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Effects of Delays in FAA's NAS Plan

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Before the
Subcommittee on Transportation of the
Senate Committee on Appropriations

Mr. Chairman and Members of the Subcommittee:

We appreciate this opportunity to comment on the Federal Aviation Administration's (FAA's) fiscal year 1988 budget request. Yesterday, we commented on appropriation issues relating to developing FAA's human resources, including adequate controller, inspector, and airway facilities maintenance work forces. Today, Dr. Palmer and I will comment on FAA's request for procuring the technologies required for the National Airspace System (NAS) plan.

We would like to point out again that FAA's human resource efforts are not mutually exclusive from and, in some instances, are partly dependent on modernization, automation, and consolidation of the national airspace system. For instance, FAA has reduced its maintenance work load for navigational aids 21 percent by replacing tube-type equipment with solid state technology. Conversely, schedule delays in certain NAS plan projects have resulted in corresponding delays in anticipated controller and maintenance productivity gains.

STATUS OF THE NAS PLAN

Because of its current $16 billion price tag and its impact on other aviation safety and efficiency issues, we have, over the past few years, monitored and reported on many aspects of FAA's NAS plan activities, including those 11 projects the Department of Transportation (DOT) had designated as major systems.[1] We have

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[1]DOT, which has final acquisition authority for the NAS plan, had designated 11 of the plan's 150 projects as major systems because they either exceed $150 million or are critical components of the plan. (A twelfth major system--the terminal Doppler weather radar--has recently been added.) The total cost for the 11 systems is about $8 billion, or roughly one half the plan's current estimated cost. A general description and status of each of the 11 systems are included as attachment II.

found that over the past 5 years all of these systems have experienced schedule delays ranging from 1 to 8 years.[2] (See attachment I.)

Causes for these delays, as shown in the attached FAA analysis (see attachment III), included FAA underestimating

-- the complexity of these highly-automated systems,

-- the time needed to develop system software, and

-- the interdependency among the systems.

Some technologies thought to be fully developed and available "off-the-shelf" required further development and testing to meet existing air traffic control operational requirements. For others, FAA had not defined the operational requirements well enough to permit developing adequate system specifications.

To expedite the benefits it estimated the NAS plan would provide, FAA used a fast-track acquisition strategy for many of the plan's major systems, involving overlapping development and production phases. (A practice known as "concurrency.") This strategy did not, however, include adequately demonstrating many systems' performance before FAA committed to production contracts, resulting in further delays.

We often have shown that this approach leads to increased technical, operational, and economic risks in highly complex government programs, including defense weapon systems. For example, we testified on February 25, 1987, that the high degree of

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[2]Aviation Acquisition: Improved Process Needs to be Followed (GAO/RCED-87-8, Mar. 26, 1987).

concurrency between development and production of the Air Force's B-1B bomber contributed substantially to that program's problems. We concluded that, for a technically challenging development program, one that advances the state of the art, testing and development should be reasonably complete before production begins.[3]

FAA has recently changed its acquisition process to correct some of the problems that have contributed to NAS plan delays. In addition to issuing its first standard operating procedures for acquiring major systems, the agency has established test and evaluation policies and procedures. FAA also is rethinking its approach to acquiring or designing individual systems.

These improvements are too late to benefit most of the major NAS plan systems, but a few, including the critical Advanced Automation System could still benefit. The same should be true for other NAS plan projects that DOT designates as major systems subject to FAA's new policies and procedures, such as the recently added terminal Doppler weather radar.

FAA IS ENTERING A CRITICAL PHASE OF THE NAS PLAN

The delays experienced to date have been system-specific. The NAS plan is, however, approaching a critical phase in which many contractors will begin delivering hardware and software to FAA field sites. The challenge for FAA will be not only to install the systems but to integrate more than 1,000 interfaces between the

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[3]The B-1B Aircraft Program (GAO/T-NSIAD-87-4A, Feb. 25, 1987).

various radars, data processors, and data links that comprise the NAS plan.

This phase is complicated further by the number of groups involved. While FAA headquarters retains decision-making authority, it will depend on

-- the Martin Marietta Corporation to share responsibility and accountability for NAS plan effectiveness and provide system engineering and integration contractor (SEIC) services;
-- a technical support services contractor (TSSC) to provide hands-on hardware installation, testing, and, to a lesser extent, site preparation for possibly over 20,000 separate facilities and pieces of equipment; and
-- its nine autonomous regional offices to provide direction to the technical support services contractor and to contract competitively for individual construction efforts.

