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Report to the Chairman, Subcommittee on Transportation, Committee on Appropriations, House of Representatives

June 1989

AIR TRAFFIC CONTROL

FAA's Implementation of Modernization Projects in the Field

GAO/RCED-89-92

GAO

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Resources, Community, and
Economic Development Division

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June 28, 1989

The Honorable William Lehman
Chairman, Subcommittee on
Transportation
Committee on Appropriations
House of Representatives

Dear Mr. Chairman:

This report is in further response to your request that we monitor the Federal Aviation Administration's (FAA) progress in implementing the National Airspace System (NAS) plan. The NAS plan is the largest segment of the agency's air traffic control (ATC) modernization program.

In November, we issued our report entitled Air Traffic Control: Continued Improvements Needed in FAA's Management of the NAS Plan (GAO/RCED-89-7). The report provided the Congress with an overview of our work on the status and progress of the NAS plan. Now that some projects are being delivered to the field for installation, testing, and operation, you asked if FAA regions were prepared to install and operate this equipment in accordance with existing schedules.

In discussions with your office, we agreed to determine (1) whether headquarters planning and scheduling were adequate for FAA's regions to perform construction and related tasks necessary to install, integrate, and test this equipment and (2) if the regions possessed sufficient management information to identify and perform these tasks in time to meet headquarters project schedules. To address these objectives, we selected nine projects that involved ongoing or completed construction, or equipment deliveries in fiscal year 1989.

Results in Brief

Based on our review of nine projects in five of FAA's nine regions, we found that headquarters plans inadequately defined requirements and time frames for what regions were supposed to do, and facility designs to accommodate the new equipment in some cases were not ready. Because equipment deliveries were often delayed, lagging site preparation has had little adverse effect on implementation to date. However, without sufficient design and preparation guidance, regions could be unprepared for equipment installation if future deliveries are on time.

Information systems for managing NAS project implementation were not adequate. Headquarters scheduling information for 1988 deliveries was out of date and did not match the time frames set in the existing regional information systems. Regional information systems did not include all tasks to be performed in schedule tracking and estimates of staffing needs. Consequently, these systems did not show the stage of work that any given project had reached or work that remained to be done, nor did they provide reliable resource estimates. FAA acknowledged the inadequacy of its information systems and is planning a new system.

In our opinion, because of the planning and information management problems, tasks and staffing requirements needed to complete implementation were not accurately defined. Unless these problems are corrected, FAA cannot assure the Congress either that established implementation milestones can be met, or that staffing levels are adequate to meet such milestones.

FAA and Department of Transportation officials acknowledged these weaknesses and told us that the agency has made progress resolving these problems.

Background

Since 1978, air traffic has grown enormously. This increased demand, combined with obsolescence of much of the ATC technology currently used, prompted FAA to begin a massive effort to modernize and integrate the ATC system. As part of this effort, the NAS plan was initiated in 1981 The plan consists of more than 90 separate projects for modernizing ATC facilities and equipment. Equipment is now being delivered to the field in increasing quantities; implementation of several NAS plan projects is underway. Implementation involves planning and scheduling, site preparation, installing new equipment, and training staff to operate and maintain facilities. This process must occur at each of the more than 20,000 facilities that comprise the ATC system. FAA headquarters oversees the implementation effort, providing regions with standardized initial plans, facility designs, and schedules for equipment delivery and installation. The regional offices then must use this guidance to prepare sites, install systems, and train personnel on equipment operation and maintenance in accordance with national schedules and standards, but in a manner reflective of local facility and staffing conditions.

We used a case study approach to examine project implementation, focusing on nine projects currently scheduled to be completed by 1999

at an estimated cost of $3 billion—including $256 million for regional implementation activities—in five of FAA's nine regions. The projects are described in detail in appendix II. Our objectives, scope, and methodology are provided in appendix I.

Headquarters Plans Did Not Provide Adequate Details to Meet Regional Responsibilities

Our case studies showed instances of (1) implementation plans developed by headquarters program offices which did not adequately identify tasks and project requirements that had to be performed or met and (2) project requirements that were changed by headquarters after regional activities had already begun. Regional work to overcome such omissions required more time than FAA anticipated in its original project schedules. Because equipment was delivered later than scheduled, the extra time helped the regions address implementation problems and avoid staffing constraints without creating additional delays.

Tasks and Requirements Were Not Adequately Defined in Headquarters Plans for Over Two-Thirds of the Projects

Project implementation plans are published as FAA orders and serve as the primary documents for coordinating activities with the regions. They are prepared by headquarters project managers to provide guidance and direction to all those responsible for project implementation.

