

GAO

Testimony

Before the Subcommittee on Aviation,
Committee on Transportation and
Infrastructure, House of Representatives

For Release on Delivery
Expected at 10:00 a.m. EST
Thursday, October 30, 2003

AIR TRAFFIC CONTROL

FAA's Modernization Efforts—Past, Present, and Future

Statement of Gerald L. Dillingham, Director,
Physical Infrastructure Issues




Highlights

Highlights of [GAO-04-227T](#), a testimony before the Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives

Why GAO Did This Study

The Federal Aviation Administration's (FAA) air traffic control modernization (ATC) efforts are designed to enhance the safety, capacity, and efficiency of the national airspace system through the acquisition of a vast network of radar, navigation, communications, and information processing systems, as well as new air traffic control facilities. Since 1981, when these efforts began, FAA's ATC modernization projects have consistently experienced cost, schedule, and performance problems that GAO and others have attributed to systemic management issues. As a result, FAA's cost estimates have grown and planned improvements have been delayed. Initially FAA estimated that its ATC modernization efforts would cost \$12 billion and could be completed over 10 years. Now, two decades and \$35 billion later, FAA expects to need another \$16 billion through 2007 to complete key projects, for a total cost of \$51 billion.

This testimony (1) provides an overview of the systemic management issues that GAO and others have identified in FAA's ATC modernization efforts over time, (2) discusses key actions that FAA and others have taken to address these issues, and (3) identifies the challenges that lie ahead for FAA.

www.gao.gov/cgi-bin/getrpt?GAO-04-227T.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Gerald L. Dillingham at (202) 512-2834 or dillinghamg@gao.gov.

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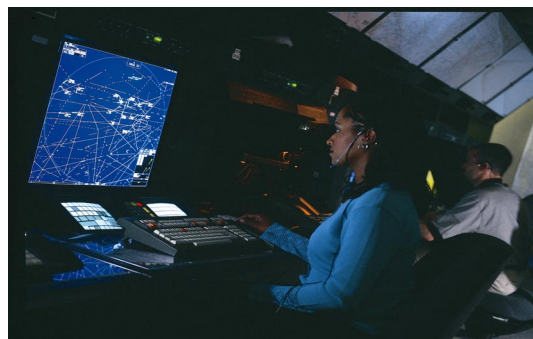
What GAO Found

Over the years, systemic management issues, including inadequate management controls and human capital issues, have contributed to the cost overruns, schedule delays, and performance shortfalls that FAA's major ATC projects have consistently experienced. These problems occurred, in large part, because FAA lacked the information technology and financial management systems that would have helped it reliably determine the projects' technical requirements and estimate and control their costs and schedules. In addition, organizational culture issues discouraged collaboration among technical experts and users, and frequent changes in FAA's leadership—seven different Administrators and Acting Administrators in the first 10 years—hampered the modernization efforts.

FAA has taken steps to improve the management of its ATC modernization efforts and has made progress. For example, it implemented a cost-effective, incremental development approach that avoided costly late-stage changes. In addition, it has fully or partially implemented over 30 GAO recommendations designed to improve its management controls and address human capital issues. The Congress also extended the term of the FAA Administrator to 5 years, providing for greater continuity and stability, and enacted legislation designed to bring the benefits of performance management to ATC modernization.

FAA faces a number of challenges in fully implementing recommendations that GAO and others have made to improve its management controls and address human capital issues. FAA also faces the challenge of becoming a more efficient and accountable performance-based air traffic organization. Finally, FAA has an opportunity to review its current 10-year plan for modernizing the National Airspace System and to assess the relative importance and feasibility of the plan's priorities in light of current federal and private sector economic constraints, new aviation security requirements, and other issues.

Air Traffic Controller at Work



Source: National Air Traffic Controllers Association.

Mr. Chairman and Members of the Subcommittee:

We appreciate the opportunity to participate in today's hearing to discuss our work on FAA's air traffic control modernization (ATC) efforts, which are designed to enhance the safety, capacity, and efficiency of the national airspace system, primarily through software-intensive technology improvements. As you know, these efforts involve acquiring a vast network of radar, navigation, communications, and information processing systems, as well as new air traffic control facilities. Since 1981, when these efforts began, FAA's ATC modernization projects have consistently experienced cost, schedule, and performance problems that we and others have attributed to systemic management issues. As a result, FAA's cost estimates have grown and planned improvements have been delayed. Initially FAA estimated that its ATC modernization efforts would cost \$12 billion and could be completed over 10 years. Now, two decades and \$35 billion later, FAA expects to need another \$16 billion through 2007 to complete key projects, for a total cost of \$51 billion.