SEIC role, contribution, and costs

In January 1984 FAA and Martin Marietta entered into a 10-year, $684 million contract for systems engineering and integration services. The contract is divided into three phases--a 5-year phase ending in January 1989, followed by two optional phases of 3 and 2 years. Over the past 3 years

-- the cost of this contract has increased over $200 million;
-- Martin Marietta's responsibilities have been expanded to include technical direction for six NAS plan systems; and
-- Martin Marietta has received over 80 percent of the available performance award fee bonuses despite delays, cost overruns, and other acquisition problems relating to

the NAS plan's major systems--all of which are used in determining the award fee bonuses.

In light of these events, FAA is preparing a report on alternatives to the existing contractual agreement in response to questions raised by the Congress about Martin Marietta's independence and FAA's award fee process. We will review FAA's report to identify the major, contract-related performance issues that the Congress should consider in deciding whether to fund the contract's first option phase in fiscal year 1989.

TSSC role, contribution, and cost

FAA anticipates awarding a technical support services contract in June of 1988. FAA estimates that the contract will cost between $350 million and $400 million over 9 years. According to FAA, this cost is within the scope of the current NAS plan estimate.

The need for such support appears well founded. A 1984 FAA study suggests that FAA will need 5,000 more staff years than it presently has available to install the NAS plan systems. Both FAA and Martin Marietta have since confirmed that FAA needs more people to supplement FAA's facilities and equipment work force.

Our ongoing review of TSSC has identified two issues we believe need to be addressed before a technical support services contract is awarded. First, Martin Marietta has identified a 1,850 staff-year shortfall for site-adapted design work that it believes is outside the SEIC scope and FAA must resolve in some other way. Conversely, FAA's Office of Chief Counsel believes that this same site-adapted design work is clearly within the scope of the SEIC contract and is Martin Marietta's responsibility. If the latter is true, FAA must closely monitor TSSC contract development and

implementation to ensure that it does not include any site-adapted design work.

Second, FAA must still decide what kind of contract to use for the TSSC. Much of the work to be accomplished under the technical support services contract cannot be precisely defined to obtain real price competition in the contract award process. This is so because the contractor will be used to supplement FAA's work force and the work to be performed is dependent on the delivery schedules of others, such as the individual system contractors. Therefore, a "level-of-effort" contractual arrangement, whereby potential contractors bid on work skills and projected levels of staff years identified by FAA rather than on an indefinite description of work to be performed, may be appropriate. Under this type of arrangement, FAA would commit TSSC resources only after identifying the work to be performed.

EFFECTS OF NAS PLAN DELAYS ON SYSTEM SAFETY AND EFFICIENCY

It has become increasingly apparent to us that, even with substantial management efforts, the NAS plan integration challenges lying ahead for FAA are such that further delays and other acquisition problems may be unavoidable. In addition to delaying various anticipated work force productivity gains, existing and expected NAS plan schedule delays are having and will continue to have a variety of other effects.

For instance, NAS plan delays have postponed almost $38 billion in anticipated aviation user benefits. These include $24 billion in reduced airline schedule delays and almost $14 billion in fuel efficiencies that are expected to result from allowing

users to operate with a minimum of artificial constraints along preferred routes.

The airlines and the traveling public are becoming increasingly dissatisfied with mounting schedule delays. Delays were up 24 percent in 1986 compared to 1985. And the airlines are pressing FAA to reduce certain aircraft separation standards now even though the advanced technologies in the NAS plan, that will permit FAA to better track aircraft so it can reduce separation standards without compromising safety, have been delayed.

IMPACT OF NAS PLAN DELAYS ON CONGRESSIONAL DELIBERATIONS

Another effect of NAS plan delays is that revenues into the plan funding source--the airport and airway trust fund--were set in 1982 at a level that would have paid for the plan if it had proceeded on schedule. Schedule delays over the past 5 years have resulted in a huge unused balance, which FAA estimates will reach $5.6 billion by the end of fiscal year 1987.

Additional delays may further increase the size of the trust fund's unused balance. We reported in May 1986 that the unused balance in the trust fund could increase to $12.4 billion by the end of fiscal year 1990 even if (1) the trust fund and aviation taxes are reauthorized without change and (2) revenues and expenditures materialize as projected.[4] Unless reauthorized by the Congress, the trust fund expires at the end of 1987.

The trust fund has an unused balance primarily because fiscal year appropriations for the NAS plan through fiscal year 1987 have lagged almost $1.6 billion behind the amount authorized in the

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[4]Aviation Funding: Options Available for Reducing the Aviation Trust Fund Balance (GAO/RCED-86-124BR, May 21, 1986).

