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NEXT GENERATION AIR TRANSPORTATION SYSTEM

Preliminary Analysis of the Joint Planning and Development Office's Planning, Progress, and Challenges

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Highlights of [GAO-06-574T](#), testimony before the Subcommittee on Space and Aeronautics, Committee on Science, House of Representatives

Why GAO Did This Study

The health of our nation’s air transportation system is critical to our citizens and economy. However, the current approach to managing air transportation is becoming increasingly inefficient and operationally obsolete. In 2003, Congress created the Joint Planning and Development Office (JPDO) to coordinate the federal and nonfederal stakeholders necessary to plan and implement a transition from the current air transportation system to the “next generation air transportation system” (NGATS). JPDO, although housed within the Federal Aviation Administration (FAA), has seven partner agencies: the Departments of Transportation, Commerce, Defense, and Homeland Security; FAA; the National Aeronautics and Space Administration (NASA); and the White House Office of Science and Technology Policy. This testimony provides preliminary results from GAO’s ongoing study of the status of JPDO’s efforts. GAO provides information on (1) the extent to which JPDO is facilitating the federal interagency collaboration and aligning the human and financial resources needed to plan and implement the NGATS, (2) the actions taken by JPDO to adequately involve stakeholders in the planning process, and (3) the extent to which JPDO is conducting the technical planning needed to develop the NGATS.

www.gao.gov/cgi-bin/getrpt?GAO-06-574T.

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.

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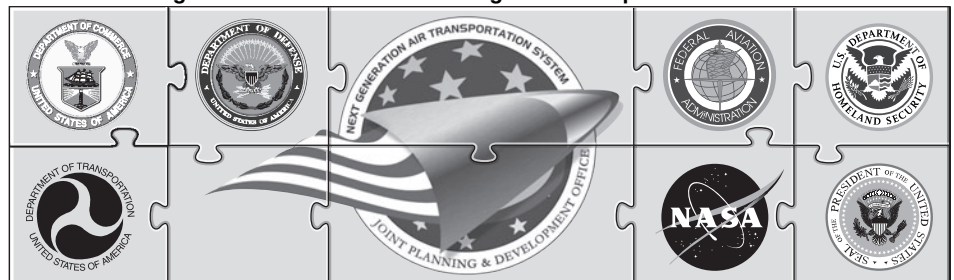
What GAO Found

JPDO is implementing a number of practices that GAO’s work has shown facilitates collaboration among federal agencies, but faces a challenge in sustaining this collaboration over the longer term. These practices include defining and articulating a common outcome, establishing mutually reinforcing or joint strategies to achieve that outcome, and identifying and addressing needs by leveraging resources among partner agencies. However, JPDO faces a challenge in leveraging resources because it is fundamentally a planning and coordinating body that lacks authority over the key human and financial resources needed to continue developing plans and system requirements for the NGATS. To its credit, JPDO is working with its partner agencies to align their fiscal year 2008 budget requests to support NGATS and is working with the Office of Management and Budget to develop a budget review process that easily identifies partner agencies’ NGATS-related programs.

JPDO has involved federal and nonfederal stakeholders throughout its organization. Federal stakeholders from the partner agencies work with JPDO throughout multiple levels of the organization. The NGATS Institute has been established as the mechanism for involving nonfederal stakeholders. The Institute has obtained participation from industry and other nonfederal stakeholders and has assigned them to work with JPDO. However, JPDO has experienced difficulties with soliciting the participation of current air traffic controllers, who will play a key role in the NGATS. Additionally, JPDO could face a challenge in sustaining nonfederal stakeholders’ participation in an effort where tangible benefits may not be realized until several years in the future.

JPDO is using an iterative technical planning process that appears to be reasonable in light of the NGATS’ complexity. The process includes iterative modeling—a technique that mathematically represents the NGATS’ system performance parameters, demand, and economic factors—to narrow the range of potential options. This fall, JPDO plans to have an initial version of its enterprise architecture—a blueprint to guide NGATS development—and will refine the architecture as the NGATS effort moves forward.

Seven Partner Agencies Form the Joint Planning and Development Office



Source: GAO.

Mr. Chairman and Members of the Subcommittee:

We appreciate the opportunity to participate in today's hearing to discuss the status of the Joint Planning and Development Office (JPDO) after its first 2 years of existence. The health of our nation's air transportation system is critical to our citizens and economy. However, the current approach to managing air transportation is becoming increasingly inefficient and operationally obsolete. In November 2002, the congressionally chartered Commission on the Future of the United States Aerospace Industry recommended transforming the U.S. air transportation system as a national priority.¹ Transforming the 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.

