been giving some thought of involving an organization such as the National Academy of Engineering in some of our deliberations. We do not see, at this time, a need for a Technical Advisory Committee type function.

FAA has conducted a number of studies and supporting technology activities to define and evaluate alternative configurations of satellite systems to provide communication, navigation and surveillance services for air traffic control. These activities have included definition of technology experiments which have been conducted jointly with NASA utilizing the ATS-6 system configuration studies conducted by Boeing, Autonetics, MITRE, and Aerospace Corporation, and cost-benefit studies conducted by FAA. These studies have resulted in definition of several system concepts determined suitable for meeting ATC communication/navigation/surveillance requirements. The system configurations have been analyzed and while technically feasible configurations appear to exist, all systems examined to date have proven to have projected costs higher than the current system and also higher than other alternative approaches to meeting future FAA requirements.

Current studies (MITRE/METREK) are addressing the questions of use of GPS to perform some of the services. These studies have shown the costs for such a system are higher than the alternative approaches. The studies have also identified cost targets which must be met before satellites can become a viable part of the ATC system.

A joint program has been established with NASA to examine both alternative satellite system configurations and to define areas of new technology which will be needed to provide avionics and space segment hardware meeting cost targets established by the several cost-benefit studies conducted to date.

New Initiatives User Groups

Users in topic groups 1 and 3 studied automation and navigation technologies including data link applications and various means of separation assurance to improve point-to-point flight and to reduce pilot controller conversation. Users have assessed the efficacy of the guideline that higher levels of automation should not foreclose automatic transmission of relevant traffic information to properly equipped aircraft; that the future ATC system should be capable of involving flow control procedures (including metering and sequencing to manage traffic from takeoff to touchdown; and that the FAA should continue with the development of active BCAS for possible use in the future system. (See document on Consensus Views of User/Aviation Industry attached.)

Finding 6

Recommendation

As part of its presentation to the subcommittee in the fiscal year 1980 program review, FAA should include proposed implementation plans for the several R&D programs that are maturing, to the degree permitted by the state of the R&D development.

Response

FAA's implementation plans for the products of its major development programs are normally covered in the annual program reviews. The subject was addressed in both the FY-1980 and the FY-1981 material presented to the Subcommittee.

COMMITTEE VIEWS, page 3

Navigation

Covered in previous comments.

COMMITTEE VIEWS

Beacon Systems

FAA divert \$100,000 of 03 Beacon line item funds to support a request to NTIA (National Telecommunications and Information Administration) to thoroughly review DABS as a telecommunications system with particular attention to interference problems (within the system and external to it) and possible international treaty conflicts. It is assumed with undeniable logic that funds for such analysis would be included in the 03 Beacon line item and that no recommended cut from other funding need be made to compensate.

Response:

An Interagency Agreement in the amount of \$100K between NTIA and FAA is currently being processed. The initial NTIA report summarizing their assessment of DABS utilizing existing interference documentation will be available 2 months after the agreement is approved. Additional analysis is expected this summer to be conducted by NTIA that will result in final spectrum authorization approval for DABS.

COMMITTEE VIEWS

Aircraft Separation Assurance

The FAA has recently proposed a National Standard for Active BCAS which specifies an ACAS system utilizing the current altitude encoding ATCRBS as the common element. The Committee requests that \$500,000 be diverted from Full BCAS funds in the 05 Aircraft Separation Assurance line item of \$5,330,000 to be used to:

1. Do a detailed hardware design development of low cost features to meet General Aviation active BCAS needs on an accelerated basis.
2. Particularly address lowest cost for maximum benefit for General Aviation Active BCAS Hardware.
3. Propose a best effort accelerated system implementation plan and alternatives.
4. Fully coordinate with user community.

Response:

The FAA has initiated a \$250,000 contract with Lincoln Laboratory for the design of a low-cost GA BCAS. The GA BCAS will depart from the air carrier design by virtue of its lower requirements for power and number of targets tracked. This activity is the first step in the hardware design and fabrication of the lowest-cost GA BCAS unit. The design will be flight tested in GA aircraft beginning in October 1980. Additionally, the planned "seed money" contracts with industry to fabricate commercial versions of the air carrier type Active BCAS equipments will provide the basis for the normal progression to General Aviation-type equipments.

COMMITTEE VIEWS

Landing Systems

One of the prime arguments and attractive features of the MLS (Microwave Landing System) was the companion cheap, site insensitive, Small Community MLS system. These were to be widely installed at VOR airports for convincing arguments of vastly improved safety over nonprecision VOR approaches and to preclude proliferation of other noncompatible low priced interim systems.

The FAA MLS implementation plan shelves the installation of the Small Community MLS for which T&E has been completed to wait for completion of T&E and installation of full all-up central hub systems several years downstream. This appears to reverse a major argument supporting the urgency of MLS as a national system. It is requested that FAA rework the MLS implementation plan to accelerate the installation of Small Community MLS.

Response:

On June 30, 1978, the FAA advised the Congressional Committee that development of an Implementation Plan for the Microwave Landing System would be carried out in consonance with the completion of Stage 3 of the ICAO process (adoption of technical specifications). An MLS Transition Plan, which will form the basis for the full-scale Implementation Plan, has been developed by the FAA and is currently being coordinated through the Department of Transportation with the Office of Management and Budget. The Transition Plan will be released to the Public after the review is completed.

The FAA anticipates that limited MLS implementation will begin in FY-1982 with a limited production of MLS systems. Factors which will be considered in selecting the types of equipment and sites for initial implementation include: (1) the specific community needs; (2) the benefits that might be derived; and (3) the breadth of user community exposure that will result. The implementation of the small community systems will be given full consideration during this implementation planning program. We expect that the candidate sites and types of equipment which will constitute this initial procurement will be identified during 1980.

Technical Advisory Committee

Covered in previous comments.

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

March 12, 1980

MAR 12 1980



OFFICE OF
THE ADMINISTRATOR

Honorable Tom Harkin
Chairman, Subcommittee on Transportation,
Aviation, and Communication
Committee on Science and Technology
House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

Pursuant to your directives at our hearing before your Subcommittee on February 19, 1980, enclosed is (1) our current view of the five-year requirements for the Research, Engineering and Development (R,E&D) Appropriation; and (2) the requested ranking of the Committee's list of "potential enhancements."

This material is being developed in its present format for this Spring's annual reassessment of FAA's R,E&D five-year plan. As I said at the hearing, this information would have been available to you at the completion of the normal process.

It represents FAA's most current thinking about an optimal, feasible program to provide the Engineering and Development underpinning to meet the operational demands that will be placed on the National Air Space System through this decade and into the early 1990's.

