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Report to Congressional Requesters

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AIR TRAFFIC CONTROL

The Interim Support Plan Does Not Meet FAA's Needs

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Resources, Community, and
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The Honorable Frank R. Lautenberg
Chairman, Subcommittee on Transportation
and Related Agencies
Committee on Appropriations
United States Senate

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

As requested in your letter of December 15, 1989, we evaluated the planning and analysis supporting the Federal Aviation Administration's (FAA) Interim Support Plan (ISP). More specifically, we (1) determined whether FAA adequately identified its requirements when developing the ISP and (2) assessed whether the program is progressing in a manner that reflects its stated urgent nature.

FAA developed the ISP in 1987 to sustain existing air traffic control (ATC) equipment and increase computer capacity, primarily at terminal radar approach control facilities.[1] The program was intended to bridge the gap between current and future ATC systems caused by delays in long-term modernization programs. The ISP is a conglomeration of 15 projects that will upgrade or provide additional air traffic controller positions, airport radars, weather sensors, landing systems, and communications equipment. It has an estimated cost of about $416 million. The ISP projects are described in appendix I.

Results in Brief

FAA inadequately identified its requirements for the ISP. FAA did not conduct a requirements analysis as called for by federal regulations and its own procedures. Moreover, FAA did not complete its assessment and approval process for the ISP until over a year after seeking funding from the Congress. FAA now views the ISP as insufficient to meet its interim needs and is initiating programs costing at least another $126 million to further expand capacity.

[1]Terminal radar approach control facilities are located at or near airports to direct aircraft arrivals and departures into and out of the jurisdiction of the airport control towers.

be determined through a requirements analysis. The analysis is to include the present and projected work load and a performance evaluation of the currently installed automated data processing systems. These regulations apply to the most costly ISP projects, which upgrade the information processing equipment for air traffic controllers.

FAA Did Not Adequately Plan and Assess the ISP

FAA now intends to supplement the ISP with programs that provide additional interim capacity. We believe FAA might not have underestimated its capacity needs if it had adequately analyzed its requirements when designing the ISP and assessed it in a timely and responsive manner.

FAA Did Not Adequately Analyze Its Requirements

As a large expenditure of Airport and Airway Trust Funds, the ISP deserves a strong justification.[3] Such a justification should have been provided by a requirements analysis, as mandated by the Federal Information Resources Management Regulation and configuration management. A requirements analysis should assess the performance of current systems. For the ISP, we believe data such as current capacity usage levels, equipment outages, and spare parts shortages would have been appropriate indicators of performance. A requirements analysis should also assess the present and projected work load. We believe that a comparison of current and projected capacity, reliability, and maintainability levels would have accomplished this assessment for the ISP.

However, FAA did not perform such an analysis in designing the ISP or before requesting funds for the ISP from the Congress. In July 1987, FAA commissioned a working group of its headquarters, regional, and contractor staff to devise a plan to meet FAA's interim needs. Teams on capacity, reliability and maintainability, and air-to-ground equipment were established. The teams defined problems, received briefings from FAA and contractor staff, surveyed the regions, and identified projects they believed were necessary. The teams then reconvened, combined their various projects, and proposed them as the ISP. Instead of developing projects on the basis of a rigorous requirements analysis, the working group based the projects primarily on the general knowledge of experienced regional and headquarters staff. According to the working

[3]Established in 1970, the Airport and Airway Trust Fund finances capital and other costs associated with the ATC system facilities and equipment. Trust Fund revenues are generated mostly by an 8-percent tax on airline tickets

requirements for the Voice Switching and Control, Advanced Automation, Automated Weather Observing, Microwave Landing, and Air Route Surveillance Radar Systems.[7]

FAA Did Not Assess the ISP in a Timely or Responsive Manner

The working group finished developing the ISP in August 1987. Support and approval of the program were soon gained through briefings to FAA's Associate Administrator for Development and Logistics, the Associate Administrator for Air Traffic, and the Department of Transportation's Assistant Secretary for Budget and Programs. Such high-level approval allowed the ISP to be included in the fiscal year 1989 budget submission to the Congress in January 1988. FAA officials wanted to include the ISP in the first budget possible because they considered it urgent. In June 1988, FAA added the ISP to the NAS Plan, and in September 1988, the Congress appropriated the total $150 million that was requested for the first year.