In 2003, Congress passed the Vision 100 - Century of Aviation Reauthorization Act, which created JPDO within the Federal Aviation Administration (FAA) to manage work related to the creation of a "next generation air transportation system" (NGATS). JPDO has responsibility for coordinating the research efforts of its partner agencies—the Departments of Transportation (DOT), Commerce (DOC), Defense (DOD), and Homeland Security (DHS); FAA; and the National Aeronautics and Space Administration (NASA). JPDO is also working with its final partner agency—the White House Office of Science and Technology Policy—to coordinate funding with the Office of Management and Budget. Additionally, JPDO has responsibility to consult with the public; to coordinate federal goals, priorities, and programs with those of aviation and aeronautical firms; and to ensure the participation of stakeholders from the private sector, including commercial and general aviation, labor, aviation research and development entities, and manufacturers. JPDO is jointly funded through FAA and NASA. The JPDO Director reports to the FAA Administrator and to the Chief Operating Officer of FAA's Air Traffic Organization.²

¹Commission on the Future of the United States Aerospace Industry, *Final Report* (Nov. 2002).

²The Air Traffic Organization is FAA's business unit that is responsible for operating, maintaining, and modernizing the nation's current air traffic control system.

Vision 100 directed JPDO to develop an integrated plan for the NGATS and to include in the plan, among other things, a vision statement for an air transportation system that meets potential air traffic demand by 2025; a description of the demand and required performance characteristics of the future system; and a high-level, multi-agency roadmap and concept of operations for the future system. Key tenets of the plan are transitioning from the current largely ground-based navigation system to one that is more focused on aircraft and satellite-based navigation, and automating many of the routine air traffic control functions. In addition, the integrated plan discusses a strategy to harmonize the NGATS with equipment and operations around the world to enhance safety and efficiency on a global scale. As directed by Vision 100, the FAA Administrator provided this integrated plan to Congress in December 2004 and issued the first annual progress report earlier this month.

My statement today provides preliminary results from our ongoing study of the status of JPDO and focuses on three specific questions. (1) To what extent is JPDO facilitating the federal interagency collaboration and aligning the human and financial resources needed to define and perform the centralized planning function for the detailed implementation of the NGATS? (2) What actions or initiatives has JPDO implemented to ensure adequate involvement of stakeholders in the planning process? (3) To what extent is JPDO conducting the technical planning needed to develop the NGATS? My statement is based on our analysis of documents provided by JPDO and its partner agencies; the perspectives of agency officials and stakeholders with whom we have spoken; the results of a panel of experts that we convened earlier this month; and our review of relevant literature, including the integrated plan and the progress report. We also draw upon our prior work on FAA's national airspace system modernization program, which we have listed as a high-risk program since 1995. To assess JPDO's prospects for facilitating collaboration among its partner agencies, we compared its practices to those that we have found to be effective in facilitating other federal interagency collaborative efforts.³ We also reviewed the National Research Council's 2005 report on JPDO, which provided a technical assessment of the research, development, and technology components of JPDO's integrated plan.⁴ In addition, we

³GAO, *Results-Oriented Government: Practices That Can Help Enhance and Sustain Collaboration among Federal Agencies*, GAO-06-15 (Washington, D.C.: Oct. 21, 2005).

⁴National Research Council, *Technology Pathways: Assessing the Integrated Plan for a Next Generation Air Transportation System* (Washington, D.C.: 2005).

reviewed relevant documents and interviewed officials and stakeholders regarding Europe's effort to harmonize and modernize its air traffic management system. Later this year, we expect to issue a detailed report that will provide our assessment of the status of JPDO's efforts as it works to develop the NGATS. We are performing our work in accordance with generally accepted government auditing standards.

In summary:

- JPDO is implementing a number of practices that our work has shown facilitates collaboration among federal agencies, but faces a challenge in maintaining this collaboration over the long term. These practices include defining and articulating a common outcome, establishing mutually reinforcing or joint strategies to achieve that outcome, and identifying and addressing needs by leveraging resources among partner agencies. JPDO's legislation established a common outcome—a transformed national airspace system by 2025—that JPDO expanded on in its integrated plan, which establishes an overarching framework and goals for its activities. The plan also laid out eight joint strategies for partner agencies to use as they help develop the NGATS. Additionally, JPDO is leveraging partner agency resources by staffing its organization with employees of the partner agencies, many of whom work for JPDO as a collateral duty. JPDO has also reviewed these agencies' research and development programs to identify work that could support the NGATS. By using these practices for facilitating collaboration, JPDO has gotten off to a positive start. However, because JPDO is fundamentally a planning and coordinating body, it does not have authority over the partner agencies' human and financial resources that it needs to continue performing the centralized, interagency planning function for detailed implementation of the NGATS. Consequently, leveraging resources will continue to be critical to JPDO's success, particularly in future years as partner agencies begin to implement projects on a larger scale. JPDO was successful in prompting FAA to request funding to accelerate system development for two key NGATS systems in its fiscal year 2007 budget request. However, JPDO officials told us that, while FAA did receive an increase, it did not receive the full amount requested in the budget formulation documents submitted to the Office of Management and Budget. Our work on FAA's current air traffic control modernization program has shown that receiving fewer resources than planned was a contributing factor in schedule delays and subsequent cost increases. To its credit, JPDO is working with its partner agencies to align their fiscal year 2008 budget requests to support the NGATS. JPDO has also opened a dialog with the Office of Management and Budget to develop a systematic means of reviewing partner agency budget requests so that NGATS-related programs can be easily identified.