According to FAA's own standard,[1] developed in 1987, implementation plans are used to define requirements for deployment, verification, and logistical support. The standard calls each of these critical to successful project implementation. For example, deployment information is supposed to include site preparation activities that regions have to perform, requirements for delivered equipment, each site's planned equipment delivery date, and plans for installing the equipment.

Although the Host computer project was successfully deployed, the program's implementation plan and architect and engineering design illustrate FAA's initial project planning difficulty. The plan for this project provided little guidance to identify what or how facility preparation activities were to occur, or how the new system was to be installed, integrated, and tested. Moreover, the architect and engineering drawings for modifying the buildings to accommodate the new equipment were not completed in time for the start of regional construction. As a result, (1) it took 6 months more than FAA scheduled for the first region to plan the

[1] Preparation of Project Implementation Plans, Department of Transportation, Federal Aviation Administration Standard, FAA-STD-036, March 11, 1987.

sequence of installation and (2) construction undertaken without finished designs in three of the five regions reviewed did not initially meet the system's operating requirements and had to be changed. According to FAA headquarters officials, these initial difficulties were subsequently overcome without adverse schedule results.

In two other cases, originally scheduled implementation dates for airport surface detection equipment and integrated communications switching systems could not be met based on their project implementation plans. Incomplete equipment grounding requirements for the integrated switching system, without which it would not operate, resulted in several months delay in installing the equipment in two of the five regions. The airport surface detection system, as designed, was too heavy for many of the existing air traffic control towers where it was to be installed. Regions needed additional plans for reinforcing existing towers, building new air traffic control towers, or installing the system on remote towers. In four of the five regions, these project implementation plans for tower requirements were not detailed enough for the regions to know where they could be located or how to construct them in time for originally scheduled equipment deliveries.

Changing Requirements Caused Implementation Problems

Regions had to change completed site preparations and do additional work at low-level wind shear alert system (LLWAS) and radio communication link locations to comply with changed headquarters deployment plans and engineering requirements. About 100 LLWAS locations and at least 28 radio communication link locations were affected.

The LLWAS implementation requirements were not developed until several years after FAA began installing the system. In 1987, FAA developed requirements for installing LLWASs at 110 airports, as well as for an enhanced system to replace existing LLWAS sensors. However, a number of systems had already been installed at airports by that time as a result of the agency's effort to respond quickly to the threat low-level wind shear hazards posed for aviation. Some regions wanted to defer remaining LLWAS installations in favor of the enhanced version, but FAA headquarters decided that all the initial systems had to be installed. As a result, sensors will have to be removed and relocated in the future to bring these systems up to the enhanced level of capability.

Original deployment plans for radio communication links were based on an invalid assumption—that equipment could be installed on existing radio microwave towers—rather than site analyses. Not all of the

existing towers were high enough or in the right location to meet operational requirements. To date, at least 28 of the 312 radio communication links that have already been installed will have to be dismantled and reinstalled on taller towers or at different locations.

Equipment Delivery Delays Allowed Regions More Time to Prepare and Staff Facility Installations

All nine of the projects we reviewed experienced some delay in equipment deliveries ranging from several months to over 2 years. However, in at least four of these projects, delays provided regions more time to prepare facilities and increased staff availability. In the case of the airport surface detection equipment and Host computer projects, delays allowed more time to complete necessary headquarters requirements and regional planning. In the case of non-directional beacons and microwave landing systems, equipment delivery delays allowed the regions to defer scheduled staffing commitments to do other work. Because of equipment delivery delays, construction schedules for the five regions we reviewed generally showed that facilities were, or would be, ready for currently scheduled equipment deliveries through fiscal year 1989.

Information Systems Were Inadequate to Ensure Reliable Regional Implementation

Our case studies showed that FAA regions used separate information systems to manage task scheduling, progress tracking, and estimates of staff needs and that each of these systems yielded results which differed from headquarters implementation data. As a result, FAA information systems contained incomplete and inaccurate data with respect to regional equipment delivery dates, status of project implementation, and staffing needs.

Existing Information Systems

The three main information systems used in NAS implementation are the material delivery date file (MDDF), the facility and equipment reporting system (FERS), and the facility and equipment manpower system (FEMS). FAA headquarters is responsible for maintaining the MDDF, which contains the official dates for equipment delivery. The regions maintain the FERS, which is used to schedule the start and completion of each project's implementation tasks. FAA uses MDDF and FERS to plan and schedule regional work on NAS projects. Regions are also responsible for the FEMS, which they use to estimate future implementation staffing needs according to annual project schedules.

