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Issues Related to FAA's Modernization of the Air Traffic Control System

Statement of
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Before the
Subcommittee on Aviation
House Committee on Public Works and Transportation

Mr. Chairman and Members of the Subcommittee:

We appreciate the opportunity to testify on the major issues regarding the Federal Aviation Administration's (FAA) modernization of the air traffic control (ATC) system. This hearing is timely because modernization is at a critical stage. Decisions need to be made to ensure that modernization's promise of safety, capacity, and productivity benefits will be achieved. Our testimony will focus on two major issues, modernization problems and funding needs, as well as additional areas of concern:

-- FAA is still experiencing problems in modernizing the ATC system. Major projects, such as the Advanced Automation System, have encountered additional delays. We have reported on several occasions that FAA's ATC modernization effort has fallen well behind schedule. FAA's inability to meet project schedules has deferred benefits to system users and postponed productivity gains to the agency. Additionally, these delays necessitated the creation of new projects, as well as modifications to existing ones.

-- Modernization problems have led to profound financial repercussions. Last year, we estimated that the cost of ATC modernization had more than doubled from the $12-billion effort FAA envisioned in the early 1980s, to an estimated $27 billion. The growing cost of ATC modernization, coupled with FAA's announcement that recurring funding will be needed for the foreseeable future, brings to a head the issue of how FAA's needs will be financed. If existing project schedules can be maintained, greater funding will be required over the next few years. As a result, the Administration has proposed increasing user contributions to the Airport and Airway Trust Fund to pay for modernization and a greater proportion of FAA's operational activities. However, if

FAA cannot expend the additional funds because of future project delays, the danger exists that these increased revenues will only serve to mask the federal deficit and not to benefit the flying public. Denial of the Administration's proposal to increase user fees will require FAA to reassess its approach to modernization. Rather than allowing across-the-board reductions to modernization projects, FAA needs to set project priorities. FAA owes the Congress this information so that funding is provided for those projects most urgently needed.

-- Other emerging issues also deserve attention. FAA needs to more precisely define the roles of its support contractors to avoid overlapping responsibilities and unnecessary costs. Furthermore, the agency needs to identify how many field staff are required to make new systems operational. Otherwise, current schedules and cost estimates have little validity. From a longer range perspective, uncertainties regarding the modification of existing air traffic control procedures must be resolved prior to operational use of new systems. If this is not done, FAA, the flying public, and the aviation community will not gain the full benefits of the new technologies.

We will now discuss each of these issues in greater detail.

MODERNIZATION PROBLEMS

In 1981, FAA launched the National Airspace System (NAS) Plan to modernize, automate, and consolidate its air traffic control system. Projected benefits included increased controller productivity, reductions in FAA maintenance staff, reduced risk of collisions and weather-related accidents for the flying public, and increased fuel efficiency for system users. Although 95 percent of

NAS Plan projects are now under contract, the promise of FAA work force and user benefits remains largely unfulfilled. Delays in project schedules, the need to add more systems to complete modernization, and the resultant cost increases have raised concern about FAA's management of the NAS Plan.

Project Delays and Inadequate Risk-Mitigation

The Department of Transportation (DOT) designated 12 NAS Plan projects as key to the successful completion of the Plan. These projects are either high in cost or are a critical part of the Plan. As such, these key projects were to receive special management oversight by DOT through its Transportation Systems Acquisition Review Council. Despite this special designation, these major systems experienced significant delays in implementation. In November 1988,[1] we reported that implementation milestones had slipped an average of about 2-1/2 years between the 1983 and 1987 NAS Plans. Delays in first-site implementation ranged from 1 to 4 years.

