

GAO

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Committee on Transportation and
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AIR TRAFFIC CONTROL MODERNIZATION

Status of the Current Program and Planning for the Next Generation Air Transportation System

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



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Highlights

Highlights of [GAO-06-653T](#), 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) effort to modernize the nation's air traffic control (ATC) system has been listed by GAO as a high risk program for more than a decade now, due to systemic management and acquisition problems. Two relatively new organizations housed within FAA—the Air Traffic Organization (ATO) and the Joint Planning and Development Office (JPDO)—have been given the bulk of the responsibility for planning and implementing these modernization efforts. Congress created ATO to be a performance-based organization that would improve the culture, structure, and processes and improve accountability in the ATC modernization program. Congress created JPDO, made up of seven partner agencies, to coordinate the federal and nonfederal stakeholders necessary to plan a transition from the current air transportation system to the “next generation air transportation system” (NGATS). This testimony is based on GAO's recently completed and ongoing studies of the ATC modernization program. GAO provides information on (1) the status of ATO's efforts to implement processes and other initiatives aimed at efficiently managing and modernizing the current ATC system and (2) the status of JPDO's planning efforts and the key challenges that JPDO faces in planning for NGATS.

www.gao.gov/cgi-bin/getrpt?GAO-06-653T.

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

AIR TRAFFIC CONTROL MODERNIZATION

Status of the Current Program and Planning for the Next Generation Air Transportation System

What GAO Found

ATO has made significant progress toward the efficient management of the nation's ATC system, but faces several challenges. ATO has implemented organizational and business process changes, and has taken steps to increase scrutiny of its acquisition decisions. ATO has met its acquisition performance goal for the second consecutive year—that is, 80 percent of its system acquisitions are on schedule and within 10 percent of budget. ATO has identified cost savings opportunities through consolidation of administrative activities and outsourcing. However, ATO faces several challenges, including sustaining and institutionalizing its progress toward operating effectively as a performance-based organization, hiring and training thousands of air traffic controllers, ensuring stakeholder involvement in major system acquisitions, and keeping acquisitions on schedule and within budget.

JPDO is making progress in its planning for NGATS, but faces several challenges. JPDO is implementing a number of practices that our work has shown facilitates the federal interagency collaboration that is central to its mission and legislative mandate. However, JPDO is fundamentally a planning and coordinating body that lacks authority over the key human and technological resources needed to continue developing plans and system requirements for NGATS. Thus, a challenge may arise in leveraging the resources of the partner agencies. As part of its planning, JPDO is working to develop a cost estimate for NGATS through a series of workshops with various stakeholders. JPDO has taken several important first steps and is following effective practices in developing an NGATS enterprise architecture—a blueprint for NGATS and one of the most critical planning documents in the NGATS effort. JPDO faces several challenges, including maintaining stakeholder support over the long term, defining roles and responsibilities and deciding how to coordinate the implementation of NGATS, and addressing several critical policy issues, such as the extent to which NGATS will accommodate visual flights versus instrument-only flights.

Air Traffic Management



Sources: GAO and PhotoDisc.

Mr. Chairman and Members of the Subcommittee:

We appreciate the opportunity to participate in today’s hearing to discuss the status of efforts by the Air Traffic Organization (ATO) and the Joint Planning and Development Office (JPDO) to modernize and transform the nation’s air traffic control (ATC) system. Both organizations are within the Federal Aviation Administration (FAA) and represent recent efforts by Congress to, among others things, ensure a national airspace system that is safe, efficient, and capable of meeting a growing demand for air transportation—a demand that is expected to triple by 2025. ATO has responsibility for operating, maintaining, and modernizing the current ATC system. ATO was authorized as a performance-based organization (PBO)¹ in 2000 and includes 36,000 of FAA’s roughly 46,000 employees. JPDO, authorized in 2003, is responsible for planning and coordinating the broader and longer-term transformation (through 2025) to the “next generation air transportation system” (NGATS). JPDO is conducting its work with the assistance of seven partner agencies: the Departments of Commerce, Defense, Homeland Security, and Transportation; FAA; the National Aeronautics and Space Administration (NASA); and the White House Office of Science and Technology Policy.

In 1981, FAA began a program to replace and upgrade ATC facilities and equipment, but encountered chronic cost, schedule, and performance problems, leading us to classify FAA’s ATC modernization program as high risk in 1995.² We have issued a series of reports on these problems and made numerous recommendations over the years. Our reports focused on many aspects of the national airspace system, including the management of modernization projects; the management of the information technology that is at the heart of many modern ATC systems; the challenges FAA faces in increasing system capacity and reducing delays; and an acquisition workforce culture that lacked the mission focus, accountability, coordination, and adaptability needed for FAA to meet its cost, schedule, and performance targets. FAA has implemented many of our recommendations to varying degrees.

¹PBOs are discrete units, led by a Chief Operating Officer, that commit to clear objectives, specific measurable goals, customer service standards, and targets for improved performance.

²ATC Modernization has remained on our high-risk list since 1995. See GAO, *High Risk Series: An Update*, [GAO-05-207](#) (Washington, D.C.: January 2005).

System modernization, as envisioned in NGATS and being planned by JPDO, will be costly and will have to compete with other national priorities and demands for resources. ATO will be especially challenged to maintain the current ATC system while simultaneously developing and transitioning to the future system. These tasks will require ATO to make the best and most efficient use of increasingly scarce resources. Additionally, the transition also involves the recognition that other nations are upgrading their aviation systems, creating a need for global harmonization to support international travel and commerce.

My statement today focuses on two key questions. (1) What is the status of ATO's efforts to implement processes and other initiatives aimed at efficiently managing and modernizing the current ATC system? (2) What is the status of JPDO's planning efforts, and what are the key challenges that JPDO faces in planning for NGATS? My statement is based on our recently completed and ongoing studies of FAA's ATC modernization program, together with updated information from ATO and JPDO officials and aviation stakeholders.³ Later this year, we expect to issue two detailed reports related to the issues discussed in this statement. One report will provide our assessment of the status of JPDO's efforts to plan for the development of NGATS. Another report will examine financial management issues at FAA, including options for cost savings and alternative funding mechanisms. We are performing our work in accordance with generally accepted government auditing standards.

The following is a summary of our findings to date:

- ATO has made significant progress toward the efficient management of the nation's ATC system, but faces several challenges. ATO has implemented organizational and business process changes to improve management of the ATC modernization program. ATO has taken several steps to increase its scrutiny of its acquisition decisions, in part by ensuring executive-level oversight of key decisions and improving understanding of system requirements to avoid delays and cost overruns. ATO has met its acquisition performance goal for the second consecutive year—that is, 80 percent of its system acquisitions are on schedule and within 10 percent of budget. ATO has identified cost savings opportunities through consolidation of administrative activities and outsourcing. However, ATO faces several challenges, including sustaining and institutionalizing ATO's

³Because ATO includes the majority of FAA employees, this statement will refer to ATO initiatives, even though some may apply FAA-wide.

progress toward operating effectively as a performance-based organization, hiring and training thousands of air traffic controllers, ensuring stakeholder involvement in major system acquisitions, and keeping acquisitions on schedule and within budget.

- JPDO is making progress in its planning for NGATS, but faces several challenges. JPDO is implementing a number of practices that our work has shown facilitates the federal interagency collaboration that is central to its mission and legislative mandate. However, JPDO is fundamentally a planning and coordinating body that lacks authority over the key human and technological resources needed to continue developing plans and system requirements for NGATS. Thus, a challenge may arise in leveraging the resources of the partner agencies—agencies with a variety of missions and priorities other than supporting NGATS. For example, NASA has reduced its aeronautics budget, raising questions about how the research and development efforts necessary for NGATS will be completed. As part of its planning, JPDO is working to develop a cost estimate for NGATS through a series of workshops with various stakeholders. JPDO has taken several important first steps and is following effective practices in developing an NGATS enterprise architecture—a blueprint for NGATS and one of the most critical planning documents in the NGATS effort. In addition to the challenge of leveraging resources noted above, JPDO faces several other challenges, including maintaining stakeholder support over the long term, defining roles and responsibilities and deciding how to coordinate the implementation of NGATS, and addressing several critical policy issues, such as the extent to which NGATS will accommodate visual flights versus instrument-only flights.

