

GAO

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**JOINT PLANNING AND
DEVELOPMENT OFFICE**

**Progress and Key Issues in
Planning the Transition to
the Next Generation Air
Transportation System**

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Highlights of [GAO-07-693T](#), a testimony before the Subcommittee on Space and Aeronautics, Committee on Science and Technology, House of Representatives

Why GAO Did This Study

The skies over America are becoming more crowded every day. The consensus of opinion is that the current system cannot be expanded to meet projected growth. In 2003, recognizing the need for system transformation, Congress authorized the creation of the Joint Planning and Development Office (JPDO), housed within the Federal Aviation Administration (FAA), to lead a collaborative effort of federal and nonfederal aviation stakeholders to conceptualize and plan the Next Generation Air Transportation System (NextGen)—a fundamental redesign and modernization of the national airspace system. JPDO operates in conjunction with its partner agencies, which include FAA; the Departments of Transportation, Commerce, Defense, and Homeland Security; the National Aeronautics and Space Administration (NASA); and the White House Office of Science and Technology Policy.

GAO's testimony focuses on the progress that JPDO has made in planning the NextGen initiative and some key issues and challenges that JPDO continues to face. This statement is based on GAO's November 2006 report to this subcommittee as well as ongoing work. In our November 2006 report, we recommended that JPDO take actions to institutionalize its collaboration and determine if it had the involvement of all key stakeholders. JPDO said it would consider our recommendations.

www.gao.gov/cgi-bin/getrpt?GAO-07-693T.

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

JOINT PLANNING AND DEVELOPMENT OFFICE

Progress and Key Issues in Planning the Transition to the Next Generation Air Transportation System

What GAO Found

JPDO has made progress in several areas in its planning of the NextGen initiative, but continues to face a number of challenges. JPDO's organizational structure incorporates some of the practices that we have found to be effective for federal interagency collaborations, and includes an institute that facilitates the participation of nonfederal stakeholders. JPDO has faced some organizational challenges, however. Leadership turnover at JPDO and the Institute have raised concerns about the stability of JPDO and the impact of the turnovers on its progress. Additionally, we and JPDO officials have heard concerns from stakeholders about the productivity of some integrated product teams and the pace of the planning effort. In response, JPDO officials are currently proposing several changes to JPDO's organizational structure aimed at improving the organization's effectiveness.

JPDO has also made progress toward releasing several key planning documents, including a Concept of Operations, an Enterprise Architecture, and an Integrated Work Plan, although in some cases on a revised and extended timeline. JPDO is focusing on the right types of key documents for the foundation of NextGen planning, although the current draft Concept of Operations still lacks important details. In our November 2006 report, we noted that JPDO is fundamentally a planning and coordinating body that lacks authority over the key human and technological resources of its partner agencies. Consequently, institutionalizing the collaborative process with its partner agencies will be critical to JPDO's ability to facilitate the implementation of NextGen. JPDO has identified several tasks including aligning the enterprise architectures of its partner agencies, working with OMB to establish a cross-agency mechanism for NextGen funding decisions, and working with FAA to revamp a key planning document to focus on the NextGen effort.

JPDO has made progress in developing cost estimates for NextGen, recently reporting that it estimates the total federal cost for NextGen infrastructure through 2025 will range between \$15 billion and \$22 billion. Questions remain, however, over which entities will fund and conduct some of the necessary research, development, and demonstration projects that in the past were often conducted by NASA, and which will be key to achieving certain NextGen capabilities. For example, JPDO's investment simulation capability, which relies heavily on a NASA modeling platform, may be constrained unless the JPDO or another partner agency can assume the modeling work. JPDO also faces a challenge in addressing questions concerning how human factors issues, such as the changing roles of air traffic controllers in a more automated NextGen environment, will be researched and addressed. Finally, JPDO has a continuing challenge in ensuring the involvement of all key stakeholders, including controllers and technicians. Similarly, issues have arisen over whether conflict of interest issues could chill the participation of industry stakeholders.

Mr. Chairman and Members of the Subcommittee:

I appreciate the opportunity to testify before you today to discuss the progress of the Joint Planning and Development Office (JPDO) in conceptualizing, planning, and facilitating a transformation of the current national airspace system to the Next Generation Air Transportation System (NextGen). Our nation's current airspace system is under growing strain as the demand for air travel is steadily increasing, from over 740 million passengers flying in fiscal year 2006 to an estimated 1 billion passengers by 2015, according to Federal Aviation Administration (FAA) estimates. The system is also expected to absorb a growing variety of aircraft, from the jumbo A380 which can hold more than 500 passengers to very light jets which will transport six or fewer passengers per flight. The consensus is that the current system cannot be expanded to meet this projected growth. Without a timely transition to NextGen capabilities, JPDO officials estimate a future gap between the demand for air transportation and available capacity that could cost the U.S. economy billions of dollars annually.