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- JPDO has incorporated representatives from federal and nonfederal stakeholders throughout its organization. Federal stakeholders from the partner agencies work with JPDO throughout multiple levels of the organization. The NGATS Institute was created as the mechanism for involving nonfederal stakeholders and has obtained their participation and assigned them to work with JPDO's federal stakeholders. The NGATS Institute Management Council, composed of top officials and representatives from the aviation community, provides a means for advancing consensus positions on critical NGATS issues. However, a critical stakeholder in the nation's air traffic control system has yet to become an active participant in this forum. Air traffic controllers, who work in the current system and will play a key role in the NGATS, have not been involved in JPDO's efforts. In the past, FAA's failure to adequately involve air traffic controllers in its acquisition of new technologies, such as the Standard Terminal Automation Replacement System—a workstation for air traffic controllers—contributed to costly rework and schedule delays. A challenge for JPDO could be sustaining nonfederal stakeholders' participation in an effort where tangible benefits may not be realized until several years in the future. JPDO also faces the challenge of convincing nonfederal stakeholders that the government is financially committed to the NGATS. Additionally, JPDO could face a challenge in resolving the divergent perspectives that are represented by its nonfederal stakeholders.
 - JPDO is using an iterative process to address the technical planning needed to develop the NGATS that appears reasonable in light of the system's complexity. The office has assembled a suite of models to iteratively analyze and understand the interactions among system performance parameters, demand, and economic factors, and has developed an enterprise architecture, or "blueprint," for the NGATS. JPDO is testing the adequacy of its suite of models, publishing the results, and seeking peer review opportunities. However, these modeling efforts, including those addressing human factors, are currently in the early stages, and more time and field testing will be needed to increase confidence that the final range of solutions for the NGATS is based on realistic assumptions. With respect to enterprise architecture, JPDO has established the organizational structure for enterprise architecture development—an important first step—and anticipates having an initial version of the architecture by the end of fiscal year 2006. Recognizing that further work will be required, JPDO is using a multiyear phased planning approach in which the enterprise architecture will be continuously refined. This "build a little, test a little" approach is similar to a process that we have previously advocated for FAA's major system acquisition programs.

Background

FAA, with research assistance from NASA, has had the primary responsibility for planning and implementing national airspace system modernization since these efforts began more than 20 years ago. Recently, FAA placed the modernization program under a new Air Traffic Organization, headed by a Chief Operating Officer. JPDO's approach differs from FAA's past modernization efforts in that its scope is "curb-to-curb," encompassing in-terminal passenger and baggage security screening and environmental issues. Additionally, JPDO's approach will require unprecedented consensus and cooperation among many stakeholders—federal and nonfederal—about necessary system capabilities, equipment, procedures, and regulations. JPDO seeks to leverage the resources of NASA and the Departments of Transportation, Commerce, Defense, and Homeland Security, each of which has expertise and technology that will play a part in the NGATS. For example, the Department of Defense has deployed "network centric" systems, originally developed for the battlefield, which 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.

Concurrent with JPDO's efforts, the European Commission⁵ is conducting a project to harmonize and modernize the pan-European air traffic management system. Known as the Single European Sky Air Traffic Management Research Programme (SESAR), the project is being managed by the Air Traffic Alliance, an industry partnership that was awarded the management contract by the European Organisation for the Safety of Air Navigation (Eurocontrol).⁶ Eurocontrol develops, coordinates, and plans for the implementation of pan-European air traffic management strategies. While the U.S. and European efforts are both directed at modernization, Europe faces the additional challenge of harmonizing its air traffic control system—currently operated through a patchwork of national air navigation service providers. The work of the SESAR effort, which was scheduled to officially start this month, is being done by a 30-member consortium of airlines, air navigation service providers, airports, manufacturers, and others. The consortium is receiving 60 million euros

⁵The European Commission is a politically independent institution that prepares and implements legislative instruments.

⁶Eurocontrol is an autonomous organization established in 1963 with the intention of creating a single upper airspace.

(\$73 million)⁷ to conduct a 2-year definition phase and produce a master plan for SESAR. The next steps following the definition phase, from 2008 to 2013, are currently under discussion. One proposal would develop the technologies for the new system and would be funded annually at 300 million euros (\$363 million) per year, with equal contributions being provided by the European Commission, Eurocontrol, and other parties.

JPDO Is Engaging in Effective Practices for Interagency Collaboration, but Faces Challenges in Leveraging Resources and Defining Responsibilities

Our work to date shows that JPDO has engaged in practices to facilitate federal interagency collaboration, including defining and articulating a common outcome; establishing mutually reinforcing or joint strategies; and beginning to leverage the partner agency resources needed to perform the centralized, interagency planning function for the detailed implementation of the NGATS. However, JPDO faces a challenge in leveraging resources because it is fundamentally a planning and coordinating body that lacks authority over the key human and financial resources needed to continue developing plans and system requirements for the NGATS. Additionally, JPDO faces the challenge of clearly defining roles and responsibilities among its partner agencies. Our work has shown that collaborating agencies should work together to define and agree on their respective roles and responsibilities, including how the collaborative effort will be led. To its credit, JPDO is taking some actions to mitigate these challenges.