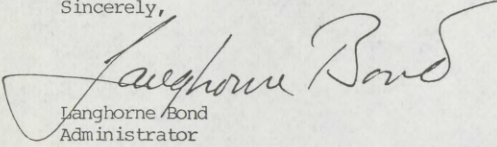
I would also like to remind the Subcommittee that as I said last week, I accept the necessity for aviation's needs and priorities to compete with other vital national needs and priorities within the framework of the unified budget. Not only is that sound fiscal policy, but I am confident that this process's treatment of our needs will acknowledge their importance. I can assure the Subcommittee that there will be no compromising of our unparalleled safety record.

Please note that our basic program excluding the Advanced Computer and the new requirement for Doppler Weather Radar Programs do not change over the five-year plan period. Given the required offsets to account for inflation, that portion of the plan will still meet the requirements associated with its contributions to system safety, capacity, and productivity in a timely fashion.

I trust this provides the information you desired. We are available to discuss the subjects in further detail if you desire.

Thank you for the courtesies extended during the hearing.

Sincerely,

A handwritten signature in cursive script, reading "Langhorne Bond". The signature is written in dark ink and is positioned above the typed name and title.

Langhorne Bond
Administrator

Enclosures

PROPOSED ADJUSTMENT IN THE FUNDING LEVELS
PLANNED FOR THE
RESEARCH, ENGINEERING AND DEVELOPMENT APPROPRIATION

A. BACKGROUND

Current ADAP legislation provides that the first \$50M of the trust fund be made available for these Research, Engineering and Development activities.

The proposed Airport and Airway Development Act now before the Congress provides for an initial level of funding in Fiscal Year 1981 of \$90M with a growth factor of \$5M for each succeeding year through Fiscal Year 1985 at which time the level would reach \$110M. The overall level for the five years would be \$500M.

Over the past year, a number of questions have been raised concerning the adequacy of funding levels contained in the proposed legislation. The concern is that additional resources are required if the Research, Engineering and Development Programs are to produce the products necessary to sustain or improve safety and productivity necessary to meet the expanding demands for service.

B. DEVELOPMENT OF THE CURRENT R,E&D FIVE-YEAR ADAP PLAN

The R,E&D five-year plan upon which the proposed legislation is based was formulated in 1978. The overall program content of the plan reflects the program requirements and priorities as they are recognized today. Primary emphasis is placed on high priority programs related to safety, productivity, costs and energy conservation. The scheduling of the programs was calculated to provide products in a manner consistent with reasonable technological progress, system needs and the integration of all requirements. The schedules are consistent with the planning associated with the F&E implementation programs. Meeting these schedules, except for those noted below, is subject to the availability of the resources comparable to those presented in the plan.

The plan was formulated during the initiation of the effort to define the Advanced Computer Program. Since then, a variety of studies and analyses have been conducted which have refined the definition of the program and permitted the development of better cost estimates. Also within this time frame, the requirement to accelerate the program to provide the additional capacity and reliability as soon as possible was established. These two factors, combined with the multiple contractual requirements of OMB Circular, have necessitated the revision of the estimates for the Advanced Computer Program.

A new requirement for FAA's participation in the development of a Doppler weather radar arose in Fiscal Year 1980. Initially, we had expected that the National Weather Service would develop the radar utilizing its funds. However, the Federal Weather Coordinating Committee has established a joint NWS/FAA/USAF Program to which FAA will have to contribute approximately \$16M during the plan period for the development of the radar.

C. CURRENT ESTIMATED PLANNING LEVELS FOR FISCAL YEAR 1981-1985

The impact of inflation on the requirements for R,E&D is shown in Enclosure A.

- o Line 1 depicts the history of the R,E&D appropriations from FY-76 through FY-80 and the proposed ADAP plan levels from FY-81 through FY-85.
- o Line 2 plots the buying power of the R,E&D dollar from FY-76 through the plan period. It shows that \$110M in FY-1985 will buy about \$44M worth of effort when it is related to FY-76 dollars. One hundred and ten million dollars in FY-85 will buy \$23M less than \$67M did in FY-76.
- o Line 3 portrays the levels of funding that would be required if the requests and plan were based upon FY-76 dollars. The FY-1985 plan level of \$110M would have to equate to \$250M in order to provide comparable buying power.

The adjustments required in the plan resource levels in order to accommodate inflation and the additional requirements for the Advanced Computer development and the Doppler weather radar are shown in Line 4 of Enclosure A. The inflation factors used in developing this requirements line were based upon Fiscal Year 1980 dollars.

The adjustments are summarized as follows:

	<u>FY-81</u>	<u>FY-82</u>	<u>FY-83</u>	<u>FY-84</u>	<u>FY-85</u>	<u>Total</u>
Inflation	9.0M	19.0M	33.0M	49.0M	68.2M	178.6
*Doppler Wx radar	-	4.4	4.6	2.9	4.1	16.0
*Add'l. Advanced Computer	-0-	-0-	55.0	97.0	103.0	255.0
Other (see below) ^{1/}	9.0	-0-	-0-	-0-	-0-	9.0
Request Plan	85.0	95.0	100.0	105.0	110.0	495.0
Total	\$103.0	118.4	192.0	254.3	285.3	953.6

* Inflated - 1980 dollar base

^{1/} There are several efforts which could be effectively expedited with positive results on product availability by funding them in FY-1981. They are:

STEP (MLS) - \$5.0M Restoration of the plan to deploy a limited number of MLS systems for user and operators familiarity.

