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AIR TRAFFIC CONTROL

Improvements Needed In FAA's Management of Acquisitions

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GAO/T-RCED-93-36

Mr. Chairman and Members of the Subcommittee:

We welcome the opportunity to appear before you today in order to discuss acquisition management in the Federal Aviation Administration (FAA), particularly in the context of modernization of the air traffic control (ATC) system. This statement summarizes our numerous reviews of FAA's modernization program done over the past several years (see app. III for a list of related reports).

As you know, increases in air traffic have strained the capacity of the nation's ATC system. Aircraft operations have increased by 40 percent over the last decade and FAA estimates that they will increase by another 30 percent over the next 10 years. This growing demand exacerbates FAA's already difficult task of relying on its aging ATC equipment to handle traffic safely and efficiently.

To deal with increased demand on the ATC system and aging equipment, FAA launched a major effort in 1981--now called the Capital Investment Plan (CIP)--to modernize the ATC system. Modernization involves the acquisition of new equipment such as sophisticated radars, computers, and communications networks. Successful acquisition of new equipment is crucial to the timely implementation of the CIP. Poorly planned and managed acquisitions often result in systems that must be redesigned or further developed to meet agency needs, are deployed late, and require additional funding to cover cost overruns. Furthermore, expectations that new systems can reduce costs for airspace users--such as fuel savings for the airlines from more direct routes--cannot be met within established time frames.

In our testimony today, we will describe problems with the modernization projects' costs and schedules, the causes of those problems, and the steps needed to strengthen FAA's acquisition process. We will make three major points:

-- First, FAA has experienced substantial schedule delays and cost growth in modernizing the ATC system. For 12 major systems, the average delay is 5 years from the milestones established in 1983. For 10 of those same projects, cost growth--calculated on a per unit basis--has ranged from 11 to 444 percent. The most vivid example of schedule delays and cost growth is the Advanced Automation System (AAS)--the biggest project in the CIP. The estimated costs for AAS have increased from $2.5 billion in 1983 to $5.1 billion today. Completion of AAS has been delayed from 1994 to 2002. The impacts of delays in modernization projects are significant: long awaited safety and efficiency benefits have been postponed, costly interim projects have been started to sustain existing equipment, and FAA's credibility as a capable manager of the modernization program has been eroded.

-- Second, these schedule delays and cost increases occurred largely because FAA did not follow federal acquisition guidance aimed at reducing cost, schedule, and performance risks. For example, FAA did not prepare mission need statements that would have documented the need for key requirements such as the level of reliability for new systems--how much down time the system can have. In the case of the $1.4 billion Voice Switching and Control System (VSCS), without analyzing the needed level of system reliability, FAA established requirements that have been extremely costly and time-consuming to achieve.

-- Third, FAA has taken some steps to address its cost and schedule problems. For example, in accordance with federal acquisition guidance, FAA now requires mission need statements that should document the inability of current equipment to fulfill agency needs and the consequences of not meeting these needs. The agency has also announced a series of initiatives to put a key segment of the AAS project on track. However, opportunities exist for FAA to strengthen its acquisition management. During our review of FAA's mission needs process, we found that the statements seldom used quantitative or qualitative evidence of problems with the ATC system to justify new investments. In the past year, we made several recommendations to FAA regarding the need to improve its acquisition management, and FAA has generally agreed with our recommendations. The agency now needs to follow through with its planned improvements.

SCHEDULE DELAYS AND COST INCREASES HAVE HINDERED THE MODERNIZATION PROGRAM

We have reported on the status of FAA's ATC modernization program over the past several years. In total, delays and cost increases since the beginning of the modernization program have been significant. Also, delays have resulted in deferred benefits and costly interim projects.