Information Systems Contained Inaccurate Equipment Delivery Dates

By communicating equipment delivery schedules for regional facilities, MDDF indicates when the regions must have facilities and staff ready in order to install, test, and integrate equipment and meet planned operating dates. It represents a significant planning milestone. However, almost 80 percent of the regional FERS data we reviewed in 1988 showed equipment deliveries occurring earlier or later than the headquarters-maintained MDDF said such deliveries would occur. The differences occurred largely because headquarters did not update the MDDF to reflect realistic delivery dates and because regional officials did not keep FERS data current.

Both regional and headquarters program officials knew that the MDDF data were not reliable. Consequently, the regions generally did not use them. However, headquarters officials also maintained an informal schedule that was more accurate than the MDDF system. Instead of using MDDF, regional officials called headquarters to find out the more realistic equipment delivery schedules, which they then entered into FERS.

Calling headquarters for reliable schedules enabled regions to plan according to more realistic delivery dates. However, such planning was the intended purpose for using the MDDF. Because of the headquarters-regional differences in delivery dates, formal equipment delivery milestones were not in accord with regional scheduling and could not be used as management tools ensuring schedule discipline.

Headquarters and Regional Milestone Dates Were Not Comparable

Regions use FERS to schedule implementation activities and indicate progress of the various projects. To be useful the FERS dates should relate to headquarters milestones, such as equipment delivery and operational readiness dates, and should reflect how far any one project has proceeded with the tasks needed to accomplish these milestones. As used in our case study projects, however, the FERS data did not provide such information.

The system's usefulness is limited by the way FERS classifies work. The system tracks progress of a project in terms of standardized reporting segments, such as "plant construction/start/complete," rather than specific tasks identified in site implementation plans in fulfillment of headquarters milestones. Because FERS does not include data on specific tasks that are performed between starting and completing reporting segments, FAA management does not know how many of the tasks necessary to implement a particular project milestone have been completed.

The lack of an internal review process for changing data entries in FERS also makes the system for scheduling regional performance against headquarters milestones essentially unaccountable. Start and completion dates for regional reporting segments were changed frequently. In our opinion, this could affect the realization of overall headquarters milestones. However, these regional changes were made without obtaining headquarters or regional division-level concurrence, and without retaining the initial start and completion dates. According to a lead engineer in FAA's Great Lakes Region, regions make so many changes in FERS schedules that it is hard to make sure that all of them are consistently updated.

Information Systems Do Not Accurately Estimate Staffing Needs

The facility and equipment manpower system—FEMS—uses data from MDDF and FERS-related tasks to estimate future staffing needs, thereby creating unreliable estimates. For example, the projected regional staffing needs derived from FEMS for fiscal years 1988-90 show a shortfall of about 170 staff years for the five regions covered in our review. However, in our opinion, this may not be an accurate staffing estimate. As mentioned previously, FEMS uses MDDF delivery dates, and our data suggest that informally communicated delivery milestones are more accurate. Therefore, if the amount of time actually available for the regions to prepare facilities for equipment deliveries were different than the time allowed by FEMS, regional staffing needs could also be different than estimated. This is because regions may actually have more or less time than FEMS computes, affecting the number of staff they need to meet the same staffing requirement.

On the other hand, FEMS regional staffing estimates also are based on regionally identified, FERS-related tasks that do not sufficiently detail the work that needs to be done. Thus, the system may underestimate needs because not all tasks that need to be staffed are identified, and without these additional tasks, FEMS staffing estimates are not a reliable indication of regional staffing needs.

FAA revised FEMS in 1987. However, according to FAA's draft implementation report to the Congress, staffing may have to be revised in future budget presentations.[2] According to the draft report, an improved method to identify staffing resources is underway. The size of the resulting staffing shortfall is now being identified by the agency.

[2]National Airspace System (NAS) Field Implementation Plan (Draft), Report of the Administrator of the Federal Aviation Administration, Washington, D.C., February 1989.

FAA's Attempt to Address Information Management Problems Is Incomplete

FAA has recognized that problems exist with the information systems used for planning and monitoring regional NAS implementation and has begun to develop improved information. FAA's major step toward correcting its information management problems is the development of the regional project management information system (RPMS). According to FAA's draft report, RPMS will provide a planning mechanism for use in scheduling tasks and deriving resource requirements. According to the NAS Program Director, regions will be required to estimate future implementation staffing resources to meet current schedule milestones using the new system. However, RPMS still must generate and maintain regional project implementation data bases over a period of 5 years.