Only after these events did FAA begin activities associated with assessing and approving the program through the configuration management process. For example, in March 1989, after including the ISP in its budget for the second year, FAA started the required assessment and approval process for the ISP to ensure that it was technically sound and properly coordinated with other programs. This process involved developing an ISP proposal and having the 32 relevant FAA offices and the SEIC evaluate and comment on the proposal. The ISP was approved through the process 3 months later, in June 1989, almost 2 years after the program was developed, and 9 months after it was initially funded.

FAA's guidance for conducting the formal assessment and approval process does not clearly state when it should take place in relationship to a funding request for a project. The FAA official responsible for developing the guidance believes it is preferable for projects to be formally assessed and approved before being included in the budget. We agree because the process provides a thorough review by key officials at FAA and the SEIC. As it did for the ISP, this review can raise concerns that necessitate important changes in the program.

During the assessment and approval process for the ISP, FAA and the SEIC raised serious concerns in their written comments. Some of the SEIC's comments were related to its February 1988 cost-benefit study on the

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

it planned to procure and provided support for the locations where it planned to install the equipment.

FAA Is Developing Additional Interim Projects

FAA now plans additional interim projects for more computer capacity at terminals. FAA has proposed one new project and is considering others to address unforeseen needs at terminals. These projects will cost at least $126 million. One project will modernize and enhance FAA's terminal software at a cost of $59 million. The initial year of funding for this program was fiscal year 1990. Among other things, this project will standardize the software changes made locally at terminals to gain capacity. FAA is developing another project to provide 150 controller displays for large terminal facilities, in addition to the 100 provided by ISP, at a cost of $67 million. FAA is also considering providing additional computer capacity for 5 to 15 "high density" terminal facilities, probably through systems like that at the New York terminal facility. On the basis of the cost of equipment and related items for the New York system, we believe upgrading each terminal will cost at least $8 million. Although our review did not assess the justification provided for these additional projects, we believe FAA should conduct a requirements analysis in conformity with the Federal Information Resources Management Regulation for each to avoid the same problems that characterized the ISP's planning and assessment.

FAA's Procurement and Installation of ISP Equipment Are Behind Schedule

FAA's procurement and installation of ISP equipment are behind schedule, although FAA considers the program urgently needed. When FAA planned the ISP, it set unrealistic procurement and installation schedules.

At the April 1988 hearings to consider the first FAA budget submission that included the ISP, the then-FAA Administrator said of the program: "there is probably no more serious operational requirement." FAA's original schedules and plans to expedite procurements through sole source and existing contracts whenever possible reflected this urgency. By the end of fiscal year 1989, FAA had planned to have virtually every ISP project under contract and the first equipment installed for several projects. However, only 5 of the 15 projects were under contract by the end of fiscal year 1989. At the time of our review, 8 of the 15 projects were under contract, but no ISP projects have been completed and only 2 projects have had any equipment installed. On average, FAA is about 1 year behind its original contract schedule and 3 years behind its original installation schedule (see app. I). According to FAA's estimates, it will be

Conclusions

We believe that before proposing the ISP, FAA should have given this expenditure from the Airport and Airway Trust Fund more careful consideration. FAA should have better defined its interim requirements for sustaining terminal operations until long-term modernization programs are completed. Also, FAA should have conducted the formal assessment and approval process and requirements analysis before asking the Congress to fund the ISP and should have better addressed the major concerns raised during the process once it was conducted. If FAA had adequately planned and assessed the ISP, it might not have underestimated its interim capacity needs. As a result, FAA now intends to supplement the ISP with additional projects.

We also believe that, in planning the ISP, FAA should have set more realistic schedules for procuring and installing ISP equipment. Despite the purported urgency of the program, FAA now estimates that it will be 1998 before the traveling public can benefit from FAA's using all the ISP equipment at its terminal facilities.