Three problems generally contributed to delays in the development of key projects: (1) inadequate definition of operational and quantity requirements, (2) contractors' technical problems in developing system software, and (3) inadequate operational testing before production. We believe these problems occurred largely because of FAA's inexperience in developing large-scale, highly automated systems and because it did not follow guidance provided by the Office of Management and Budget (OMB) to minimize potential development and production problems. OMB's guidance on major acquisitions is designed to reduce the potential for cost increases, schedule delays, performance deficiencies, and premature commitments to production. The guidance calls for a

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[1]Air Traffic Control: Continued Improvements Needed in FAA's Management of the NAS Plan (GAO/RCED-89-7, Nov. 10, 1988).

disciplined review process at each acquisition phase. This phased approach minimizes the risk of adding requirements during development and allows decisionmakers to make "go/no go" decisions on the basis of demonstrated performance at different stages of a procurement. For example, production commitment could be withheld until a system's performance is tested in a realistic operational environment. We have found that FAA did not follow such guidance, nor did the Department's oversight require its use. As a result, several projects were prematurely moved into full-scale development and production.

For example, production of the $288-million Flight Service Automation System was initiated before the software was developed. Subsequently, this program was delayed for 2 years because of software problems. As a result, the equipment sat in storage. In the case of the Microwave Landing System (MLS), a project that may eventually cost over $1 billion, FAA also did not obtain sufficient performance information before committing to production. Prototype testing, for example, was conducted only in good weather and did not include all system capabilities. MLS entered production even though potential benefits remained unvalidated and safety and reliability capabilities were still questionable. Another key element of the NAS Plan, the $892 million Voice Switching and Control System encountered cost, schedule, and technical difficulties because system requirements were inadequately defined. Both prototype contractors had to substantially modify equipment they initially proposed in order to meet FAA's stringent availability requirements. Additionally, FAA changed operational requirements, which doubled the number of units to be produced. As a result, costs increased and the development schedule was extended by about 4 years.

Over the years, FAA has taken some positive first steps to correct deficiencies in its acquisition process. For example, an agency review team found problems with the quality of project

documentation and supporting data that it attributed to a lack of written procedures. As a result, in 1985, FAA issued guidance on how to prepare, coordinate, and secure approval of key project documents. Consequently, data submissions and reviews have been done in a more timely manner. FAA has also recently issued a new test and evaluation order that, if properly implemented, can address some of the shortcomings we found with how FAA tests systems. Among other actions, the new order requires the air traffic organization to be involved in the testing and evaluation process. FAA needs to ensure it implements this step, because air traffic's agreement is needed to ensure that controller needs will be met. However, FAA's new order does not go far enough. FAA still lacks an independent test and evaluation group.[2] Independent testing is important because contractors, developers, and users may have goals, such as meeting cost and schedule commitments, that conflict with thorough testing. An independent test group within FAA could help ensure that top-level officials are provided unbiased results of system tests when they make key acquisition decisions.

Although many major systems have moved into production, project delays are still occurring. For example, FAA recently announced a 13-month delay in delivery of the Initial Sector Suite System, a major component of the $4.4-billion Advanced Automation System. Other major systems that experienced schedule delays in the past 2 years include the Airport Surveillance Radar (ASR-9), and the Mode S communications system. (See attachments I and II for information on major system schedules and costs).

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[2]Air Traffic Control: FAA Needs to Implement an Effective Testing Program (GAO/IMTEC-89-62, Sept. 22, 1989).

EXPANSION OF MODERNIZATION AND FUNDING IMPLICATIONS

Project delays and new requirements have forced FAA to expand the scope of the original NAS Plan. This expansion has led to a significant increase in the estimated cost of modernization. Furthermore, this has brought us to a key decision point regarding how future modernization activities will be funded.

Scope Expansion and Cost Increases

Because of project delays and increased demand on an air traffic system still recovering from the 1981 controllers' strike, FAA has identified additional requirements and started new initiatives (see attachment III for data on the growth in the number of modernization projects). For example, FAA developed the Interim Support Plan to counter protracted delays in the Advanced Automation System and to procure additional equipment, such as airport surveillance radars. New requirements and initiatives have contributed to building a bow wave of facilities and equipment (F&E) needs (see attachment IV for trends in F&E funding from fiscal years 1982 through 1995). Last year's all-time high of about $1.7 billion for F&E will be eclipsed this year if FAA receives its requested amount of $2.5 billion. FAA projects even greater needs in subsequent fiscal years, reaching a peak of $3 billion in fiscal years 1992 and 1993.