FAA had no clear timetable for completing RPMS as of the time we completed our audit work. Subsequently, FAA headquarters officials reviewing a draft of this report provided a final schedule stating that RPMS may be able to provide implementation staffing requirements and schedule implications for all nine regions by January 30, 1990. The NAS Program Director showed us 5-year plans suggesting that two of FAA's regions may have already done so. According to FAA's draft implementation report, the agency will need additional time to develop RPMS-derived resource and schedule estimates that are currently being identified, and FAA will continue to indicate needed staffing and contract funding increases as part of the budgetary process.

Conclusions

The initial results of FAA's multi-billion-dollar investment in modernizing the air traffic control system are starting to appear as equipment is being delivered to the field. However, our case studies indicate that facilities have encountered problems in planning and scheduling work, as well as estimating staff needed to complete projects. While to date these problems have not caused delays, we believe that corrective action is necessary to preclude delays from occurring in the future, particularly as more equipment is delivered to the field.

Because headquarters planning information did not contain vital details individual regions had to devote additional time and staff to develop th information needed to properly design and prepare needed facilities. In our opinion, if equipment delivery had not been delayed, the added time the regions spent in developing necessary planning details and inadequate staffing levels would have caused deployment delays.

Of even greater concern are the management information systems' problems. Information systems did not allow regions to reasonably estimate

what needs to be done, at what time, in what sequence relative to other activities and, most importantly, with how much staff. Without such information, FAA cannot provide assurance to the Congress of the true status of implementation, and whether current project milestones established in annual NAS plans can be attained within existing budget estimates.

FAA acknowledges it has encountered problems in implementing NAS plan projects. The agency has undertaken a variety of initiatives that FAA officials state will overcome most of the problems we identified, including the development of the RPMS information system. FAA provided a timetable for completing RPMS that would permit the agency to make resource and schedule implications for the NAS plan available in time for the fiscal year 1991 budget request.

Considering the staffing and schedule implications in FAA's draft implementation report to the Congress, a more accurate assessment based on more realistic planning needs to be established to justify future funding needs. However, until FAA corrects shortcomings in the guidance provided to regions and puts into operation the planned RPMS, we believe the Congress will not have adequate information necessary for oversight and budgetary decisions.

Recommendations to the Secretary of Transportation

More realistic and detailed planning, combined with related and consistent information systems to manage regional progress are necessary to achieve the deployment milestones identified in the NAS plan, and to minimize the impact of unavailable or inadequate information and staffing needed to meet such milestones. Therefore, we recommend that the Secretary of Transportation direct the FAA Administrator to

- ensure that project implementation plans conform to FAA's established planning standards before they are issued and
- ensure that RPMS is available in time to develop the fiscal year 1991 budget request.

Agency Comments and Our Evaluation

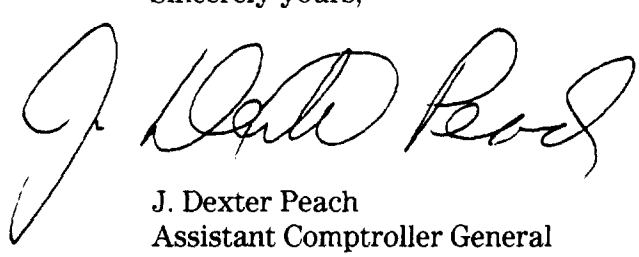
FAA and the Department of Transportation provided official oral comments on a draft of this report. Responsible agency and departmental officials agreed with our report findings, conclusions, and recommendations. However, the NAS program Director also stated that he considered the report dated and unrepresentative of the progress that has been made since completion of our audit work, and that conditions portrayed

were no longer reflective of the current situation. While we agree FAA is continuing to make progress, in that it has acknowledged the problems and has begun work on systematic corrections to its planning and information systems, much remains to be done before the deficiencies identified in this report will be corrected. Completion of the regional project management information system, for example, is not expected before the end of January, 1990. Appendix III provides a more detailed discussion of FAA's comments.

In preparing this report, we reviewed documents and interviewed FAA officials located at FAA's headquarters in Washington, D.C., and five of its nine regional offices. (See app. I for details on the scope and methodology.) As arranged with your offices, unless you publicly announce its contents earlier, we plan no further distribution of this report until 15 days from the date of this letter. At that time, we will send copies to the appropriate congressional committees, the Secretary of Transportation; the Administrator, FAA; and to other interested parties. We also will make copies available to others upon request.

This work was performed under the direction of Kenneth M. Mead, Director, Transportation Issues. Major contributors to this report are listed in appendix IV.