JPDO Has Articulated a Common Outcome, Established Mutually Reinforcing or Joint Strategies, and Begun to Leverage Resources

JPDO's integrated plan provides a vision statement that elaborates on the broadly stated common outcome set forth by the Vision 100 legislation—an air transportation system that meets potential air traffic demand by 2025. In working together to develop JPDO's integrated plan, the partner agencies agreed upon a broad statement of future system goals, performance characteristics, and operational concepts. Our research shows that, for interagency collaborative efforts to overcome significant differences in agency missions, cultures, and established ways of doing business, the agencies must have a clear and compelling rationale to work together. JPDO's partner agencies agreed to a vision statement: a transformed air transportation system that provides services tailored to

⁷A 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 Tuesday, March 21, 2006, as published in *The Washington Post*.

individual customer needs, allows all communities to participate in the global economy, and seamlessly integrates civil and military operations.

The plan also provides eight strategies—again developed by the partner agencies—that broadly address the goals and objectives for the NGATS. JPDO has formed eight integrated product teams (IPTs), one for each strategy. Our work has shown that mutually reinforcing or joint strategies help in aligning the partner agencies’ activities, core processes, and resources to accomplish the common outcome. In addition to jointly identifying the strategies for the NGATS, the various partner agencies have taken the lead on specific strategies. (See table 1.) JPDO is currently reevaluating whether all of these IPTs should be expected to create products. For example, the IPT that is addressing the global interoperability strategy might be more likely to have cross-cutting influence over the other seven IPTs, rather than developing a product of its own, according to JPDO officials.

Table 1. JPDO’s Strategies and Responsible Agencies

Strategy	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
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 equipment and operations globally	Federal Aviation Administration

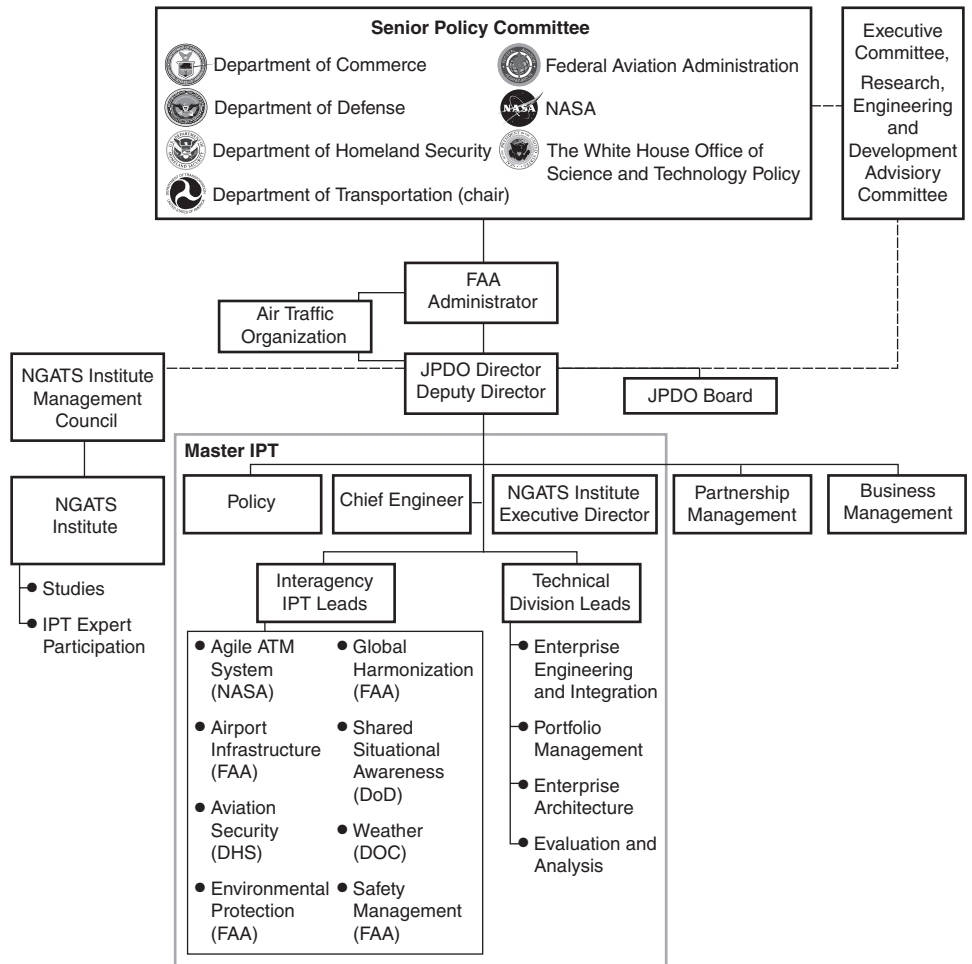
Source: GAO presentation of JPDO data.