We have disagreed with FAA on how it characterizes modernization. In the past, FAA has differentiated original NAS Plan projects from new requirements, such as radars for the new Denver airport. We reported that regardless of whether projects are designated as NAS Plan or non-NAS Plan, they are all related to ATC modernization and should be managed as a single entity. We estimated total modernization costs at about $27 billion, substantially greater than the $12 billion FAA projected when the

NAS Plan was unveiled. In November 1988, we recommended that FAA revise its Plan to include all projects needed to modernize the ATC system in one single plan, and prioritize such projects.[3] In response, FAA recently stated that it is revamping the NAS Plan to make it a more all-inclusive document called the ATC Capital Investment Plan. We believe placing all ATC needs in one plan is only partially responsive to our recommendation. FAA needs to set relative project priorities on the basis of benefit-cost ratios, mission needs, or safety considerations. Prioritization would provide visibility to FAA's proposed emphasis in the Capital Investment Plan. Indeed, since the new plan will differentiate those projects required to sustain the existing ATC system from those needed to raise capacity, the Congress would be in a better position to weigh trade-offs between near-term and long-term activities.

Funding Modernization

Over the last decade, the Airport and Airway Trust Fund's revenues have been more than adequate to meet annual F&E outlays. The Trust Fund is the funding source for capital development of the nation's air transportation system. Its revenues are generated by fees paid by users in the form of ticket taxes and fuel excise taxes. Past F&E appropriations reflected the slower-than-anticipated pace of modernization caused by project delays. This contributed to increasing the uncommitted balance in the Trust Fund. FAA estimates that this uncommitted balance, often characterized as "the trust fund surplus," will be over $7.5 billion by the end of fiscal year 1990.

The continued movement of major systems toward production will result in higher F&E needs. As noted previously, F&E needs will

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[3]Air Traffic Control: Continued Improvements Needed in FAA's Management of the NAS Plan (GAO/RCED-89-7, Nov. 10, 1988).

peak at about $3 billion in fiscal years 1992 and 1993. Although they will increase significantly, projected F&E requirements, by themselves, do not necessitate an immediate rise in user fees. On the other hand, the Administration's proposal to finance a greater percentage of FAA's operations through the Trust Fund, coupled with these F&E needs, would soon eliminate the Fund's surplus if an increase in user fees was not enacted. Because of the growing needs of FAA's safety work forces, we continue to support the financing of a larger portion of FAA's operations from the Trust Fund.[4]

We believe that in evaluating FAA's F&E reauthorization proposal, this Subcommittee must consider consequences which extend beyond FAA's F&E account. For example, acceptance of the Administration's proposal to increase user fees should ensure a sufficient flow of revenue to support both FAA's projected capital development and operational needs. However, if spending lags behind increased revenues--particularly if modernization delays continue--the Fund's surplus will rise, further masking the federal deficit. In recent testimony, the Comptroller General spoke of the dangers of using such reserves as an excuse to avoid other deficit reduction actions.[5] On the other hand, if user fees stay at their current levels, FAA may need to scale back its modernization effort. Operational needs would require greater reliance on the General Fund, thereby exacerbating the federal deficit. Under this option, our recommendation that FAA prioritize its projects becomes even more urgent. Those systems providing the greatest benefit should be affected the least during the budget reduction process. In our opinion, decisionmakers need to see the relative merits of F&E projects up front in order to evaluate options and weigh the consequences of different funding options.

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[4]Transportation Trust Funds, (GAO/T-RCED-89-36, May 11, 1989).

[5]The Question of Rolling Back the Payroll Tax: Unmasking the Deficit Illusion (GAO/T-HRD-90-10, Feb. 5, 1990).

ADDITIONAL AREAS OF CONCERN

We have also expressed concern about three other areas that require FAA attention. These involve (1) the increasing use of support contractors, (2) field implementation, and (3) successfully integrating new systems into the day-to-day operations of air traffic control.