We have previously reported on problems with planning and implementing major NAS Plan initiatives. The ISP exhibits the same problems. We are recommending changes to ensure that future interim projects are planned and assessed more effectively.

Recommendations

Because FAA has been developing additional interim projects, we recommend that the Secretary of Transportation direct the FAA Administrator to

- ensure that FAA properly applies its assessment and approval process and the Federal Information Management Resources Regulation, including conducting requirements analyses, to future projects before submitting them to the Congress for funding; and
- develop specific capacity, reliability, and maintainability requirements and goals for planning and assessing interim programs.

To determine how effectively FAA planned and assessed the ISP, we reviewed studies on equipment upgrades, interviewed officials who were part of the 1987 team that devised the ISP, and reviewed documentation of the configuration management process for the ISP. We reviewed the SEIC's cost-benefit study and discussed the ISP and FAA's planning and approval process with SEIC officials. We interviewed the ISP program manager as well as the facility and equipment program managers for the

Abbreviations

ARTS	Automated Radar Terminal System
ASR	airport surveillance radar
EARTS	En Route Automated Radar Terminal System
FAA	Federal Aviation Administration
ISP	Interim Support Plan
NAS	National Airspace System
ORD	first operational readiness demonstration
SEIC	System Engineering and Integration Contractor
TRACON	Terminal Radar Approach Control Facility

Table I.1: Status of ISP Contracts, as of April 1990

Dollars in millions

Projects	Original contract award milestone	Current contract award milestone[a]	Cost of project
ARTS IIIA			
Solid state memory	1989	1989	$47.5
Keyboards, trackballs, software, and ancillary equipment	1989	1989	3.2
Additional radar positions	1989	1990	83.4
Disk drive refurbishment	1989	1989	7.9
ARTS II/IIA			
Separate flight plan	1989	1990	.3
Multi-sensor processor	1988	1990	4.8
Tape drive replacement	1989	1990	5.4
Additional radar positions	1989	1990	40.8
Uninterruptable power system	1989	1988[b]	7 5
Refurbishment of En Route Automated Radar Terminal System (EARTS)	1989	1989	3.1
Airport surveillance radars	1989	1990	135.6
Long-range radar upgrade			43.5
Receivers	1989	1990	[c]
Transmitters	1990	1992	[c]
Integrated communications switching systems bypass	1989	1990	17.0
Instrument landing system glide slope antennas	1989	1990	7.3
Airport weather sensors	1989	1990	5.1
Total estimated project cost			**412.4**
ISP program support			3.3
Total Estimated Cost			**$415.7**

Note The years provided are fiscal years.

[a]FAA has already awarded some contracts for projects with current milestones in 1990 including the long-range radar receivers upgrade, airport weather sensors, and airport surveillance radar projects

[b]Funds were borrowed from other programs to make use of an existing contract, no ISP funds have been obligated yet on this item

[c]For the purposes of our review, we obtained only the total cost for the long-range radars and not how that total was broken down between receivers and transmitters

FAA awarded contracts for upgrading both systems so that now all of the ARTS III systems have been converted to ARTS IIIA, and FAA plans to convert all the ARTS IIs to ARTS IIAs by August 1991.

ARTS IIIA Solid State Memory

ARTS IIIA facilities have been experiencing limited track capacity and low memory reliability largely because of the outdated core memory currently used. To increase capacity and improve reliability, FAA plans to replace the core memory at each ARTS IIIA facility with solid state memory. The solid state unit processes data 20- to 30-percent more efficiently than the core memory. Since the core memory is no longer manufactured, FAA believes that replacing it with solid state units will facilitate maintenance and supply support of the existing ARTS IIIA equipment. FAA contracted for solid state memory in 1989.

ARTS IIIA Keyboards, Trackballs, Software, and Ancillary Equipment

FAA claims that ARTS IIIA facilities have a high failure rate with their keyboards and trackballs, which together make up part of the data entry subsystem. The keyboard is arranged in alphabetical and numerical sequence and is used by the controllers to enter flight data and to make modifications to the displayed information. To enter display coordinate information, the controllers rotate the black plastic trackball, which causes the small symbol on the display to move in a corresponding motion. FAA plans to procure 126 keyboards and trackballs and the necessary software and ancillary equipment (communications, clocks, etc.) to accommodate the hardware requirements. The planned procurement will provide two keyboard and trackball spares for each TRACON. FAA contracted for this equipment in fiscal year 1989 and expects that it will improve system performance and facilitate easier maintenance.