By the summer of 2000, the ATC system no longer had the capacity to manage demand efficiently, and flight delays produced near-gridlock conditions at many U.S. airports. The events of September 11 and the subsequent economic downturn severely reduced the demand for air travel for a time, but the aviation industry is gradually recovering, and FAA forecasts a return to pre-9/11 demand levels in about 2005 or 2006. This current period of reduced but growing demand for air travel has created a narrow window of opportunity to address the management issues underlying FAA's ATC modernization problems and to prepare the ATC system for managing a growing volume of air traffic more safely and efficiently than in the past.

My statement today (1) provides an overview of the systemic management issues that we and others have identified in FAA's ATC modernization efforts over time, (2) discusses key actions that FAA and others have taken to address these issues, and (3) identifies the challenges that lie ahead for FAA. The statement is based on our past reports on ATC modernization (see Related GAO Products)—updated to reflect important milestones—and recent interviews with key stakeholders in the aviation community, including the Air Transport Association, National Air Traffic Controllers Association, and Professional Airways Systems Specialists. We performed our work in accordance with generally accepted government auditing standards.

In summary:

- Over the years, systemic management issues, including inadequate management controls and human capital issues, have contributed to the cost overruns, schedule delays, and performance shortfalls that FAA's major ATC projects have consistently experienced. These systemic management issues have kept FAA's ATC modernization efforts on our watch list of high-risk federal programs since 1995. Both the Wide Area Augmentation System (WAAS)—designed to provide satellite-based navigation for airspace users—and the Standard Terminal Automation Replacement System (STARS)—designed to replace aging displays and processing systems used by air traffic controllers—have missed cost, schedule, and performance targets because of such issues. For both projects, FAA initially underestimated the costs and time needed to meet complex technical requirements and for STARS, it failed to involve stakeholders sufficiently in determining the project's requirements. Consequently, when the projects failed to meet requirements, FAA had to contract for costly, time-consuming modifications and revise its cost and schedule estimates. These problems occurred, in large part, because FAA lacked the information technology and financial management controls that would have helped it reliably determine the projects' technical requirements and estimate and control their costs and schedules. In addition, organizational culture issues discouraged collaboration among technical experts and users, and frequent changes in FAA's leadership—seven different Administrators and Acting Administrators in the first 10 years—hampered the modernization effort. In numerous reports and testimonies, we, the Department of Transportation's Inspector General, and others have made recommendations to address these issues.
- FAA has taken steps to improve the management of its ATC modernization efforts and has made progress in a number of areas. For example, it implemented an incremental, "build a little, test a little" approach that improved its management by providing for mid-course corrections and thus helping FAA to avoid costly late-stage changes. Furthermore, since 1995, FAA has fully or partially implemented over 30 of our recommendations, including recommendations to improve its management controls and address human capital issues. In the area of management controls, it has (1) developed a blueprint for modernization (systems architecture) to manage the development of ATC systems; (2) established processes for selecting and controlling information technology investments, (3) introduced an integrated framework for improving software and system acquisition processes, and (4) improved its cost-estimating and cost-accounting practices. In addition, it has taken steps to identify and address its information systems security needs. In the human

capital area, FAA has attempted to improve collaboration among technical experts and system users by establishing integrated teams to serve as vehicles for identifying needs, pooling expertise, and reconciling priorities. Additionally, in 1994, the Congress extended the term of the FAA Administrator to 5 years, providing for greater continuity and stability; in 1995, the Congress exempted FAA, at its request, from certain federal human capital requirements; and in 2000, the Congress and the administration together provided for a new oversight and management structure and a new air traffic organization to bring the benefits of performance management to ATC modernization. To date, one FAA Administrator has completed a 5-year term; FAA has fully or partially implemented the personnel reforms that the Congress authorized; and the Air Traffic Services Subcommittee, which provides oversight, has recently appointed a chief operating officer to manage the new air traffic organization, which has yet to be formed. It is still too early to assess the results of some of these initiatives, and some challenges remain.

- While FAA has taken steps to improve its management controls and resolve human capital issues, it still faces challenges in fully implementing recommendations that we and others have made. For example, it still needs to (1) complete and make better use of its information technology blueprint to manage change; (2) put processes in place for evaluating projects after implementation to strengthen the investment management process, (3) ensure that systems achieve a minimum level of software capability before being funded; and (4) incorporate actual costs from related system development efforts in its processes for estimating the costs of new projects. Efforts to secure FAA's air traffic control systems from cyber threats also remain a critical challenge. In the human capital area, FAA needs to do more to foster collaboration among technical experts and users, as well as fully implement the personnel reforms that the Congress authorized. FAA also faces the challenge of becoming a more efficient and accountable performance-based air traffic organization under the leadership of the Air Traffic Services Subcommittee and the recently hired chief operating officer. Finally, during the remaining lull in the demand for air travel, FAA has an opportunity to review its 10-year plan for modernizing the National Airspace System and to assess the relative importance and feasibility of the plan's priorities in light of current federal and private sector economic constraints, new security requirements, and other issues.