In 2003, recognizing the need for system transformation, Congress authorized the creation of JPDO,¹ housed within FAA, to lead a collaborative effort of federal and nonfederal aviation stakeholders to conceptualize and plan the NextGen system. NextGen is envisioned as a major redesign of the air transportation system that will move from largely ground-based radars to precision satellite-based navigation and includes digital, networked communications; an integrated weather system; layered, adaptive security; and more. In addition to FAA, JPDO operates in conjunction with multiple federal partner agencies, including the Departments of Transportation, Commerce, Defense, and Homeland Security; the National Aeronautics and Space Administration (NASA); and the White House Office of Science and Technology Policy.

My testimony today focuses on the following question: What is the status of JPDO's planning and facilitation of NextGen with respect to its organizational structure, technical planning, and initial research and development? My statement is based on our November 2006 report to this

¹JPDO was authorized by the Vision 100—Century of Aviation Reauthorization Act (Pub. L. No. 108-176). The office began operating in early 2004.

subcommittee² as well as on-going work. We conducted this work in accordance with generally accepted government auditing standards.

In summary:

JPDO has made progress in several areas in its planning of the NextGen initiative, but continues to face a number of challenges. JPDO's organizational structure incorporates some of the practices that we have found to be effective for federal interagency collaborations, and includes an institute that facilitates the participation of nonfederal stakeholders. JPDO has faced some organizational challenges, however. Leadership turnover at JPDO and the Institute have raised concerns about the stability of JPDO and the NextGen initiative. Additionally, we and JPDO officials have heard concerns from stakeholders about the productivity of some integrated product teams (IPTs) and the pace of the planning effort at JPDO. In response, JPDO officials are currently proposing several changes to JPDO's organizational structure aimed at improving the effectiveness of the organization. We believe that these changes could help address stakeholder concerns, but the effectiveness of these changes will have to be evaluated.

JPDO has also made progress toward releasing several key planning documents, including a Concept of Operations, an Enterprise Architecture, and an Integrated Work Plan, although in some cases on a revised and extended timeline. JPDO is focusing on the right types of key documents for the foundation of NextGen planning, although the current draft Concept of Operations still lacks important details. In our November 2006 report, we noted that JPDO is fundamentally a planning and coordinating body that lacks authority over the key human and technological resources of its partner agencies. Consequently, institutionalizing the collaborative process with its partner agencies will be critical to JPDO's ability to facilitate the implementation of NextGen. JPDO has identified several tasks that will help institutionalize collaboration, including aligning the enterprise architectures of its partner agencies, working with OMB to establish a cross-agency mechanism for NextGen funding decisions, and working with FAA to revamp a key planning document to focus on the NextGen effort.

²GAO, *Next Generation Air Transportation System: Progress and Challenges Associated with the Transformation of the National Airspace System*, GAO-07-25 (Washington, D.C.: Nov. 13, 2006).

JPDO has made progress in developing cost estimates for NextGen, recently reporting that it estimates the total federal cost for NextGen infrastructure through 2025 will range between \$15 billion and \$22 billion. Questions remain, however, over which organizations will fund and conduct some of the necessary research, development, and demonstration projects that in the past were often conducted by NASA, and which will be key to achieving certain NextGen capabilities. For example, JPDO's investment simulation capability relies heavily on a NASA modeling platform that NASA does not plan to upgrade for 2 years. As a result, JPDO's investment simulation capability might be constrained. JPDO also faces a challenge in addressing questions concerning how human factors issues, such as the changing roles of air traffic controllers in a more automated NextGen environment, will be researched and addressed. Finally, JPDO has a continuing challenge in ensuring the involvement of all key stakeholders. For example, active air traffic controllers and technicians are not currently involved in NextGen planning. Similarly, issues have arisen over whether conflict of interest issues could chill the participation of industry stakeholders.

In November 2006, we recommended that the Secretary of Transportation direct JPDO to take actions to institutionalize the partner agencies' collaboration in supporting NextGen, including action on a Memorandum of Understanding among the partner agencies, actions to finalize procedures to leverage partner agency resources, and actions to develop procedures for dispute resolution. We also recommended that the Secretary direct JPDO to determine whether key stakeholders and expertise are not currently represented in JPDO planning efforts. JPDO officials neither agreed nor disagree with our recommendations, but said they would consider them.

JPDO Has Made Progress in Planning NextGen, but Continues to Face a Number of Challenges

JPDO has continued to make progress in facilitating the collaboration that is central to its mission and in furthering its key planning documents. However, JPDO faces a number of challenges involving its organizational structure, institutionalization of its efforts, research and development activities, and stakeholder participation.

JPDO’s Organizational Structure Facilitates Collaboration, but Continues to Evolve

Vision 100 includes requirements for JPDO to coordinate and consult with its partner agencies, private sector experts, and the public. JPDO’s approach has been to establish an organizational structure that involves federal and nonfederal stakeholders throughout the organization. This structure includes a federal interagency senior policy committee, a board of directors, and an institute to facilitate the participation of nonfederal stakeholders. JPDO’s structure also includes eight integrated product teams (IPT), which is where the federal and nonfederal experts come together to plan for and coordinate the development of technologies for NextGen. The eight IPTs are linked to eight key strategies that JPDO developed early on for guiding its NextGen planning work (see table 1).