Airport and Airway Improvement Act of 1982 (Title V of Public Law 97-284). Moreover, because of a penalty provision in the 1982 authorization act, the shortfall between NAS plan and airport improvement program authorizations and appropriations through fiscal year 1987 will cause the share of FAA operations and maintenance appropriations financed from the trust fund to be $3.3 billion lower than authorized.[5]

FAA, DOT, and others have pointed to the appropriation shortfall as a reason for NAS plan delays. Our work, however, shows that none of the NAS plan major systems have experienced a shortage of funding to date. FAA simply has not been able to accomplish as much as originally anticipated in the 1981 plan on which the fiscal year 1982 through 1987 authorizations were based.

This presents a dilemma for the Congress as it deliberates reauthorizing the trust fund this year. FAA's own analysis of its 1983 NAS plan update, which it says is the appropriate baseline on which to measure progress, shows that the plan's major systems have slipped from 6 months to 4 years since the 1983 update was published. Therefore, appropriations may continue to lag behind authorizations. Until such time as the baseline for authorizations reflects realistic implementation schedules, we expect that the

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[5]Currently, the maximum allowable amount of trust funds that can be used to pay FAA's operations and maintenance costs is determined through the use of a formula specified in the 1982 Act. The formula was set up to provide an incentive to fully fund the authorized amounts for the airport and airway development programs. The closer appropriations for these programs match the amounts authorized, the greater the amount that can be used for operations and maintenance. As the difference between the amounts authorized and appropriated for airport and airway development programs increases, the application for the formula results in a lesser amount that can be used for operations and maintenance.

Congress will face a continued growth in the trust fund's already substantial unused balance unless changes are made to the authorizing legislation.

FAA's inability to deliver promised aviation user benefits on schedule along with the current and projected size of the trust fund balance have generated a variety of demands for spending programs. In addition, the fund balance has resulted in proposals to remove the trust fund from the unified federal budget and exempt it from the requirements of the Balanced Budget and Emergency Deficit Control Act of 1985.

The Air Transport Association (ATA) estimates that scheduling delays, which the NAS plan is intended to reduce, are costing the airlines and their customers about $2 billion annually. These delays are one of the reasons for ATA's proposal to set up a federal corporation to oversee FAA's operational functions. The Reason Foundation has called for a private, nonprofit, user-oriented corporation responsible for air traffic control facilities, personnel, and equipment. And, the Aircraft Owners and Pilots Association has also recommended that FAA be removed from the oversight of DOT and its functions be restored as an independent agency. All of these proposals would require changes to existing law, and simply changing FAA's organizational structure may not solve the underlying causes for NAS plan schedule delays.

TERMINAL DOPPLER WEATHER RADAR

In the meantime, our work on four NAS plan major systems has identified issues that should be addressed before fiscal year 1988 funds are appropriated. Despite recent changes to FAA's acquisition process, the current implementation schedule for the

first of the four systems--the terminal Doppler weather radar--does not allow adequate time to resolve the many technical issues that are still outstanding. If the radar is to be FAA's "optimal" ground-based, low-level wind shear detection system, it should, according to FAA, be able to

(1) measure accurately the wind shear headwind-tailwind component,

(2) scan all airport runways and flight paths,

(3) forecast the development of microbursts (extremely violent, rapidly developing, vertical wind shears) by detecting wind shear precursors,

(4) detect at least 90 percent of all microbursts,

(5) provide a 10-percent or less false alarm rate, and

(6) be fully automated so that radar signals are automatically translated into information that is useful to controllers and pilots.

It is not likely that all of these criteria can be met by FAA's planned fiscal year 1988 production contract date.

We recognize that this system has significant safety benefits and recommend that the Congress appropriate the $130 million requested by FAA in fiscal year 1988. We believe however, that FAA should be required to identify the safety and other implications associated with any unresolved technical issues and adequately demonstrate that the system can meet at least minimal requirements before committing to production.

MICROWAVE LANDING SYSTEM

We have also looked at the microwave landing system (MLS)--the second most expensive NAS plan project, costing $1.5 billion. FAA

currently plans to replace every existing instrument landing system (ILS) in use with an MLS. This, in turn, will require every aircraft owner who wants precision landing capability to buy new on-board MLS avionics equipment, including the entire commercial fleet and over 50 percent of the general aviation aircraft which are presently equipped to use ILS.

Our continuing evaluation of this system raises policy issues concerning FAA's current procurement and implementation plan. We have briefed appropriate DOT officials on our findings relating to the system's need and justification, cost and benefits, and implementation strategy. We have also given FAA our written observations, concerning the validity of the assumptions and calculations made in the original 1976 cost-benefit study and the limited 1983 update, for consideration in conducting its new cost-benefit study to be issued this August.