Sincerely yours,



J. Dexter Peach
Assistant Comptroller General

Contents

Abbreviations

AFSS	automated flight service station
ASDE	airport surface detection equipment
ASR	airport surveillance radar
ATC	air traffic control
FAA	Federal Aviation Administration
FEMS	facility and equipment manpower system
FERS	facilities and equipment reporting system
FSAS	flight service automation system
GAO	General Accounting Office
ICSS	integrated communications switching system
LLWAS	low level wind shear alert system
MDDF	material delivery date file
MLS	microwave landing system
NAS	National Airspace System
NDB	nondirectional beacon
RCL	radio communications link
RPMS	regional project management system
SEIC	systems engineering and integration contractor
TSSC	technical support services contract

Objectives, Scope, and Methodology

Objectives

In a July 21, 1987, letter, the Chairmen of the Senate and House Transportation Subcommittees requested that we review how the Federal Aviation Administration's (FAA) regional offices were planning and executing the construction of facilities needed to house the equipment being delivered to field sites, and how regions were performing National Airspace System (NAS) implementation activities in the absence of a technical support services contract. Last year, we testified on a number of these issues.[1] In subsequent discussions, we agreed to address additional work in a separate report to the Chairman of the House Transportation Subcommittee.

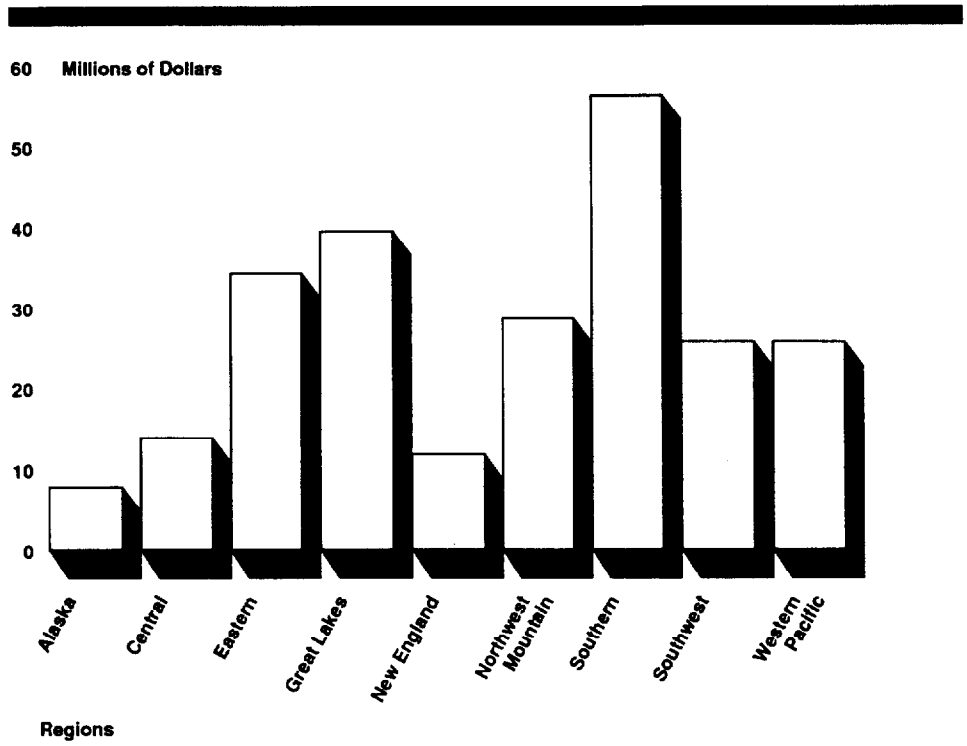
Our objectives were to evaluate FAA's planning, scheduling, and resource-estimating responsibilities for implementing NAS projects. We focused on headquarters planning and regional information systems for constructing, installing, testing, and integrating NAS projects.

Scope and Methodology

We selected five FAA regions for review. We selected the Southern, Great Lakes, Eastern, and Northwest Mountain Regions on the basis of the estimated amount of construction dollars to be allocated to them for all NAS programs through fiscal year 1988—they ranked first through fourth, respectively. We selected the Central Region to obtain additional geographical coverage. Figure I.1 shows total construction dollars through fiscal year 1988 for all FAA regions.

[1]See "FAA Appropriation Issues," Testimony Before the Subcommittee on Transportation of the Senate Committee on Appropriations, March 31, 1988 (GAO/T-RCED-88-32), and Testimony Before the Subcommittee on Transportation of the House Committee on Appropriations, April 12, 1988 (GAO/T-RCED-88-35).