The National Research Council, in its recent study of JPDO, noted the IPT structure is oriented by discipline, which the Council believes works against a product orientation. The Council recommended that JPDO reorganize into three IPTs that parallel the way FAA currently organizes its operations—airport, terminal, and en route/oceanic. JPDO officials do not agree with this recommendation. They told us that the existing airspace

segmentation by phase of flight—airport , terminal, and en route—creates inefficiencies. As aircraft transition from one phase of flight to the next, they encounter a “speed bump.” For example, operations are slowed as en route air traffic controllers transfer responsibility for aircraft to terminal controllers. This segmentation is not part of JPDO’s vision for the NGATS. In our view, if JPDO’s IPT structure begins to show evidence that it is hindering rather than promoting progress toward achieving NGATS goals, JPDO might look again at the Council’s recommendations to determine whether a different structure or fewer IPTs would help it achieve its goals. In the end, the progress and outcomes achieved by the structure are as important, if not more important, than the organizational model selected.

JPDO has begun leveraging the resources of its partner agencies, which is another practice that we have found helps facilitate interagency collaboration. Our research shows that collaborating agencies should identify the human, information technology, physical, and financial resources needed to initiate or sustain their collaborative effort. To leverage human resources, JPDO has staffed its organization with partner-agency employees, many of whom work for JPDO as a collateral duty. The JPDO board, which provides coordination between partner agencies and JPDO, is composed of key executives of the partner agencies who can facilitate bringing agency resources to bear on NGATS development. JPDO’s eight IPTs, which are developing the plans and requirements for the NGATS, include staff from the partner agencies. Additionally, Vision 100 created the Next Generation Air Transportation Senior Policy Committee, composed of partner agency senior executives, to provide ongoing policy review and identify resource needs from the partner agencies. (See fig. 1.)

Figure 1: JPDO Organization Chart



Source: JPDO.

To further begin leveraging resources, during the past year JPDO conducted an interagency program review of its partner agencies' research and development programs to identify the work that could support the NGATS, as well as identify areas for more effective interagency collaboration. Through this process, JPDO identified early opportunities that could be pursued during fiscal year 2007 to produce tangible results for the NGATS. For example, JPDO noted that FAA had amassed considerable technical expertise in the standards, protocols, and near-term air traffic applications for Automatic Dependent Surveillance-Broadcast (ADS-B). ADS-B is a technology through which an aircraft broadcasts information on its position to ground-based transceivers,

rather than having its position detected by ground-based radars. JPDO envisions FAA beginning to purchase ADS-B transceivers, decommission obsolete ground-based radars, and develop air traffic procedures that would permit ADS-B-equipped aircraft to obtain near-term operational benefits such as routings that save fuel.

JPDO Faces Challenges in Continuing to Leverage Resources and Defining Roles and Responsibilities

Although JPDO's legislation, integrated plan, and established governance structure provide the framework for institutionalizing collaboration among multiple federal agencies, JPDO is fundamentally a planning and coordinating body that lacks authority over the key human and financial resources needed to continue developing plans and system requirements for the NGATS. Consequently, leveraging resources on a continuing basis will be critical to JPDO's success. Our research has also shown that agreement on roles and responsibilities facilitates interagency collaboration. However, in JPDO's situation, some important roles and responsibilities have not yet been clearly defined.

The challenge of leveraging resources will likely intensify beginning in 2008, when JPDO expects a significant increase in the workload of its IPTs. JPDO anticipates needing more resources for the IPTs to, among other things, plan demonstrations of potential technologies to illustrate some of the early benefits that could be achieved from the transformation to the NGATS. 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 partner agencies are willing to allow their staff to devote larger portions of their time to JPDO as the office develops more detailed plans and requirements for the NGATS. Partner agencies have a variety of missions and priorities other than supporting the NGATS. Some partner agency employees, including some IPT directors, have been told by their partner agencies that their work for JPDO is approved so long as it does not interfere with their regular assigned duties. Such resource issues would ultimately go to the Senior Policy Committee for resolution. However, the role of the committee's members, as stated in Vision 100, is only to make recommendations to their respective agencies for the required resources.

The challenge of leveraging financial resources has already manifested itself. As JPDO requested, FAA included in its fiscal year 2007 budget request to the Office of Management and Budget funding to accelerate

systems development of ADS-B and System Wide Information Management (SWIM),⁸ which are two key systems identified for the NGATS. However, JPDO officials told us that, while FAA did receive an increase, it did not receive the full amount requested in the budget formulation documents submitted to the Office of Management and Budget.⁹ Our past work on FAA's national airspace modernization program has shown that, among other factors, receiving fewer resources than planned contributed to delays in implementing technologies and significant cost increases. For example, reduced funding was one factor that caused FAA to reduce the initial deployment of its ASR-11 digital radar system from 111 systems to 66 systems, and defer decisions on further deployment pending additional study. In the meantime, FAA will have to continue to maintain the aging analog radars that the new system was intended to replace.

JPDO also faces the challenge of clearly defining roles and responsibilities among its partner agencies. Our work has shown that collaborating agencies should work together to define and agree on the respective roles and responsibilities, including how the collaborative effort will be led. In JPDO's case, there is no formalized long-term agreement on the partner agencies' roles and responsibilities in creating the NGATS. According to JPDO officials, a memorandum of understanding that would define partner agency relationships was being developed as of August 2005, but has not yet been completed.