Table 1: JPDO’s Strategies and Related IPT Lead Agencies

Strategy	Related IPT Lead Agency
Develop airport infrastructure to meet future demand	Federal Aviation Administration
Establish an effective security system without limiting mobility or civil liberties	Department of Homeland Security
Establish an agile air traffic system that quickly responds to shifts in demand	National Aeronautics and Space Administration ^a
Establish shared situational awareness—where all users share the same information	Department of Defense
Establish a comprehensive and proactive approach to safety	Federal Aviation Administration
Develop environmental protection that allows sustained aviation growth	Federal Aviation Administration
Develop a systemwide capability to reduce weather impacts	Department of Commerce
Harmonize equipage and operations globally	Federal Aviation Administration

Sources: GAO and JPDO.

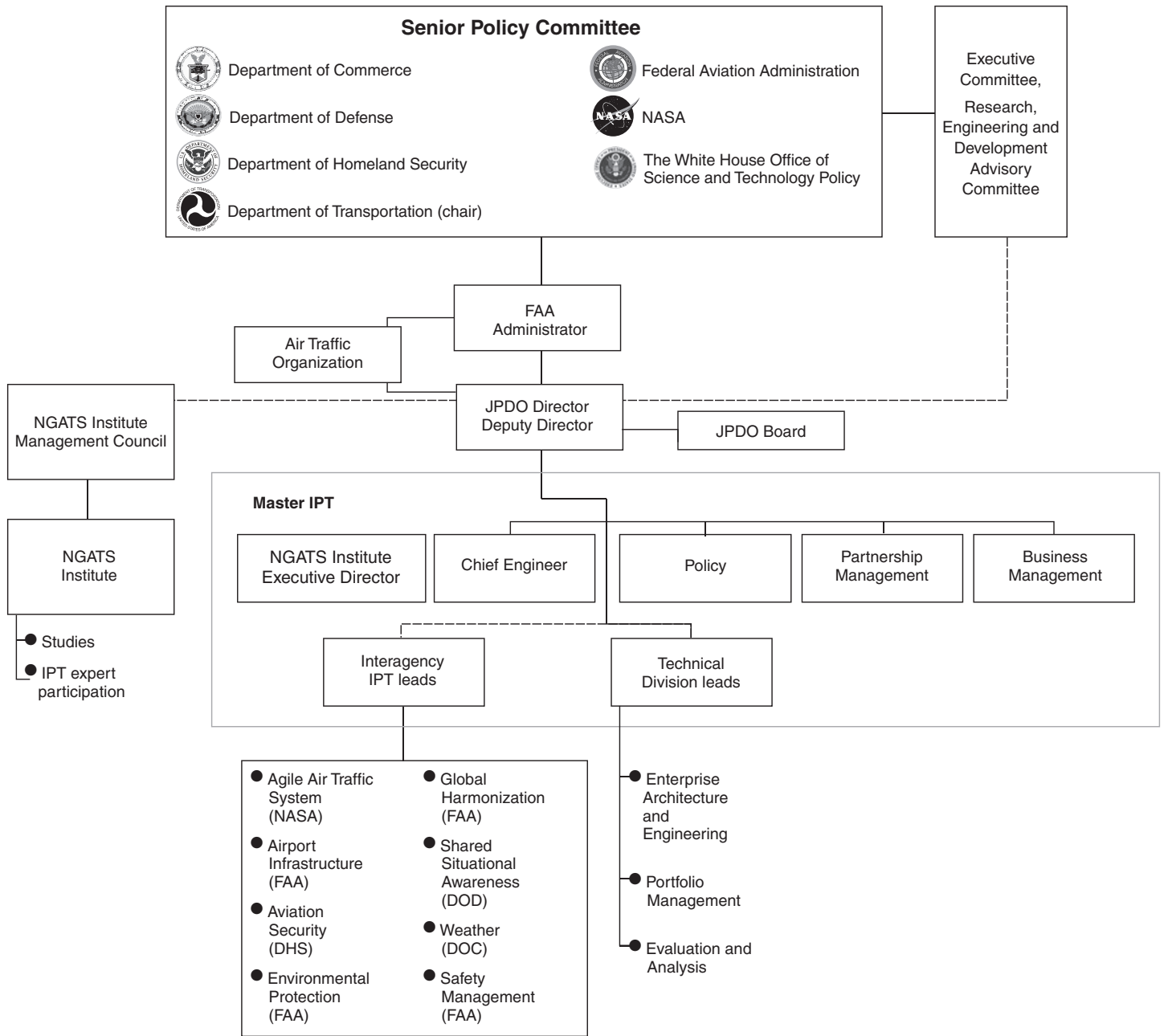
^aNASA leads this IPT because it has primary responsibility for conducting the necessary research; implementation of the agile air traffic system is the responsibility of FAA.