Figure I.1: Total Construction Dollars Through Fiscal Year 1988



We selected nine NAS programs[2] which at the time (October 1987) had (1) some recently completed or ongoing regional construction activity or (2) equipment delivery dates starting within fiscal year 1988, thus requiring some regional planning or implementation activities. The nine programs meeting one or both of these conditions were:[3]

- Airport Surface Detection Equipment (ASDE),
- Airport Surveillance Radar (ASR),
- Flight Service Automation System/Automated Flight Service Stations (FSAS/AFSS),
- Integrated Communications Switching System (ICSS),
- Low Level Wind Shear Alert System (LLWAS),
- Nondirectional Beacon (NDB),
- Radio Communications Link (RCL),

[3]The term "program," when associated with the nine cases we reviewed, is synonymous with the term "project."

[2]The Department of Transportation designated five of the nine selected programs as major acquisition programs (ASR-9, FSAS/AFSS, RCL, Host, and MLS) because they either exceed $150 million or are critical components of the NAS plan.

- Host Computer System (Host), and
- Microwave Landing System (MLS).

These nine projects may not be representative of all NAS projects, but we believe they provide a good cross section of the kinds of implementation problems that may occur. Table I.1 summarizes the number of planned sites for the nine selected programs and the overall implementation schedule. Appendix II provides a description of each program, and table II.1 shows details on the implementation status of the selected programs.

Table I.1: Number of Sites Planned and Implementation Schedule for Selected Programs

	Number of sites planned		Implementation schedule	
NAS program	Nationwide	Five regions	Complete first site	Complete last site
ASDE-3	30	22	1989	1991
ASR-9	96	68	1988	1991
FSAS/AFSS	61	39	1986	1994
ICSS	227	159	1983	1992
LLWAS	330	84	1985	1992
NDB	682	116	1987	1988
RCL	69[a]	62	1986	1992
Host	20	14	1986	1988
MLS	960	88	1988	1999

[a]Segments; NAS plan shows 1,000 facilities.

Through April 30, 1988, the Congress had appropriated about $1.9 billion to FAA to acquire equipment and implement the nine programs we reviewed. FAA's nine regions had been authorized a total of about $256 million through April 30, 1988, for implementing these programs. The five regions we reviewed had received authorizations totaling about $165 million. Some inconsistencies exist in amounts for regional authorizations because funding is not separately identified and accumulated for some programs.

We interviewed numerous FAA regional and headquarters officials with responsibilities for implementing the nine NAS programs selected for review. We also interviewed systems engineering and integration contractor (SEIC) officials assigned to the regions and headquarters. In the regions, we interviewed regional Airway Facilities division managers; NAS program coordinators; managers of the Engineering Establishment and Program and Planning branches, as well as the lead project civil and electronic engineers and associate program managers assigned to those branches; Logistics division managers, Procurement branch managers,

and contractor specialists; and SEIC regional managers and various other SEIC personnel assigned to assist regions with information and NAS project management.

In headquarters, we interviewed NAS program managers and various program or project specialists. We also interviewed the FAA project managers responsible for developing the technical support services contract (TSSC) and FAA's new Regional Project Management System and the SEIC officials assigned to assist headquarters with regional project management system (RPMS) development.

To identify regional NAS roles and implementation responsibilities, we reviewed various NAS transition plans, national and regional program implementation plans, and regional organization manuals and handbooks containing functions and responsibilities of Airway Facilities and Logistics division officials.

To determine consistency of construction plans and their compliance with NAS system requirements, we reviewed NAS program implementation plans, correspondence on specific project implementation problems and other NAS program concerns, implementation status reports, regional and national implementation goals and strategies, and construction contract documents.

To determine if regional construction schedules coincided with planned equipment delivery dates, we compared regional construction schedules contained in the regions' official automated facilities and equipment reporting system (FERS) to the equipment delivery dates in the SEIC-maintained material delivery date file (MDDF). We also attempted to track the regions' past performance against schedules established in FERS using a judgmental sample of projects for selected NAS programs where construction projects had been completed. This specific analysis was limited to four of the nine selected NAS programs and four of the five FAA regions. Information on individual construction projects for three programs was not readily identifiable in FERS, and it was too early to review construction progress on two other programs. One region did not retain the old hard-copy FERS reports we needed for this analysis. We also found that the information in these two systems was not always reliable for tracking project implementation.