Defining roles and responsibilities is particularly important between JPDO and FAA's Air Traffic Organization, since both organizations have responsibilities related to planning national airspace system modernization. JPDO's planning must build upon the Air Traffic Organization's existing modernization program, while the Air Traffic Organization must ensure that its ongoing modernization efforts are consistent with JPDO's plans. JPDO's former director served concurrently

⁸SWIM would support the transition to network-centric operations by providing the infrastructure and associated policies and standards to enable information sharing among all authorized users, such as the airlines, other government agencies, and the military.

⁹FAA's fiscal year 2007 budget request for research and development includes about \$18 million for JPDO, which is supplemented by matching funds from NASA. NASA has committed to continuing this match in the future, according to a JPDO official. JPDO uses these funds to conduct planning and studies. Outyear funding plans for JPDO show a slight decline through fiscal year 2010. Vision 100 authorized \$50 million annually for seven years for JPDO.

as the Air Traffic Organization's Vice President for Operations Planning, which helped with coordination between the two organizations. However, FAA now plans to establish separate positions for the JPDO Director and the Air Traffic Organization Vice President for Operations Planning. Doing so increases the importance of having a clearly defined relationship between these organizations.

Ultimate decisionmaking authority is another role and responsibility that has not been clearly defined. According to JPDO, decisions are the collective responsibility of the government agencies. The Senior Policy Committee makes decisions through consensus of the members. If there are any issues that the committee cannot resolve among themselves, JPDO officials expect that the Secretary of Transportation would elevate these issues to the appropriate White House-level policy council, such as the Domestic Policy Council. Although JPDO strives to make decisions and resolve disputes through its collaborative bodies, its experience thus far is limited. It is not clear whether this process will be effective as the NGATS planning and implementation effort moves forward. As part of our ongoing work, we will further explore the decisionmaking and dispute resolution mechanisms within JPDO.

To its credit, JPDO, in concert with the Air Traffic Organization, has begun to address these challenges. To assist with leveraging resources, JPDO has issued guidance to its partner agencies identifying areas that JPDO would like to see emphasized in their fiscal year 2008 budget requests. The Air Traffic Organization, in recognition of the need to align its plans with the 20-year planning horizon of JPDO, has extended its planning horizon. Finally, JPDO is 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 budget request is easily identified. Such a process would help the Office of Management and Budget consider NGATS as a unified program rather than as disconnected line items across partner agency budget requests. To better define roles and responsibilities, JPDO planned to transmit the proposed memorandum of understanding to the JPDO board this month.

JPDO Established Mechanisms to Involve Stakeholders but Faces Challenges

As required by Vision 100, JPDO developed and implemented mechanisms for soliciting the expertise and views of federal and nonfederal stakeholders as it plans the NGATS. Although JPDO has obtained the involvement of over 180 participants from over 70 organizations for the IPTs, the current air traffic controllers—who will play a key role in the NGATS—have not been involved in JPDO’s efforts. In addition, JPDO may face challenges in sustaining stakeholder involvement over the long term.

JPDO Is Involving Federal and Nonfederal Stakeholders

JPDO has structured itself in a way that involves federal and nonfederal stakeholders throughout its organization. Vision 100 directed JPDO to involve federal and nonfederal stakeholders as it fulfills its mission. Our work shows that involving stakeholders can, among other things, increase their support for the collaborative effort. Federal stakeholders from the partner agencies participate with JPDO through the Senior Policy Committee, the JPDO board, and the IPTs. To incorporate the expertise and views of stakeholders in private industry, state and local governments, and academia, the NGATS Institute (the Institute) was created by an agreement between the National Center for Advanced Technologies and FAA.¹⁰

Within the Institute, the Institute Management Council (the Council), composed of top officials and representatives from the aviation community, oversees the policy and recommendations of the Institute. The Council provides a means for advancing consensus positions on critical NGATS issues. It is co-chaired by the president of the Air Transport Association, which represents commercial airlines, and the president of the Air Line Pilots Association, which represents airline pilots. The Institute has solicited participation from nonfederal stakeholders and assigned them to each IPT. Additionally, the Institute planned to hold its first public meeting on March 28, 2006, to solicit information from other interested stakeholders who are not involved in the Council or the IPTs.

JPDO officials are generally pleased with the quality of stakeholder participation. Through the Institute, JPDO obtained the participation of over 180 stakeholders from over 70 organizations for the IPTs. The Institute received positive feedback from IPT directors on the skills, insight, and expertise of the private sector volunteers. Additionally, an

¹⁰The National Center for Advanced Technologies is a nonprofit unit within the Aerospace Industries Association.

official affiliated with the Institute told us that the collective quality and breadth of expertise of applicants for the IPTs has exceeded expectations.

However, JPDO has experienced difficulties with soliciting the participation of current air traffic controllers, who will play a key role in the 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 the 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. JPDO is tapping the expertise of former air traffic controllers, but current air traffic controllers are not yet involved with JPDO.