Background

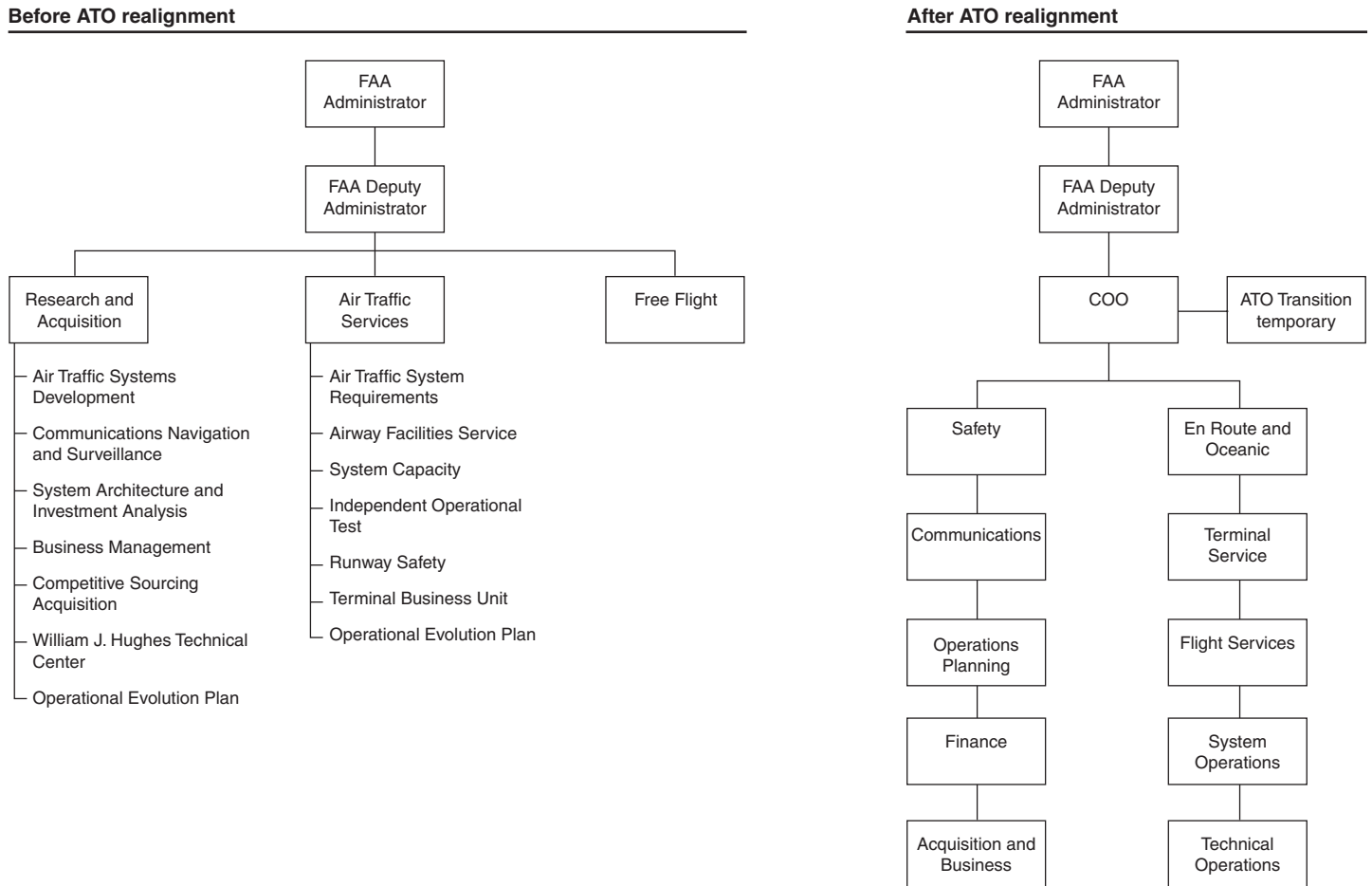
The ATC system is composed of an array of largely ground-based subsystems, including radars; automated data-processing, navigation, and communications equipment; and ATC facilities. These subsystems work together to support all phases of flight for aircraft operating in U.S. airspace. The ATC system also includes the FAA employees who manage, operate, and maintain ATC equipment and facilities.

In 1995, based on the premise that FAA would be better able to manage the ATC modernization if it were not constrained by federal personnel and acquisition laws, Congress passed legislation that exempted FAA from most federal personnel and acquisition laws and regulations.⁴ In December

⁴Pub. L. No. 104-50, Fiscal Year 1996 Department of Transportation Appropriations Act.

2000, President Clinton signed an executive order and a few months later Congress passed supporting legislation that, together, provided FAA with the authority to create ATO as a PBO to control and improve FAA's management of the modernization effort. In February 2004, FAA reorganized, transferring 36,000 employees (most of who worked in air traffic services and research and acquisitions) to ATO. (See fig. 1.)

Figure 1. Prior and Current Structure of Research and Acquisitions and Air Traffic Services, and Free Flight Organizations



Source: FAA.

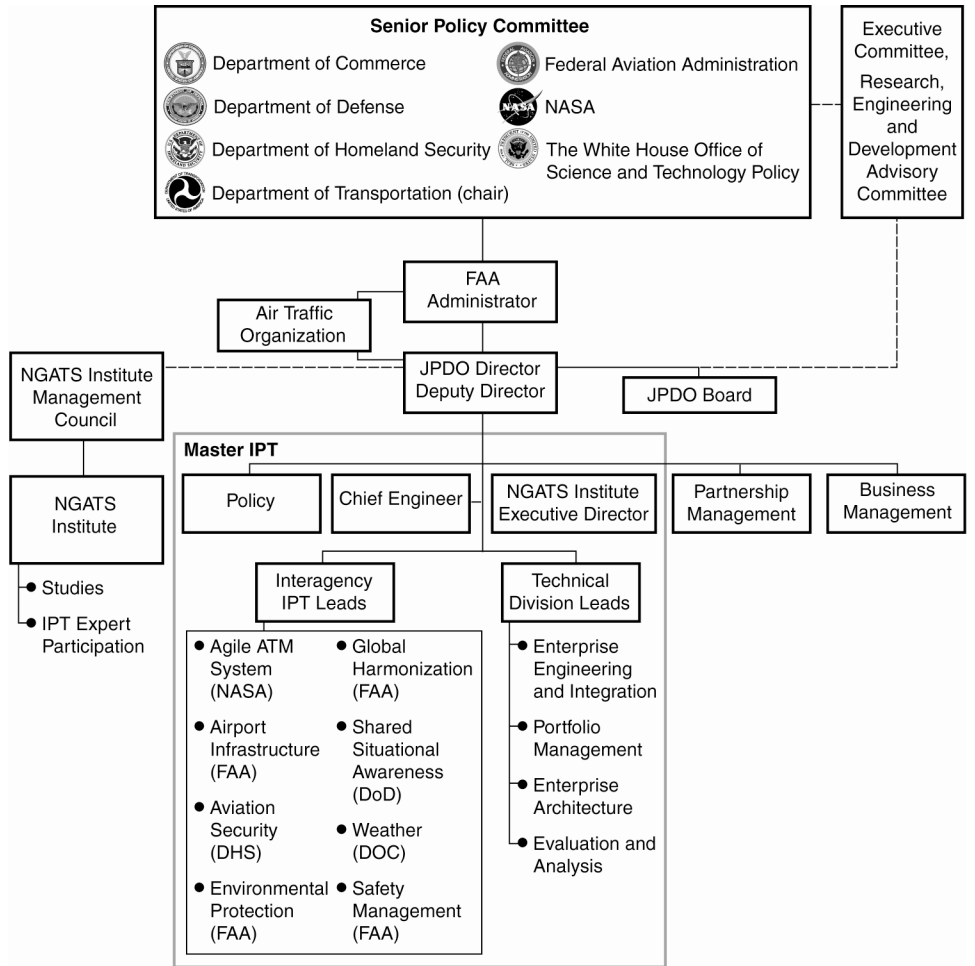
In late 2003, recognizing that the current approach to managing air transportation is becoming increasingly inefficient and operationally obsolete, Congress created JPDO⁵ to plan NGATS, a system intended to accommodate what is expected to be three times more air traffic by 2025 than there is today. JPDO's scope is broader than traditional ATC modernization in that it is "airport curb to airport curb," encompassing such issues as security screening and environmental concerns. Additionally, JPDO's approach will require unprecedented collaboration and consensus among many stakeholders—federal and nonfederal—about necessary system capabilities, equipment, procedures, and regulations. Each of JPDO's partner agencies will play a role in creating NGATS. For example, the Department of Defense has deployed "network centric" systems,⁶ originally developed for the battlefield, that are being considered as a framework to provide all users of the national airspace system—FAA and the Departments of Defense and Homeland Security—with a common view of that system. To incorporate the expertise and views of nonfederal stakeholders, the NGATS Institute was created by an agreement between the National Center for Advanced Technologies and FAA.