JPDO’s senior policy committee is headed by the Secretary of Transportation (as required in Vision 100) and includes senior-level officials from JPDO’s partner agencies. The Next Generation Air Transportation System Institute (the Institute) was created by an agreement between the National Center for Advanced Technologies³ and

³The National Center for Advanced Technologies is a nonprofit unit within the Aerospace Industries Association.

FAA to incorporate the expertise and views of stakeholders from private industry, state and local governments, and academia. The Institute Management Council (IMC), composed of top officials and representatives from the aviation community, oversees the policy, recommendations, and products of the Institute and provides a means for advancing consensus positions on critical NextGen issues. The IPTs are headed by representatives of JPDO's partner agencies and include more than 200 nonfederal stakeholders from over 100 organizations, whose participation was arranged through the Institute. Figure 1 illustrates JPDO's position within FAA and the JPDO structures that bring together federal and nonfederal stakeholders, including the Institute and the IPTs. To meet Vision 100's requirement that JPDO coordinate and consult with the public, the Institute held its first public meeting in March 2006 and plans to hold another public meeting in May 2007.

Figure 1: Organization of JPDO



Source: JPDO.

In November 2006, we reported that JPDO's organizational structure incorporated some of the practices that we have found to be effective for federal interagency collaborations—an important point given how critical such collaboration is to the success of JPDO's mission. For example, the JPDO partner agencies have worked together to develop key strategies for NextGen and JPDO has leveraged its partner agency resources by staffing various levels of its organization with partner agency employees. Also, our work has shown that involving stakeholders can, among other things, increase their support for a collaborative effort, and the Institute provides a method for involving nonfederal stakeholders in planning NextGen.

Recently, JPDO officials told us they have proposed to FAA management and the IMC executive board a change in the IPT structure and operation to improve the efficiency of the organization. JPDO has proposed converting each IPT into a "work group" with the same participants as the current IPT, but with each work group led by a joint government and industry steering committee. The steering committee would oversee the creation of small, ad hoc subgroups that would be tasked with short-term projects exploring specific issues and delivering discrete work products. Under this arrangement, work group members would be free of obligations to the group when not engaged in a specific project. According to JPDO officials, if these changes are approved, the work groups would be more efficient and output- or product-focused than the current IPTs. JPDO officials also noted that they are proposing to create a ninth work group to address avionics issues.

We believe that these changes could help address concerns that we have heard from some stakeholders about the productivity of some IPTs and the pace of the planning effort at JPDO. Nonetheless, the effectiveness of these changes will have to be evaluated over time. Also, JPDO's director has pointed out the need for the office to begin transitioning from planning NextGen to facilitating the implementation of NextGen. We believe that these changes are potentially useful in supporting such a transition. However, it will be important to monitor these changes to ensure that the participation of stakeholders is neither decreased nor adversely affected. Maintaining communications within and among work groups could increase in importance if, as work group members focus on specific projects, they become less involved in the overall collaborative planning effort.

Finally, while the organizational structure of JPDO and the Institute have been in place and largely unchanged for several years now, both of these entities have suffered from a lack of stable leadership. As JPDO begins its

fourth year in operation, it is on its third director and operated during most of 2006 under the stewardship of an acting director. The Institute pointed out in its recent annual report that JPDO's leadership turnover had made it a challenge for JPDO to move out more aggressively on many goals and objectives, as the office waited on a full-time director. The Institute also stated that JPDO's leadership turnover had limited the ability of the IMC executive committee to forge a stronger relationship with JPDO leadership and work jointly on strategic issues and challenges. However, the Institute has also had issues with turnover and is currently functioning under an acting director due to the recent departure of its second director, who had been in the position less than two years. The leadership turnovers at both JPDO and the Institute raise concerns about the stability of JPDO and about the impact of these turnovers on the progress of the NextGen initiative.

JPDO Has Made Progress Toward Releasing Key Planning Documents, although Further Work Remains

JPDO's authorizing legislation requires the office to create a multi-agency research and development plan for the transition to NextGen. To comply, JPDO is developing several key documents that together form the foundation of NextGen planning. These documents include a NextGen Concept of Operations, a NextGen Enterprise Architecture, and an Integrated Work Plan.

The Concept of Operations is the most fundamental of JPDO's key planning documents, as the other key documents flow from it. Although an earlier version was delayed so that stakeholder comments could be addressed, Version 1.2 of the Concept of Operations is currently posted on JPDO's Website for review and comment by the aviation community. This 226-page document provides written descriptions of how the NextGen system is envisioned to operate in 2025 and beyond, including highlighting key research and policy issues that will need to be addressed.⁴ For example, some key policy issues are associated with automating the air traffic control system, including the need for a backup plan in case automation fails, the responsibilities and liabilities of different stakeholders during an automation failure, and the level of monitoring needed by pilots when automation is ensuring safe separation between