Our report on this highly complex and controversial system is being drafted at this time. But, because you must make judgments on MLS before we can finish, we will present our preliminary findings today.

MLS was originally justified in 1969 as a replacement for ILS, but during the intervening 18 years, FAA has largely fixed the problems it had been having with the ILS. For example, solutions have been found--and are now being implemented--for the ILS' reliability, siting, and radio channel congestion problems. Improvements to both on-board avionics and ILS ground-based equipment now permit more landings under lower ceiling and visibility conditions than before. There are some airports and runways, however,

(1) where a precision landing capability is justified, but an ILS cannot be sited,

(2) where operations, such as helicopter activity, may economically justify MLS rather than ILS, or

(3) where MLS is needed to meet international commitments made in 1978.

We have found little support for FAA's current MLS implementation strategy by either the Air Transport Association or the 10 major air carriers (representing about 70 percent of the 30 largest airlines' total enplanements). Instead, they are interested in having a precision landing capability at airports and on runways which presently have none. Their lack of support for MLS is reflected in a March 18, 1987, letter from Boeing to the FAA Administrator informing him that recent detailed negotiations with its customers resulted in every airline rejecting the MLS option being offered by Boeing. As a result, Boeing stated it would not begin delivery of MLS-equipped 747s in 1988 as originally planned. This means that Boeing aircraft delivered over the next 4 to 5 years will not be equipped for MLS.

Some recent movement has occurred toward accepting MLS as a long-term complement to, rather than a replacement for, ILS; and FAA now assumes that ILSs and MLSs will be collocated until at least 1998. FAA is also in the process of rethinking its MLS implementation plan and is developing a new policy for acquiring more ILSs that will foster their use where they are needed and can be supported. Further, the Department of Defense now plans to equip its transport aircraft with both ILS and MLS avionics and to equip its tactical aircraft with dual avionics that will be

compatible with both ILS and MLS ground units. This will ensure civilian/military compatibility.

In the meantime, FAA's "official" plan still is to acquire 1,250 MLSs under an all-or-nothing ILS replacement strategy. Toward this end, FAA is requesting $48.7 million in fiscal year 1988 to begin a 500-unit, $572 million, second MLS procurement. While we think MLS should be used when it provides important advantages, we see no basis for appropriating funds for a second buy until FAA's implementation strategy is revised to recognize MLS as a long-term complement to ILS and a decision is made on both where to locate the 178 units already acquired and how many more MLS units are justified.

AUTOMATED FLIGHT SERVICE STATIONS

While FAA's MLS implementation strategy may have been overtaken by events, our work on the third major system--FAA's flight service station consolidation program--shows that it deserves this Subcommittee's continued support. We have recently completed our work on various aspects of this program for the Chairman of the Joint Economic Committee and the Chairman of the House Subcommittee on Aviation. What we found is that FAA has solved most of the start-up problems it had when it began consolidating flight service stations. For example, pilot complaints about lost flight plans within FAA's new, partially automated Model 1 system have been corrected. Delayed access to weather briefers, the other main complaint by pilots, is due primarily to staffing constraints at the automated stations rather than to Model 1 system deficiencies.

The staffing problem has arisen because consolidation of flight service specialists at the automated stations has been delayed by the lack of Permanent Change of Station funds. If FAA is to achieve the benefits of increased productivity that economies of scale make possible, flight service station consolidation must proceed.

For fiscal year 1988, FAA is requesting $25.5 million to reconfigure Model 1 software to increase the system's operating capacity and complete consolidation. The House Committee on Appropriations has sought assurance from DOT that the present total estimated cost of FAA's proposed Model 1 reconfiguration will not grow and that this option is the most cost-effective and timely alternative available.

Our work to date indicates that FAA's proposed approach may not be the most cost-effective and timely alternative. Under FAA's proposed approach, consolidation of the remaining flight service stations would begin in October 1989 and be completed in August 1993. Another alternative developed by the MITRE Corporation for FAA would permit consolidation to begin now, thus permitting FAA to capture additional efficiency benefits at less cost than FAA's preferred approach. This is possible because MITRE proposes to use automation hardware and software as well as data processing systems already purchased by FAA. We are currently drafting a report on this subject.

AUTOMATED WEATHER OBSERVING SYSTEM

We have also found some evidence suggesting FAA may be changing its approach to providing weather observations for areas previously served by flight service stations that have been closed.

FAA plans to provide weather observations by contracting out for weather observers. Once the plan is implemented, FAA's consolidated flight service stations will meet the legislative requirement in the Airport and Airway Improvement Act of 1982 to provide as good or better weather information than the old flight service stations.