Major Projects Have Encountered Schedule Delays and Cost Growth

Over the years, we have tracked the progress of 12 major acquisition projects that are important in terms of their size and their potential contribution to improving the safety and efficiency of the ATC system. As we recently reported to this Subcommittee, the average schedule delay for these 12 projects has been 5 years from milestones published in FAA's 1983 modernization plan.[1] For

[1]Air Traffic Control: Status of FAA's Modernization Program (GAO/RCED-93-121FS, Apr. 16, 1993).

example, the first-site implementation milestone for FAA's new Airport Surface Detection Equipment (ASDE-3) radar--which could prevent runway incursions--has been delayed by 6 years because of continuing software development problems. Another example is AAS. Significant delays have occurred in AAS's schedule and have grown more severe over the past few months. FAA recently announced that a key initial segment of AAS, in which controller work stations will be replaced at some major ATC facilities, has been delayed another 14 months because of problems in developing the system software. In 1983, FAA reported to the Congress that AAS would be completed by 1994. FAA's most recent estimate for AAS completion is now 2002. A third example is the Mode Select (Mode S) radar and communications system. Similar software development problems have been experienced with Mode S and, as a result, no system is yet operational 9 years after the production contract was signed. Appendix I lists key milestone dates associated with these 12 major acquisitions.

Costs for the 12 major acquisitions we follow have also grown. Because system quantities can change over time, we have developed a cost index to compare 1983 and current Facilities and Equipment (F&E) cost estimates.[2] For 10 of the 12 projects, increases in per-unit costs have ranged from 11 to 444 percent. From a total project perspective, cost increases have also been significant. For example, AAS has doubled in cost from $2.5 billion in 1983 to $5.1 billion. The VSCS communications system that was designed to work with AAS has experienced even more serious cost growth. Estimated F&E costs for VSCS have increased from $259 million to $1.4 billion, or by well over 400 percent.

Delays Have Deferred Benefits And Led to Costly Interim Projects

Pervasive delays in the modernization program have delayed benefits to systems users and thus have diminished the aviation community's confidence in FAA's ability to manage the modernization program. The overall goal of FAA's modernization program is to improve the safety and efficiency of the nation's ATC system. FAA currently estimates a total of $230 billion in benefits to aviation system users. However, schedule delays in modernization have deferred many of these benefits. For example, the potential safety benefits of ASDE-3 have been delayed 6 years. Potential fuel savings from user-preferred routes, available through the use of AAS advanced software functions, have been delayed until at least 1996.

Delays have also caused FAA to initiate costly interim projects to sustain the current ATC system. For example, delays in

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[2]Facilities and Equipment is the FAA appropriation account which primarily funds the modernization program.

AAS have contributed to the need for over $700 million in interim projects, including the $435 million Interim Support Program. Also, in the fiscal year 1994 budget, FAA is requesting $10.8 million in F&E funds to initiate an interim replacement of the Display Channel Complex--a computer that is to be replaced by AAS.

COST AND SCHEDULE PROBLEMS HAVE OCCURRED LARGELY BECAUSE FAA DID NOT FOLLOW FEDERAL ACQUISITION GUIDANCE

In the past, we reported that problems with modernization projects occurred largely because FAA did not follow federal acquisition guidance in the form of Office of Management and Budget (OMB) Circular A-109. A-109 is the principal guidance for acquiring major systems in the federal government. It calls for following a disciplined, five-phased approach to acquisition in order to minimize problems, such as cost increases and schedule delays. Before moving from each phase to the next, A-109 calls for a key decision point at which time agency heads are to evaluate the cost, schedule, and performance of major projects. The purpose of the evaluations is to ensure that the acquisition does not advance to the next phase until management's concerns have been resolved. The A-109 acquisition model is depicted in Appendix II.

From the inception of the ATC modernization program until 1991, FAA did not follow the A-109 process. The agency believed that it could deliver and install new systems more quickly by combining A-109 phases. However, FAA was proven wrong in not following A-109 as shown by the delays that occurred in most of the major systems in the modernization plan.

The first and most important step in the A-109 process--key decision point #1--is the approval of a mission need statement. Agencies should document their inability to fulfill mission needs with current assets. At the outset of its modernization program, FAA did not prepare mission need statements for its major acquisitions. Instead, it used its modernization plan as a blanket mission need statement. As a result, FAA did an inadequate job both of analyzing problems with existing systems and of establishing requirements for the new systems. For example, for VSCS, FAA did not analyze the needed level of system reliability. VSCS costs have grown, in part to achieve a near-perfect 4 seconds of downtime per year. This far surpasses the 8 hours of downtime per year achieved with the current systems that VSCS will replace.