ARTS IIIA Additional Radar Positions

Because of the increase in air traffic and training needs, FAA has determined that it needs 100 additional ARTS IIIA radar positions at a limited number of terminal facilities. FAA plans to replace the older ARTS IIIA data entry and display subsystems at 5 facilities with the 100 new fully digital ARTS displays and then use the displaced data entry and display subsystems for expansion positions at less busy ARTS IIIA locations. The installation of these additional positions will accommodate continued air traffic growth and eliminate the output display overload problems now encountered at some ARTS IIIA facilities. FAA expects to sign the contract for these new positions in fiscal year 1990.

occur with the magnetic tape unit. FAA plans to contract for disk drive subsystems to replace the tape drives at all ARTS II locations in fiscal year 1990.

ARTS IIA Additional Radar Positions

As with ARTS IIIA, FAA has determined that because of projected air traffic growth and training needs at various ARTS IIA facilities, an additional 158 radar positions are needed. FAA plans to procure the necessary additional radar displays: 30 to be used as operational positions and the remaining 128 to be used for training. Procuring these new positions allows some radars to be designated specifically for training instead of training controllers on the operational displays that are needed to control traffic. FAA plans to contract for these new positions in fiscal year 1990.

ARTS IIA Uninterruptable Power System

Some ARTS IIA facilities have been reporting a high incidence of outages because of electrical power fluctuations and interruptions. These outages occur because commercial power fluctuates beyond what FAA's solid state systems can tolerate. FAA plans to resolve this problem by procuring uninterruptable power systems for those sites showing a high incidence of power-induced failures. These power systems will "rectify" the commercial power so that it is more easily accepted by solid state systems and thus less likely to fluctuate or stop. They will also provide a backup within 15 seconds if the commercial power fails. FAA procured these systems through an existing contract in fiscal year 1988.

Upgrades to En Route Automated Radar Terminal System (EARTS)

EARTS is essentially an expanded ARTS position in an en route environment instead of in a terminal facility. EARTS can accept either short- or long-term radar information and can therefore provide both en route and terminal air traffic control services, depending on what is needed at a given location. The ISP project will upgrade or provide spare parts for three different parts of the system: tape drives, generators, and communications. It will also enable EARTS to place lost or downed aircraft more accurately. Two of the four EARTS projects have been completed, one is in operational testing, and FAA plans to complete contracting for the other project in 1991.

Airport Surveillance Radars (ASR-9)

ASR-9 radars provide controllers with air traffic and weather information within about 60 miles of terminals. FAA uses such criteria as the cost of the establishment, the instrument operations at the terminal, and the

additional landing guidance to pilots, helping them to achieve the optimal glide slope of 3 degrees. FAA intends to contract for the conversion kits in fiscal year 1990.

Airport Weather Sensors

Airport weather sensors provide critical information to controllers who use the information to assist pilots in takeoff and landing procedures. The current weather sensors at terminals are failing because of their age. This has prompted supply support problems. FAA plans to procure 109 cloud height indicators and 80 remote readout hygrothermometers to replace the old equipment. The cloud height indicators determine the height of clouds with laser beams, replacing the older equipment that used the light reflected off the clouds to measure cloud height. The remote readout hygrothermometers give the controllers the temperature and the dew point, from which they determine the likelihood of fog. This new equipment will provide more accurate weather information and facilitate easier maintenance by ensuring manufacturer-supportable equipment. FAA contracted for the new sensors in fiscal year 1990, via an existing contract.

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weather at the terminal to determine whether a facility qualifies for an ASR-9 radar. FAA plans to procure six ASR-9 radars with ISP funds. Two of these will be the second radars at their respective sites; the remaining four are new establishments. These six sites qualified for radars after the original NAS Plan ASR-9 radar contract was signed. These additional radars are being purchased through an option to the original contract. FAA executed this option in late 1989.