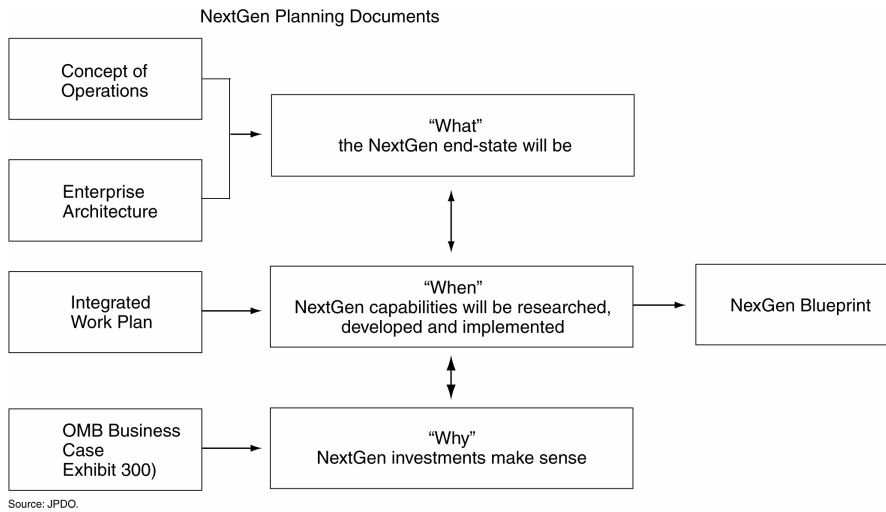
⁴Following an introductory section, the Concept of Operations has eight sections covering air traffic management operations, airport operations and infrastructure services, net-centric infrastructure services, shared situational awareness services, security services, environmental management framework, safety management services, and performance management services.

aircraft. Over the next few months, JPDO plans to address the public comments it receives and issue a revised version of the Concept of Operations.

In addition to the Concept of Operations, JPDO is working on an Enterprise Architecture for NextGen—that is, a technical description of the NextGen system, akin to blueprints for a building. The Enterprise Architecture is meant to provide a common tool for planning and understanding the complex, interrelated systems that will make up NextGen. According to JPDO officials, 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. JPDO plans to issue an early version of its Enterprise Architecture next month, although it was originally scheduled for release in September 2006.

Finally, JPDO is developing an Integrated Work Plan that will describe the capabilities needed to transition to NextGen from the current system and provide the research, policy and regulation, and schedules necessary to achieve NextGen by 2025. The Integrated Work Plan is akin to a project plan and will be critical for fiscal year 2009 partner agency budget and program planning. According to a JPDO official, the office intends to issue its initial draft of the Integrated Work Plan in July 2007.

Figure 2: Key NextGen Planning Documents



We have discussed JPDO’s planning documents with JPDO officials and examined both an earlier version of JPDO’s Concept of Operations⁵ and the current version that is out for public comment.⁶ Based on our analysis, JPDO is focusing on the right types of key documents for the foundation of NextGen planning. As for the Concept of Operations, the current version is much improved from the prior version, with additional details added. Nonetheless, we believe that it still does not include key elements such as scenarios illustrating NextGen operations, a summary of NextGen’s operational impact on users and other stakeholders, and an analysis of the benefits, alternatives, and trade-offs that were considered for NextGen. In addition, it lacks an overall description that ties together the eight key areas that the document covers. As noted, JPDO does plan to release another version of the Concept of Operations later this year.

In fact, JPDO plans further versions of all of its key planning documents. We see the development of all three of JPDO’s key documents as part of an iterative and evolutionary process. Thus, it is unlikely that any of these

⁵Concept of Operations for the Next Generation Air Transportation System, version 0.2, July 24, 2006.

⁶Our senior level technologist reviewed JPDO’s current Concept of Operations for the Next Generation Air Transportation System, version 1.2, dated February 28, 2007, by comparing it with the IEEE Standard 1362-1998 for concept of operations documents.

documents will ever be truly “finalized,” but rather will continue to evolve throughout the implementation of NextGen to reflect, for example, the development of new technologies or problems uncovered during research and development of planned technologies.

Finally, while each of the three key documents has a specific purpose, the scope and technical sophistication of these documents makes it difficult for some stakeholders to understand the basics of the NextGen planning effort. To address this issue, JPDO is currently drafting what the office refers to as a “blueprint” for NextGen, meant to be a short, high-level, non-technical presentation of NextGen goals and capabilities. We believe that such a document could help some stakeholders develop a better understanding of NextGen and the planning effort to date.

Institutionalizing the Collaborative Process Poses a Continuing Challenge for JPDO

In our November 2006 report, we noted that JPDO is fundamentally a planning and coordinating body that lacks authority over the key human and technological resources of its partner agencies. Consequently, institutionalizing the collaborative process with its partner agencies will be critical to JPDO’s ability to facilitate the implementation of NextGen. As we reported in November, JPDO has not established some practices significant to institutionalizing its collaborative process. For example, one method for establishing collaboration at a fundamental level would be for JPDO to have formal, long-term agreements among its partner agencies on their roles and responsibilities in creating NextGen. Currently, there is no mechanism that assures the partner agencies’ commitment continuing over the 20-year timeframe of NextGen or their accountability to JPDO. According to JPDO officials, they are working to establish a memorandum of understanding (MOU), signed by the Secretary or other high-ranking official from each partner agency, which will broadly define the partner agencies’ roles and responsibilities. JPDO first informed us of the development of this MOU in August 2005; in November 2006 we recommended that JPDO finalize the MOU and present it to the senior policy committee for its consideration and action. However, as of March 28, 2007, the MOU remained unsigned by some of the partner agencies.