As the second step in the A-109 process--key decision point #2--agency heads approve acquisitions to proceed after alternative design concepts have been identified and explored. FAA has not always evaluated a wide-range of alternatives. For example, with Mode S, FAA initially considered five alternatives, but its determination to combine surveillance and communications functions effectively foreclosed all but the Mode S alternative from consideration.

As the third step--key decision point #3--agencies should demonstrate that systems meet their operational requirements before proceeding into full-scale development. In the past, FAA was not always sure that requirements could be met before entering full-scale development. For example, with AAS, FAA contracted with International Business Machines in 1988 to develop and produce the Initial Sector Suite System (ISSS)--the segment of AAS which provides new work stations for air traffic controllers.[3] However, the operational requirements for ISSS have continued to change. An April 1992 review of AAS by the Volpe National Transportation Systems Center noted that FAA's lack of clarity and decisiveness in resolving requirements issues has contributed to the problems with ISSS development.[4] FAA's Executive Director for Systems Development and its Executive Director for Acquisition and Safety Oversight recently acknowledged that the agency still needs to improve its systems requirements process and said that the agency plans to focus on this area.

Before committing resources to full-production--the final phase of A-109--agencies should ensure at key decision point #4 that the full-scale development and limited production phase is complete. During full-scale development and limited production, systems should be tested under operational conditions. Before 1991, FAA did not have an independent test function that could fairly assess system performance and often did not operationally test systems before making production decisions. Because FAA did not always operationally test systems before approving full production, it has requested and obligated funds before knowing whether the new systems would meet all of its requirements. For example, FAA has obligated most of the funds for the 33 ASDE-3 radars that it originally intended to purchase. However, controllers have not been able to use the radars because of persistent software problems. Had FAA completed a full-scale development and limited production phase, it is unlikely that it would have committed funds to production before these problems were resolved. As of last week, ASDE-3 was not operational at any airport. We believe that it is especially important for FAA to complete the development and testing of systems before committing to production when software development is involved. The protracted development of software for many of these systems has delayed their completion, as was demonstrated with ISSS. Until

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[3]The ISSS is one of four remaining segments of the AAS project. For a detailed discussion of AAS related issues see Air Traffic Control: Uncertainties and Challenges Face FAA's Advanced Automation System (GAO/T-RCED-93-30, Apr. 19, 1993).

[4]An Assessment of the Status and Technical Risk of Federal Aviation Administration's Advanced Automation System Software Development (IR-MA-1298-2), Volpe National Transportation Systems Center and Intermetrics, Inc., Apr. 1992.

software code is written and tested, it is difficult to have confidence that systems will work as designed. The steps laid out in the A-109 process should help to ensure that software risks are adequately minimized.

While following the risk mitigation steps of A-109 is important to successful acquisitions, sound oversight of contractors is also essential. FAA has not always adequately monitored the performance of the contractors it has hired to produce new modernization systems. For example, for AAS, FAA did not assign enough staff or implement adequate quantitative measures to assess its contractor's progress in software development. As the Volpe report pointed out, FAA's practice of measuring progress in terms of software builds--increments in which software is written and tested--did not provide an adequate measure of progress. Therefore, although FAA and its contractor thought they were making good progress, software code for the most difficult functions remained unwritten and untested.

DESPITE CHANGES, FAA NEEDS TO FURTHER STRENGTHEN ACQUISITION MANAGEMENT

FAA has made changes to help strengthen its acquisition management. For example, FAA acquisition guidance now requires that projects have mission need statements before they can be included in the agency's budget and that systems will be operationally tested before FAA commits resources to production. In addition, the agency recently implemented a series of management initiatives to enhance its oversight of ISSS development activities. However, opportunities exist in several areas to make further improvement.

FAA Has Made Changes to Follow Federal Acquisition Guidance

To reduce the risk of cost growth, schedule delays, and technical problems, FAA has initiated changes to improve its acquisition management. In 1990, FAA created the position of Executive Director for Acquisition to head an office responsible for overseeing acquisition policy and monitoring independent operational testing. In September 1990, the Executive Director reported that FAA did not have adequate policies and procedures to manage the acquisition of major systems and identified this area as a major internal control weakness.