Background

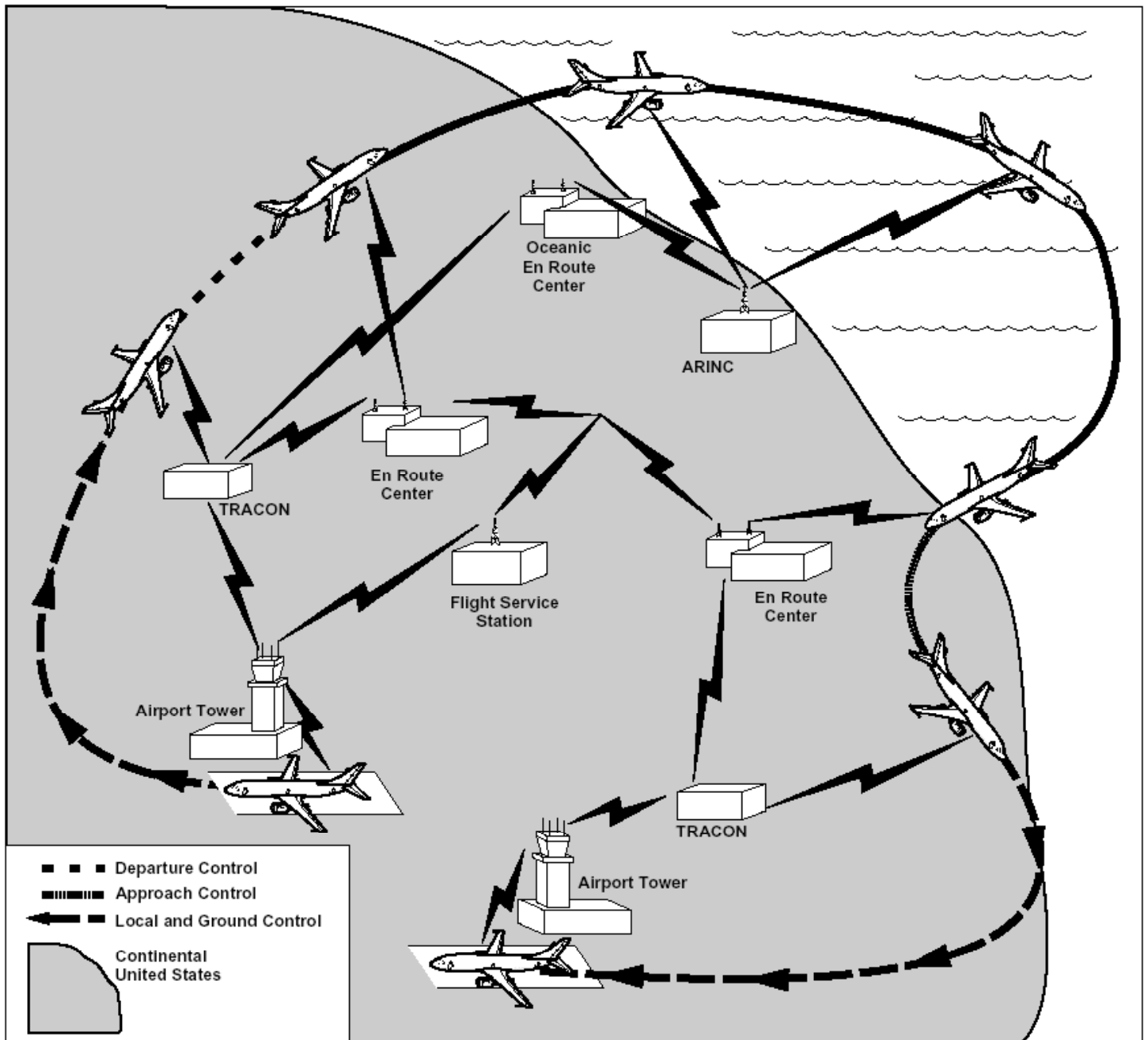
Commercial aviation is a critical component of our nation's transportation infrastructure and a significant contributor to our nation's economy. For example, in 2000, there were over half a billion passenger boardings of

commercial airline flights and the airline industry contributed \$800 billion to Gross Domestic Product (8 percent) and employed nearly 10 million people (7 percent).¹

Automated information processing and display, communication, navigation, surveillance, and weather resources permit air traffic controllers to view key information, such as aircraft location, aircraft flight plans, and prevailing weather conditions and to communicate with pilots. These resources reside at, or are associated with, several ATC facilities—flight service stations, air traffic control towers, terminal radar approach control (TRACON) facilities, and air route traffic control centers (en route centers). These facilities are depicted in figure 1.

¹These 10 million people include those with jobs both directly and indirectly related to aviation activities.