To determine if regions had sufficient staff to implement NAS programs, we obtained data on current and planned FAA staffing levels for regional Airway Facilities and Logistics divisions, and identified the SEIC staff

assigned to assist regions. We also obtained data on regional use of local contracting from review of regional contract files and information compiled by regional officials. We obtained tentative regional allocations of TSSC support from schedules in the Request for Proposal for that contract and compiled and analyzed staffing needs projections generated by FAA's automated facility and equipment manpower system.

We performed our site work during the period July 1987 through June 1988. Our review was performed in accordance with generally accepted government auditing standards.

Description and Status of Nine NAS Programs Reviewed

This appendix contains a brief description of each program we reviewed, and tables showing the number of sites planned, equipment installed, and available funding data for nine selected programs in the five regions we reviewed.

Airport Surface Detection Equipment (ASDE)

The ASDE will provide surveillance of aircraft and airport service vehicles on the airport surface. At high-activity airports, radar monitoring of aircraft surface operations (ground movement of aircraft and other supporting vehicles) is required to maintain safe aircraft operation and provide an effective and expeditious means of directing and moving surface traffic. This is especially important during periods of low visibility such as rain, fog, and night operations.

The ASDE may be located on top of the airport traffic control tower, which may require structural modifications to the towers. In some cases, the ASDE may be located on a separate, remote tower.

Airport Surveillance Radar (ASR-9)

The ASR-9 program is designed to upgrade the terminal radar systems at the highest density airports with state-of-the-art equipment. The ASR-9 system will provide positional information for aircraft targets within 60 nautical miles of the radar locations. It will acquire, process, and disseminate information for air traffic control and weather in the vicinity of the terminal, but will not detect wind shear or microburst conditions.

Automated Flight Service Station (AFSS)

The AFSS program is designed to improve, through automation, user access to pre-flight and in-flight information. Pre-flight briefings will provide the latest information regarding current and forecast weather, general flying conditions, and the status of airspace and navigational facilities along the planned flight route. Either visual or instrument flight plans may be filed. Inflight services include providing updated weather information, traffic control information to aircraft unable to contact a traffic control center, flight assistance to lost or disoriented pilots, flight following of aircraft under visual flight rules in hazardous areas, and coordination of search and rescue operations. The facilities to house the system may be either federally owned or leased from a local government sponsor.

Integrated Communications Switching System (ICSS)

The ICSS program is designed to provide voice communications switching systems for air traffic control towers, terminal radar approach controls, and automated flight service stations. FAA plans three types of ICSS equipment depending on the type of facility involved. The Type 1 ICSS, for control towers and approach controls having up to 15 operator positions, will have basic intercom, interphone, and radar capabilities. The Type 2 ICSS, for larger approach controls with 16 to 80 operator positions, will have the same capabilities as Type 1 plus rapid automatic reconfiguration of push button terminations, alphanumeric displays of the button functions, and traffic data collection. The Type 3 ICSS, for automated flight service stations, will have the same capabilities as Type 2 plus an automatic call distributor, call transfer, pilot's automatic telephone weather answering service, fast file recorders, and a management information system display.

Low Level Wind Shear Alert System (LLWAS)

The LLWAS programs is designed to provide pilots with information on hazardous wind conditions, on or near airports, that create unsafe conditions for aircraft landings or departures. The LLWAS monitors winds in the terminal area through wind sensors located at the center of the field and at the periphery of the airport. A computer processes sensor information and displays wind shear conditions to air traffic controllers, who relay the information to pilots.

The LLWAS program will initially include 110 systems composed of 6 sensors. Because of changes in criteria for the LLWAS, FAA plans to improve the 6-sensor system by re-siting the sensors and increasing computer capacity for all 110 sites.

FAA also plans to increase the number of sensors at all sites. FAA will survey the sites to determine the optimum number of sensors for each site and will use a cost/benefit analysis of the wind shear programs to help determine the number of expansion systems to be completed.

Nondirectional Beacon (NDB)

The NDB is a navigational-aid system which transmits low/medium frequency, omindirectional signals that aircraft pilots use to determine the bearing from or to the station. The NDBs are used for en route navigation and to supplement other navigational aids for standard instrument approach procedures.

The NDB program will replace old facilities; relocate some existing facilities; and establish additional, new facilities. FAA has not yet determined

specifically how many NDB sites will be needed. The locations and total number needed will depend on network studies. NDB equipment includes antennas, transmitters, and monitor receivers.

Radio Communications Link (RCL)

The RCL system will serve as a general transmission network for FAA voice and data communications between FAA facilities. Eventually the system will tie together all air control facilities and many other FAA facilities with large communications needs. FAA plans to replace the equipment in its 750 outdated, special-purpose radar microwave link facilities with the new RCL equipment, and to establish 250 new facilities to form a complete national radio communications network. FAA plans to implement the RCL system by segments, which are made up of varying numbers of individual sites.