Another key method for institutionalizing the collaborative effort is incorporating NextGen goals and activities into the partner agencies’ key planning documents. For example, we noted in November 2006 that NASA and FAA had incorporated NextGen goals into their strategic plans. These types of efforts will be critical to JPDO’s ability to leverage its partner agency resources for continued JPDO planning efforts. Even more importantly, these efforts will be critical to helping ensure that partner

agencies—given competing missions and resource demands—dedicate the resources necessary to support the implementation of NextGen research efforts or system acquisitions.

Recognizing that JPDO does not have authority over partner agency resources, FAA and JPDO have initiated several efforts to institutionalize NextGen. For example, JPDO is working with FAA to refocus one of FAA's key planning documents on the implementation of NextGen—an effort that also appears to be improving the collaboration and coordination between JPDO and FAA's Air Traffic Organization (ATO), which has primary responsibility for modernization of the air traffic control system. FAA has expanded and revamped its Operational Evolution Plan (OEP)—renamed the Operational Evolution Partnership—to become FAA's implementation plan for NextGen.⁷ The OEP is being expanded to apply to all of FAA and is intended to become a comprehensive description of how the agency will implement NextGen, including the required technologies, procedures, and resources. (Figure 3 shows the OEP framework.) An ATO official told us that the new OEP is to be consistent with JPDO's key planning documents and its budget guidance to the partner agencies. According to FAA, the new OEP will allow it to demonstrate appropriate budget control and linkage to NextGen plans and will force FAA's research and development to be relevant to NextGen's requirements. According to FAA documents, the agency plans to publish a new OEP in June 2007.

⁷Prior to expansion of the OEP, the document centered around plans for increasing capacity and efficiency at 35 major airports.

Figure 3: New OEP Framework



Source: JPDO.

Note: The concentric rings indicate the nature of initiative development from the outer ring (NextGen strategic initiatives), in which new programs and concepts are analyzed and demonstrated; to the second ring, where decisions are made regarding safety, operating policy, performance standards, and certification requirements; to the third ring (technical development), where concepts are prototyped and investment analysis decisions are made. The progression through the rings is not necessarily linear, and a program may be in more than one ring at a time. Data communications, for example, is in the technical development ring and also in the middle ring as policy and rulemaking is considered. The core is divided into three sections, which indicate the FAA offices that implement the final NextGen program.

In addition, to further align FAA's efforts with JPDO's plans for NextGen, FAA is creating a NextGen Review Board to oversee the OEP. This Review Board will be co-chaired by JPDO's Director and ATO's Vice President of Operations Planning Services. Initiatives, such as concept demonstrations or research, proposed for inclusion in the OEP will now need to go through the Review Board for approval. Initiatives are to be assessed for their relation to NextGen requirements, concept maturity, and risk. An ATO official told us that the new OEP process should also help identify some smaller programs that might be inconsistent with NextGen and which could be discontinued. Additionally, as a further step towards integrating ATO and JPDO, the administration's reauthorization proposal calls for the JPDO director to be a voting member of FAA's Joint Resources Council and ATO's Executive Council.

While progress is being made in incorporating NextGen initiatives into FAA's strategic and planning documents, more remains to be done with FAA and the other JPDO partner agencies. For example, one critical activity that remains in this area will be synchronizing the NextGen enterprise architecture, once JPDO releases and further refines it, with the partner agencies' enterprise architectures. Doing so should help align agencies' current work with NextGen while simultaneously identifying gaps between agency plans and NextGen plans. Also, while FAA is making significant progress toward creating an implementation plan for NextGen, the other partner agencies are less far along or have not begun such efforts. JPDO's lack of authority over partner agency resources will be minimized as a challenge if the partner agencies commit to NextGen goals and initiatives at a structural level. By further incorporation of NextGen efforts into strategic planning documents, the partner agencies will better institutionalize their commitments to JPDO and the NextGen initiative.

Finally, another important method for institutionalizing the collaborative effort will be for JPDO to establish mechanisms for leveraging partner agency resources. JPDO has made progress in this area, although further work remains. As we noted in our November report, JPDO is working with OMB to develop a process that would allow OMB to identify NextGen-related projects across the partner agencies and consider NextGen as a unified, cross-agency program. We recently met with OMB officials who said that they felt there has been significant progress with JPDO over the last year. JPDO is now working on an OMB Exhibit 300

form for NextGen.⁸ This will allow JPDO to present OMB a joint business case for the NextGen-related efforts within the partner agencies and will be used as input to funding decisions for NextGen research and acquisitions across the agencies. This Exhibit 300 will be due to OMB in September 2007 to inform decisions about the partner agencies' 2009 budget submissions.