JPDO began its initial operations in early 2004. A Senior Policy Committee, chaired by the Secretary of Transportation and including senior representatives from each of the participating departments and agencies, provides oversight to JPDO. JPDO is located within FAA and reports to the FAA Administrator and to the Chief Operating Officer within ATO. (See figure 2.)

⁵Pub. L. No. 108-176, Vision 100—Century of Aviation Reauthorization Act, December 12, 2003.

⁶Network centric operations aim to exploit technical advances in information technology and telecommunications to improve situational awareness and the speed of decision making.

Figure 2: Organizational Chart of JPDO



Source: JPDO.

ATO Has Made Significant Progress Toward More Efficiently Managing ATC Modernization, but Challenges Remain

ATO has implemented organizational and business process changes to improve management of the ATC modernization program. ATO has taken several steps to increase its scrutiny of its acquisition decisions and has met its acquisition performance goal for the second consecutive year. ATO has identified cost savings opportunities through consolidation of administrative activities and outsourcing. However, ATO faces several challenges, including sustaining and institutionalizing ATO's progress toward operating effectively as a performance-based organization, hiring and training thousands of air traffic controllers, ensuring stakeholder involvement in major system acquisitions, and keeping acquisitions on schedule and within budget.

ATO Has Implemented Organizational and Business Process Changes to Improve Management of the ATC Modernization Program

In our past work, we noted that FAA's acquisitions workforce operated in an environment where accountability was not well defined or enforced and vertical lines of authority impaired productivity, communication, and decision-making across the organization. Our recent studies have shown that ATO is taking steps to break down those vertical lines of authority and organizational "stovepipes." ATO has become a flatter organization, with fewer management layers. Additionally, the Chief Operating Officer (COO), who heads ATO, is holding ATO's vice presidents collectively accountable for the organization's success, in addition to their areas of specific responsibility. The COO conducts daily meetings with the managers of ATO's departments to review operations. According to the COO, these meetings have provided a more holistic perspective on the organization since, formally, some managers were only focused on and responsible for their own departments.

ATO is also in the early stages of involving the line staff in the efforts aimed at increasing organizational effectiveness and efficiency. For example, ATO surveyed the workforce to determine the extent to which employees and managers believe the organization exhibits managerial accountability, customer focus, and transformational leadership. The first survey established a baseline against which ATO plans to measure progress through future annual surveys. By analyzing the results, ATO expects to determine the underlying assumptions that drive employee behavior and decide where to target efforts for change. According to an ATO official, such a root-cause level of analysis has never been done before in FAA. FAA is also undertaking an initiative that includes creating a training framework and measures for the effectiveness of that training. These initiatives mirror effective human capital practices that we have identified in previous reports.

In addition to organizational efforts, ATO is moving forward with an improvement to its business processes with the development of a cost accounting system, which will eventually be implemented throughout FAA to improve its financial management. Ultimately, ATO plans to routinely incorporate the cost information generated by the cost accounting system into its investment decision-making. When implemented, this cost accounting system will address a long-standing GAO concern that FAA has not had the needed cost accounting practices in place to effectively manage software-intensive investments, which characterize many of the agency's major ATC system acquisitions. This type of information can be used to improve future cost estimates for these acquisitions.

In another change to its business processes, FAA has stated that its management will provide additional information to decision makers to better illustrate the rationale behind its budget requests. This information is helpful to decision makers when budget constraints do not allow all system acquisitions to be fully funded at their planned and approved levels, leaving FAA to decide which programs to fund and which to cut, according to its priorities. Those that are cut may fall behind schedule, requiring FAA to continue operating and maintaining the older equipment and possibly delaying the realization of benefits from the new system. To address this issue, we recommended that FAA identify and annually report on programs that have had funding deferred, reduced, or eliminated, and the impact of those decisions on ATC modernization.⁷ Such information would make clear how constrained budgets will affect modernization of the national airspace system and how FAA is working to live within its means. In its formal written response to our recommendation, FAA stated its intent to better inform Congress in the future by providing information in its capital investment plan, submitted to Congress annually with the President's Budget, that will identify changes from the preceding year. We have not yet verified whether FAA's action fully responds to our recommendation.

ATO Has Increased Scrutiny of Its Investment Decisions

ATO has taken several steps to increase its scrutiny of its acquisition decisions, both with initial investment decisions and as part of acquisition oversight. Since 2004, the ATO executive council has been reviewing the

⁷GAO, *The National Airspace System: FAA Has Made Progress but Continues to Face Challenges in Acquiring Major Air Traffic Control Systems*, [GAO-05-331](#) (Washington, D.C.: June 10, 2005).

mission need and readiness for decisions for all proposed investments. Furthermore, to ensure executive-level oversight of all key decisions, FAA plans to incorporate key decision points in a knowledge-based product development process by June 2006, as we have recommended; however, we have not yet independently assessed the sufficiency of this change. FAA has also issued guidance on how to develop and use investment pricing, including guidelines for disclosing the levels of uncertainty and imprecision that are inherent in cost estimates for major ATC systems.

To improve its understanding of system requirements, FAA has developed a software acquisition process improvement model.⁸ When a system's requirements are not fully understood at the start of an acquisition, requirements must often be redefined or unplanned work performed, which takes time and can be costly. In addition, unplanned work may occur when the agency misjudges the extent to which a commercial-off-the-shelf or nondevelopmental item, such as one procured by another agency, will meet the agency's needs. To address these issues, FAA has developed and applied a process improvement model that assesses the maturity of FAA's software and systems capabilities. As we reported, this approach has resulted in enhanced productivity, higher quality, greater ability to predict schedules and resources, better morale, and improved communication and teamwork.⁹ However, FAA did not mandate the use of the model throughout the organization. In response to our recommendation that FAA institutionalize the model's use throughout the organization, FAA has begun developing a requirement that acquisition projects have process improvement activities in place before seeking approval from FAA's investment review board.

With regard to acquisition investment oversight, ATO has increased the use of an earned value approach to program oversight.¹⁰ In fiscal year 2000, only 4 programs used an earned value approach, compared to 19 major active programs in fiscal year 2006. Going forward, all new acquisitions will use an earned value approach. ATO has also conducted business case

⁸FAA's process improvement model, titled "Integrated Capability Maturity Model," is a tool to assess the maturity of the agency's software acquisition capabilities.

⁹GAO, *Air Traffic Control: System Management Capabilities Improved, but More Can Be Done to Institutionalize Improvements*, GAO-04-901 (Washington, D.C.: Aug. 20, 2004).