Long-Range Radar Upgrade

Long-range radars provide en route controllers with information for a 200-mile radius. These radars are having supportability and maintainability problems, largely because they are equipped with outdated vacuum tube circuitry. FAA plans to procure 76 solid state transmitter modification kits and 12 solid state receiver modification kits to replace the vacuum tubes. The radars will eventually be replaced under the NAS Plan, but FAA believes that upgrading the existing radars will allow these radars to be maintained until the replacement program is complete. FAA contracted for the receivers in late 1989 by modifying an existing contract and will establish a new contract for the transmitters in fiscal year 1992.

Integrated Communications Switching Systems Bypass

Integrated communications switching systems bypass allows communication between pilots and briefers in TRACONs and towers that handle aircraft operating under instrument flight rules.[1] As its name suggests, the bypass will make it possible to circumvent the integrated communications switching systems and continue communications on a limited number of frequencies when the switching system fails. This equipment will be installed at 80 facilities. FAA plans to contract for this equipment in fiscal year 1990.

Instrument Landing System Glide Slope Antennas

Obstructions around runways, either naturally occurring or resulting from new construction, can adversely affect landings by interfering with signals being transmitted to the planes by existing instrument landing systems. As a result, pilots can misgauge the angle of descent. To avoid this danger, FAA plans to procure 55 glide slope conversion kits, which, by adding a third antenna to the glide slope facilities, will give

[1] Aircraft fly under either instrument or visual flight rules. Instrument flight rules aircraft must be controlled and in contact with an air traffic controller, while visual flight rules aircraft are only monitored by controllers Visual flight rules aircraft, however, must follow the rules and flight procedures governing the specific airspace in which they choose to fly and are restricted from some airspace around major airports for safety reasons.

ARTS IIIA Disk Drive Refurbishment

The disk drive units of the ARTS IIIA system store air traffic control software, load the software into computer memory, download the software from computer memory, and record air traffic control activity information. This recorded information is used to identify software glitches and investigate accidents and incidents. The units have been failing at an increasing rate. FAA plans to refurbish 154 disk drives, upgrade 86 disk control units, and procure disk test equipment. This project will involve pulling disk drives out of the TRACONS and replacing them temporarily with spares while they are refurbished. Once the refurbishment is complete, the drives will be reinstalled at the TRACONS. FAA contracted for the refurbishment and spares in fiscal year 1989.

ARTS IIA Separate Flight Plan

To cope with insufficient flight plan capacity at ARTS IIA facilities, FAA plans to develop a separate flight plan data file for all ARTS IIA software. Thus far, all aircraft data have been contained in a single table in memory that holds a total of 256 aircraft. FAA has determined that a separate arrival/departure tabular list of flight plans will hold data for more aircraft and will in this way meet the continued demands of growing air traffic. FAA plans to contract for this new software in fiscal year 1990.

ARTS IIA Multi-Sensor Processor

The procurement of dual-sensor, dual-processor ARTS IIA systems is proposed for the largest ARTS IIA locations and those ARTS IIA locations requiring dual-radar coverage. Currently, ARTS IIA facilities are unable to accept more than 11 radar displays or to support dual-radar sensors. In addition to enabling the ARTS IIA system to accept more than 11 displays or another radar sensor, this second processor will also provide a back-up level of operations in the event of a processor failure. The ISP will provide funding for the first site at Pensacola, Florida, and the contract will have options for the remaining sites. FAA is scheduled to contract for the processor in fiscal year 1990.