Host Computer System

The Host computer program is designed to provide needed computer capacity for present en route systems and to improve computer reliability and availability. The Host computer, the first step in the advanced automation program, has been installed at all 20 en route traffic control centers.

Microwave Landing System (MLS)

The MLS is an all-weather approach and landing guidance system. It is designed to provide precision guidance to satisfy the full range of operational requirements, both civil and military, to all types of aircraft in all categories of landings. FAA plans to gradually integrate the MLS into the national airway system, with full implementation by the year 2000. This gradual transition will require the collocation of new MLS equipment at existing instrument landing system ground facilities for a substantial period of time as aircraft and airport facilities acquire MLS avionics and equipment.

Table II.1: Implementation Status of the Nine Programs in Five Regions Reviewed

Program	Total sites in NAS plan	Total for five regions reviewed		Southern	
		Sites planned	Equipment installed	Sites planned	Equipment installed
1. ASDE-3	30	22	0	4	0
2. ASR-9	96	68	0	22	0
3. AFSS					
Federally owned	•	6	4	3	2
Leased	•	33	27	8	6
AFSS Total	61	39	31	11	8
4. ICSS					
Type I	132	98	73	30	11
Type II	31	21	11	11	4
Type III	64	40	31	12	8
ICSS Total	227	159	115	53	23
5. LLWAS (note a)					
I (Basic 6-sensor)	110	68	68	25	25
II (Improved 6-sensor)	110	84	14	37	10
III(Optimized LLWAS)	110	84	0	37	0
LLWAS Total	110	84			
6. NDB	682	116	7	26	0
7. RCL (note b)	69	62	10	14	1
8. Host	20	14	12	4	3
9. MLS	960	88	0	10	0
Total	**2,255**	**652**			

Eastern		Northwest Mountain		Central		Great Lakes	
Sites planned	Equipment installed	Sites planned	Equipment installed	Sites planned	Equipment installed	Sites planned	Equipment installed
9	0	3	0	2	0	4	0
19	0	8	0	6	0	13	0
0	0	3	2	0	0	0	0
7	5	4	2	5	5	9	9
7	5	7	4	5	5	9	9
23	20	14	12	5	5	26	25
2	1	3	3	4	3	1	0
7	5	7	4	5	5	9	9
32	26	24	19	14	13	36	34
12	12	4	4	9	9	18	18
16	3	4	0	9	0	18	1
16	0	4	0	9	0	18	0
30	3	15	0	13	3	32	1
11	2	16	2	7	1	14	4
2	2	3	2	1	1	4	4
42	0	22	0	4	0	10	0

[a]The LLWAS program is broken into 3 phases that affect the same sites. Basic program installation was discontinued in Southern and Eastern regions after new siting criteria were developed and the regions proceeded with installation using the new siting criteria (Improved 6-sensor phase). Because the same sites are involved, columns are not totaled for individual regions.

[b]Segments; NAS plan shows 1,000 facilities.

Agency Comments

FAA and Department of Transportation officials reviewed a draft of this report and provided official oral comments. Responsible agency officials agreed with our findings. They said that our facts were correct and that planning, scheduling, and staffing problems discussed would have delayed implementation had it not been for equipment delivery delays. FAA officials also indicated that a new organization, the NAS Transition Service, was created to address implementation issues discussed in the report. They also did not disagree with our conclusions and recommendations. However, the NAS Program Director stated that he considered the report dated and unrepresentative of progress that was being made as a result of new actions FAA had initiated since our audit work was completed, and that this progress is not reflected in our report.

We agree that FAA is addressing problems associated with implementing NAS projects. However, we disagree with the NAS Program Director's assessment that the report is not reflective of the agency's progress. Past difficulties discussed in the report were attributed to underlying problems of adhering to FAA's project implementation planning standard, and to significant discrepancies among related management information systems. It follows that adherence to the planning standard and completion of the new regional project management information system are the essential criteria for measuring progress.

Deficiencies complying with the agency's standard for project implementation planning, such as those cited in the report, have not been corrected. According to agency officials, the deficiencies are caused by delays associated with securing the approval of each project implementation plan by all FAA organizations prior to its issuance. Also, according to FAA's current schedule, the system to address most of the management information problems discussed in this report will not be fully operational until January 30, 1990. Thus far, the system has been delayed more than a year beyond its originally scheduled completion. Therefore, we believe the concerns expressed in the report still need to be addressed.

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Related GAO Products

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