Figure 1: Overview of U.S. Air Traffic Control System



Source: GAO

Notes:

^aThe Standard Terminal Automation Replacement System (STARS) is designed to allow controllers at TRACONs to separate and sequence aircraft.

^bThe Wide Area Augmentation System (WAAS), when fully developed, will comprise a network of up to 76 ground stations (not depicted in graphic) and three to four geostationary communications satellites.

^cThe Next-Generation Air/Ground Communications System (NEXCOM), is an integrated voice and data system that will be in aircraft avionics, with the ground network infrastructure to support data link services to be deployed, as appropriate, for operation in en route centers.

Systemic Issues Have Contributed to ATC Modernization Projects' Cost, Schedule, and Performance Problems

Over the years, systemic management issues, including inadequate management controls and human capital issues, have contributed to the cost overruns, schedule delays, and performance shortfalls that FAA's major ATC projects have consistently experienced.

These problems were of such magnitude that we designated ATC modernization as high risk in 1995. Table 1 summarizes the types of problems experienced by five major air traffic control projects.

Table 1: Cost, Schedule, and Performance Information for Selected ATC Modernization Efforts

Project	Purpose	Cost overruns	Schedule slips	Performance issues
Standard Terminal Automation Replacement System (STARS)	To replace aging displays and processing systems used by air traffic controllers	Yes	Yes	Yes
Next-Generation Air/Ground Communications (NEXCOM)	To replace existing communications systems and provide additional voice channels	No	Yes	Test pending
Wide Area Augmentation System (WAAS)	To provide satellite-based navigation for airspace users	Yes	Yes ^a	Yes
Integrated Terminal Weather System (ITWS ^b)	To provide air traffic managers with enhanced weather information that does not require meteorological interpretation	Yes	Yes	Yes
Weather and Radar Processor (WARP ^b)	To provide controllers, traffic managers, and meteorologists with accurate and reliable weather information	Yes	Yes	Yes

Sources: GAO and Department of Transportation, Office of Inspector General.

^aWhile WAAS was deployed in July 2003, historically, the project has had schedule slips.

^bInformation for WARP reported by the Department of Transportation, Office of Inspector General.

Two Projects Illustrate the Effects of Systemic Management Issues on Costs, Schedules, and Performance

Two projects, WAAS and STARS, illustrate the effects of inadequate management controls and human capital issues on the costs, schedules, and performance of major ATC modernization projects. More specifically, FAA lacked adequate information technology and financial management controls to comprehensively identify these projects' requirements, reliably estimate their costs and schedules, and hold contractors accountable for meeting cost, schedule, and performance targets. In addition, FAA lacked effective processes for fostering collaboration among technical experts and users, as well as sustained leadership to provide direction and follow-through. As a result, these projects cost more, took longer, and met fewer requirements than planned.

WAAS is designed to provide satellite-based navigation for airspace users. As we reported in June 2000,² FAA underestimated the complexity of developing WAAS. FAA originally planned to start deploying WAAS in 1998 and finish in 2001; however, the agency could not deliver on this promise because an aggressive schedule contributed to software development problems, and the project was unable to meet a key integrity requirement—that WAAS would virtually never fail to warn pilots of potential navigation hazards. In January 2003, we reported in our high-risk series that the cost for WAAS had grown from an original estimate of \$892 million to \$2.9 billion.^{3,4} In July 2003, FAA commissioned WAAS for instrument flight use.

STARS is designed to replace the outdated computer equipment that air traffic controllers currently use at some facilities to control air traffic within 5 to 50 nautical miles of an airport. In 1996, FAA anticipated very little software development, planned to install STARS in 172 facilities at a cost of \$940 million, and expected implementation to begin in 1998 and end in 2005. In 1999, FAA modified its acquisition approach (from off-the-shelf software to a combination of customized and off-the-shelf software) and then concluded that it did not have adequate funding to deploy STARS as widely as planned. In March 2002, FAA estimated that the project's development costs would total \$1.33 billion, and it received approval to deploy STARS at 74 facilities. FAA does not yet know to what extent its development cost estimate is reliable because, as we reported in January 2003,⁵ it lacks accurate, valid, current data on the STARS project's remaining costs and progress. FAA commissioned STARS at Philadelphia International Airport in June 2003. Figure 2 shows a STARS display.

²U.S. General Accounting Office, *National Airspace System: Problems Plaguing the Wide Area Augmentation System and FAA's Actions to Address Them*, [GAO/T-RCED-00-229](#) (Washington, D.C.: June 29, 2000).

³These dollars are nominal.

⁴U.S. General Accounting Office, *High-Risk Series: An Update*, [GAO-03-119](#) (Washington, D.C.: January 2003).

⁵U.S. General Accounting Office, *National Airspace System: Better Cost Data Could Improve FAA's Management of the Standard Terminal Automation Replacement System*, [GAO-03-343](#) (Washington, D.C.: Jan. 31, 2003).