FAA's fiscal year 1988 budget request, however, includes $2.7 million to begin installing automated weather observing systems (AWOS) at locations where flight service stations had been providing weather observations before they were closed. FAA's justification is that AWOS is cheaper than providing weather observations through contracted weather observers.

Our work on this fourth system, presented in a July 1985 report, found that FAA's operational testing had shown that AWOS did not meet all of FAA's operational requirements for the nine weather elements considered essential to providing airport and area aviation weather forecasts and to maintaining aviation safety.[6] Conversely, surface weather observations made by observers using equipment to measure or estimate the nine weather elements meet or exceed FAA's operational requirements.

FAA's program manager for the flight service station modernization program informed us that an AWOS has been developed and will be tested soon that FAA anticipates will meet all its weather forecasting operational requirements. If successful, FAA believes that the improved AWOS will meet the 1982 Act's

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[6]Installation of Automated Weather Observing Systems by FAA at Commercial Airports Is Not Justified (GAO/RCED-85-78, July 29, 1985).

requirement, and contract observers will not be needed. If unsuccessful, however, it will not meet FAA's operational requirements and will not provide as good or better weather information than the old flight service stations. Therefore, we believe this Subcommittee should consider making money appropriated for AWOS installation contingent on AWOS' meeting FAA's operational requirements and the intent of the 1982 Act.

WHAT SHOULD BE DONE

In addition to our system-specific recommendations, we have previously suggested other remedies to the current NAS plan situation. First, we suggested that the Congress require FAA to assure that systems function properly before appropriating further moneys for their production. Second, we suggested that FAA should produce a revised NAS plan, one that

-- includes realistic schedules for project implementation and integration,
-- can be used as a basis for multiyear funding authorizations and annual appropriations, and
-- can be used to hold FAA accountable for achieving the plan's objectives.

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This concludes my testimony, Mr. Chairman. Dr. Palmer now will address FAA's current plans concerning the single most expensive system in the NAS plan--the Advanced Automation System--and several other key automation projects, after which I will be happy to answer your or other Subcommittee Members' questions.

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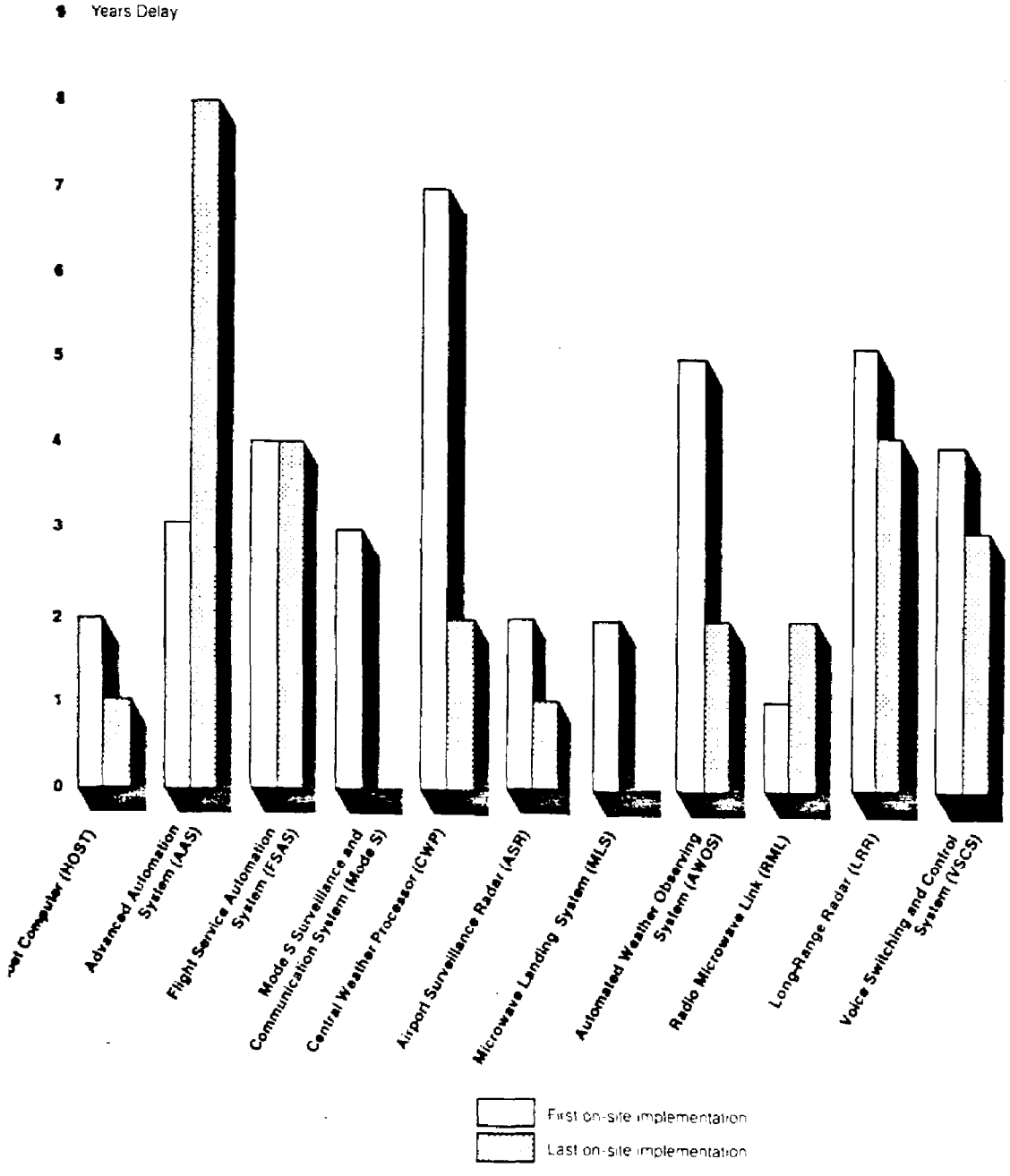
Figure 1.1: Number of Years of Estimated Delays in Major NAS Plan Projects