Increased Use of Support Contractors

Following a review of the NAS Plan in 1982, the White House Science Council Panel recommended that FAA hire a prime contractor charged with the formulation, design, and systems integration of the entire NAS Plan.[6] The panel believed that an independent, experienced, private-sector organization was needed to conduct such an effort. DOT and FAA hired a support contractor but did not completely follow the Panel's recommendation. In 1984, FAA selected Martin Marietta to perform duties as its Systems Engineering and Integration Contractor (SEIC). The SEIC, unlike a prime contractor, is not responsible for either the initial system design or for directly controlling individual system vendors. Instead, Martin Marietta serves as FAA's technical adviser for implementing the NAS Plan. One of the SEIC's primary responsibilities is to ensure that the thousands of components being built will be capable of working together, a process called systems integration. Working with FAA, the SEIC identified hundreds of incomplete or incorrect interfaces between systems. Corrective action had to be taken in the form of engineering changes and adding new projects.

As FAA's modernization effort has expanded, so has its use of support contractors. Most recently, FAA awarded a $139-million

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[6]Report of the White House Science Council Panel on the National Airspace System Proposal by the FAA, Office of Science and Technology Policy, Nov. 1982.

Systems Engineering and Technical Assistance (SETA) contract to Federal Systems Group of TRW Incorporated to assist with its automation effort, including such projects as the Advanced Automation System. Some of the types of tasks the SETA will perform parallel those listed in Martin Marietta's contract.

Because of FAA's growing use of support contractors, we are concerned about how additional players will affect the SEIC's overall role in integrating all modernization projects. FAA officials told us that they plan to review their overall policy on support contractors. We believe this assessment should, at a minimum, define precise roles to avoid overlapping responsibilities and unnecessary costs. Furthermore, in light of the recurring nature of ATC modernization, development of in-house systems engineering expertise is an option that deserves serious consideration.

Weaknesses in Field Implementation

We initially focused our review of the NAS Plan on the front-end of the acquisition process, namely systems development activities. As more systems were developed, we expanded our review to encompass field implementation. Field implementation involves planning and scheduling, site preparation, installing new equipment, and training staff to operate and maintain facilities. We found two major problems in FAA's field implementation of the NAS Plan.[7] First, information systems for managing the implementation phase of modernization were inadequate and, as a result, did not include reliable estimates of personnel resources, among other problems. Second, headquarters' plans inadequately defined requirements and time frames for tasks to be performed by FAA's regions. For example, we found that original deployment

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[7]Air Traffic Control: FAA's Implementation of Modernization Projects in the Field, (GAO/RCED-89-92, June 28, 1989).

plans for radio communications links were based on an invalid assumption--that equipment could be installed on existing radio microwave towers--rather than site analyses. Not all the existing towers were high enough or in the right locations to meet operational requirements. Some equipment that had been installed had to be dismantled and reinstalled in taller towers or at different locations. While these field implementation difficulties did not result in significant installation delays because equipment was not being delivered on time, we believe these issues will become more critical as equipment reaches the field in substantial numbers. We have just initiated a new assignment to analyze the status of FAA's efforts to resolve these problems. We expect to report on the results of our work early next year.

In addition, although FAA has not identified its complete staffing needs for implementation, it appears that the agency will need substantially more operations staff--such as controllers and maintenance technicians--at its Air Route Traffic Control Centers. For example, at the Seattle Center alone, FAA estimates that 225 additional staff years are needed over the next 5 fiscal years to accomplish implementation tasks associated with automation projects such as the Advanced Automation System. These resource shortfalls will occur despite the services of a Technical Support Services Contractor (TSSC) to assist with field implementation activities. The TSSC contract was awarded in 1988 at an estimated value of $368 million. We pointed out 2 years ago that this contract would be inadequate to meet FAA's field implementation requirements. We believe that until FAA fully defines its complete staffing needs, it cannot ensure that it will meet current schedule milestones within projected costs.

Integration of Technology

FAA faces a major challenge in successfully incorporating new ATC systems into its day-to-day air traffic control environment.