¹⁰An earned valued management system measures performance by comparing the value of work accomplished with work scheduled and thereby provides early warning of schedule delays and cost overruns.

reviews for facilities and equipment- and operations-funded programs. Based on these reviews, ATO terminated funding for three projects. One was cancelled because the prototype lacked demonstrable benefits, another due to a poor business case, and the third due to weaknesses in its business case as well as schedule and performance issues.¹¹

Additionally, FAA has implemented, or is in the process of implementing, a number of recommendations that we have made to improve acquisition investment management. For example, FAA is now considering all information technology investments as a complete portfolio. In 2004, we pointed out that FAA was not evaluating projects beyond the first 2 years of service to ensure alignment with organizational goals.¹² Consequently, the agency could not ensure that projects with a longer service history (which at the time totaled about \$1.3 billion per year) were still aligned with FAA's strategic plans and business goals and objectives. We recommended that FAA include these projects in its investment portfolio management for review. In response to this and other recommendations we have made, FAA is making revisions to its Acquisition Management System. FAA has modified its Acquisition Management Policy to require periodic monitoring of in-service systems to collect and analyze performance data to use as the basis for sustained deployment. In a similar vein, ATO has committed to basing future funding decisions for system acquisitions on their contribution to reducing the agency's operating costs while maintaining safety. ATO is also requiring that acquisition planning documents be prepared in a format consistent with that prescribed by the Office of Management and Budget for use in justifying all major capital investments.

¹¹The Medium Intensity Airport Weather System (MIAWS), intended to provide a real time display of storm positions and estimated storm tracks, was terminated for lack of demonstrable benefit. The Mode Select (Mode S) program, intended to provide enhanced radar surveillance information, was terminated due to a poor business case. The Asset and Supply Chain Management Program, intended to assist in asset and logistics management, was terminated due to business case weaknesses and schedule and performance issues.

¹²GAO, *Information Technology: FAA Has Many Investment Management Capabilities in Place, but More Oversight of Operational Systems Is Needed*, [GAO-04-822](#) (Washington, D.C.: Aug. 20, 2004).

FAA Met Its Acquisition Performance Goal for the Second Consecutive Year, but Use of Revised Milestones Does Not Provide Consistent Benchmarks

FAA has met its acquisitions performance goal 2 years in a row. The goal for fiscal years 2004 and 2005 was to have 80 percent of its system acquisitions on schedule and within 10 percent of budget. The goal gradually increases to 90 percent by fiscal year 2008. The increase will make FAA's acquisition performance goal consistent with targets set in the Department of Transportation's strategic plan and will comply with the Federal Acquisition Streamlining Act of 1994.¹³

Having such a goal is also consistent with the President's *Management Agenda*, which calls for a commitment to achieve immediate, concrete, and measurable results in the near term, and meeting this goal shows progress toward better acquisition management. However, because the milestones for certain acquisitions have changed over the years to reflect changes in cost and schedule, using those revised milestones may not provide a complete picture of the acquisition's progress over time. For example, the milestones for 3 of the 16 major system acquisitions that we reviewed in detail during 2004 and 2005 were being revised to reflect cost or schedule changes during 2005. These revised milestones, together with revised targets for meeting them, will become the new milestones for fiscal year 2006. While revising milestones and targets that are no longer valid is an appropriate management action, using revised targets for measuring performance does not provide a consistent benchmark over time. The extent to which an acquisition meets its annual performance targets is one measure of its performance and should be viewed together with other measures, such as its progress against original and revised baselines. The variance reports provided to the FAA Administrator and to Congress may also be useful in evaluating an acquisition's performance.¹⁴

Since fiscal year 2003, the number of acquisition programs measured by FAA has varied from 31 to 42. According to FAA, the number varies from year to year, in part, because some programs reach completion and others are initiated. The programs that are selected each fiscal year represent a cross section of ATO programs, including investments in new capabilities and others that are ready for use without modification. FAA's Portfolio of Goals, which provides supplementary information on the agency's performance goals, asserts that no bias exists in the selection of

¹³Pub. L. No. 103-355.

¹⁴According to FAA, the agency tracks acquisition program performance from its original baseline or any subsequently approved baselines approved by the Joint Resource Council and reports variances to the Administrator and to Congress as required.

milestones for performance review, but does not state the basis for this conclusion. The portfolio also states that the milestones selected represent the program office's determination of the efforts that are "critical" or important enough to warrant inclusion in the acquisition performance goal for the year. However, we have not conducted a detailed examination of the reliability and validity of FAA's metrics for its acquisition program performance.

ATO Is Reviewing Its Infrastructure and Operations for Cost Savings, but Lacks Consistent Processes for Determining Savings

ATO is seeking cost savings by reviewing its operations and infrastructure. It has begun to decommission ground-based navigational aids, such as compass locators, outer markers and nondirectional radio beacons, as it begins to transition to a satellite-based navigation system. In fiscal year 2005, ATO decommissioned 177 navigational aids, claiming a savings of \$2.9 million. In addition to the savings generated from decommissioning, one expert with whom we spoke noted that these sites could be converted to revenue-generating uses, such as leasing the sites for warehouses or cell phone towers. ATO also expects to reduce costs through streamlining its operations. For example, it is consolidating its administrative activities, currently decentralized across its nine regions, into three regions, and anticipates an annual savings of up to \$460 million over the next 10 years. Our work analyzing international air navigation service providers has shown that additional cost savings may be possible by further consolidating ATC facilities such as terminal radar approach control (TRACON) facilities and air traffic control centers. According to one estimate, consolidating the existing 21 air route traffic control centers into 6 centers could save approximately \$600 million per year.

ATO also expects to reduce costs through outsourcing. For example, it reduced costs by outsourcing its automated flight service stations to a private contractor and expects to achieve savings of \$1.7 billion over ten years. Additionally, \$0.5 billion in savings are expected to be realized by staffing reductions of 400 that occurred between the time the outsourcing began and the new contract was actually implemented. The agency expects to receive \$66 million—the first installment of these cost savings—in fiscal year 2007.

However, we have found that ATO lacks a consistent process for identifying the costs and benefits associated with some of its cost control efforts. For example, ATO did not offset its reported savings from decommissioning navigational aids with the costs likely to accompany such activities, such as real property disposition (including buildings or real property leases, standby power systems, and fuel storage tanks), site

cleanup, and restoration. Without a transparent and verifiable process for determining the savings, as well as the offsetting costs, the true savings remain unclear. As ATO proceeds with these efforts, stakeholders also caution that decommissioning navigational aids should entail comprehensive risk mitigation to ensure that ATO retains adequate safety levels.

However, while facility consolidations could offer additional savings, an FAA official noted that there are practical limits to these efforts. For example, consolidated facilities would need to handle higher volumes of communication, but as the volume of communication increases, so does “latency”—the delay in transmission that occurs between sending and receiving messages. According to FAA, studies of telecommunications centers in the private sector suggest that 15 facilities that combine the approximately 180 existing en route and oceanic air traffic control centers and terminal radar approach control facilities might be appropriate. Security concerns, such as the need for redundancy, also come into play in consolidation decisions. Consequently, if FAA decides to proceed with facility closures, it is important that it do so within the context of a logical, well-documented, and risk-based process in consultation with congressional oversight committees.

ATO Faces Human Capital Challenges in Institutionalizing Its Performance-based Organization and Hiring and Training Thousands of Air Traffic Controllers

ATO faces a challenge in sustaining and institutionalizing its efforts to operate as a PBO. Our work has shown that successful transformations and the institutionalization of change in large public and private organizations can take 5 to 7 years or more to fully implement.¹⁵ Long-term, high-level management attention will be needed to assess ATO’s transformation on a continuing basis.

FAA also faces the challenge of hiring and training thousands of air traffic controllers during the coming decade. According to its controller staffing plan, FAA expects to lose about 11,000 air traffic controllers due to voluntary retirements or mandatory retirements at age 56, as well as other reasons.¹⁶ These retirements stem from the 1981 controller strike, when President Ronald Reagan fired over 10,000 air traffic controllers, and FAA then had to quickly rebuild the controller workforce. From 1982 through

¹⁵GAO-03-669.

¹⁶Federal Aviation Administration, *A Plan for the Future: The Federal Aviation Administration’s 10-Year Strategy for the Air Traffic Control Workforce* (Dec. 21, 2004).

1991, FAA hired an average of 2,655 controllers per year. These controllers will become eligible for retirement during the next decade.