Source Comparison of December 1981 NAS plan and May 1986 NAS Program Master Schedule Baseline.

Major NAS Plan Projects

The following is a general description and status of each of the 11 major NAS plan projects. The information is, for the most part, taken from the current NAS plan project resumes and from project descriptions contained in the SEIC's August 1984 evaluation of the NAS plan.

Advanced Automation System (AAS)

Because the current en-route and terminal automation systems were approaching the end of their useful lives and could not accommodate FAA's planned consolidation of terminal and en-route operations into a single system at the planned Area Control Facilities, FAA decided that a totally new automation system design was required.

According to FAA, AAS will provide the primary upgrade to air traffic control automation capability in the NAS plan. It will provide the foundation for the Automated En-Route Air Traffic Control system and is the key system through which the benefits for the Next Generation Weather Radar, the Mode S surveillance and communication system, and the Central Weather Processor will be realized. AAS will contribute to the NAS plan's operational, cost, and expandability goals. Operationally, the system will improve air traffic control efficiency and safety and provide for increased NAS capacity. AAS is also expected to contribute to decreasing NAS maintenance costs by providing highly reliable hardware and software and reducing the maintenance staff needed. The system will provide the computer capacity needed to support facility consolidation—a major cost benefit in the NAS plan. Finally, AAS is structured to be expandable to meet future growth requirements. This expandability is targeted both to software and hardware.

Status

DOT approved the project for full-scale development and initial production in April 1983, and two design contracts were awarded in August 1984. DOT authorized a 6-month extension to the contracts in October 1985 at an additional cost of $128.3 million. FAA is currently discussing restructuring the AAS project to address congressional concerns over the risks in proceeding to full production without adequate testing. Total funding required for the program is estimated to be about $3.2 billion.

Automated Weather Observing System (AWOS)

AWOS is designed to automatically collect weather observation data and distribute the data to pilots, FAA weather observers, and National Weather Service aviation weather forecasters. According to FAA, AWOS will increase efficiency at commercial airports by reducing the amount of time now required to make weather observations and by reducing or

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eliminating the higher maintenance costs of obsolete weather-observing equipment currently in use. Consequently, FAA plans to install 304 AWOSS at commercial airports and 441 AWOSS at general aviation airports (those serving private aircraft only) where no weather observations are currently provided. FAA expects that such systems, by providing weather data where none are now available, will reduce the number of private aircraft accidents, thereby enhancing flight safety.

Status

The project's schedule has been delayed as a result of the unreliable technical performance of sensors and a change in the procurement strategy. DOT has not yet approved this program for any key decision point. The AWOS program is estimated to cost about $203 million.

Central Weather Processor (CWP)

CWP is planned to provide needed improvements in the quality of weather information available throughout the NAS by automating many of the weather-data processing and disseminating functions, including the distribution of near real-time weather information to controllers. A total of 26 production systems are planned and are to be implemented by the end of 1993.

Status

DOT approved this program to proceed with full-scale development and initial production in January 1985. Prototype delivery to the FAA Technical Center for test and evaluation is scheduled for March 1989. The estimated cost of this program is about $155 million.