Figure 2: STARS Display with Air Traffic



Source: FAA.

Inadequate Management Controls Have Hampered ATC Modernization Efforts

Our work has shown that several types of information technology and financial management controls are important to manage large ATC projects efficiently and effectively. These include a blueprint for planning, a system for managing information technology investments, and an integrated framework for improving system and software processes, as well as systems for estimating and accounting for costs. Efforts to ensure the security of ATC systems are also critical. As we have reported over the years, inadequate information technology and financial management

controls made it difficult for FAA to ensure, among other things, the integrity, efficiency, and security of ATC modernization projects.

- *Incomplete blueprint for modernization (system architecture)*: This blueprint would define and constrain the development and maintenance of the many interrelated systems comprising the ATC infrastructure. In 1997, we reported that FAA lacked a complete blueprint. The agency's lack of a complete and enforced systems architecture had permitted incompatibilities among existing ATC systems.⁶
- *Ineffective information technology investment management*: FAA lacked a complete framework for selecting, controlling, and evaluating a portfolio of investments. Investments in information technology can have a dramatic impact on an organization's performance. If managed effectively, these investments can vastly improve government performance and accountability.⁷ If not, however, they can result in wasteful spending and lost opportunities for improving delivery of services to the public.
- *Immature software acquisition processes*: FAA lacked a structured process for improving its capabilities in acquiring and developing software-intensive systems. As a result, we found that its processes for acquiring software were ad hoc.
- *Inadequate cost estimating and cost accounting systems*: In our 1997 high risk series,⁸ we reported that FAA's cost estimating processes and cost accounting practices were not adequate to effectively manage its billion dollar information technology investments for ATC modernization.⁹ Among other things, we recommended that FAA institutionalize defined processes for estimating projects' costs.
- *Poor information security*: Since September 1996, we have reported that poor information security is a high-risk area across the federal government

⁶U.S. General Accounting Office, Complete and Enforced Architecture Needed for FAA Systems Modernization [GAO/AIMD-97-30](#) (Washington, D.C.: Feb. 3, 1997).

⁷U.S. General Accounting Office, *Information Technology Investment Management: A Framework for Assessing and Improving Process Maturity, Exposure Draft*, [GAO/AIMD-10.1.23](#) (Washington, D.C.: May 2000).

⁸U.S. General Accounting Office, *High Risk Program: Information on Selected High-Risk Areas*, [GAO/HR-97-30](#) (Washington, D.C.: May 16, 1997).

⁹U.S. General Accounting Office, *Information Needed to Make Billion-Dollar Modernization Investment Decisions*, [GAO/AIMD-97-20](#) (Washington, D.C.: Jan. 22, 1997).

with potentially devastating consequences.¹⁰ One serious issue is protecting the information systems that support the nation's critical infrastructure, including segments of the air traffic control system. Security at our nation's airports alone does not ensure safe air travel. It is also critical to secure FAA's air traffic control computer systems, which provide information to air traffic controllers and aircraft flight crews to help ensure the safe and expeditious movement of aircraft. Failure to adequately protect these systems, as well as the facilities that house them, could cause a nationwide disruption of air traffic or even a loss of life due to collisions. Between May 1998 and December 2000, we made 39 recommendations to FAA to address pervasive weaknesses in the agency's facilities' physical and information systems security—both for currently operational and future air traffic control systems, security management, and personnel security.

Human Capital Issues Also Impeded ATC Modernization

Our work has also shown that, to avoid costly changes to ATC system contracts, it is important to bring technical experts and users together to design and test the systems to ensure that they will meet users' needs and work as intended. We found that FAA's organizational culture discouraged such collaboration. In addition, a lack of sustained leadership slowed the progress of ATC modernization.

- *FAA's "stovepiped" organizational culture*, as we reported in 1996,¹¹ created barriers to collaboration and encouraged a focus on the goals of individual program offices, rather than on the goals of projects as a whole. As a result, employees sometimes acted in ways that did not reflect a strong enough commitment to mission focus, accountability, coordination, and adaptability, and the conflicting priorities led to project delays.
- *The lack of sustained leadership* at FAA was problematic throughout the first decade of ATC modernization and beyond. During the first 10 years, the agency had seven different Administrators and Acting Administrators, whose average tenure was less than 2 years. In addition, five people held the position of senior acquisition executive between 1990 and 1995. As we

¹⁰U.S. General Accounting Office, *Information Security: Opportunities for Improved OMB Oversight of Agency Practices*, [GAO/AIMD-96-110](#) (Washington, D.C.: Sept. 24, 1996).

¹¹U.S. General Accounting Office, *Aviation Acquisition: A Comprehensive Strategy Is Needed for Cultural Change at FAA* (Washington, D.C.: Aug. 22, 1996).

reported in 1995,¹² such frequent turnover at the top contributed to an agency culture that focused on short-term initiatives, avoided accountability, and resisted fundamental improvements in the acquisition process.