To replace these controllers, as well as those who will leave for other reasons, and to accommodate forecasted changes in air traffic, FAA plans to issue annual air traffic controller staffing plans based on the agency's air traffic forecast. FAA's December 2004 Air Traffic Controller Work Force Plan called for hiring 12,500 new controllers over 10 years, based on the agency's 2004 air traffic forecast.¹⁷ FAA informed us that its 2006 staffing plan update, which it expects to issue shortly, will reflect the need to hire fewer controllers over the next few years, compared to the 2004 plan, because FAA's 2006 air traffic forecast predicts less air traffic during this time frame. In fiscal year 2005, FAA hired 438 controllers—three more than its target, which was constrained that year due to budget considerations. According to an FAA official, FAA plans to hire 930 controllers in fiscal year 2006 (FAA had hired 637 controllers through May 2006).

FAA Faces Challenges in Ensuring Stakeholder Involvement in Major System Acquisitions

Adequately involving stakeholders in a system's development is important to ensure that the system meets users' needs. In the past, air traffic controllers were permanently assigned to FAA's major system acquisition program offices and provided input into air traffic control modernization projects. In June 2005, FAA terminated this arrangement because of budget constraints and other reasons. According to FAA, it now plans to obtain the subject-matter expertise of air traffic controllers or other stakeholders as needed in major system acquisitions. It remains to be seen whether this approach will suffice for stakeholder involvement. Our past work has indicated that a lack of stakeholder involvement both early on and throughout a system's development was a systemic factor contributing to acquisitions missing their cost, schedule, and performance targets.

FAA Faces Challenges in Keeping Acquisitions on Schedule and within Budget

Three systems—all communications-related—missed their fiscal year 2005 acquisition performance goals for schedule. According to FAA, the \$310 million FAA Telecommunications Infrastructure (FTI) acquisition, which is replacing costly existing networks of separately managed systems and services by integrating advanced telecommunications services, was behind

¹⁷According to FAA, since issuing its controller staffing plan, it has achieved productivity gains that have reduced the need to hire about 460 air traffic controllers.

schedule because the program was unable to ramp up its activities to the level specified in its plan. To complete the installations in the first quarter of fiscal year 2008 as originally scheduled, FAA initiated a plan to put the program back on schedule and has met the plan's milestones since August 2005.

To the extent that delays in FTI persist, FAA will not accrue the full extent of the \$672 million in cost savings that the program was expected to produce. The Department of Transportation's Office of the Inspector General has reported that FAA did not realize \$32.6 million in anticipated operating cost savings in fiscal year 2005 because of the limited progress made in disconnecting legacy circuits. The office also reported that without a nearly tenfold increase in its rate of transferring service to FTI and disconnecting legacy circuits, FAA stands to miss out on an additional \$102 million in cost savings in fiscal year 2006. FAA has informed us that since the Inspector General made this assessment, the program has achieved a significant increase in the rates of transferring over services and disconnecting legacy circuits. As an alternative to continuing the current FTI program, some experts have suggested that FAA consider outsourcing this activity, as it did for its flight service stations.¹⁸

Two other communications acquisition programs also missed their acquisition performance goals for schedule in 2005—the \$325 million Next Generation Air-to-Ground Communication system, segment 1A, which replaces analog communication systems with digital systems, and the \$85 million Ultra High Frequency Radio Replacement, which replaces aging equipment used to communicate with Department of Defense aircraft. According to an FAA official, as the agency assessed its priorities for fiscal year 2005, a decision was made that these programs would receive fewer resources. The resources that were then available were not sufficient to allow the programs to meet established milestones.

In summary, ATO has made a number of promising moves toward operating effectively as a PBO, and we view ATO's efforts to improve its management and acquisitions processes as positive steps. However, ATO has been established for only slightly more than 2 years. Work remains to ensure that these processes become institutionalized and that continuing challenges are addressed. Although it is still too early to evaluate the effectiveness of many of these steps, we are monitoring ATO's progress.

¹⁸In February 2005, FAA awarded a contract for the operation of its flight service stations.

Moving forward, ATO will play a key role in implementing NGATS, as planned by JPDO. I will now discuss the status of JPDO's planning efforts.

JPDO Has Made Progress in Planning for NGATS, but Faces Challenges in Several Areas

JPDO has implemented several effective practices to facilitate collaboration among its partner agencies, but faces challenges in continuing to leverage resources. JPDO is working to develop a cost estimate for NGATS through a series of workshops with various stakeholders. JPDO is taking a reasonable approach to technical planning, but some key tasks are yet to be completed. However, JPDO faces several challenges, including maintaining stakeholder support over the long term, defining roles and responsibilities as well as deciding how to coordinate the implementation of NGATS, and addressing several critical policy issues.

JPDO Is Working to Facilitate Collaboration among Federal Agencies, but Faces Challenges in Continuing to Leverage Resources

Our work to date shows that JPDO is implementing a number of practices that our work has shown facilitates the federal interagency collaboration that is central to its mission and legislative mandate. According to our research, agencies must have a clear and compelling rationale for working together to overcome significant differences in their missions, cultures, and established ways of doing business. In developing JPDO's integrated plan,¹⁹ the partner agencies agreed to a vision statement and eight strategies that broadly address the goals and objectives for NGATS. These strategies formed the basis for JPDO's eight integrated product teams (IPT), and various partner agencies have taken the lead on specific strategies. Our research has also shown that it is important for collaborating agencies to leverage the human, technological, and physical resources needed to initiate or sustain their collaborative effort. To leverage human resources, JPDO has staffed the various levels of its organization with partner-agency employees, many of whom work part time for JPDO. To leverage technological resources, JPDO conducted an interagency program review of its partner agencies' research and development programs to identify work that could support NGATS. Through this process, JPDO identified early opportunities that could be pursued during fiscal year 2007 to produce tangible results for NGATS,

¹⁹The Vision 100 Act called for JPDO to create and carry out an integrated plan for NGATS. This integrated plan was developed by the partner agencies and submitted to Congress on December 12, 2004.

such as the Automatic Dependent Surveillance-Broadcast (ADS-B)²⁰ program at FAA.

However, while JPDO's legislation, integrated plan, and governance structure²¹ provide the framework for collaboration among multiple federal agencies, JPDO is fundamentally a planning and coordinating body that lacks authority over the key human and technological resources needed to continue developing plans and system requirements for NGATS. Consequently, the ability to continue leveraging resources of the partner agencies will be critical to JPDO's success. Beginning around 2008, JPDO expects a significant increase in its IPTs' workloads. JPDO officials told us that although the partner agencies have not yet expressed concerns over the time that their employees spend on JPDO work, it remains to be seen whether agencies will be willing to allow their staff to devote more of their time to JPDO. In addition, JPDO anticipates needing more agency resources to plan and coordinate demonstrations of potential technologies to illustrate some of the early benefits that could be achieved from the transformation to NGATS.

This challenge of leveraging resources arises, in part, because the partner agencies have a variety of missions and priorities other than supporting NGATS. NASA, for example, while conducting key aeronautical and safety research and development relevant to NGATS, nonetheless has other competing missions. NASA has recently reduced its aeronautics budget and plans to focus its efforts on foundational research.²² This decision raises two important questions. First, what research needed for NGATS will NASA perform or not perform? Second, for the foundational research that will be performed, who will perform the development steps—the validation and demonstration of new technology—that must take place

²⁰ADS-B is a surveillance technology that transmits an aircraft's identity, position, velocity, and intent to other aircraft and to ATC systems on the ground, thereby enabling pilots and controllers to have a common picture of airspace and traffic. By providing pilots with a display that shows the location of nearby aircraft, the system enables pilots to collaborate in decision making with controllers, safely allowing reduced aircraft separation and thereby increasing capacity within the national airspace system.

²¹Some of JPDO's governance structure was determined by Vision 100, which directed the Secretary of Transportation to establish a Senior Policy Committee and set forth the membership of this committee. In addition, JPDO has established a Board of Directors, a Master IPT, and several divisions.

²²NASA uses the term foundational to refer to research that explores core science, but does so with a view toward how the research will be applied.

before a new technology can be transferred to industry and incorporated into a product? JPDO and FAA officials told us that not enough is understood about what NASA plans to do and not do and, therefore, the impact of NASA's action on NGATS remains unclear at present.