Flight Service Automation System (FSAS)

To meet an increased demand for services, FAA plans to automate flight service stations, enabling pilots to brief themselves either through a computer terminal or by use of a "touch-tone" telephone.

FSAS will be implemented in three segments, called models 1, 2, and 2 enhancements. With model 1, FAA's objective is to quickly establish a limited-capability automated system at its 37 busiest stations. Model 2 will automate all the manual operations now carried out by specialists and will have the capacity to handle the workload of 318 stations. Model 2 enhancements will incorporate additions and improvements to model 2, enabling pilot self-briefings. In this way, the present and projected long-term demand for preflight services can be met without a proportional increase in staff or operating costs.

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Status	DOT approved the program to proceed with full production in August 1981. The first Model 1 system was commissioned in February 1986. The estimated cost of the program is about $480 million.
Host Computer	The current en-route and terminal computers in use in the NAS are of 1960's vintage and are approaching obsolescence. The total hardware/software replacement of these systems with a common system will not be completed until the early 1990's. To provide the computer capacity for the demand projected for the late 1980's, the en-route computers must be replaced prior to full AAS implementation. This replacement will take the form of computers called Host, which will use existing software with minimum modification. The purpose of the air traffic control Host computer is to provide needed computer capacity for the present en-route system as early as is practical. The modernization consists of implementation of the Host computers, which is the first step of the advanced automation program, and will provide the required capacity until the AAS has been fully implemented.
Status	DOT approved this program to proceed with full-scale development and initial production in March 1983 and full production in June 1985. The first Host computer went to the FAA Technical Center in August 1985. FAA expects to have the computer systems operational at all 20 Air Route Traffic Control Centers by the end of 1987. The estimated cost of this program is about $406 million.
Long-Range Radar (LRR)	The NAS plan requires the networking and upgrading of en-route radar and terminal radar into a cost-effective system providing primary radar coverage of both en-route and terminal airspace. The present LRR system has surpassed its design life expectancy. This program is for the procurement and installation of 48 3-dimensional radars (range, azimuth, height) to be located at 39 existing joint-use, long-range radar facilities; 8 existing military-only sites; and the FAA Academy. The FAA and U.S. Air Force determined that, owing to the age of the present equipment and anticipated poor logistics supportability, replacement of joint-use, long-range radars and height-finder radars is required. They also determined that a combined

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	3-dimensional radar would be the most cost-effective method for providing a suitable replacement.
Status	Although this project was scheduled for key decision point 4 approval in July 1986, it had not yet been submitted for DOT's consideration as of September 1986. (FAA had not submitted this project for prior key decision point approval). The estimated cost of the program is about $485 million.
Microwave Landing System (MLS)	The MLS program was initiated in 1971. In 1979, the Service Test and Evaluation Program was initiated to gain initial operational experience with MLS and to develop operational procedures and criteria. A transition plan was published in 1981 which defined the strategy for MLS implementation. The project's objective is to develop and implement a new common civil/military approach and landing system that will meet the full range of user operational requirements well into the future and be selected for international standardization as the replacement for the current Instrument Landing System.
Status	DOT approved this program to proceed with full production in April 1983. A contract for the first purchase of 208 MLS systems was awarded in January 1984. Contractor delays, attributed to software and personnel problems, are expected to slow production by about 1-1/2 years. The estimated cost for the MLS program is about $1.5 billion.
Mode S	Mode S is a cooperative surveillance and communication system to support air traffic control and provide other data link services. It employs ground-based sensors and airborne transponders. Ground-to-air and air-to-ground data link communications are integral with the surveillance interrogations and replies. In Mode S, each aircraft is assigned a unique address code. Using this unique code, interrogations can be directed to a particular aircraft and replies can be unambiguously identified. Interference is minimized because a sensor limits its Mode S interrogations to specific targets, and proper timing of interrogations permits replies from closely spaced aircraft to be received without mutual interference.

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The objective of the Mode S program is to provide the improved surveillance and communications capabilities required to meet the need of automated air traffic control in the 1980's. Specific goals are

- overcoming surveillance limitations of the present air traffic control radar beacon system,
- providing an integral two-way data link,
- evolutionary transition from the present system,
- reasonable cost to the airborne user, and
- high availability and reliability.

A total procurement of 197 Mode S systems is planned. The first procurement of 137 systems will provide surveillance and data link coverage from the ground up at most major terminals and above 12,500 feet in the en-route airspace. The second procurement, for 60 systems, will complete the system by lowering the en-route coverage to 6,000 feet or to the minimum instrument flight rules altitude if higher.