Specifically, the National Air Traffic Controllers Association (NATCA)—the labor union that represents air traffic controllers—is not participating in the development of the NGATS. In July 2005, FAA terminated the controller liaison program, wherein active controllers were assigned to, among other things, provide input on national airspace modernization projects. At that time, the union disengaged from participating on all FAA workgroups and technological projects, including JPDO. Although the Institute Management Council includes a seat for the union, an official of that union 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 the NGATS effort at the end of the contract negotiations between FAA and NATCA.

The lack of current air traffic controllers’ participation could result in future problems. The input of current air traffic controllers who have recent experience controlling aircraft is important in considering human factors and safety issues. Our work on FAA’s current national airspace modernization program has shown that early and continuing stakeholder input is important, particularly concerning human factors, in avoiding costly rework and schedule delays late in system development efforts. For example, as FAA procured new air traffic controller workstations (known as Standard Terminal Automation Replacement Systems (STARS)), not adequately including stakeholders during the development phase contributed to unplanned work which, in turn, contributed to cost growth,

schedule delays, and eventually a reduction in the number of systems to be deployed.¹¹

Another method for stakeholder involvement is through JPDO's facilitation of technology transfer in its requests for studies to be contracted out through the Institute. For example, at JPDO's request, the Institute plans to analyze trade-offs between potential technologies to narrow the range of options that are most critical for the NGATS. JPDO has sent to the Institute its first request for studies, including an analysis of satellite navigation backup technology.

The Institute also creates industry-government partnerships through advanced-technology demonstrations. These demonstrations provide a mechanism for collaboratively testing operational concepts, refining requirements, and sharing technology between the public and private sectors. To date, two demonstration projects have been conducted by JPDO partner agencies, including demonstrations on the Small Aircraft Transportation System and Network Enabled Operations.

JPDO Faces Challenges in Maintaining Nonfederal Stakeholder Support Over the Long Term

Although JPDO has developed the mechanisms for involving stakeholders and brought stakeholders into the process, JPDO faces challenges in sustaining nonfederal stakeholder participation over the long term. Much as with the federal partner agencies, JPDO has no direct authority over the human and financial resources of its nonfederal stakeholders. To date, these stakeholders' investment in the NGATS effort has been through their pro bono participation on the IPTs and the Institute Management Council. The nonfederal stakeholders' participation varies from approximately 10 to 25 percent of their time per week on the IPTs and involves approximately one meeting per month for members of the Council. The challenge for JPDO is to maintain the interest and enthusiasm of these nonfederal stakeholders, who will have to juggle their own multiple priorities and resource demands in order to maintain this level of participation, when some tangible benefits may not be realized for several years. For example, stakeholder support will be important for programs such as SWIM, which is a necessary prerequisite to future benefits, but may not produce tangible benefits in the near term.

¹¹GAO, *National Airspace System: Transformation will Require Cultural Change, Balanced Funding Priorities, and Use of All Available Management Tools*, [GAO-06-154](#) (Washington, D.C.: Oct. 14, 2005).

Rather than obtaining voluntary, pro bono participation from nonfederal stakeholders, several members of our expert panel suggested JPDO should outsource the NGATS planning efforts, as Europe has done. As previously noted, the European SESAR effort is led by an industry consortium under a contract with Eurocontrol. The contract calls for the consortium to deliver a master plan at the end of a 2-year definition phase. JPDO officials told us that they considered various ways to structure their work, such as having the government formulate plans with industry comment, or having industry formulate plans and provide them to the government. JPDO settled on the existing model, which is a hybrid that involves initial government work with close industry participation. Because of the different circumstances surrounding the U.S. and European approaches (such as the European need to harmonize various national systems), we have not taken a position on which approach might be more effective.

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 the NGATS. While FAA's major air traffic control acquisitions programs are currently on track, earlier attempts at modernizing the national airspace system encountered many difficulties. In one instance, for example, FAA developed a controller-pilot datalink communications system that transmitted scripted e-mail-like messages between controllers and pilots. One airline equipped its aircraft with this new technology, but because of funding cuts, FAA ended up canceling the program.¹² 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.¹³ One expert with whom we spoke suggested that a way to mitigate this issue would be for the government to make an initial investment in a specific technology before requesting that airlines or other industry stakeholders purchase equipment.

Finally, JPDO could face a challenge in resolving the potentially divergent perspectives that are represented by its nonfederal stakeholders. The range of nonfederal interests that JPDO has solicited for this effort is

¹²JPDO noted that FAA used this technology to conduct an operational datalink demonstration that will provide valuable information for developing future requirements and reducing development and implementation risks.

¹³[GAO-06-154](#).

broad and varied, and potentially conflicting (for example, the interests of commercial airlines versus the interests of general aviation aircraft owners and pilots). While the intent is to ensure that all stakeholders are given the opportunity to participate in developing the NGATS, dissension among these stakeholders is nevertheless possible. A large portion of the nonfederal stakeholder participation is through the IPTs. JPDO officials told us that they expect IPT directors to resolve potential disputes among stakeholders and obtain a “convergence of opinion,” which is defined by JPDO as working toward as close to a single position as possible while recognizing that the IPT director might need to make a final decision. JPDO officials told us that depending on the issue, the IPT director may elect to elevate the different views to the collection of IPT directors and senior JPDO officials for resolution. In such a situation, JPDO will be challenged to settle the dispute without alienating those nonfederal stakeholders who might believe themselves to be adversely affected by the decision.