However, many experts with whom we spoke believe that NASA's new focus on foundational research creates a gap in the technology development continuum. Some believe that FAA has neither the research and development infrastructure nor the funding to do this work. FAA's Research, Engineering and Development Advisory Committee (REDAC),²³ in a draft report, estimates that FAA would need at least \$100 million annually in increased funding to perform this research and development work, and that reestablishing the infrastructure within FAA to accomplish this work could delay NGATS implementation by 5 years. An official of the working group that produced the draft report stated that a significant amount of research and development is needed to create NGATS. For example, the official stated that more research is needed to understand wake vortex, which could be a limiting factor in airspace capacity and would impact aircraft sequencing for landing or departure.²⁴ The official also stated that intermediate-level technology development is important in establishing "product proof," meaning that technology needs to be validated, demonstrated, and certified before beginning the systems acquisition process.

JPDO officials view leveraging partner agency resources as one of their most significant near-term challenges. JPDO officials stated that they feel the process has worked sufficiently well so far. For example, JPDO successfully requested that FAA pursue funding in its fiscal year 2007 budget request to accelerate development of ADS-B and System Wide Information Management (SWIM),²⁵ which are two key systems identified

²³FAA's Research, Engineering and Development Advisory Committee, established in 1989, advises the FAA Administrator on research and development issues and coordinates FAA's research, engineering, and development activities with industry and other government agencies. The committee considers aviation research needs in air traffic services, airport technology, aircraft safety, aviation security, human factors, and environment and energy.

²⁴Wake vortex is air turbulence that occurs behind an aircraft and was a cause in the 2001 American Airlines accident in which 265 people died.

²⁵SWIM is expected to help in the transition to network-centric operations by providing the infrastructure and associated policies and standards to enable information sharing among all authorized system users, such as the airlines, other government agencies, and the military.

for NGATS. However, as noted, our past work on FAA's national airspace modernization program has shown that receiving fewer resources than planned was one factor that contributed to delays in implementing technologies and significant cost increases. Thus, continuing success in leveraging partner agencies' resources will help avoid program delays and reduction in the benefits-to-cost ratio.

To further leverage resources for NGATS, JPDO has issued guidance to its partner agencies identifying areas that JPDO would like to see emphasized in the agencies' fiscal year 2008 budget requests and expects to follow this process annually in the years to come. JPDO officials have informed us that they have held face-to-face discussions with partner agency managers about the guidance and are currently in the process of reviewing partner agency responses to the guidance and identifying whether gaps exist. Such gaps will be presented to the Senior Policy Committee for discussion at its July meeting, according to these officials.

JPDO is currently working with the Office of Management and Budget to develop a systematic means of reviewing partner agency budget requests so that the NGATS-related funding in each request is easily identified. This includes a review of budgets submitted by the Department of Homeland Security for efforts by the Transportation Security Administration and the Department of Commerce for efforts by the National Oceanic and Atmospheric Administration. Such a process would help the Office of Management and Budget consider NGATS as a unified federal investment, rather than as disparate line items distributed across several agencies' budget requests.

JPDO Is Working to Develop a Cost Estimate for NGATS

Important to the planning of NGATS is the development of realistic cost estimates for the entire NGATS. To assist in developing such estimates, JPDO is holding a series of investment analysis workshops with stakeholders to obtain their input. The first workshop, held in April 2006, was for commercial and business aviation, equipment manufacturers, and systems developers. The second workshop is planned for early July for operators of lower performance aircraft used in both commercial and non-commercial operations, including general aviation personal and business flying, flight training, piston and turbine rotorcraft as well as public users of the system including civil and military aircraft operated by local, state, and federal governments. The third workshop, planned for late July or early August, will focus on airports and other local, state, and regional planning bodies. JPDO plans to use the combined information from these

three workshops to begin to develop a range of the potential costs of NGATS.

Preliminary estimates of NGATS' cost, developed by REDAC and ATO, could also provide input into JPDO's cost estimate. REDAC and ATO officials emphasized that their estimates are preliminary and not yet endorsed by any agency. A draft study by REDAC's Financing the NGATS Working Group estimated that to implement NGATS and continue operating the national airspace system through 2025, the combined costs of FAA's four appropriation accounts—operations, facilities and equipment, research, engineering and development—and grants-in-aid for airports (commonly known as the Airport Improvement Program)—would average about \$15 billion per year, or about \$900 million more than FAA's fiscal year 2006 appropriation. The estimate assumes that (1) the general fund contribution will be 20 percent, using the current trust fund revenue model and (2) between 2011 and 2025, productivity increases will offset the increased operating costs of additional demand.²⁶

ATO has developed a preliminary estimate of the increased facilities and equipment cost that NGATS would require. ATO estimates that the cumulative additional facilities and equipment cost between fiscal years 2006 and 2025 would be about \$15.3 billion, or about \$800 million per year, on average, from fiscal year 2007 through 2025. According to an ATO official, the ATO facilities and equipment cost estimate is the same as the facilities and equipment component of REDAC's cost estimate. The only difference is that ATO's estimate accounts for inflation, while REDAC expresses its estimate in constant 2005 dollars.

In addition to being preliminary, it is important to note the limitations of these estimates. First, ATO's estimate does not include any costs other than those for facilities and equipment. However, an ATO official acknowledged that there would likely be additional costs within FAA, such as for safety certification or making operational changes to respond to NGATS' new technologies. Additionally, ATO's facilities and equipment cost estimate assumes that the intermediate technology development work, which NASA has historically performed, has been completed. As I

²⁶The \$15 billion estimate is based on the working group's "base case" scenario. The working group also calculated a lower cost "best case" scenario, in which FAA achieves an annual 2 percent productivity increase beyond the cost of increased demand; and a higher cost "worst case" scenario, in which costs grow with the increase in operations with no productivity increases.

previously stated, REDAC believes that the cost of intermediate technology development could be substantial. Furthermore, neither estimate includes other partner agencies' costs to implement NGATS, such as those that the Department of Homeland Security might incur to develop and implement new security procedures. Also, these estimates treat NGATS' development and implementation period as an isolated event. Consequently, the costs drop dramatically toward 2025. In reality, officials who developed these estimates acknowledge that planning for the subsequent "next generation" system will likely be underway as 2025 approaches and that actual operations and modernization costs could be higher in this time frame than these estimates indicate.

In addition, several unknown factors will drive the cost of NGATS. According to JPDO, one of these drivers is the technologies expected to be included in NGATS. Some of these are more complex and thus more expensive to implement than others. A second driver is the sequence in which NGATS technologies will replace the technologies now in use. A third driver is the length of time required to transition to NGATS, since a longer transition period would impose higher costs. Later this year, JPDO expects to issue a first draft of its enterprise architecture, or blueprint for the NGATS, which could reduce these variables, thereby allowing improved, albeit still preliminary, estimates of NGATS' cost.

JPDO Is Taking a Reasonable Approach to Technical Planning, but Some Key Tasks are Yet to Be Completed

To conduct the technical planning for NGATS, JPDO has formed separate divisions to perform system modeling and create the NGATS enterprise architecture, but has not yet completed key activities. JPDO has formed an Evaluation and Analysis Division (EAD), composed of FAA and NASA employees and contractors, to assemble a suite of models that will help JPDO refine its plans for NGATS and iteratively narrow the range of potential solutions. For example, EAD has used modeling to begin studying how possible changes in the duties of key individuals, such as air traffic controllers, could affect the workload and performance of others, such as airport ground personnel.

As I previously noted, NGATS could shift some tasks now done by air traffic controllers to pilots. According to JPDO officials, the change in roles of pilots and controllers is the most important human factors issue involved in creating the NGATS. JPDO officials noted that the Agile Airspace and Safety IPTs contain human factors specialists and that JPDO's chief architect has a background in human factors. However, EAD has not yet begun to model the effect of the shift in roles on pilots' performance because, according to an EAD official, a suitable model has

not yet been incorporated into the modeling tool suite. According to EAD, addressing this issue is necessary, but will be difficult because data on pilot behavior are not readily available to use in creating such models. Furthermore, EAD has not yet studied the training implications of various NGATS-proposed solutions because further definition of the concept of operations for these solutions has not been completed. As the concept of operations matures, it will be important for air traffic controllers and other affected stakeholders to provide their perspectives on these modeling efforts. In addition, as the concept of operations and plans for sequencing equipment matures, EAD will be able to study the extent to which new air traffic controllers will have to be trained to operate both the old and the new equipment.