We reported in October 1989 on two problem areas, both associated with the detection and dissemination of hazardous weather information. Specifically, we found that operational procedures for using the Airport Surveillance Radar's (ASR-9) enhanced weather capabilities were not yet developed.[8] We were concerned about the procedures' absence because one unit was in operation and more units were being installed. Controllers had no guidance on how often to use the radar's weather channel--which can detect various levels of precipitation intensity--or how to interpret the radar's precipitation display. FAA officials believe that they need to obtain a better understanding of the ASR-9 weather channel's capabilities, and the effects of intense precipitation on aircraft, prior to developing ironclad procedures. We recommended that the agency issue interim guidelines if significant ASR-9 implementation will occur before final procedures are developed. While it generally agreed, FAA has not formally replied to our recommendation.

Similarly, FAA needs to resolve how its air traffic controllers will use wind shear warnings from its new Terminal Doppler Weather Radar (TDWR). Although operational deployment of the radar is not scheduled until 1993, concerns raised during operational tests in Denver demonstrated that these issues need to be addressed. In particular, during system testing in 1988, four pilots from the same airline flew their aircraft into wind shear activity despite warnings from controllers. Later analysis concluded that the crews either did not hear clearly or did not know the meaning of the terms used in the controller's alert message. Although FAA has considered some changes to the structure and content of the advisory message, it has not yet tested the feasibility of the alternative of rerouting planes around wind shear activity.

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[8]Aviation Weather: FAA Needs to Resolve Questions Involving the Use of New Radars (GAO/RCED-90-17, Oct. 12, 1989).

We believe the problems associated with the ASR-9 and TDWR reflect FAA's difficulty in achieving full benefits from new systems, and that FAA will face similar problems when integrating other systems into the ATC environment. For example, FAA projects that future air traffic control using the Advanced Automation System will eventually permit automated routine clearances to be issued directly to pilots. At issue is how controllers will regain control in a safe manner if computer malfunctions occur. FAA needs to address these human factors-related issues if the traveling public is to receive the full safety and capacity benefits of technological advances.

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In summary, we believe FAA has made progress toward modernizing certain portions of the ATC system. However, in light of the tremendous levels of F&E funding projected for the next few years, it is crucial that FAA show the Congress, the aviation community, and the flying public that ongoing and future activities will result in demonstrable improvements. It is also important, in this year of Trust Fund reauthorization, that we come to grips with the issue of how ATC modernization should be financed. Furthermore, to minimize future delays, FAA needs to ensure that systems are thoroughly tested and to promptly resolve open issues related to implementation and integration of the new technologies with existing operational procedures. We intend to continue our work in advising the Congress on FAA's progress in modernizing the ATC system through both cross-cutting and system-specific reviews.

This concludes our prepared statement. I will be pleased to address the Subcommittee's questions at this time.

ATTACHMENT I

NAS PLAN MILESTONES FOR MAJOR SYSTEM ACQUISITIONS

System Name	Year of First-Site Implementation			Year of Last-Site Implementation		
	1983 Plan	1987 Plan	1989 Plan	1983 Plan	1987 Plan	1989 Plan
Advanced Automation System (AAS)	1990	1993	1994	1994	1998	2000
Air Route Surveillance Radar (ARSR-4)	1985	1987	1988	1995	1996	1996
Airport Surveillance Radar (ASR-9)	1985	1988	1989	1992	1992	1993
Automated Weather Observing System (AWOS)	1986	1989	1989	1990	1994	1994
Central Weather Processor (CWP)	1990	1994	1990	1991	1995	1996
Flight Service Automation System (FSAS)	1984	1986	1986	1989	1994	1994
Host Computer	1986	1987	1987	1987	1989	1988
Microwave Landing System (MLS)	1985	1988	1988	1999	2001	2004
Mode S	1986	1990	1992	1993	1995	2000
Radio Communication Links (RCL)	1985	1986	1986	1989	1992	1993
Terminal Doppler Weather Radar (TDWR)	[a]	1993	1993	[a]	1996	1996
Voice Switching and Control System (VSCS)	1989	1991	1993	1992	1993	1995

[a]The TDWR was not included in the 1983 NAS Plan.
Source: FAA 1983, 1987, and 1989 NAS Plans.