In February 1991, FAA issued revised guidance on major acquisitions that put FAA policy in compliance with A-109. Among the changes incorporated in this guidance was a requirement that new projects have a mission need statement before being included in FAA's budget. The guidance also required that alternatives be identified and evaluated and that operational testing be conducted and reviewed by an independent test group within FAA before

production decisions were made. FAA has recently issued a new acquisition policy that reinforces its commitment to follow the A-109 process. FAA's Acquisition Review Committee--which is composed of top level agency officials--is responsible for ensuring that projects comply with FAA's acquisition policies.

FAA has extensively updated its various acquisition orders and made other changes that FAA officials believe will improve the agency's acquisition process. For example, the status and risks of each major acquisition must be regularly reviewed by the Committee. Also, FAA now requires that program managers submit a risk management plan, including measures to reduce risk, that the Committee must approve before an acquisition can proceed to the next phase. Program managers must also develop acquisition program baselines for the most costly major acquisitions. These baseline documents are intended to promote stability and control costs by establishing quantified targets for key performance, cost, and schedule parameters that are critical to the success of the acquisition.

FAA has also issued a new acquisition policy order that encourages the purchase of nondevelopmental items (NDI) when appropriate. An NDI is any item previously developed and available in the commercial marketplace, including off-the-shelf technology. Until recently, FAA generally procured systems that were specially developed to meet its stringent requirements. However, since major systems have taken longer to build and install and have been more costly than planned because of development problems, FAA has decided to emphasize the need to consider off-the-shelf items. By relaxing some of its requirements, the agency believes that it can install new equipment more quickly and at a lower cost. For example, for high-capacity voice recorders, which record ATC voice communications, FAA was able to reduce its unit cost from $115,000 to $13,000 by buying an off-the-shelf item.

Management Initiatives to Address ISSS Problems

In March of this year, FAA acknowledged that it had not been exercising sufficient, continuing top-level management focus on the AAS project, including providing adequate attention to requirements issues and taking too long to respond to technical issues. To address these problems, FAA instituted three management-related initiatives. First, the agency elevated the AAS project by naming a program director to oversee AAS who now reports directly to the Administrator. The program director is empowered to make decisions on issues affecting requirements, except where schedule or cost of the project will be affected by a requirements change. As a result, the program director is accountable for cost containment and keeping the project on schedule. The Acquisition Review Committee is responsible for reviewing the status of the AAS project at least every 2 weeks, and more often if necessary. The

Committee is also responsible for ruling on requirements changes that impact on ISSS cost or schedule.

Second, FAA is in the process of establishing separate program managers for each of the four remaining segments of the AAS project. The former deputy program manager for AAS has been selected as the ISSS program manager. Third, FAA established a dedicated ISSS team at the contractor's site. The team includes representatives from Air Traffic and Airway Facilities organizations within FAA, as well as a contracting officer. The team is fully empowered to resolve technical problems as they arise, eliminating the decision-making delays of the past where it took too long for the agency to come to grips with such problems.

In our opinion, these management initiatives are reasonable under present circumstances and should help to address ISSS problems. However, they will take time to work.

Opportunities to Strengthen the Acquisition Process

Continued cost growth and schedule delays are, to a large extent, a reflection of decisions made years ago. Most of the projects whose progress we report on were begun in the early 1980s. Improvements in FAA's acquisition management can help to minimize problems with existing projects, as well as prevent cost and schedule problems with newer projects. These newer projects will consume an increasing portion of the F&E budget.

Specifically, FAA can improve its acquisition management by developing well-supported mission need statements; assessing alternatives for key projects, such as those involving precision landing systems; and developing performance measures to quantify progress toward CIP goals.

Improved Mission Need Statements and Mission Analysis Would Provide Strong Foundation for FAA's Acquisitions

This past year, we looked at what, in our view, is the most important step in FAA's acquisition process: the development of a mission need statement. A good mission need statement will result in well-defined operational requirements that will guide the contractor and will allow FAA to test new systems against users' needs. Although a good mission need statement will not ensure a problem-free acquisition, poorly defined needs create a weak foundation for the remaining steps in FAA's acquisition process.