To develop an enterprise architecture—a blueprint for NGATS and one of the most critical planning documents in the NGATS effort—JPDO has taken several important first steps and is following several effective practices that we have identified for enterprise architecture development. However, JPDO’s enterprise architecture is currently a work in progress and many of JPDO’s future activities will depend on the robustness and timeliness of its architecture development. The enterprise architecture will describe FAA’s operation of the current national airspace system, JPDO’s plans for the NGATS, and the sequence of steps needed to transition between them. The enterprise architecture will provide the means for coordinating among the partner agencies and private sector manufacturers, aligning relevant research and development activities, and integrating equipment. And as I noted earlier, the enterprise architecture will also be a key tool in developing cost estimates for NGATS.

To date, JPDO has formed an Enterprise Architecture Division and has established and filled a chief architect position. JPDO has also established an NGATS Architecture Council composed of representatives from each partner agency’s chief architect office to provide the organizational structure and oversight needed to develop the enterprise architecture. JPDO is using a phased “build a little, test a little” approach for developing and refining its enterprise architecture that is similar to a process that we have advocated for FAA’s major system acquisition programs. In addition, this phased development process will allow JPDO to incorporate evolving market forces and technologies in its architecture and thus better manage change. JPDO plans to have an early version of the architecture by the end of fiscal year 2006.

Maintaining Stakeholder Support Will Be a Long-Term Challenge for JPDO

JPDO has structured itself to involve federal and nonfederal stakeholders throughout its organization, but maintaining their long-term support will be a challenge. Our work has shown that involving stakeholders can, among other things, increase their support for a collaborative effort. Federal stakeholders from the partner agencies serve on JPDO's Senior Policy Committee, board, and IPTs. Nonfederal stakeholders may participate through the NGATS Institute (the Institute). Through the Institute, JPDO obtained the participation of over 180 stakeholders from over 70 organizations for the IPTs. The NGATS Institute Management Council, composed of top officials and representatives from the aviation community, oversees the policy and recommendations of the Institute and provides a means for advancing consensus positions on critical NGATS issues.

Although JPDO has developed the mechanisms for involving stakeholders and brought stakeholders into the process, it faces challenges in sustaining nonfederal stakeholders' participation over the long term. Much as with the federal partner agencies, JPDO has no direct authority over the human, technical, or financial resources of its nonfederal stakeholders. To date, these stakeholders' investment in NGATS has been through their part-time, pro bono participation on the IPTs and the NGATS Institute Management Council.²⁷ The challenge for JPDO is to maintain the interest and enthusiasm of these nonfederal stakeholders, which will have to juggle their own multiple priorities and resource demands, even though some of the tangible benefits of NGATS may not be realized for several years. For example, stakeholders' support will be important for programs such as SWIM, which is a prerequisite to future benefits, but may not produce tangible benefits in the near term.

In the wake of past national airspace modernization efforts, JPDO also faces the challenge of convincing nonfederal stakeholders that the government is financially committed to NGATS. While most of FAA's major ATC acquisition programs are currently on track, earlier attempts at modernizing the national airspace system encountered many difficulties. In one instance, for example, FAA developed a datalink communications system that transmitted scripted e-mail-like messages between controllers and pilots. One airline equipped some of its aircraft with this new

²⁷Nonfederal stakeholders' participation varies from approximately 10 percent to 25 percent of their time per week on the IPTs and involves approximately one meeting per month for members of the council.

technology, but because of funding cuts, among other things, FAA ended up canceling the program. In a similar vein, we have reported that some aviation stakeholders expressed concern that FAA may not follow through with its airspace redesign efforts and are hesitant to invest in equipment unless they are sure that FAA's efforts will continue. One expert suggested to us that the government might mitigate this issue by making an initial investment in a specific technology before requesting that airlines or other industry stakeholders purchase equipment.

In addition to maintaining stakeholder involvement, JPDO faces challenges in obtaining the participation of all stakeholders. In particular, JPDO does not involve current air traffic controllers, who will play a key role in NGATS. The current air traffic control system is based primarily on the premise that air traffic controllers direct pilots to maintain safe separation between aircraft. In NGATS, this premise could change and, accordingly, JPDO has recognized the need to conduct human factors research on such issues, including how tasks should be allocated between humans and automated systems and how the existing allocation of responsibilities between pilots and air traffic controllers might change. The input of current air traffic controllers who have recent experience controlling aircraft is important in considering human factors and safety issues.

However, as mentioned, no current air traffic controllers are involved in NGATS. In June 2005, FAA terminated its labor liaison program based on its determination that program was not providing sufficient benefit compared to the program's cost. The liaison program assigned air traffic controllers to major system acquisition program offices, as well as to JPDO. Since that time, the National Air Traffic Controllers Association (NATCA), the labor union that represents air traffic controllers, has not been a participant in planning NGATS. Although the NGATS Institute Management Council includes a seat for the union, a NATCA official told us that the union's head had been unable to attend the council's meetings. According to JPDO officials, the council has left a seat open in hopes that the controllers will participate in NGATS as the new labor-management agreement between NATCA and FAA is implemented.

Finally, some of the benefits of NGATS' are contingent on users of the system—airlines and general aviation—equipping their aircraft with NGATS-compatible technologies. This is particularly important concerning ADS-B, a new air traffic surveillance system that JPDO has determined will be one of the early core technologies for NGATS. The first phase of ADS-B implementation, known as "ADS-B out," will allow FAA to replace many

ground radars that currently provide aircraft surveillance with less costly ground-based transceivers. Aircraft would be equipped with ADS-B out, which broadcasts a signal to these transceivers. FAA anticipates significant cost savings from this phase and, according to trade association officials, regional and large commercial airlines are largely supportive of this initial phase. But implementing ADS-B out is just the first step to achieving the larger benefits of ADS-B, which would be provided by “ADS-B in.” ADS-B in would allow aircraft to receive signals from ground-based transceivers or directly from other ADS-B equipped aircraft—this could allow pilots to “see” nearby traffic and, consequently, take on some responsibility for maintaining safe separation from those aircraft.

However, before airlines can establish a business case that supports an investment, several unknowns concerning ADS-B in must be resolved. For example, the cost of installing ADS-B in must be determined. Also, human factors considerations need further exploration to determine whether pilots can safely use ADS-B in to maintain separation of aircraft. Finally, it is unclear whether air carriers will be willing to equip with the second frequency that ADS-B would require.²⁸ How these issues are resolved will be an important factor in airlines’ decisions on whether to equip with ADS-B in. Given the breadth and complexity of NGATS, issues involving equipage decisions by nonfederal stakeholders are likely to arise again and can impact the extent and speed to which the benefits envisioned by NGATS will be realized.

As NGATS Moves Toward Implementation, Defining Roles and Responsibilities and Deciding How to Coordinate Implementation Are Challenges

JPDO also faces the challenge of clearly defining its partner agencies’ roles and responsibilities. Our work has shown that collaborating agencies should work together to define and agree on their respective roles and responsibilities, including how the collaboration will be led. JPDO has operated thus far with no formal, long-term agreement on partner agencies’ roles and responsibilities in creating NGATS. JPDO officials informed us that they are working to establish a memorandum of understanding (MOU) signed by the heads of the partner agencies that will broadly define partner agency roles and responsibilities at a high level. JPDO officials said they hope to have the MOU signed and released next

²⁸In 2002, FAA established a policy whereby commercial air transport, regional, and military fleets operating in the nation’s higher airspace would use the 1090 MHz frequency. The policy also prescribed the use of 978 MHz, known as the “universal access transceiver” or UAT, for general aviation operating in lower airspace. Uplinking weather and national airspace status information is only possible on the 978 MHz frequency.

month. JPDO is also developing more specific MOUs with partner agencies that lay out expectations for support on NGATS components, such as information sharing through network-enabled operations.