DESCRIPTIONS AND COSTS FOR MAJOR SYSTEMS ACQUISITIONS

Advanced Automation System (AAS)
Total estimated F&E cost: $4.4 billion

FAA expects AAS to replace the computer hardware, software, and air traffic controller work stations at airport tower, terminal area, and en route air traffic control facilities. According to FAA, AAS benefits include (1) increasing controller productivity and ATC system availability, (2) saving fuel and passenger time, and (3) reducing operating costs. Benefits also are expected to accrue from automating many functions now performed by controllers and consolidating en route and terminal facilities.

Air Route Surveillance Radar (ARSR-4)
Total estimated F&E cost: $476 million

Able to search long distances, ARSR-4 radars provide air traffic controllers with radar coverage of both en route aircraft and weather information. These radars rely only on signals reflected off of aircraft or weather and are called primary radars. The ARSR-4s are the fourth in a series developed to supplement "beacon radars", which, unlike primary radars, receive more precise signals from aircraft and are controllers' main source of air traffic surveillance information.

Airport Surveillance Radar (ASR-9)
Total estimated F&E cost: $711 million

The ASR-9 is primarily a short-range, highly accurate system for monitoring aircraft movement and position within a radius of 60 miles from the airport terminal. Air traffic controllers use ASR aircraft position data to keep aircraft safely separated and control their movements into and out of the airport. In replacing the older models, the ASR-9 will provide controllers improved aircraft detection and improved hazardous weather information, including a six-level weather display, each showing a different degree of precipitation severity.

Automated Weather Observing System (AWOS)
Total estimated F&E cost: $199 million

FAA plans to install this system primarily at nontowered airports where no human weather observers are currently stationed. At some towered airports, the system also will replace the current system of human observers. It will provide data describing nine critical airport weather elements. This information will be sent directly to pilots by computer-synthesized voice.

Central Weather Processor (CWP)
Total estimated F&E cost: $129 million

This system's purpose is to collect, synthesize, and disseminate weather data from all sources and produce data that are tailored to user's specific needs. The CWP has two components. The first is the commercially available Meteorologist Weather Processor, which will be leased in the near term. The second element is a Real-Time Weather Processor, which will create unique weather products required by the National Airspace System.

Flight Service Automation System (FSAS)
Total estimated F&E cost: $288 million

This system is automating the way FAA provides weather data to pilots before take-off. For example, one new telephone service allows pilots to record their flight plans and obtain recorded messages concerning weather for both the general area and popular air routes, thus avoiding or reducing the time needed to talk to a flight specialist. It will also provide improved access to FAA's system of notifying pilots of very recent information concerning changes to any aspect of the National Airspace System. The 317 manual Flight Service Stations (FSS) that existed in 1981 are scheduled to be consolidated into 60 automated FSSs.

Host Computer
Total estimated F&E cost: $291 million

The Host computer has replaced the existing computers at FAA's 20 en route air traffic control centers with new, higher capacity computers. The Host uses a modified version of the previous air traffic control software. FAA justified the Hose computer acquisition on the basis of existing computers' capacity limitations and the agency's inability to implement operational and safety enhancements until additional capacity was available.

Microwave Landing System (MLS)
Total estimated F&E cost: $1.1 billion

This system's purpose is to guide specially equipped aircraft to safe landings in reduced visibility conditions. Because it can guide approaching aircraft from a wider angle than can the Instrument Landing Systems currently in place, FAA believes that MLS will allow more varied landing approaches. This could permit aircraft to land more frequently and could give pilots more flexibility in choosing approach paths to the airport than possible using the existing systems. This would enhance an airport's capacity to accept landing aircraft and could mitigate the noise effects of aircraft by directing the noise over less populated areas than is possible with current landing systems.

Mode S
Total estimated F&E cost: $495 million

The Mode S system consists of sensors and antennae on the ground for receiving and transmitting information from and to aircraft. Mode S will replace existing radar beacon systems aboard commercial and general aviation aircraft. Unlike the current beacon system, in which all aircraft within range respond to signals from the ground radar, Mode S will enable separate addressing by specific aircraft. This will reduce signal interference and establish a message channel for the aircraft to exchange data with the ground.