According to FAA's guidelines for mission need statements, all unsupported assertions of need are of no value and unsupported statements will be rejected. The Acquisition Review Committee reviews and approves these statements thereby allowing projects to proceed to the next phase of the A-109 process. To test FAA's implementation of these guidelines, we examined 25 of the 76

mission need statements that FAA had approved by August 1992 for funding in fiscal year 1994. We found that FAA's mission need statements were often not supported and therefore did not justify that a need existed for the projects.[5] The 25 mission need statements we examined listed 110 deficiencies or current problems with the ATC system. FAA contended that these deficiencies have adverse effects on FAA's operations, such as driving up operating costs, threatening air traffic safety, or limiting capacity. However, 68 (62 percent) of the deficiencies were not supported by either qualitative or quantitative evidence explaining what performance problem was to be fixed, such as the extent of maintenance problems with the current system or the extent to which a new investment could be expected to improve capacity and safety or to reduce operating costs. For example, one statement asserted that "catastrophic consequences" could result and maintenance costs would "escalate" if a new communication system was not acquired. However, the statement did not provide any supporting information.

According to A-109, mission analysis is a crucial beginning point in the acquisition management process and a precursor to the mission need statement. It should consist of first defining FAA's various mission areas and performance criteria and standards for each. Mission analysis then measures performance against the standards to identify current or projected shortfalls that affect FAA's ability to fulfill its overall mission of providing a safe and efficient aviation system. However, we found that the mission need statements we examined were often not based on analyses of existing ATC systems' performance. Such analyses would have measured how well these systems were performing, identified areas most in need of improvement, and helped set priorities for capital investments.

FAA has recently made some progress in improving its mission need statements by establishing a mission analysis team to review statements submitted for the fiscal year 1995 budget. The mission analysis team's purpose is to provide a bridge between descriptions of need written by FAA operations officials--such as those in FAA's air traffic organization--and more quantitative descriptions of performance appropriate for exploring alternative systems in the next acquisition phase. Also, FAA's new acquisition policy stresses the need for mission analysis to be performed on an ongoing basis. The Acquisition Review Committee will play the key role in encouraging mission analysis and in ensuring that mission need statements are well supported.

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[5]Air Traffic Control: Justifications for Capital Investments Need Strengthening (GAO/RCED-93-55, January 14, 1993).

Reassessing Needs and Identifying Alternatives for Existing Projects

The assessment of needs and alternatives was the subject of our recent report on FAA's plans to develop alternative precision landing systems, including the existing Instrument Landing System (ILS) enhanced with aircraft-based computer technology and two emerging and potentially more capable systems--the Microwave Landing System (MLS) and a satellite-based landing system. As we reported in November 1992, FAA had not determined, runway by runway, which category of system would be needed and whether the replacement of each ILS with a higher capability system was justified.[6] We recommended that FAA provide full budgetary support for the development of all alternatives and prepare a new mission need statement for precision landing systems in general, before deciding on whether to replace existing ILSs. FAA's fiscal year 1994 budget request now provides adequate resources to develop alternative precision landing systems. The potential costs to FAA and system users--between $252 million and $336 million in MLS avionics costs for the commercial aviation fleet--make it essential that FAA thoroughly assess its needs and alternatives for precision landing systems, as we have recommended.

Establishing Modernization Goals and Measuring FAA's Progress

Last year, we recommended that FAA incorporate measurable goals in the CIP to help guide funding decisions for the modernization program.[7] FAA has not yet published its 1992 CIP. However, our review of a draft of the CIP and the fiscal year 1994 F&E budget request indicates that FAA has developed measurable goals. For example, one goal is to increase airport and airspace capacity by 20 percent by 1999. Another is to reduce runway incursions by 80 percent by 2000.

Now that FAA is taking this important step, it would be helpful to decisionmakers in both the executive branch and the Congress if FAA were to report its progress against these goals. Up until now, FAA has reported its progress in terms of the number of CIP projects under contract and completed. Those could be indicators of progress, but they do not show how FAA is improving the safety and efficiency of the ATC system, which is the overall goal for the CIP and the F&E budget.

FAA has recently indicated that it is developing performance measures to track progress against these new CIP goals. Measuring

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[6]Airspace System: Emerging Technologies May Offer Alternatives to the Instrument Landing System (GAO/RCED-93-33, Nov. 13, 1992).