In addition, according to FAA, burdensome governmentwide human capital rules impeded its ability to hire, train, and deploy personnel, thereby hampering its ability to manage ATC modernization projects efficiently.

FAA Has Taken Steps to Address Systemic Management Issues

FAA has taken a number of steps to improve the management of its ATC modernization efforts and has made progress. First, it has implemented an incremental approach to project development, under which it “builds a little, tests a little” to better estimate the time and costs needed to complete modernization projects. In addition, it has fully or partially implemented over 30 recommendations that we have made, as well as recommendations made by the Department of Transportation’s Inspector General and others. Our recommendations focused on two key areas—(1) strengthening management controls for major ATC modernization systems (e.g., improving estimates of the time and cost to develop and implement projects) and (2) better managing FAA’s human capital resources (e.g., improving FAA’s organizational culture to better leverage its human capital resources to effectively support ATC modernization). The Congress has also taken actions designed to address some of FAA’s human capital issues.

A New Development Approach and Better Management Controls Have Given FAA Stronger Tools for Managing ATC Projects

- *“Build a little, test a little” approach to system development:* During its implementation of Free Flight Phase 1, FAA adopted a more incremental approach to acquiring its ATC modernization systems than it had for previous systems. FAA refers to this as the “build a little, test a little” or spiral development approach. Some aviation stakeholders applaud this approach because, although they have found that its use can increase costs initially, money can be saved in the long run by avoiding mistakes that are very costly to fix once a system has been developed. This approach helps to ensure that the necessary building blocks of a system are tested along the way through the early and ongoing involvement of key stakeholders, such as those who will use and maintain the system. These

¹²U.S. General Accounting Office, *Exempting FAA From Procurement and Personnel Rules*, [GAO/RCED-96-27R](#) (Washington, D.C.: Oct. 27, 1995).

stakeholders are key to identifying critical omissions and “no go” items that could prevent a system from operating as intended.

- *Blueprint for modernization (system architecture)*: FAA has developed a systems architecture, or overall blueprint, that clarifies interdependencies and interrelationships among national airspace systems and the technical standards to which systems must comply for information technology. In November 2002, the Office of Management and Budget instructed agencies to base investments in information technology on enterprise architectures, which define (in both business and technology terms) how an entity operates today and how it wants to operate in the future, including a roadmap for transitioning to this future operational state. In April 2003, GAO issued guidance on developing enterprise architectures.¹³
- *Improved information technology investments management*: In response to our recommendations, FAA has improved its process for managing information technology investments (e.g., the software-intensive systems under ATC modernization) by overseeing investment risks and capturing key information from the investment selection process in a management information system. Also, FAA has developed and implemented guidance for validating costs, benefits, and risks.
- *Improved software acquisition processes*: In response to shortcomings that we identified in FAA’s process for acquiring software, FAA developed an integrated framework for improving its software acquisition, software development, and systems engineering processes. FAA has also continued to expand the number of system development projects that use this integrated framework.
- *Cost-estimating and cost-accounting systems*: To improve cost estimates, FAA developed a standard work breakdown structure and established an historical database for tracking ATC systems’ estimated costs and other information. As we reported in January 2003,¹⁴ FAA has made significant progress in implementing its cost accounting system since our last high-risk series.

¹³U.S. General Accounting Office, *Information Technology: A Framework for Assessing and Improving Enterprise Architecture Management (Version 1.1)*, [GAO-03-584G](#) (Washington, D.C.: April 2003).

¹⁴U.S. General Accounting Office, *High-Risk Series: An Update*, [GAO-03-119](#) (Washington, D.C.: January 2003).

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- *Information security:* FAA has initiated numerous activities in response to our recommendations about pervasive weakness in its facilities' physical and information security system. For example, in recent years, the Chief Information Officer's information systems security office has developed an information systems security strategy, security architecture (i.e, overall blueprint), security policies and directives, and a security awareness training campaign. The security office also implemented a certification and accreditation process to ensure that vulnerabilities in current and future ATC systems are identified and weaknesses are addressed.