Ultimately, the success of JPDO will have to be measured in the efforts of its partner agencies to implement policies and procedures and acquire systems that support NextGen. To date, JPDO can point to its success in collaborating with FAA to fund and speed its rollout of two systems considered cornerstone technologies for NextGen: Automatic Dependent Surveillance-Broadcast (ADS-B) and System Wide Information Management (SWIM). ADS-B is a new air traffic surveillance system that will replace many existing radars with less costly ground-based transceivers. SWIM will provide an initial network centric capability to all the users of the air transportation system. This means that the FAA and the Departments of Homeland Security and Defense will eventually share a common, real-time, secure picture of aviation operations across the airspace system. Identifying such NextGen programs across the partner agencies and establishing implementation plans for them in JPDO's Integrated Work Plan will be critical going forward to creating performance metrics for JPDO.

Although we recommended in our November report that JPDO develop written procedures that formalize agreements with OMB regarding the leveraging of partner agency resources, this is still a work in progress. For example, OMB officials said they had not reviewed JPDO's 2008 partner agency budget guidance prior to its release to the partner agencies, which highlights the need for JPDO to further develop its procedures for working with OMB. Going forward, it will be important for Congress and other stakeholders to evaluate the success of the 2009 budgets in supporting NextGen initiatives, especially as 2009 is expected to be a critical year in the transition from planning NextGen to implementing NextGen.

⁸ Section 300 of OMB Circular No. A-11, Preparation, Submission, and Execution of the Budget (Nov. 2, 2005), sets forth requirements for federal agencies for planning, budgeting, acquiring, and managing information technology capital assets.

FAA and JPDO Have Begun to Release Early Cost Estimates for NextGen, but Questions Remain Over Who Will Conduct Necessary Research and Development

In our November report, we noted that JPDO had not yet developed a comprehensive estimate of the costs of NextGen. Since then, in its recently released 2006 Progress Report,⁹ JPDO reported some estimated costs for NextGen, including specifics on some early NextGen programs. JPDO believes the total federal cost for NextGen infrastructure through 2025 will range between \$15 billion and \$22 billion. JPDO also reported that a preliminary estimate of the corresponding cost to system users, who will have to equip with the advanced avionics that are necessary to realize the full benefits of some NextGen technologies, produced a range of \$14 billion to \$20 billion. JPDO noted that this range for avionics costs reflects uncertainty about equipage costs for individual aircraft, the number of very light jets that will operate in high-performance airspace, and the amount of out-of-service time required for installation.

FAA, in its capital investment plan for fiscal years 2008-2012, includes estimated expenditures for 11 line items that are considered NextGen capital programs.¹⁰ The total 5-year estimated expenditures for these programs is \$4.3 billion. In fiscal year 2008, only 6 of the line items are funded for a total of roughly \$174 million; funding for the remaining 5 programs would begin with the fiscal year 2009 budget. According to FAA, in addition to capital spending for NextGen, the agency will spend an estimated \$300 million on NextGen-related research and development from fiscal years 2008 through 2012. The administration's budget for fiscal year 2008 for FAA includes a total of \$17.8 million to support the activities of JPDO.

While FAA and JPDO have begun to release estimates for FAA's NextGen investment portfolio, questions remain over which entities will fund and conduct some of the necessary research, development, and demonstration projects that will be key to achieving certain NextGen capabilities. In the past, a significant portion of aeronautics research and development,

⁹JPDO, *Making the NextGen Vision a Reality: 2006 Progress Report to the Next Generation Air Transportation System Integrated Plan* (Washington, D.C.: Mar. 14, 2007).

¹⁰FAA has six capital investment programs that it considers transformational NextGen programs slated to receive funding in fiscal year 2008: ADS-B nationwide implementation, System Wide Information Management (SWIM), NextGen Data Communications, NextGen Network Enabled Weather, National Airspace System Voice Switch, and NextGen Technology Demonstration. In addition, five other programs are slated to begin funding in 2009: NextGen System Development, NextGen High Altitude Trajectory Based Operations, NextGen High Density Airports, NextGen Networked Facilities, and NextGen Cross-Cutting Infrastructure.

including intermediate technology development, has been performed by NASA. However, NASA's aeronautics research budget and proposed funding shows a 30-percent decline, in constant 2005 dollars, from fiscal year 2005 to fiscal year 2011. To its credit, NASA plans to focus its research on the needs of NextGen. However, NASA is also moving toward a focus on fundamental research and away from developmental work and demonstration projects, which could negatively impact NextGen if these efforts are not assumed by others. According to its 2006 Progress Report, JPDO is building a research and development plan that will document NextGen's research needs and the organizations that will perform the work.