ARTS II Tape Drive Replacement

Like the ARTS IIIA disk drives, the ARTS II magnetic tape drive units store air traffic control software, load the software into computer memory, download the software from computer memory, and record air traffic control information. The problems with these tape drives include both a high failure rate and inadequate supply support because one of their necessary components, the drive motor, is no longer manufactured. This situation is especially critical because the facilities have no back-up method to permit a reload of the operation software if a failure should

Table I.2: Status of the Implementation of ISP Projects, as of April 1990

Projects	Original ORD date[a] milestone	Current or actual ORD date milestone	Equipment installed
ARTS IIIA			
Solid state memory	1990	1990	yes
Keyboards, trackballs, software, and ancillary equipment	1989	1992	no
Additional radar positions	1990	1993	no
Disk drive refurbishment	[c]	1992	no
ARTS IIA			
Separate flight plan	1989	1992	no
Multi-sensor processor	1989	1992	no
Tape drive replacement	1989	1992	no
Additional radar positions	1989	1992	no
Uninterruptable power systems	[c]	1989	no
Refurbishment of En Route Automated Radar Terminal System (EARTS)[b]	[c]	[c]	yes
Airport Surveillance Radars	[c]	1993	no
Long-range radar upgrade			
Receivers	1989	1991	no
Transmitters	1990	1995	no
Integrated communications switching systems bypass	1989	1993	no
Instrument landing system glide slope antennas	1989	1992	no
Airport weather sensors	1989	1990	no

Note: Years provided are fiscal years.

[a]ORD means first operational readiness demonstration

[b]This ISP project refurbishes or provides spare parts for three different parts of the EARTS system. The equipment involved in these efforts is all either fully or partially installed. In 1991, FAA hopes to complete contracting for the fourth part of this project, which will enable EARTS to place lost or downed aircraft

[c]ORD dates not available for these projects.

Automated Radar Terminal System (ARTS)

Air traffic controllers at FAA's Terminal Radar Approach Control (TRACON) facilities sequence and separate aircraft arriving at or departing from airports under their control. These TRACONs are each equipped with Automated Radar Terminal Systems (ARTS), a computer system that receives input from radar, identifies and tracks aircraft, associates the aircraft with flight plans, provides safety warnings, and displays aircraft identification and position location to controllers. The ARTS system is divided into two groups: ARTS III, which supports the 63 largest TRACONs, and ARTS II, which supports the 119 smaller TRACONs.

ISP Projects

The Interim Support Plan (ISP) is divided into 15 projects, which are intended to forestall system support problems, increase capacity, and provide for expansion of the air traffic system until the Advanced Automation System is implemented under the National Airspace System (NAS) Plan. Four of these projects were contracted in fiscal year 1989, four have been contracted in fiscal year 1990, and the remaining projects are scheduled to be contracted in late fiscal year 1990 or in 1991. Table I.1 gives the dollar value of each project and the original and recently revised schedule for contracting. Table I.2 gives the original and recently revised schedule for the first installation under each project and shows whether any of the upgrades have been installed. This appendix also briefly describes the ISP projects, the inadequacies of the existing system that the Federal Aviation Administration (FAA) believes made the projects necessary, and what FAA hopes to accomplish through their installation.

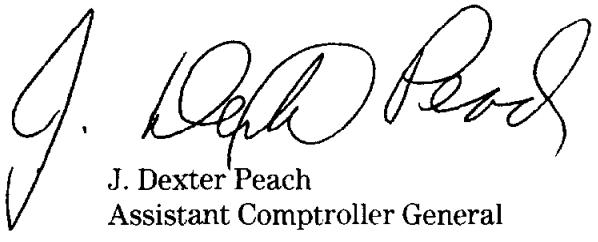
Contents

individual ISP projects. We discussed the need for the ISP with FAA's Air Traffic Requirements staff, officials at a terminal radar approach control facility, and an official at the FAA Supply Depot.

To determine the status of FAA's implementation of the ISP, we discussed its progress with the ISP program manager, Air Traffic Requirements officials, and the facility and equipment program managers. We reviewed project performance schedules maintained by the SEIC for certain ISP projects. We also obtained funding information from FAA's budget office. Our review was conducted between August 1989 and July 1990 in accordance with generally accepted government auditing standards.

As agreed with your office, we did not obtain official agency comments. However, FAA officials reviewed a draft of this report for accuracy. They generally agreed that the information in the report was accurate. In a few instances, they suggested some technical changes, which we made as appropriate. Unless you publicly announce its contents earlier, we plan no further distribution of this report until 14 days from the date of this letter. At that time, we will send copies to interested congressional committees; the Secretary of Transportation; and the Administrator, FAA. We will also make copies available to other interested parties upon request.