Status

DOT approved the program to proceed with full production in March 1983. FAA plans to award two sequential contracts—a contract for a total of 137 systems was awarded in October 1984 and a follow-on contract for 60 systems is planned for March 1990. The initial installation of Mode S is scheduled for mid-1988. The program is estimated to cost about $526 million.

Radio Microwave Link (RML)

The existing interfacility communications system is a hybrid of landlines, radio links, and satellite media, and a combination of FAA owned and leased services. The primary FAA-owned medium is radio microwave. RML systems are virtually the only alternative FAA has to a totally leased interfacility communication transmission system. Virtually all existing FAA facilities have interfacility communications requirements. FAA-owned RML systems will play an expanding and changing role from that of primary broadband radar remoting to one of communications trunking. The majority of the FAA-owned systems are over 24 years old and are maintenance-intensive and difficult to supply support. With modern equipment, the FAA transmission systems will offer a viable option to total agency dependence on commercial communications.

As part of the FAA transmission system, the existing RML facilities will serve as a national area transmission medium for voice and data communications. Existing RML equipment, used primarily for radar remoting,

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	will be replaced with Radio Communications Link equipment that can be used for general purpose interfacility communications. New facilities will be added to tie existing facilities together, forming a complete national radio communications network. FAA plans to replace 750 existing RML facilities and establish an additional 250 new facilities.
Status	DOT approved the program to proceed with full production in March 1984. A contract was awarded in May 1985 to procure 312 units of radio and linking equipment. The estimated cost of this program is about $264 million.
Terminal Radar Program	The airport surveillance radar (ASR) models 4/5/6s were originally procured in 1958. The first system was commissioned in 1960 and the last in the 1964-65 timeframe. Thus, the average age of the hardware and design is currently over 20 years old. Replacement of all 96 ASR-4/5/6 systems, together with associated air traffic control beacon interrogator equipment, is planned. Present plans call for the direct replacement of 40 ASR-4/5/6 radars with new ASR-9s and the remainder with leapfrog donor ASR-7/8 radars. The 56 donor ASR-7/8 sites will receive ASR-9 radars.
Status	DOT approved the program to proceed with full production in May 1982 and a contract was awarded in September 1983. Delivery of ASR-9 systems is expected to begin in mid-1987. The estimated cost of this program is around $606 million.
Voice Switching and Control System (VSCS)	VSCS provides the man-machine interface and the switching control system for voice communications. The VSCS provides an integrated system for the operation and management of voice communications resources for air traffic control. VSCS is the prime system that supports the availability requirements of operational communications services. It provides the means for reconfiguration of voice communication resources and is a critical item for achieving increased controller productivity along with reduction of leased services costs.
Status	Approval was given by DOT to proceed with the full-scale development and initial production in February 1985, and a prototype request for

ATTACHMENT II

proposal was issued in the same month. The estimated cost for this program is about $429 million.

ATTACHMENT III

Status of Major NAS Plan Projects

MSA Project	Amount of Slippage in Initial Implementation Comparison 1983 NAS Plan with Draft 1987 Plan	Reason for Slip
HOST	6 Months	Contractor delays in software coding and documentation.
AAS	2 Years	Additional requirements added (color/AERA) and provision for pre-production testing.
VSCS	1 Year	Additional requirements (number of operational positions, redundancy) and testing to reduce risk.
FSAS	2 Years	Software development problems.
AWOS	2 Years	Contractor difficulty complying with Critical Design Review requirements and failure to perform required quality assurance procedures.
CWP	3 Years	Addition of prototype phase, redefinition of statement of work with contractor (NASA/JPL), less than optimum contractor staffing.
Long Range Radar (ARSR-4/FARR)	4 Years	Delay in consummating FAA/USAF agreement on number of systems required and funding.
MODE-S	4 Years	Prototype added, clarification of specifications, revised test plan, contractor late meeting critical design review.

Source: March 5, 1987. Statement by FAA's Acting Deputy Associate Administrator for NAS Programs before the Subcommittee on Aviation, House Committee on Public Works and Transportation.

ATTACHMENT III

Status of Major NAS Plan Projects (Cont.)

MSA Project	Amount of Slippage in Initial Implementation Comparison 1983 NAS Plan with Draft 1987 Plan	Reason for Slip
ASR-9	3 Years	Delay in completion of critical design review, problems in system integration testing, FAA rejection of inadequate test procedures, contractor problem obtaining critical parts.
MLS	2 Years	Delay in contractor software coding; changes of deployment location/runway; delay in receipt of valid frequency assignments.
RML	1 Year	Implementation started in 1986.
TDWR (New project in 1986 plan)	1 Year	Revision of draft project specification; evaluation of impact of various siting options

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