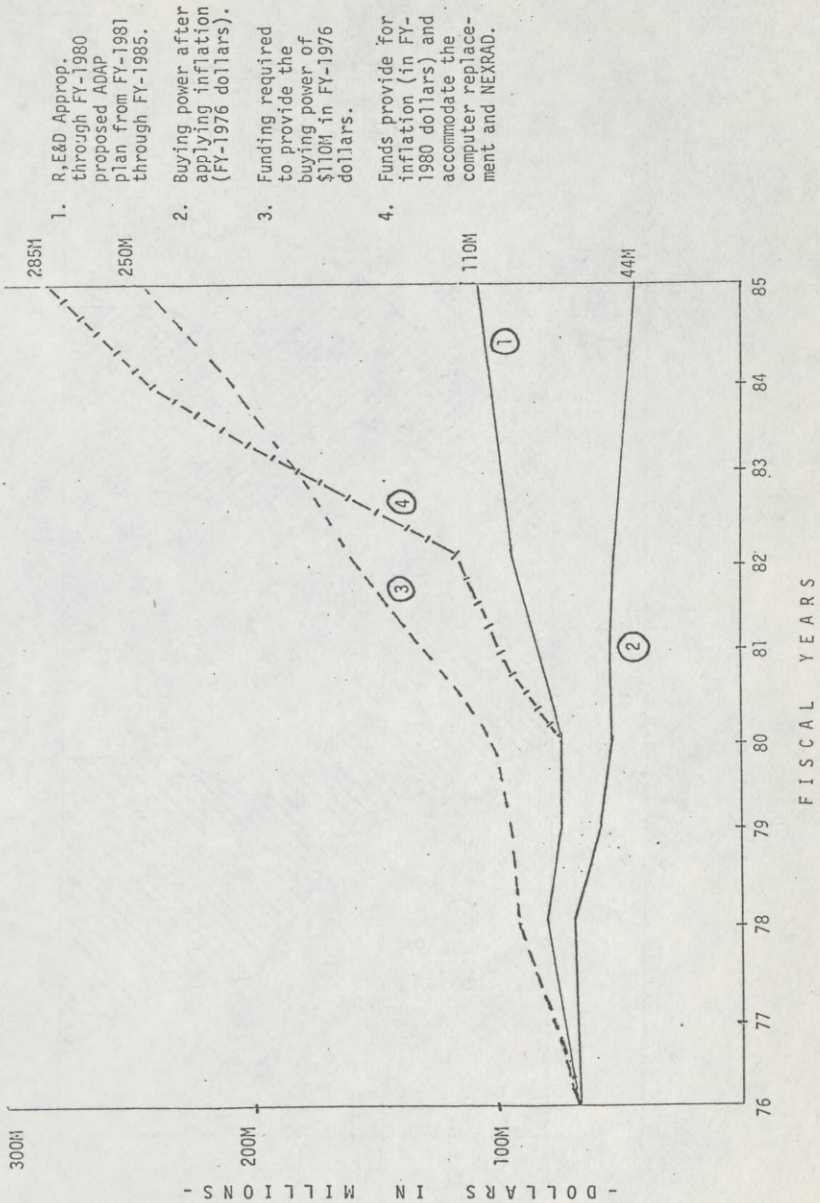
FL-290 - \$1.0 Initiation of studies to establish the feasibility of reducing aircraft separation to 1,000 feet in the airspace above flight level 290. Potential high level benefits in fuel consumption.

DELAY/CAPACITY - \$2.0-Expansion and acceleration of studies to develop new/alternate technological, operating and procedural methods to improve airport capacities and decrease delays.

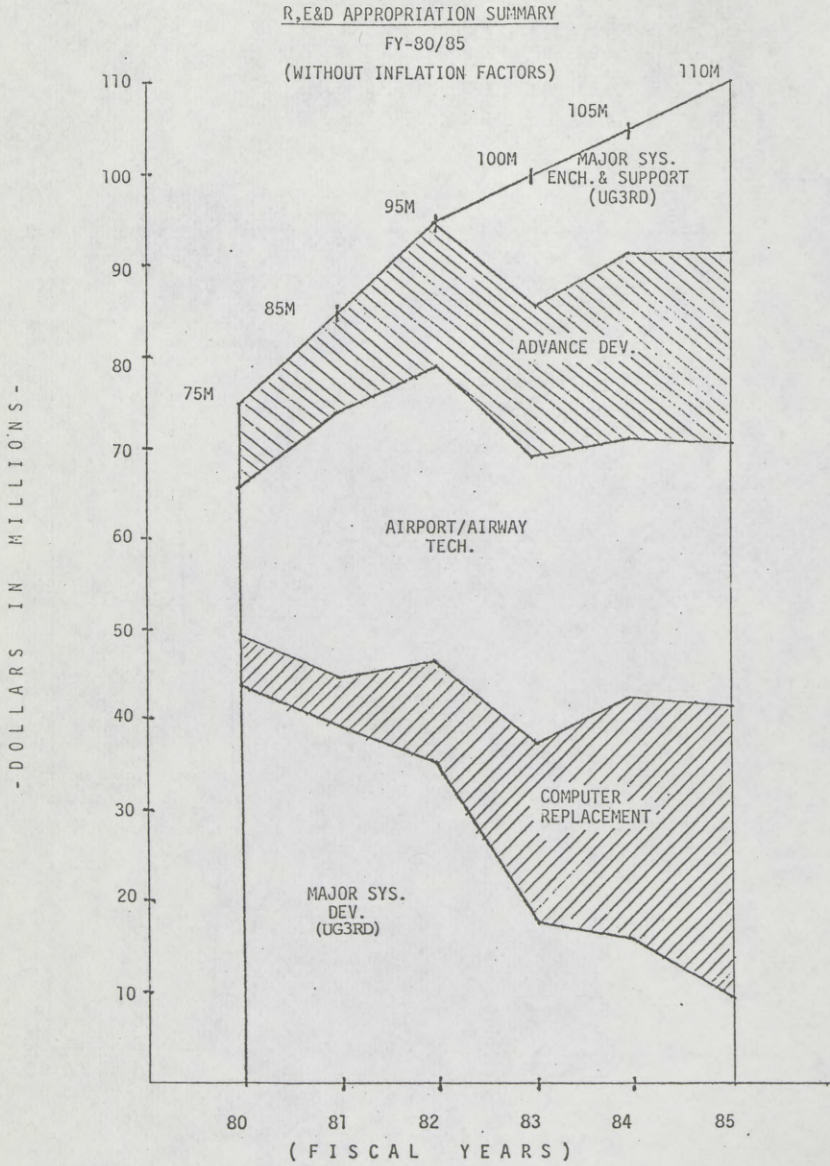
HUMAN FACTORS - \$1.0M-Expand the cockpit alerting and warning system program to include a study of causes of major accidents and develop additional monitoring and warning capabilities to assist pilots in avoiding the type of accidents that have been catastrophic in the past, and the development of algorithms to detect and prevent the execution of erroneous human directions in a highly automated system.

Enclosure B provides a graphic display of the makeup of the R,E&D Program during the plan period. The only significant revision to the enclosure that would result from the adjustment to the plan levels would be the scope of the Advanced Computer Program in the FY-83 through FY-85 time frame. The chart also portrays the phase down of the upgraded third generation air traffic control system (UG3RD) development activities as the various systems move into the implementation phase.

ENCLOSURE A



ENCLOSURE B.



HOUSE SUBCOMMITTEE ON TRANSPORTATION, AVIATION, AND COMMUNICATIONS

LIST OF
POTENTIAL ENHANCEMENT OF ACTIVITIES
IN THE FAA FY-81 R,E&D PROGRAM

The Subcommittee directed that these activities be prioritized.