For example, JPDO's investment simulation capability relies heavily on NASA's NAS-wide modeling platform, the Airspace Concepts Evaluation System (ACES).¹¹ This investment simulation capability permits JPDO to, among other things, evaluate alternative research ideas and assess the performance of competing vendors. According to a JPDO official, this capability, which is critical to NextGen research, is eroding as JPDO's investment simulation requirements are expanding. As part of its fundamental research mission, NASA intends to upgrade to ACES-X (a more sophisticated representation of the national airspace system), but not for another two years. Until then, JPDO investment modeling capability will be constrained unless the office or another partner agency can assume the modeling work. While one option would be to contract with private sector vendors to do this type of modeling on a per simulation basis, this solution could be expensive for the government. Moreover, JPDO might not be able to continue facilitating participation by both small and large companies, thus giving both an equal opportunity to demonstrate their ideas, because small companies would have to pay for access to this proprietary modeling capability. This is an issue that needs to be addressed in the short-term.

JPDO faces the challenge of determining the nature and scope of the research and technology development necessary to begin the transition to NextGen, as well as identifying the entities that can conduct that research and development. According to officials at FAA and JPDO, they are

¹¹ACES provides a detailed flight simulation environment and an open framework to integrate the results of other simulations. This allows JPDO to test concepts well before they have to be demonstrated with real hardware and people. This platform provides a basis for evaluating the timing of many agencies' current budget requests and is a method for comparing competitive ideas.

currently studying these issues and trying to assess how much research and development FAA can assume. An FAA official recently testified that the agency proposes to increase its research and development funding by \$280 million over the next 5 years. However, a draft report by an advisory committee to FAA stated that FAA would need at least \$100 million annually in increased funding to assume NASA's research and development work, and establishing the necessary infrastructure within FAA could delay the implementation of NextGen by 5 years.¹² More work remains to completely assess the research and development needs of NextGen and the ability of FAA and the other JPDO partner agencies to budget for and conduct the necessary initiatives. This information is critical as the timely completion of research and testing of proposed NextGen systems is necessary to keeping the NextGen initiative on schedule.

Some Fundamental NextGen Capabilities Will Require Human Factors Research

Addressing questions about how human factors issues will affect the move to some key NextGen capabilities is another challenge for JPDO. For example, the NextGen Concept of Operations envisions an increased reliance on automation, which raises questions about the role of the air traffic controllers in such an automated environment. Similarly, the Concept of Operations envisions that pilots will take on a greater share of the responsibility for maintaining safe separation and other tasks currently performed by controllers. This raises human factors questions about whether pilots can safely perform these additional duties.

Although JPDO has begun to model how shifts in air traffic controllers' workloads would affect their performance, it has not yet begun to model the effect of how this shift in workload to pilots would affect pilot performance. According to a JPDO official, modeling the effect of changes in pilot workload has not yet begun because JPDO has not yet identified a suitable model for incorporation into its suite of modeling tools. According to a JPDO official, the evolving roles of pilots and controllers is the NextGen initiative's most important human factors issue, but will be difficult to research because data on pilot behavior are not readily available for use in creating models. In addition to the study of changing roles, JPDO has not yet studied the training implications of various

¹²Research, Engineering and Development Advisory Committee, *Draft Report on Financing the Next Generation Air Transportation System* (Washington, D.C.: April 2006).

systems or solutions proposed for NextGen. For example, JPDO officials said they will need to study the extent to which new air traffic controllers will have to be trained to operate both the old and the new equipment as the Concept of Operations and enterprise architecture mature.

JPDO Faces A Continuing Challenge in Ensuring the Involvement of All Key Stakeholders

Some stakeholders, such as current air traffic controllers and technicians, will play critical roles in NextGen, and their involvement in planning for and deploying the new technology will be important to the success of NextGen. In November 2006, we reported that active air traffic controllers were not involved in the NextGen planning effort and recommended that JPDO determine whether any key stakeholders and expertise were not represented on its IPTs, divisions, or elsewhere within the office. Since then, the head of the controllers' union has taken a seat on the Institute Management Council. However, no active controllers are yet participating at the IPT planning level. Also, aviation technicians do not participate in NextGen efforts. Input from current air traffic controllers who have recent experience controlling aircraft and current technicians who will maintain NextGen equipment is important when considering human factors and safety issues. Our work on past air traffic control modernization projects has shown that a lack of stakeholder or expert involvement early and throughout a project can lead to costly increases and delays.

In addition, we found that some private sector stakeholders have expressed concerns that participation in the Institute might either preclude bidding on future NextGen acquisitions or pose organizational conflicts of interest. FAA's acquisition process, generally, precludes bids from organizations that have participated in, materially influenced, or had prior knowledge of the requirements for an acquisition. The Institute was aware of this concern and attempted to address it through an amendment to its governing document that strengthened the language protecting participants from organizational conflicts of interest for participation in the NextGen initiative. However, while the amendment language currently operates to protect stakeholders, the language has never been tested or challenged. Thus, it is unclear at this time whether any stakeholder participation is being chilled by conflict of interest concerns.

Mr. Chairman, this concludes my statement. I would be pleased to respond to any questions from you or other Members of the Subcommittee.

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Acknowledgements**

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