FAA Is Implementing Human Capital Initiatives

- *Organizational culture framework:* In response to recommendations we made about the need for FAA to address the organizational barriers that had impaired its ATC acquisition process, the agency issued an organizational culture framework in 1997 and is working to implement it. For example, it has used integrated project teams to improve collaboration among technical experts and users.
- *Personnel reform:* In response to FAA's request, the Congress exempted FAA from many federal laws governing human capital, and the agency began implementing sweeping human capital reforms in 1996. These reforms addressed (1) compensation and performance management, (2) workforce management, and (3) labor and employee relations. In our February 2003 report on FAA's implementation of personnel reform,¹⁵ we found that the agency had fully or partially implemented initiatives in each of these areas.
- *Actions to sustain leadership:* To provide FAA's ATC modernization efforts with needed direction and stability, the Congress established a 5-year term for the FAA Administrator in 1994. Former Administrator Garvey was the first to complete a term of this length in 2002. In addition, the three individuals who served as FAA's senior acquisition executive—the Associate Administrator for Research and Acquisitions—between 1996 and 2003 held this position longer than their predecessors.
- *Chief operating officer and Air Traffic Organization:* To accelerate ATC modernization and improve the performance of the air traffic control system, the Congress enacted legislation in 2000 that established a five-member board (the Air Traffic Services Subcommittee) to oversee, and a

¹⁵U.S. General Accounting Office, *Human Capital Management: FAA's Reform Effort Requires a More Strategic Approach*, [GAO-03-156](#) (Washington, D.C.: February 3, 2003).

chief operating officer to manage, a new performance-based organization, the Air Traffic Organization, which was created through an executive order to operate the ATC system. Under the act, the Subcommittee provides oversight by, among other things, reviewing and approving strategic plans, large contracts, and budget requests for the air traffic control system. The Subcommittee has been meeting since January 2001, and a chief operating officer was appointed in June 2003. While awaiting the appointment of a chief operating officer, the Subcommittee focused on bringing performance management, accountability, and a more businesslike structure to the ATC system, and it took some specific actions, including reviewing and approving performance metrics, a budget, and three large procurements that FAA initiated.

Key Challenges Lie Ahead

FAA faces a number of challenges in fully implementing management controls for major ATC projects and marshalling the human capital resources to deliver on these controls. Additionally, during this lull in the demand for air travel, it has an opportunity to review its long-term ATC modernization priorities to assess their relative importance and feasibility in light of current economic constraints, security requirements, and other issues.

Continuing to Improve Management Controls and Use Human Capital Resources More Effectively Poses Ongoing Challenges

Despite the progress FAA has made in improving its management controls and human capital management for ATC modernization, systemic management issues persist and warrant sustained attention. In our 2003 review of federal high-risk areas,¹⁶ we considered these issues of sufficient magnitude to continue placing ATC modernization on our high-risk list.

- *Need for complete and enforced enterprise architecture:* FAA has developed a systems architecture, or overall blueprint, which clarifies interdependencies and interrelationships among national airspace systems and the technical standards to which systems must comply. However, in February 2002, we reported that while FAA's enterprise architecture is at a moderate level of maturity—that is, the agency has begun developing architecture products such as policies and concepts—it has not yet completed the architecture products or leveraged the architecture for

¹⁶U.S. General Accounting Office, *High-Risk Series: An Update*, [GAO-03-119](#) (Washington, D.C.: January 2003).

managing change.¹⁷

- *Need to strengthen information technology investment management processes:* Although FAA has developed guidance for validating costs, benefits, and risks, the agency has not yet implemented processes for evaluating projects after implementation in order to identify lessons learned and improve the investment management process. Our work has also identified the need for sustained attention to managing ATC systems over their entire lifecycles—from the cradle to the grave.
- *Need to improve software acquisition processes:* Since our last high-risk update, FAA has continued to expand the number of system development projects that use an integrated framework. However, FAA still does not require all systems to achieve a minimum level of progress within the framework before being funded.
- *Need to improve cost-estimating practices:* FAA has not yet fully instituted rigorous cost-estimating practices. That is, it is not yet incorporating actual costs from related system development efforts in its processes for estimating the costs of new projects. Cost estimation was problematic for both STARS and WAAS. As we reported in January 2003,¹⁸ FAA lacks accurate, valid, and current data on the remaining costs and progress of STARS. Without such data, FAA is limited in its ability to effectively oversee the contractor's performance and reliably estimate future costs. Given FAA's chronic difficulty in meeting cost, schedule, and performance targets, some members of the aviation community have suggested that more rigor needs to be built into these estimates when projects are started and that this could best be done by having an independent group of experts review FAA's initial estimates for ATC projects. The accuracy of these estimates is particularly important as FAA embarks on two relatively new and costly ATC modernization projects—NEXCOM, which is expected to cost nearly \$1 billion, and the En Route Automation Replacement Modernization (ERAM), which will provide new hardware and software to facilities responsible for directing high-altitude air traffic and is expected to cost over \$2 billion.

¹⁷U.S. General Accounting Office, *Information Technology: Enterprise Architecture Use Across the Federal Government Can Be Improved*, [GAO-02-6](#) (Washington, D.C.: Feb. 19, 2002).

¹⁸U.S. General Accounting Office, *High-Risk Series: An Update*, [GAO-03-119](#) (Washington, D.C.: January 2003).