This work was performed under the direction of Kenneth M. Mead, Director, Transportation Issues, who may be reached at (202) 275-1000. Major contributors are listed in appendix II.



J. Dexter Peach
Assistant Comptroller General

1998 before the traveling public can benefit from all the ISP equipment at terminal facilities.

Obligation rates for the ISP are not as high as planned, which also indicates the program is behind schedule. FAA planned to obligate ISP funds in the year they were appropriated, although the funds are available by law for 5 years. We agree that urgency would be best served by obligating the funds as soon as FAA can arrange to do so. However, despite reprogramming $11.5 million of ISP funds to other NAS Plan projects, FAA had obligated only 34 percent of the remaining fiscal year 1989 funds as of March 1990, leaving about $91 million to be obligated. As of the same date, FAA had obligated about 31 percent of the fiscal year 1990 funds, leaving about $50 million to be obligated. By the end of fiscal year 1990, FAA estimates that only 57 percent of 1989 and 1990 funds will be obligated. In addition, FAA has extended its funding plans for the ISP into fiscal year 1992, a year beyond the original plan.

Clearly, FAA's initial contracting, installation, and obligation schedules for the ISP were optimistic. The FAA official responsible for the original schedules based them on information provided by FAA program managers who were to procure the equipment. He believes the program managers were aware of the urgency FAA attributed to the ISP and provided optimistic estimates that reflected that urgency. Because the official had recently transferred to headquarters from an FAA field office and had limited procurement experience, he said that he did not recognize that the information was unrealistic.

Given the history of ATC system procurements, we believe that FAA could have foreseen that its original schedules were optimistic. We reported in November 1988 that NAS Plan projects were behind their 1983 schedules by an average of 3 years. We recently testified that project delays persist.[9] A comparison of FAA's estimates as of January 1990 with its prior year estimates showed that 8 of 12 major projects experienced an additional delay of 200 or more days.[10] In view of these past trends, FAA needs to guard against setting unrealistic schedules for future interim projects.

[9]Issues Related to FAA's Fiscal Year 1991 Budget Request (GAO/T-RCED-90-66, Apr. 18, 1990).

[10]Air Traffic Control: Status of FAA's Effort to Modernize the System (GAO/RCED-90-146FS, Apr. 17, 1990).

ISP, which is required by the configuration management process. The study analyzed 10 of the 15 ISP projects and determined that benefits outweighed costs for only 2 projects, which upgrade existing air traffic controller positions, and a portion of a third project on airport radars. However, FAA stated in its March 1989 proposal for the ISP that a cost-benefit study was not conducted because the projects are necessary and the benefits of capacity improvement and system maintainability have no generally accepted standards for quantification. Although FAA now recognizes that a cost-benefit study was conducted, it believes the study underestimates ISP benefits. In its comments on the ISP proposal, the SEIC stated that more than a dozen studies have demonstrated valid and FAA-approved methods of assessing benefits like those projected in the ISP. We agree with the SEIC that valid analyses of benefits are possible and believe that cost-benefit analysis is a useful tool for planning the NAS modernization.[8]

The SEIC and FAA offices had other concerns about the documentation provided for the ISP. The SEIC commented that "there is no supporting documentation to define how the requested quantities were determined, or at what locations the improvements will be made." In addition, the SEIC recommended that "a line-by-line approval of the ISP initiatives be undertaken since there is no integrated functional relationship among the various ISP initiatives." By this, the SEIC meant that since the ISP projects upgrade such different types of equipment, they should be considered separately. One FAA office, the Management Control Service, commented that the justification of urgency for the ISP was "vague and contains generalities." Another, the Office of System Engineering and Program Management, was concerned that some of the proposed airport radars did not meet FAA's own criteria for establishing which airports need radars.