Priority 1

Overall Allowance for inflation	\$9.0M
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Priority 2

Capacity enhancement/delay elimination techniques	2.0M
Human factors studies	1.0M
Studies to reduce altitude separation above FL 290	1.0M
Microwave Landing System procurements for tests	5.0M

Priority 3

Alternative navigation systems studies	}	3.0M
Tests on NAVSTAR low cost avionics		
Investigate techniques for processing pulse doppler radar outputs for weather	}	1.1M
Evaluation of techniques for offshore helicopter operations		
En route modernization - studies on automation	}	2.1M
Studies of center-to-center backup techniques		
Tests of critical components for future en route computers		

Priority 4

Runway visibility sensor evaluations	}	.6M
Wake vortex avoidance sensor development		
Wake vortex impact on parallel and interX runways		
Complete wind shear investigations		

Priority 4 Cont.

Voice switching and control development	}	2.0M
Expand voice response demonstrations for FSSs		
Future aircraft separation concepts studies	}	1.2M
Complete pilot-controller interface for terminal areas		
Studies of future general aviation needs and impacts on aircrews and controllers		
Studies to improve selection and evaluation of controllers		
Demonstrations to eliminate landside restrictions	}	
		\$28.0M

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591



OFFICE OF
THE ADMINISTRATOR

April 10, 1980

The Honorable Tom Harkin, Chairman
Subcommittee on Transportation, Aviation,
and Communications
Committee on Science and Technology
House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

Thank you for providing us the opportunity to review
Mr. Israel's comments on the Federal Aviation
Administration's computer replacement program. We
have reviewed his comments and are enclosing a brief
response to the issues he has raised.

Sincerely,

A handwritten signature in dark ink, reading "Langhorne Bond". The signature is fluid and cursive, with a large, sweeping "L" and a long, horizontal stroke at the end.

Langhorne Bond
Administrator

Enclosure

COMMENTS ON MR. DAVID ISRAEL'S SUGGESTIONS ON
COMPUTER MODERNIZATION

1. Recognize the Size of the Task

I fully appreciate Mr. Israel's observations on the size and complexity of the FAA's Computer Modernization Program. This project is probably the largest "real time" computer modernization program ever tackled. For this reason, and many of the reasons Mr. Israel has stated, I have resisted the pressure to get something on line before the system can be properly developed. We will continue to carry out the detailed front end studies and analyses which are crucial to building a solid base from which a program of this magnitude can be executed. I assure you that the FAA is doing its homework and will be able to meet the critical operational dates for implementation of the program.

2. Establish a Dedicated Project Organization

Mr. Israel proposes the establishment of a Special Programs Office (SPO) similar to those traditionally utilized in the Department of Defense. We have assessed various alternative methods of providing management for this program, ranging from the traditional SPO approach, on the one hand, to FAA's traditional functional/organizational method of operation, on the other. Our assessment has led us to conclude that a hybrid of the two extremes will provide us with the most appropriate vehicle for accomplishing our overall objective of replacing the existing automation capabilities in a manner that will not disrupt the operation of the existing system.

The transition from the old to the new system must be transparent. It will involve the continuing participation of every element within the FAA having responsibility for the operation of the existing air traffic control system. We, therefore, do not believe that it would be prudent to place the operation of the replacement program in a SPO.

We will, in the near future, establish a Program Manager with an appropriate staff to manage the program. The Program Manager will report to the cognizant Associate Administrator as the program progresses from development through transition to implementation. In addition to the

expertise of his staff, the Program Manager will draw upon the expertise of various organizations for support in order to ensure the continued viability of the existing automated services.

3. Fight Off Those Who Want to Explore New ATC Concepts

I agree that the Air Traffic Control system must continue to evolve along the same general lines that have brought us to today's level of safety and service. We believe that the exposure of our plans to the various organizations within and without the Government has clearly made this point, and we are not aware of any suggestions that we begin to re-invent the basic system. In parallel with our computer program, we are examining possible adjustments or revisions to our methods of doing business within the framework of the existing system. The relative role of the pilot versus the controller in the system is an example of this type of activity.

4. Define the Problem and the Objective

We agree that this is an important point and are confident that we are properly defining the problems and the objectives, and that we are establishing the appropriate priorities.

5. Don't Try to Solve Everything Now

One of our basic goals is to achieve a transition to the new system in a way which is transparent to the user. The new system will have the capability of incorporating new features into the system we build by the addition of computer modules. Improvements will, therefore, be provided in an evolutionary manner by taking advantage of new computer technology as it is developed. While we do not necessarily agree with the need for another upgrading beginning approximately in the year 2000, we do not see the current computer modernization program as being the last.

6. Avoid Trying to Do Too Much

Our planned evolutionary modular updating, mentioned above, will ensure that the modernization program will be flexible enough to take advantage of new technology as it is developed. We are not endeavoring to "bite off more than

we can chew" at any one time, but instead, we anticipate phasing in additional system improvements as they become available.

7. Avoid Over Contemplation of the Problem

We have developed a plan that provides for the execution of the computer modernization program in a responsible and orderly manner. This plan provides for the necessary compliance with OMB Circular A-109 without inhibiting our implementation schedule.

8. Give the SPO a Broad Charter

Our comments on item 2 above are pertinent to Mr. Israel's comments on this subject.

9. Pursue the Non-Elegant As Insurance

One of our basic efforts is to be prepared to expand the life and capacity of the 9020 computer systems should such a need arise before the new systems can be operational. These efforts include off-loading, in order to provide greater capacity, in addition to the possible introduction of a computer which would be compatible with the present 9020 system. We are preparing for such an eventuality should it occur.

10. Give Parallel Attention to the Future of the Surveillance System

The question of the future role of primary radar in the en route air traffic control system is currently under study. This involves consideration of institutional and policy issues that cannot be fully addressed until the study is completed. We have identified the subject in our planning for the Computer Replacement Program for consideration at the appropriate time.

We do not agree with Mr. Israel's suggestion that "a surveillance program management office would probably also be a good idea."

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591



OFFICE OF
THE ADMINISTRATOR

April 28, 1980

The Honorable Tom Harkin, Chairman
Subcommittee on Transportation, Aviation
and Communications
Committee on Science and Technology
House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

This is in response to your letter seeking our views on recommendations presented by Dr. Goldmuntz and Mr. McCloskey at your Subcommittee hearings on February 19 and 20.

We have reviewed Dr. Goldmuntz' comments and essentially agree with the points he raises. We have briefly set out some additional FAA comments below:

- o Implementation of MLS, DABS, its associated data link, and CDTI could lead to the use of general aviation runways at major hub airports under Instrument Meteorological Conditions with spacing as close as 2500' to airline runways.
- o Automatic generation of conflict-free clearances, at least in en route airspace, would in fact expedite traffic by improving controller productivity.
- o ATARS/DABS can provide backup collision avoidance service in areas under DABS surveillance, while BCAS can provide backup service in other areas.
- o We believe it is possible to develop a less restrictive control philosophy, such as Electronic Flight Rules, without compromising safety.