[7]FAA Budget: Key Issues Need To Be Addressed (GAO/T-RCED-92-51, Apr. 6, 1992).

progress against goals would help the Congress in making decisions on where to focus its F&E resources. In addition, it would help FAA to analyze its performance and detect deficiencies in existing systems. This exercise would improve mission need statements and provide better support for modernization projects.

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In summary, to prevent a recurrence of cost and schedule problems with newer modernization projects, FAA has taken some positive steps such as requiring mission need statements. However, we believe that FAA can still make significant progress in improving its acquisition process. Given the importance of the modernization program in maintaining a safe and efficient ATC system, it is important that FAA follow through with its planned improvements in these areas.

Such follow-through will change the way FAA conducts acquisitions. FAA officials will have to reorient their thinking toward first analyzing current performance to identify and demonstrate deficiencies and the need for improved capabilities. Based on our examination of several recent mission need statements, this point cannot be overemphasized. The Acquisition Review Committee has the opportunity to emphasize its commitment to improve FAA's acquisition process by ensuring that sufficient attention is given to mission needs and to the thorough assessment of alternatives. The actions that FAA takes to strengthen its management of acquisitions will do a great deal to enhance its credibility in managing the modernization program.

Mr. Chairman, this concludes my statement. We will be happy to respond to any questions you might have at this time.

Changes in Implementation Milestones for 12 Major FAA Projects

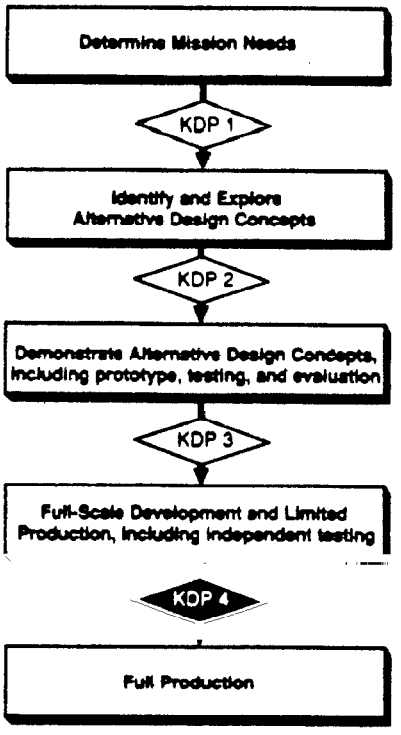
	First-site implementation				Last-site implementation			
	Year of first-site implementation			Years delayed	Year of last-site implementation			Years delayed
	83 NAS	91 CIP	92 CIP	83 NAS - 92 CIP	83 NAS	91 CIP	92 CIP	83 NAS - 92 CIP
Advanced Automation System	1990	1991	1991	1	1994	2001	2002	8
Air Route Surveillance Radar	1985	1993	1994	9	1995	1996	1996	1
Airport Surface Detection Equipment Radar	1987	1992	1993	6	1990	1994	1996	6
Airport Surveillance Radar	1985	1989	1989	4	1992	1993	1996	4
Automated Weather Observing System	1986	1989	1989	3	1990	1997	1997	7
Central Weather Processor	1990	1991	1991	1	1991	1998	[a]	[a]
Flight Service Automation System	1984	1991	1991	7	1989	1995	1995	6
Microwave Landing System	1985	1997	1997	12	1999	2008	2008	9
Mode S	1986	1993	1993	7	1993	1996	1996	3
Radar Microwave Link Replacement and Expansion	1985	1986	1986	1	1989	1994	[a]	[a]
Terminal Doppler Weather Radar	[b]	1993	1993	[b]	[b]	1996	1996	[b]
Voice Switching and Control System	1989	1995	1995	6	1992	1997	1997	5
Average years of delay				5				5

[a]Because portions of the Central Weather Processor (CWP) and the Radar Microwave Link (RML) Replacement and Expansion are being reevaluated, we cannot determine the last-site implementation dates.

[b]The Terminal Doppler Weather Radar project was not included in the 1983 NAS Plan.

Source: Implementation dates from FAA's 1983 NAS Plan, 1991 CIP, and unpublished 1992 CIP.