Radio Communication Links (RCL)
Total estimated F&E cost: $284 million

FAA is planning to install the RCL to replace and upgrade existing Radio Microwave Link communications lines used to transmit voice and radar data communications nationwide; these include weather and air traffic information. Current needs are met with a mixture of FAA-owned and -leased communication lines. However, the FAA-owned equipment is outdated and expensive to maintain and the leased lines are becoming increasingly expensive. In addition, the FAA-owned equipment will not meet NAS Plan requirements for both system expansion and flexibility to accommodate new facilities and consolidation of facilities.

Terminal Doppler Weather Radar (TDWR)
Total estimated F&E cost: $323 million

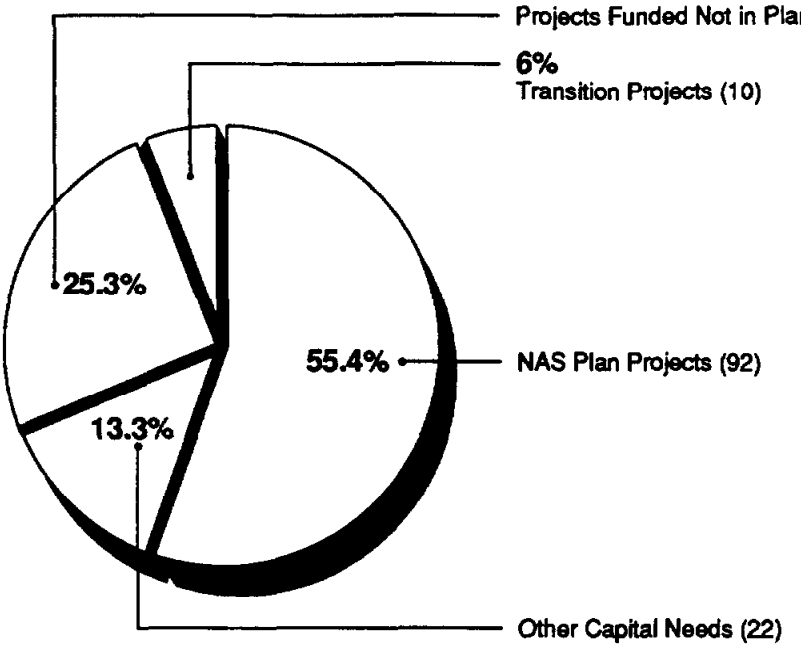
To help guard against wind shear around airports, FAA is planning to install the TDWR as its primary, ground-based wind-shear detection system. By detecting fast-developing wind velocity variations, this radar helps to identify the presence of wind-shear conditions. Currently, pilots and controllers rely on other less responsive sensors to detect wind shear.

Voice Switching and Control System (VSCS)
Total estimated F&E cost: $892 million

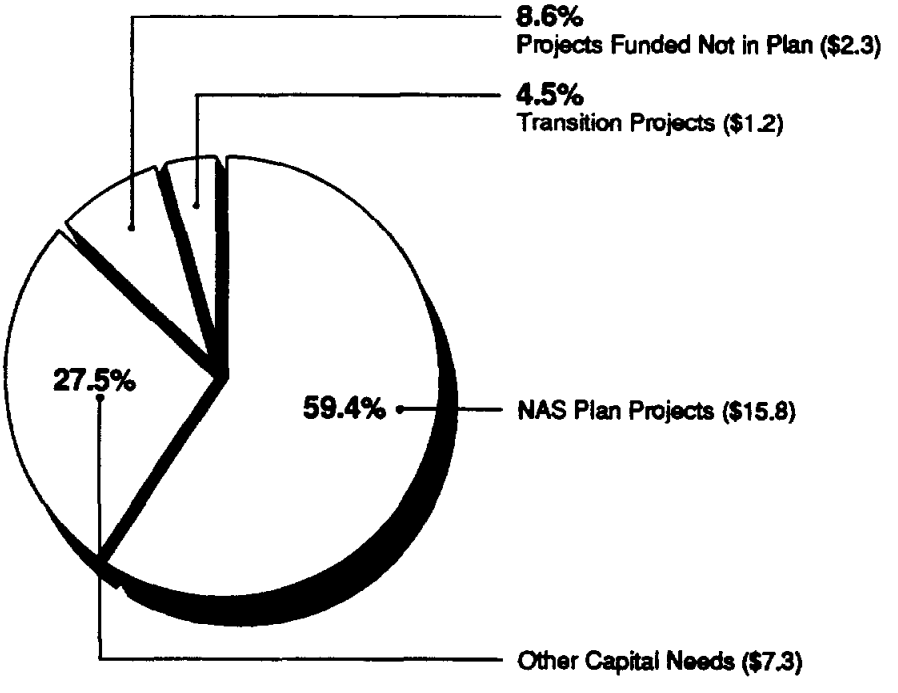
The VSCS will enhance voice communications at 23 large air traffic control facilities by improving the ability of communications to be switched among controllers and between controllers and pilots. FAA expects VSCS to increase controller productivity and reduce overall communications costs because equipment will be owned rather than leased.