- o En route radar assets converted to the use of weather detection would improve distribution of weather information to the cockpit.
- o Airspace restrictions might be reduced at major hub airports by using MLS for precision departures and missed approaches.

With respect to funding issues raised by Mr. McCloskey, the Subcommittee is in receipt of my March 12 letter to the Subcommittee detailing the optimal feasible E&D program, taking into consideration funding of the advanced computer system.

Mr. McCloskey also questions the procedural requirements of FAA's acquisition programs. A review of our recent years' experience does not substantiate his claim that there is a reduction in the number of companies responding to our R&D Requests for Proposals. The response to these types of procurements is approximately the same in recent years with little or no trend evident. The subject of reducing acquisition lead time has been and remains an important goal in achieving a more efficient process. Over a period of years, the Department has prescribed regulations that deal with the areas of acquisition planning approval, source selection, and contract review and approval. To a large extent these regulations have been required to ensure that the Department's acquisition procedures are in accordance with the Federal Procurement Regulations and General Accounting Office guidelines. These regulations have at times presented difficulties in the timely placement of contracts and have raised the question of the relative benefit of including lower dollar procurements in this process.

The Department, in recognition of these issues, has revised its Review and Proposed Contract Awards Order by raising the dollar threshold for Departmental review. In addition, the Department is taking preliminary action to revise DOT Order 4200.11 on source selection. There is, of course, little that can be done by the FAA/DOT with respect to the regulations and guidelines prescribed by sources outside the Department which contribute to time delays in contracting.

I might add that we are extremely interested in maximizing competition in all areas of procurement. We recognize the need for a viable industrial base from which to obtain the products and services needed, and to that end we are

continuing our efforts to make the acquisition process as efficient and effective as possible.

Mr. McCloskey has also recommended increased dialogue between FAA and industry. The FAA strongly supports the concept of advising users and industry of our future plans and potential development projects in addition to seeking out comments from these groups. We have encouraged a continuing dialogue with industry relative to our ATC needs. This interaction has been accomplished by frequent meetings with users, industry organizations and companies, by participation in national and international air industry meetings and forums, and by industry review and comments on our future intentions, plans, and equipment specifications. The recent conference on "New E&D Initiatives" and our subsequent follow-up meetings with user groups manifest our intent in this area. Our informal dialogue with industry and users provides a great deal of information regarding our plans and policies. However, we appreciate the need expressed by some for a more formal planning document and are currently re-examining this question.

Mr. McCloskey also proposes a Special Projects Office (SPO) for the computer replacement program, similar to those traditionally utilized in the Department of Defense. We have assessed various alternative methods of providing management for this program ranging from the traditional SPO approach, on the one hand, to FAA's traditional functional/organizational method of operation, on the other. Our assessment has led us to conclude that a hybrid of the two extremes will provide us with the most appropriate vehicle for accomplishing our overall objective of replacing the existing automation capabilities in a manner that will not disrupt the operation of the existing system. It will involve the continuing participation of every element within the FAA having responsibility for the operation of the existing air traffic control system. We, therefore, do not believe that it would be prudent to place the operation of the replacement program in a SPO.

We will, in the near future, establish a Program Manager with an appropriate staff to manage the program. The Program Manager will report to the appropriate Associate Administrator as the program progresses from development through transition to implementation. In addition to the expertise of his staff, the Program Manager will draw upon the expertise of various organizations for support in order

to ensure the continued viability of the existing automated services.

You have also asked me to respond to a series of "Follow-up Questions for FAA Regarding the FY 81 Budget," in addition to various questions submitted by Congressman Goldwater. We are enclosing our responses to the questions posed.

Pursuant to Congressman Goldwater's request, I am also enclosing a copy of the FAA's "Air Traffic Control Radio Frequency Assignment Plan." In addition, Congressman Goldwater requested the following estimates of FAA's research and developments costs for NAS Stage A and ARTS III, and their respective conversion to 1980 dollars:

<u>NAS STAGE A (R,E&D appropriation)</u>		Converted to FY-80\$
FY 1965-1969	\$ 57.6M	\$156.1M
FY 1970	16.9M	41.4M
FY 1971-1974	60.6M	137.6M
	<u>\$135.0M</u>	<u>\$335.1M</u>

ARTS III

FY 1963-1965

ARTS I (R,E&D)	\$ 3.9M	\$ 11.3M
ARTS III (R,E&D)	3.8M	9.7M
	<u>\$ 7.7M</u>	<u>\$ 21.0M</u>

I have also enclosed copies of various contracts with Mitre Corporation as requested by Congressman Volkmer.

In addition, Congressman Volkmer requested that I submit the following information to the Subcommittee concerning the availability of aviation gasoline and jet fuel. Although the FAA has no authority to directly regulate the fuel availability for users of the National Airspace System, the agency has established a liaison with users and oil refiners to monitor general supply and price conditions for the aviation industry. Beginning in January of this year, a monthly aviation fuel report has been distributed by the agency to regional offices and various aviation organizations. The reports currently contain information on jet fuel and aviation gasoline prices and availability. The information is obtained by surveying fixed based operators

(FBOs) at various airports in addition to direct contacts with aviation fuel suppliers. The report identifies those airports which have fuel supply problems, and provides projections of 30, 60, and 90-day availability of aviation gasoline and jet fuel for general aviation and air carriers. In addition, the report lists fuel prices by region, production, stocks, import and export levels, air carrier fuel consumption statistics, and will eventually include information on aviation fuel refinery sales.

When aviation fuel problems arise, the FAA informally coordinates its activities with the Department of Energy (DOE), which has the primary responsibility in this area. DOE will then seek out alternative suppliers to meet the demands of aviation users.

With regard to the specific situation concerning the availability of aviation gasoline, there are several characteristics which adversely impact on the supply of aviation gasoline. First, aviation gasoline is in direct competition with unleaded automobile gasoline. Second, aviation gasoline is a blended fuel which is more difficult to refine than other products. Finally, aviation gasoline represents a very small percentage of refinery products; therefore, a refiner has little incentive to convert to aviation gasoline production.

In addition to these fuel characteristics which limit the supply of aviation gasoline generally, a fire at the Phillips Petroleum Refinery at Borger, Texas, has complicated the current aviation gasoline situation. Phillips is a major supplier of aviation gasoline, especially 100/130 octane low lead, to the Midwest states and to some areas of the Southeast. After stopping distribution completely for several days in late January, Phillips resumed shipment to distributors at 35 percent of amounts previously contracted. Resumption of full allocation is, at best, several months away, and is subject to the completion of agreements between Phillips and other petroleum producers.