A-109 Major System Acquisition Process



Determine Mission Needs

Key Decision Point 1
Approval of the mission needs statement starts the major system acquisition process by granting authority to explore alternative system design concepts.

Identify and Explore Alternative Design Concepts

Key Decision Point 2
Advancement to a competitive test/demonstration phase may be approved when the agency's mission need and program objectives are reaffirmed and when alternative system design concepts are selected.

Demonstrate Alternative Design Concepts

Key Decision Point 3
Following reconfirmation of the mission need and program objectives and verification that the chosen system design concept(s) is sound and risks are acceptable, the agency head may authorize the next phase.

Full-Scale Development and Limited Production

Key Decision Point 4
Following satisfactory test results and reconfirmation of mission need and program objectives the agency head may authorize full production.

Full Production

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FAA Budget: Important Challenges Affecting Aviation Safety, Capacity, and Efficiency (GAO/T-RCED-93-33, Apr. 26, 1993).

Air Traffic Control: Uncertainties and Challenges Face FAA's Advanced Automation System (GAO/T-RCED-93-30, Apr. 19, 1993).

Air Traffic Control: Status of FAA's Modernization Program (GAO/RCED-93-121FS, Apr. 16, 1993).

State of the Airline Industry: Strategies for Addressing Financial and Competition Problems (GAO/T-RCED-93-21, Mar. 10, 1993).

Air Traffic Control: Advanced Automation System Problems Need to Be Addressed (GAO/T-RCED-93-15, Mar. 10, 1993).

Air Traffic Control: Justifications for Capital Investments Need Strengthening (GAO/RCED-93-55, Jan. 14, 1993).

Transportation Issues (GAO Transition Series) (GAO/OCG-93-14TR, Dec. 1992).

Airspace System: Emerging Technologies May Offer Alternatives to the Instrument Landing System (GAO/RCED-93-33, Nov. 13, 1992).

Air Traffic Control: Advanced Automation System Still Vulnerable to Cost and Schedule Problems (GAO/RCED-92-264, Sept. 18, 1992).

FAA Budget: Key Issues Need to Be Addressed (GAO/T-RCED-92-51, Apr. 6, 1992).

Air Traffic Control: Status of FAA's Modernization Program (GAO/RCED-92-136BR, Apr. 3, 1992).

Air Traffic Control: Challenges Facing FAA's Modernization Program GAO/T-RCED-92-34, Mar. 3, 1992).

Air Traffic Control: FAA Can Better Forecast and Prevent Equipment Failures (GAO/RCED-91-179, Aug. 2, 1991).

Aviation Acquisition: Further Changes Needed in FAA's Management and Budgeting Practices (GAO/RCED-91-159, July 29, 1991).

FAA Budget: Key Issues in Facilities & Equipment and Operations Accounts Need Resolution (GAO/T-RCED-91-58, June 5, 1991).

Major Acquisitions: Top Management Attention Needed to Improve DOT's Acquisition Process (GAO/T-RCED-91-45, Apr. 24, 1991).

Air Traffic Control: Status of FAA's Modernization Effort (GAO/RCED-91-132FS, Apr. 15, 1991).

Air Traffic Control: The Interim Support Plan Does Not Meet FAA's Needs (GAO/RCED-90-213, Sept. 11, 1990).

Air Traffic Control: Continuing Delays Anticipated for the Advanced Automation System (GAO/IMTEC-90-63, July 18, 1990).

Air Traffic Control: Ineffective Management Plagues $1.7 Billion Radar Program (GAO/IMTEC-90-37, May 31, 1990).

FAA Encountering Problems in Acquiring Major Automated Systems (GAO/T-IMTEC-90-6, Apr. 26, 1990).

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

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

Issues Related to FAA's Modernization of the Air Traffic Control System (GAO/T-RCED-90-32, Feb. 27, 1990).

Aviation Weather: FAA Needs to Resolve Questions Involving the Use of New Radars (GAO/IMTEC-90-17, Oct. 2, 1989).

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

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

Microwave Landing Systems: Additional Systems Should Not Be Procured Unless Benefits Proven (GAO/RCED-88-118, May 16, 1988).

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

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