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- *Need to improve cost-accounting system:* In January 2003, we reported that FAA had made significant progress in implementing its cost-accounting system since we issued our last high-risk report. However, in June 2003, the Department of Transportation's Inspector General issued an assessment of FAA's cost-accounting system and found that the system was still not effective.¹⁹ According to the Inspector General, FAA could not credibly claim to be a performance-based organization, or function as one, without a cost-accounting system that is compliant with federal cost-accounting standards.
 - *Need to improve information security:* Despite improvements by FAA, the agency faces continued challenges in improving its intrusion detection capabilities, obtaining accreditation for systems that are already operational, and managing information systems security throughout the agency.
 - *Need to change organizational culture:* Although FAA issued an organizational culture framework in 1997 and established integrated teams to implement it, the Department of Transportation's Inspector General reported in 2000 that FAA's culture remains a barrier to successful acquisition projects and that integrated teams are not working well because FAA's culture continues to operate in vertical "stovepipes" that conflict with the horizontal structure of team operations. Our 2000 report on WAAS confirmed that the integrated teams were not working as intended.²⁰ We found that competing priorities between two key organizations that are part of WAAS' integrated team negated the effectiveness of the team's approach for meeting the agency's goals for the system.
 - *Need to fully implement personnel reforms:* In our February 2003 report on FAA's implementation of personnel reforms, we found that the agency had not fully incorporated elements that are important to effective human capital management into its overall reform effort, including data collection and analysis, performance goals and measures, and links between reform goals and program goals. In turn, we recommended that FAA develop a more strategic approach to its reform effort, to better position itself to

¹⁹U.S. Department of Transportation, Inspector General, *2002 Status Assessment of Cost Accounting System and Practices, Federal Aviation Administration*, Report Number FI-2003-043 (Washington, D.C., June 3, 2003).

²⁰U.S. General Accounting Office, *National Airspace System: Persistent Problems in FAA's New Navigation System Highlight Need for Periodic Reevaluation*, [GAO/RCED/AIMD-00-130](#) (Washington, D.C.: June 12, 2000).

evaluate the effects of its reform initiatives, use the evaluations as a basis for any strategic improvements to its human capital management approach, and hold its leaders accountable for the results of its human capital management efforts. FAA generally agreed with our recommendations.

- *Implement the new Air Traffic Organization:* The new Air Traffic Organization remains to be formed by joining FAA's Air Traffic Services and Research and Acquisition offices. In addition, some issues that we identified in our May 2003 report pose potential challenges to this restructuring effort. For example, certain lines of authority between the Subcommittee and the FAA Administrator remain to be clarified.

Other Challenges Lie Ahead

FAA faces a variety of other challenges as it attempts to balance its modernization investments. These include working effectively in the post-9/11 environment to determine how best to move forward with ATC modernization. In addition, FAA must contend with a number of economic constraints, including the current economic downturn, poor financial condition of the airline industry, competing demands for agency resources (e.g. safety, security, infrastructure, and operations), and the need for airlines to voluntarily equip their fleets with technologies needed to participate in a modernized National Airspace System. As we, the Department of Transportation's Inspector General, and others have noted, to work effectively within these constraints, it is important for FAA to determine how it can best maximize the ATC system's current capabilities by (1) identifying the initiatives that hold the most promise for increasing capacity and efficiency in the near-term and (2) determining the extent to which the airline industry will be financially able to equip with new technologies in the near and mid-term. A review of FAA's 10-year plan to increase the capacity and efficiency of the National Airspace System called the Operational Evolution Plan, could ultimately result in a reordering of some ATC modernization priorities because the plan, though issued in 2002, is based on analyses that precede the important changes in aviation security and the nation's economy that have taken place during the past 2 years. A fresh view of this plan could put FAA in a better position to target its resources toward projects that will maximize the system's capacity and efficiency and identify those ATC projects that should be kept in the pipeline to meet critical future needs.

In summary, we are at a critical juncture for reassessing FAA's ATC modernization efforts. Given over two decades of experience with ATC modernization, it is time to take advantage of the lessons learned to date

and the relative lull in air traffic demand resulting from the events of 9/11 to make inroads in improving the capacity and efficiency of the National Airspace System. The systemic issues that have plagued FAA's ATC modernization efforts for over two decades also provide us with critical lessons learned as we navigate our way around past mistakes and into this new century of aviation.

This concludes my statement. I would be pleased to respond to any questions that you or other Members of the Subcommittee may have at this time.

Contact Information

For further information on this testimony, please contact Gerald Dillingham at (202) 512-2834 or by e-mail at dillinghamg@gao.gov, or David Powner at (202) 512-9286 or by e-mail at pownerd@gao.gov. Individuals making key contributions to this testimony include Elizabeth Eisenstadt, Samantha Goodman, Maren McAvoy, Beverly Norwood, Colleen Phillips, and Richard Scott.

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