Two companies, in addition to Phillips, have been immediately affected by the refinery fire at Borger. Texaco had numerous exchange agreements with Phillips in the middle U.S. As a result of the Borger fire, Texaco began producing aviation gasoline at its Amarillo refinery. They plan on producing aviation gasoline for 60 days, for the benefit of their dealers in Texas only. This is being done at the

expense of unleaded automotive gasoline and may cause problems should stocks of unleaded automotive gasoline fall below the critical level in the area.

Phillips and Texaco are also negotiating an exchange agreement for aviation gasoline supplies from the Port Arthur Texaco refinery. This agreement has yet to be completed and would only be a near term solution. Conoco was also affected at a few of its outlets in the southwest. Their allocations dropped to 40 percent at the beginning of February, but have since been increased to 100 percent for aviation gas customers. Other suppliers have maintained their allocations relatively constant; however, increased demands are being placed on these suppliers because of the overall shortage.

We anticipate that general aviation, particularly local and personal flying, will decline somewhat during the first few months of 1980. However, we anticipate that the effect will be temporary.

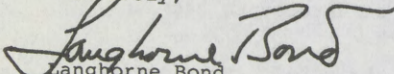
Individuals with whom we have been in contact regarding general aviation fuels are as follows:

Mr. Keith J. Bauer, Department of Energy;
Mr. Walter V. Paulhus, Manager, General Aviation,
Texaco; and
Mr. S. V. Drum, General Manager of Aviation, Chevron.

Mr. Paulhus reports that Texaco is planning an additional 25% production of aviation gasoline beginning in 1980. Mr. Drum of Chevron, reports that a 3% increase is expected in aviation gasoline production in the near future.

We trust that this information is responsive to your inquiry.

Sincerely,


Langhorne Bond
Administrator

Follow-up Questions for FAA Regarding the FY 81 Budget

Question: The budget includes funds for beginning to implement the Discrete Address Beacon System (DABS). It also includes \$6.3 million for DABS and ATARS development. Why are you still developing DABS and ATARS and how much development is left? Can you describe when the system will be in use and to what degree?

Answer: The development of DABS/ATARS will be completed in FY-1983. The first product of the program will be for single site configurations of DABS/ATARS. Additional algorithms are being developed and tested which will be used to interconnect certain single sites into networks for correlated operations. The first system should be in place in late 1983.

Question: Why are you still doing MLS development?

Answer: The MLS development program as outlined in the National Plan will be completed in FY-1981. The current activities are associated with the joint FAA/NASA efforts on the basic-wide system configuration.

Question: You state that the goal of development of BCAS is to supplement the existing system and provide protection in areas not covered. When will BCAS be operational and how many aircraft will be using it?

Answer: The National Standard for Active BCAS is scheduled to be issued in October 1980. We anticipate that most airline aircraft will be equipped as the units are produced by various equipment manufacturers.

Question: When will conflict alert between IFR and properly equipped VFR traffic be operational?

Answer: We plan on completing the development of the software for conflict alert between IFR and

VFR equipped aircraft in late Spring of 1980. The software will then undergo operational evaluations and then implementation decisions will be made by the operational services.

Question: When do you expect that the Electronic Tabular Display Subsystem (ETABS) to eliminate manual flight progress strips to be operational?

Answer: We anticipate completing the developmental phase of ETABS in early 1982. Allowing the normal time for the implementation cycle, the first system should be coming on line in the latter part of 1984.

Question: When do you expect that a multiple runway metering and spacing logic will be implementable and to what degree?

Answer: Based upon a reassessment of the operational requirements for metering and spacing, we have concluded that the program will require a longer term effort than we had anticipated. We have incorporated it as a major element of our integrated flow management program. Implementation of metering and spacing configurations will most probably occur after 1985.

Question: There are indications that you are not funding some of your navigation developments to the level that you would like. Why then are you reducing the level of funding in this area over the last year's funding level? Wouldn't this area offer significant pay-offs for whatever improvements you develop?

Answer: Please refer to my letter of March 12 explaining the FAA's most current thinking about an optimal feasible E&D program. It should be noted that the work necessary to support our decisions concerning the

post-1990 navigation systems will be completed in the late 1982/early 1983 time frame.

Question: You have previously mentioned that the FAA, next to DOD, is AT&T's largest customer. You have a large number of primary, backup, and emergency radios.

- A. Can you describe the failure rates for the major components; Transmitters, receivers, land lines, power sources?
- B. Would you describe in some detail your modernization plan? How much do you expect to reduce costs?

Answer: A. At the present time, we collect outage data on a facility basis rather than on individual transmitters and receivers. Facility performance is expressed in terms of reliability, i.e., probability of no failures in a 24-hour period, calculated on a per radio frequency basis. Thus, the performance figures reflect unexpected failures of radios as well as the ancillary equipment in the facilities. During the past few years the reliability of the communication facilities has averaged over 99 percent.

In addition, the performance of land lines is expressed in terms of Mean-Time-Between-Outages (MTBO). For our en route remote locations during FY 1979, the MTBO was 72 days. This means that, on the average, each Telco line experienced an outage every 72 days.

The failure rate due to unexpected loss of power at our remote en route radio sites during FY 1979 averaged 0.6 failures per site per year.

- B. The major objectives of our voice communications modernization program are to improve system flexibility and responsiveness through the introduction of computer controlled switching systems, and to reduce the annual

operations and maintenance cost through the use of high reliability solid state technology and automated maintenance and restoral techniques. This will be accomplished by the development and implementation of subsystems for each operational environment (centers, terminals, and FSS's). The initial subsystem development will commence in FY 1981. These subsystems, when integrated into area or national networks, will form a voice communication system which is significantly more reliable, provides better utilization of our communication resources, and will cost less to operate than our present system.

It is estimated that consolidation of the FAA radio and phone voice communication into a single modern system would save approximately \$94M a year. These savings are derived from the projected reduction of 166 employee years in our maintenance staff and a significant reduction in our lease service cost.

Question: Several manufacturers have recently introduced large electronic voice switches. Could any of these switches be adapted to your use without your having to develop one?

Answer: Our current plans involve the utilization, development and application of available equipment and techniques to meet our requirements whenever feasible.

Question: When will the National Airspace Data Interchange Network (NADIN) become operational? Will NADIN save money? What modifications to NADIN will be required to accommodate DABS/ATARS and BCAS? What are your plans for digitizing voice over NADIN?

Answer: The first phase of NADIN will become operational in late 1982. Cost savings will primarily be associated with leased line costs and will accrue as the systems' capabilities are expanded.

The introduction of DABS/ATARS will not require modifications to NADIN, but an interface will be required which is included in the program. BCAS will not be involved with NADIN.

The digitizing of voice over NADIN will be a consideration in our future plans.