In response to these concerns, in April 1989, FAA cancelled its plans to procure the airport radars that did not meet its own establishment criteria. The change reduced the total projected cost of this ISP project by about $88 million. FAA did not change any of the other seven procurements that were found not to be cost-beneficial, formally refute the SEIC's cost-benefit study, provide additional supporting documentation for quantities or locations, or conduct a line-by-line approval. We believe FAA should have been more responsive to the concerns about the ISP. FAA should have documented its explanation for the quantities of equipment

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

group, the ISP was required because of capacity, reliability, and maintainability shortfalls with current equipment, but we could find no evidence that it documented actual or projected shortfalls in these areas. Without a requirements analysis, FAA had no sound basis for claiming such shortfalls.

FAA would have been in a better position to perform a requirements analysis for the ISP if it had a capacity management and performance monitoring program. In July 1989, we reported that FAA had not effectively defined its capacity needs and did not monitor the performance of its computer systems.[4] In December 1989—2 years after initiating the ISP—FAA responded that it was implementing a performance monitoring and management tool at large terminals. In June 1990, we recommended that the Secretary of Transportation direct the Administrator, FAA, to set up computer capacity and performance management programs at smaller terminals as well.[5]

FAA would also have been in a better position to assess its requirements for interim equipment if it had capacity, reliability, and maintainability goals. Currently, FAA only has such goals for future equipment. FAA uses the NAS System Specification to assess long-term modernization programs.[6] For example, the NAS System Specification calls for the area control computer complex, a major modernization project, to have a system availability of 99.9995 percent and a mean time between failures of 3,340 hours. The FAA official responsible for developing and implementing configuration management policy, procedures, and standards acknowledges that the NAS System Specification does not provide sufficient goals for interim projects and that such goals are needed.

The inadequate definition of requirements for ISP follows a familiar pattern. FAA has had this problem with 5 of the 12 major NAS Plan systems. We reported in November 1988 that FAA had inadequately defined

[4]Air Traffic Control: Computer Capacity Shortfalls May Impair Flight Safety (GAO/IMTEC-89-63, July 6, 1989).

[5]Air Traffic Control: Smaller Terminal Systems' Capacity Requirements Need to Be Defined (GAO/IMTEC-90-50, June 25, 1990).

[6]The NAS System Specification, Volume 1, Functional and Performance Requirements for the National Airspace System, General establishes the functional, performance, design, manufacture/construction, logistics, personnel and training, documentation, verification, and interface requirements for the National Airspace System.

The ISP is not progressing in a manner that reflects its stated urgent nature. Because FAA is about 1 year behind its contracting schedule and about 3 years behind its installation schedule, it will be 1998 before the traveling public can benefit from all the ISP equipment.

FAA's problems with the ISP are familiar. We have previously reported on inadequately defined requirements and schedule slippages that delay the benefits of ATC modernization to the traveling public. Changes are needed to ensure that future projects are planned and assessed more effectively.

Background

In 1981 FAA embarked on a long-term program, the National Airspace System (NAS) Plan, to modernize the air traffic control system. The NAS Plan is funded by the Airport and Airway Trust Fund. The NAS Plan's purposes are to achieve safer airspace and a more efficient ATC system at an affordable cost to the government and the traveling public.

FAA designed the ISP to meet field operational and maintenance needs pending the implementation of NAS Plan programs. To expedite the interim program, FAA elected to use existing contracts, and sole source and off-the-shelf procurements when possible. FAA considered replacing the systems with improvements that needed developing and testing or just providing additional maintenance for the ATC systems, but it rejected these alternatives as either too slow or too expensive to meet its needs.

As described in draft FAA Order 1800.8F, National Airspace System Configuration Management, configuration management is FAA's means of formally assessing and approving changes to the NAS Plan. Among other things, the order calls for FAA to conduct a thorough requirements analysis so that changes are traceable to operational requirements and supportive of the FAA's goals and objectives. Several FAA offices and the FAA's System Engineering and Integration Contractor (SEIC)[2] were responsible for conducting the configuration management process for the ISP.

Further, the Federal Information Resources Management Regulation, Part 201-30, requires agencies to base acquisitions of new or additional information processing resources on mission needs. These needs are to

[2]In 1984, FAA selected Martin Marietta as its Systems Engineering and Integration Contractor to act as a technical adviser for integrating all the NAS Plan systems.