ATTACHMENT III

NAS PLAN AND OTHER MODERNIZATION PROJECTS

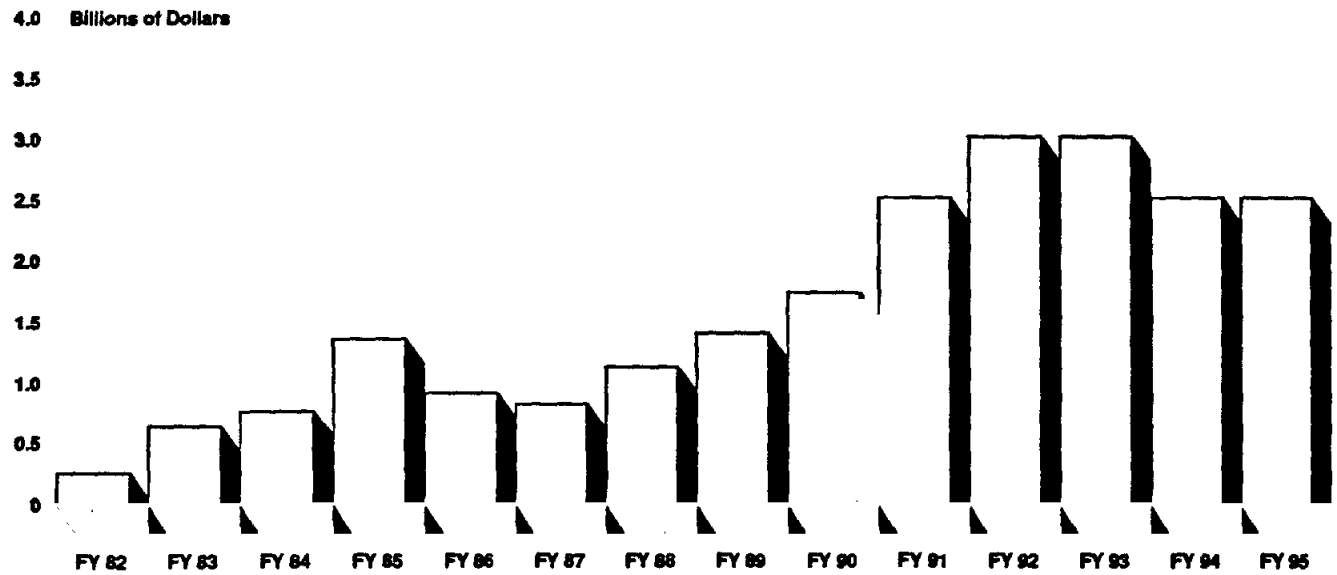


F&E FUNDING BY TYPE OF MODERNIZATION PROJECT (Dollars in Billions)



ATTACHMENT IV

F&E FUNDING BY FISCAL YEAR



F&E Funding from FY 82 through FY 95

Funding for FY 82 through FY 90 is amount appropriated by Congress

FY 91 Funding represents FAA Budget Submission to Congress

Funding for FY 92 - FY 95 represents FAA's reauthorization proposal