Question: In your general justification for your FY budget request, you point out 13 major program areas. Do you have System Requirement Statements which align with these 13 major areas? Do you have transition plans for those programs? Would you please provide a tabulation with the following information:

- Program/project number
- Title
- Date of approval of a system requirement statement
- Date of approval of a transition plan
- Date of expected transition to operation
- FY 81 funding request
- Expected development cost to complete

Answer: FAA has divided its R,E&D efforts into 13 major areas for budgetary presentation purposes. There is not necessarily a one-for-one correlation between these major program areas and the individual development projects which we manage. Within these 13 major areas we have identified several major R,E&D programs as being critical to fulfilling the agency's mission, entailing the allocation of relatively large resources or warranting special management attention. These major programs have been placed under FAA's System Acquisition Management Process (SAM). The enclosed table provides the status of those major R,E&D programs which are formally designated as major systems acquisitions.

3/28/80

STATUS
RESEARCH, ENGINEERING AND DEVELOPMENT APPROPRIATION
MAJOR SYSTEM ACQUISITION
PROGRAMS

Program Project Number	Title	Date of Approved System Requirement (initial year of planned F&E buy)	Date of Approval Transition Plan	Date of Expected Transition to Operation	FY-81 Funding Requirement	Expected Development Costs to Completion
075-324	Microwave Landing System (MLS) Development Program	7/71 <u>1</u>	<u>3</u>	FY 1982	\$750K	\$0K
034-241	Discrete Address Beacon System (DABS)	4/73 <u>10</u>	6/80 est.	FY 1981	\$4,215K	\$3,000K
062-223	Voice Switching and Control System (VSCS)	4/80 est.	<u>5</u>	FY 1982-85	\$4,020K	\$18,230K
122-113	En Route Tabular Displays (ETABS)	5/79	<u>12</u>	FY 1983	\$750K	-0-
052-241	Beacon Collision Avoidance System (BCAS)	4/80 est.	<u>5</u>	CY 1983 <u>8</u>	\$5,400K	\$6,200K
123/145/ 162	Advanced Computer Program	12/80 est.	<u>5</u>	FY 1986-88	\$6,480K	\$900,000K <u>9</u>
13	Flight Service Station Automation	1/78	<u>11</u>	FY 1981	\$5,090K	\$13,000K
154-451	Low Level Wind Shear Alert System	7/78	<u>12</u>	FY 1977	-0-	-0-

1 The systems acquisition management (SAM) process requiring formal systems requirements statements was not initiated until FY 1978. Requirements documentation for programs which were substantially into the development cycle prior to the establishment of the SAM process utilized different formats for requirements documentation. Where different formats have been used, the footnotes so indicate.

2 MLS national plan based on RTCA SC-117 requirements approved July 1971.

3 Draft transition plan currently under review by ONR.

4 Included in DABS transition plan.

5 To be developed after R&D phase.

- /6 Multiple technical data packages for specific applications will be delivered during this period.
- /7 To be developed after initial engineering evaluation at NAFEC.
- /8 Initial units in commercial aircraft.
- /9 Current estimate (includes inflation factors).
- /10 ATC performance requirements for developing prototype version of discrete address beacon systems, FAA-EM-73-6, April 1, 1973.
- /11 Implementation decision January 19, 1978.
- /12 Due to time urgency of this safety related program, the 7 R&D prototypes were commissioned without a formal transition plan during 1977-1978.

Questions for FAA from the Honorable Barry M. Goldwater, Jr.

Question: Long Range Planning. Mr. Bond, when you became Administrator you discontinued FAA's longstanding practice of issuing a "Ten Year Plan" and "Policy Summary." Since then the Subcommittee has heard numerous complaints from users and manufacturers about their difficulties in determining what FAA is planning to do past the next year. Why did you discontinue the Ten Year Plan? And, do you plan to replace it with something like the Five Year Plan included in Mr. Albrecht's written testimony?

Answer: I strongly support an extensive interchange with the aviation users and industry on E&D questions and future plans. We highly value professional input concerning system options and facility needs. The regular dialogue we have established, including the "New E&D Initiatives" symposium in which you participated, has gone far to inform all parties on issues, design questions, and capital needs.

The development of FAA's former Ten Year Plans was relatively one-sided in its approach. Today much additional interaction is taking place in the development of long range plans. However, I also see the future need for making more detailed information available to the users and industry, such as provided in Mr. Albrecht's plan. The exact form that such data will take has not as yet been determined, but we are currently focusing on this question. I believe it is increasingly essential to ensure that both FAA and industry have a common framework of understanding regarding future development.

Question: DABS and FSS. Two of your major programs have finally moved from the R&D phase to the implementation phase--DABS and Flight Service Station Modernization. I plan to

testify before Chairman Duncan's Appropriations Subcommittee on these and other issues this Spring. Could you tell me the latest on those two programs? When you discuss DABS could you include plans for ATARS and BCAS implementation?

Answer: We have revised our Flight Service Station program, which I am confident will expedite the consolidation phase of the program. As a result, the improved system, including the automated features, will be available to all users sooner.

Our DABS/ATARS program is remaining on schedule, with funding for the first procurement of production units included in our FY 1981 F&E program. The first units should be in the field in the latter part of 1983.

We will issue the National Standard for Active BCAS in October of 1980. We foresee the air carriers equipping their aircraft as rapidly as the equipment becomes available from the manufacturers.

Inasmuch as DABS/ATARS and BCAS are rather extensive and complex programs, rather than providing a detailed response at this time, the briefing we have scheduled will cover these points.

Question: Mr. Bond, at our Science and Technology Committee hearing on January 29, 1980, you stated the following with respect to your Flight Service Station Automation Program (as recorded in the unedited hearing transcript): "...I believe its program pace is unsatisfactory. We're trying to get that speeded up." Could you provide more details on both sentences of this quotation?

Answer: Our basic problem was in creating a plan and strategy that would provide for the consolidation of Flight Service Stations in the 1982-1983 time frame. Our current plan, as described to you during a recent briefing, essentially provides for the consolidation of the existing 290 Flight Service Stations into 61 stations located in buildings at general aviation airports. Pilots

will be provided direct access to these automated hubs by means of computer terminals and telephones.

Question: You requested \$4.8 million in F,E&D funds to purchase a B-727 simulator. The budget book says that this will be used part-time for R&D. Could you describe this R&D in more detail? Will it involve HUD, CDTI, cockpit alerts and warnings, human factors, wind shear, etc.? And, what percentage of the simulator time will be used for R&D?

Answer: Our first priority is to train FAA inspectors and provide an efficient and economical means for them to maintain their currency. We are currently spending \$2.0M and 1.8 million gallons of fuel per year for in-house training. After we have gained some experience with the simulator, we anticipate utilizing 10-20 percent of its normal operating time for research and development. R&D usage will be dependent upon the type and scope of each effort. Your examples, HUD, wind shear, etc., would be representative of those programs which will be carried out utilizing the simulator.