Defining roles and responsibilities is particularly important between JPDO and ATO, because both organizations have responsibilities related to planning the national airspace system's modernization. ATO has primary responsibility for the ATC system's current and near-term modernization, while JPDO has responsibility for planning and coordinating a transformation to NGATS over the next 20 years. The roles and responsibilities of each office are currently being worked out. ATO now plans to expand its Operational Evolution Plan so that it applies FAA-wide and represents FAA's piece of JPDO's overall NGATS plan.²⁹ ATO is also prioritizing its facilities and equipment investments to support the NGATS. As the roles and responsibilities of the two offices become more clearly defined, there is also a need to better communicate these decisions to stakeholders.

As NGATS moves forward, JPDO and FAA must address how to define roles and responsibilities for managing its implementation. JPDO, FAA, and other aviation experts consider NGATS to be a task of unprecedented complexity, with each partner agency having responsibility for developing and implementing portions of NGATS, while JPDO maintains a coordinating role. Recognizing the complexity involved in implementing NGATS, FAA and JPDO officials are considering several different approaches, one of which is to contract with a lead systems integrator (LSI). Generally, an LSI is a prime contractor that would help to ensure that the discrete systems used in NGATS will operate together and whose responsibilities may include designing system solutions, developing requirements, and selecting major system and subsystem contractors.

The government has used LSIs before for complex programs that require system-of-systems integration. Our research indicates that, while LSIs provide certain advantages, such as the ability to know, understand, and integrate functions across various systems, they also entail certain risks. For example, because the degree of responsibility held by the LSI may be significantly greater than that usually held by a prime contractor, careful

²⁹Currently, FAA's Operational Evolution Plan monitors how NAS capacity will change over a rolling 10-year planning horizon depending on numerous variables, such as the demand for air travel, the completion of new runways, and the availability of new ATC systems.

oversight may be necessary to ensure that the government's interests are protected and that conflicts of interest are avoided. Consequently, selecting, assigning responsibilities, and managing an LSI could pose significant challenges for JPDO and FAA.

JPDO Must Address a Variety of Policy Issues

JPDO also faces critical policy issues as NGATS moves toward implementation. Some stakeholders have noted that addressing the policy issues needed to implement NGATS technologies will be even more of a challenge for JPDO than determining the technologies for NGATS. JPDO's Concept of Operations—a document that provides a textual operational description of the transformations needed to achieve NGATS' overall goals—has been used to identify key research and policy issues for NGATS. For example, the Concept of Operations identifies several issues surrounding the automation of the air traffic control system, including the need for a backup plan in the event that automation fails, the responsibilities and liabilities of different stakeholders in the event of automation failure, and the level of monitoring needed by pilots when automation is ensuring safe separation from surrounding aircraft.

JPDO officials said that most policy decisions, when they occur, will be tied to the requirements of the enterprise architecture. However, some decisions will involve input from several entities and stakeholders. For example, it is likely that decisions on concepts and policies relating to general aviation would be made in concert among FAA, JPDO, and the Senior Policy Committee, with significant input from the general aviation community, to address concerns such as visual flight rules versus instrument flight rules. Flowing from broad policy decisions, FAA or other partner agencies would have to start developing regulations to implement the new technologies so that they would be ready at the appropriate time.

In addition, JPDO has limited control over some of the factors affecting NGATS-related policy issues. For example, the consolidation of ATC facilities could provide cost savings that could in turn be used for NGATS technologies. However, facility consolidations can often run into political hurdles that are outside of JPDO's control. Similarly, while JPDO's Airport IPT is considering how airport capacity can be expanded, a JPDO official told us that the ability of JPDO to enhance airport capacity is still limited because enhancement decisions are made at the state and local level. The official also noted that JPDO cannot channel federal funds from the Airport Improvement Program to airports where capacity expansion is most needed to achieve the goals of NGATS.

Another key policy area is how JPDO will work toward global harmonization. For example, concurrent with JPDO's efforts, the European Commission³⁰ is conducting a project to harmonize and modernize the European air traffic management systems. Known as the Single European Sky Air Traffic Management Research Programme (SESAR), the project is overseen by the European Organization for the Safety of Air Navigation (Eurocontrol).³¹ Eurocontrol has contracted out the work of SESAR to a 30-member consortium of airlines, air navigation service providers, airports, manufacturers, and others. The consortium is receiving 60 million euros (\$73 million)³² to conduct a 2-year definition phase and produce a master plan for SESAR.

JPDO officials said they recognize the need for global harmonization of systems and have met with officials from various parts of the world—including Europe, China, and East Asia—to assess the potential for cooperative NGATS demonstrations. JPDO has a Global Harmonization IPT, led by managers from ATO's International Operations Planning Services International and FAA's Office of International Aviation. The IPT's mission is to harmonize equipment and operations globally and advocate the adoption of U.S.-preferred transformation concepts, technologies, procedures, and standards. The Harmonization IPT finalized its charter in March 2006 and is working to develop an international strategy and outreach plan. In addition to external efforts, the Harmonization IPT plans to work as a crosscutting IPT that will raise awareness of global interoperability and standards issues within the other IPTs as they consider system performance requirements.

According to several European officials with whom we spoke, global harmonization (and harmonization with the U.S. system specifically) is considered to be a key ingredient for the success of SESAR. Several of these officials said that although the European organization invited JPDO to participate as a full member in SESAR and the organization has indicated its willingness to have reciprocal participation with the United

³⁰The European Commission is a politically independent institution that prepares and implements legislative instruments.

³¹Eurocontrol is an autonomous organization established in 1963 with the intention of creating a single upper airspace in Europe.

³²A portion of this funding is in-kind services from Eurocontrol. To convert euros to U.S. dollars, we used 1.2098, the foreign exchange rate for March 21, 2006, as published in *The Washington Post*.

States, personnel exchanges are just beginning to occur. JPDO officials recognize the importance of cooperative efforts and noted that if Europe and the United States were to implement different and incompatible standards and technologies, there could be a major adverse impact on airlines that serve international markets. Nonetheless, these officials point out that JPDO, as a U.S. government entity, could not participate as a member in a private industry effort like the SESAR consortium. FAA is, however, a member of the European Commission's Industry Consultation Body, which provides advice to SESAR.

According to an FAA official, negotiations are currently underway to complete an MOU between FAA and the European Commission that will commit both parties to cooperation in information sharing and the development of a seamless air traffic management system. JPDO officials noted that personnel exchanges and other cooperative activities, such as information exchanges and a joint working group on technical standards, are already occurring under a memorandum of cooperation between FAA and Eurocontrol.

While FAA and JPDO's Harmonization IPT are planning cooperative activities, our research has identified several other areas where cooperation does not appear to be fully developed. For example, the SESAR and NGATS initiatives, despite their similarities, do not have coordination activities such as peer reviews of relevant research, cooperation on safety analysis (such as through the pooling of accident data), or validation of technologies. It is possible that greater cooperation and exchange between NGATS and SESAR might develop once planning has progressed to the development and validation stage.

Concluding Observations

Transforming the national airspace system to accommodate what is expected to be three times the current amount of traffic by 2025, providing adequate security and environmental safeguards—and doing these things seamlessly while the current system continues to operate—will be an enormously complex undertaking. Both ATO and JPDO have been given difficult tasks in a difficult budgetary environment. Going forward, efforts to control costs and leverage resources will become ever more critical. Success also depends on the ability of ATO and JPDO to define their roles and form a collaborative environment for planning and implementing the next generation system.

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 and Staff Acknowledgments

For further information on this statement for the record, please contact Gerald Dillingham at (202) 512-2834 or dillingham@gao.gov. Individuals making key contributions to this statement include Nabajyoti Barkakati, Christine Bonham, Colin Fallon, Carol Henn, David Hooper, Heather Krause, Elizabeth Marchak, Edmond Menoche, Faye Morrison, Richard Scott, Sarah Veale, and Matthew Zisman.

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