Question: Could you give more details on "VOR Route Separation Studies" in Program 01. What is the purpose of these studies? Does any segment of the U.S. aviation community (besides the FAA) feel that these studies are necessary? (If so, specify who, so we can contact them.) How much has been spent on these studies in the past and how much is budgeted for the future?

Answer: The purpose of the "VOR Route Separation Studies" is to improve horizontal and lateral separation in CONUS air routes. We are currently studying the following recommendations of the ICAO (9th Air Navigation Conference):

- establishment of VOR changeover points
- warning on VOR system use accuracy
- improve spacing between parallel routes
- protect airspace boundaries
- improve operating standards.

The following organizations participated in the
"Separation Study Review Group":

- Department of Army
- Department of Air Force
- Department of Commerce
- National Aeronautics and Space
Administration (NASA)
- Aeronautical Radio, Inc.
- Aircraft Owners and Pilots Association
(AOPA)
- Air Line Pilots Association (ALPA)
- Air Transport Association of America
- Affiliated Independent Members
- Electronic Industries Association
- United Air Lines
- Mitre Corporation
- Bendix Corporation
- Radio Technical Commission for Aeronautics
- ARINC Corp. (Aeronautical Radio Inc.)
- Princeton University
- Narco Avionics
- Transport Canada
- Department of Transportation Canada

In FY 74 through FY 79 the FAA has spent \$1,403,000 studying problems associated with VOR Route separation. In addition, we have budgeted approximately \$1.8M for FY 80 through FY 85 for this continuing project.

APPENDIX E. AIR TRAFFIC CONTROL RADIO FREQUENCY ASSIGNMENT PLAN

1. PURPOSE. This appendix describes the VHF radio frequency air traffic control communications system.

2. BACKGROUND. Aviation growth has required a commensurate increase in communication channels. Because more spectrum is not available, channel splitting techniques, have been employed.

To meet the demand for new air/ground communication channels, FAA began implementing 25 kHz channel communications for high altitude en route sectors in 1977. For unrestricted IFR operation a 720 channel radio communications capability is necessary.

3. FREQUENCY ASSIGNMENT PLAN.

a. ARTCC En Route. Air Route Traffic Control Center (ARTCC) en route assignments shall be selected on any 25, 50 or 100 kHz channel in the 118-121.4, 123.575-128.825 and 132.025-136 MHz bands. The emergency frequency 121.5 MHz shall have 100 kHz protection. ARTCC low altitude en route assignments shall receive 50 kHz protection wherever possible. At this writing, no air traffic control 25 kHz assignments have been planned except for the high altitude en route structure. Continued aviation growth will eventually dictate 25 kHz channels at lower altitudes and at terminals. As in the high en route program, sufficient advance notice

will be provided. Where necessary to provide low altitude en route communications, 50 or 100 kHz assignments shall be removed from high altitude, en route service and a 25 kHz assignment substitute.

b. AIC Terminal. Where possible, air traffic control towers (ATCT's) shall be assigned one 100 kHz local control channel below 127 MHz. Additional ATCT requirements (approach control, departure control, local control, etc.) will be on 50 or 100 kHz assignments selected from the bands listed in 3a. Ground control assignments, normally will be on 50 or 100 kHz channels between 121.6 and 121.9. If adequate frequency protection cannot be obtained by using frequencies in this band, any frequency in the bands listed in 3a may be assigned. Clearance delivery may also be any 50 or 100 kHz channel in the bands listed in 3a. Where necessary to provide terminal communications, 50 or 100 KHz assignments shall be removed from high altitude en route service and a 25 kHz assignment substituted. The need of 720 channel radio communications capability in terminal service areas is foreseen.

c. Flight Service Stations. Flight Service Stations (FSS) assignments will be selected on any 50 or 100 kHz channel in the 122.0-122.65 MHz band. At some future time, 25 kHz assignments may be necessary. Flight Service Stations will be assigned one 100 kHz channel. The frequencies 123.6 and 123.65 MHz are available to FSS or air traffic control.

4. ALLOCATION OF VHF FREQUENCIES. Figure A5-1 is a listing of the frequencies from 118.0 - 136.0 MHz and the service in which they are used.

FIGURE A5-1

VHF ATC FREQUENCY ALLOCATIONS

<u>FREQUENCY</u> <u>(MHz)</u>	<u>ATC</u> <u>SERVICE</u>
118.0-121.4	Air Traffic Control
121.425-121.475	Band Protection for 121.5
121.5	Emergency Search and Rescue (ELT Operational Check (5 Sec)
121.525-121.575	Band Protection for 121.5
121.6-121.925	Airport Utility and ELT Test
121.93	Aviation Instructional
121.975	Private Aircraft Advisory (FSS)
122.0	FSS Weather Advisory for Private and Air Carrier Aircraft (EFAS)

122.025-122.075	FSS
122.1	FSS Usually Receive Only Associated with VOR (May Be Simplex)
122.125-122.175	FSS
122.2	FSS Common En Route Simplex
122.225-122.675	FSS
122.7	Aeronautical Advisory - UNICOM (AA), Private Aircraft and Air Carriers at Uncontrolled Fields
122.725	AA Private Airports Not Open to the Public
122.75	Available Air-to-Air as of January 1, 1978
122.775	AA or Multicom
122.8	AA
122.825	AA or Multicom

-----MHz-----	-----SERVICE-----
122.85	Multicom
122.875	AA or Multicom
122.9	Multicom - Search and Rescue
122.925	Multicom - Natural Resources
122.950	AA Airports with a control Tower
122.975	AA High Altitude Above 10,000 feet (3000 m) above airfield
123.0	AA
123.025	Helicopter Air-to-Air
123.05	AA, Heliports
123.075	AA, Heliports
123.1	Search and Rescue (Temporary Control Towers, Fly-ins may be assigned on a non interference basis to search and reserve).

123.125-123.275	Flight Test
123.3	Aviation Instructional - Gliders
123.325-123.475	Flight Test
123.5	Aviation Instructional - Gliders
123.525-123.575	Flight Test
123.6-123.65	FSS - Air Traffic Control
123.625-126.175	Air Traffic Control
126.2	Air Traffic Control - Military (Common)
126.225-128.8	Air Traffic Control
128.825-132.0	Operational Control (ARINC)
132.025-134.075	Air Traffic Control
134.1	Air Traffic Control - Military (Common)

134.125-135.825 Air Traffic Control

135.85 Flight Inspection

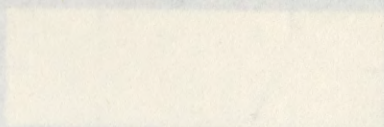
135.875-135.925 Air Traffic Control

135.95 Flight Inspection

135.975 Air Traffic Control

136.0 Space Research







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