JPDO Is Using an Iterative Technical Planning Process

JPDO is using an iterative technical planning process that appears to be reasonable in light of the complexity of the NGATS. The planning process includes conducting modeling—a technique that mathematically represents the NGATS’ system performance parameters, demand, and economic factors—as well as developing an enterprise architecture—a blueprint to guide NGATS development.

JPDO Has Begun to Use System Performance Modeling

JPDO has formed an Evaluation and Analysis Division (EAD), composed of FAA and NASA employees, and contractors, to assemble a suite of models that mathematically represent the interactions among system performance parameters, demand, and economic factors for the NGATS. These models iteratively test the relationships and interactions among factors based on a set of assumptions. For example, using models based on broad assumptions concerning fleet mix and passenger and flight demand, EAD has evaluated how the current air transportation system and proposed NGATS alternatives react. EAD has also used modeling to determine whether current airport capacity is sufficient to support a tripling of air traffic. The modeling results will help JPDO further refine its plans for the NGATS, leading to additional modeling that uses more precisely defined assumptions, all the while narrowing the range of potential solutions. In addition, EAD is modeling costs and benefits of proposed NGATS solutions, as well as interactions among system performance parameters, demand, and economic factors, to demonstrate to JPDO management and the Office of Management and Budget that the

proposed solutions are a cost-effective way to meet strategic goals and objectives.

Rather than creating its own models, EAD is assembling a suite of existing models from FAA, other agencies, and contractors. To assess the adequacy of these models, EAD has compared the results obtained from them to known previous conditions. For example, to assess how accurately a model reflects the impact of adverse weather on airport capacity, EAD has compared the model's results to what actually happened in a previous bad-weather event. In this case, the model proved to be accurate, thereby validating its further use.

EAD recognizes the importance of human factors in designing the NGATS, but has just begun studying this issue. Specifically, EAD has used modeling to study 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. NGATS could shift some tasks now done by air traffic controllers to pilots. However, EAD has not yet begun to model the effect of this shift on pilot 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 difficult because data on pilot behavior are not readily available to use in creating such models. Furthermore, EAD has not 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.

EAD plans to use outside experts to review the adequacy of its work. EAD will continue to publish results of its work in peer-reviewed journals. EAD officials said they are also exploring the possibility of pursuing a peer review relationship with SESAR officials. So far, however, EAD's modeling efforts are in the early stages and more time will be needed to conduct additional modeling and field testing to increase confidence that the final range of solutions for the NGATS is based on realistic assumptions.

JPDO Has Taken the First Steps toward Developing an Enterprise Architecture

An enterprise architecture is a tool, or blueprint, for understanding and planning complex systems. It can facilitate NGATS planning by providing a strategic and integrated approach to decisionmaking. For example, enterprise architecture can help planners decide between various scenarios that involve flight takeoff, flight landing, and en route flight in

bad weather. The NGATS 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. The enterprise architecture will describe the current national airspace system, the NGATS, and the sequence of steps needed to transition between them.

JPDO has taken the initial steps towards developing an enterprise architecture and plans to have an early version by the end of fiscal year 2006. The office has established and filled a chief architect position and established an NGATS Architecture Council composed of representatives from each partner agency's chief architect office. This provides the organizational structure and oversight needed to develop an enterprise architecture. While this is an important first step and consistent with effective practices that we have identified in enterprise architecture development, JPDO's enterprise architecture development is currently a work in progress. JPDO is working toward completing two tasks that we have also identified as effective practices. First, JPDO is planning to use the Federal Enterprise Architecture Security and Privacy Profile, currently under development by the Federal Chief Information Officer Council, to help ensure effective integration of security and privacy requirements across NGATS enterprise architecture. Second, JPDO is developing metrics that are to be compliant with guidance from us and the Office of Management and Budget to measure the enterprise architecture's progress in development and effectiveness-in-use by the end of fiscal year 2006. JPDO recognizes that the development of the NGATS architecture will be a multiyear process that will involve a series of interim architectures.

JPDO's phased "build a little, test a little" approach for developing and refining its enterprise architecture is similar to a process that we have advocated for FAA's major system-acquisition programs. After completing the initial version of its enterprise architecture, JPDO plans to undertake a comprehensive assessment to determine if additional efforts are necessary to improve the architecture and address any gaps that may have been identified. In addition, this phased development process will allow JPDO to incorporate evolving market forces and technologies in its architecture, and thus, to better manage change.

Concluding Observations

In closing, Mr. Chairman, ultimate responsibility for the success of JPDO and the broader NGATS effort is shared among JPDO and its partner agencies, nonfederal stakeholders, and the Congress. JPDO and its partner agencies have responsibility to develop a plan, test technologies through demonstrations, and implement technologies to transform the current

national airspace system in a timely and cost-efficient manner. Nonfederal stakeholders, including industry representatives, state and local government officials, and members of academia, must actively participate in developing the plan. Some of these stakeholders—such as commercial airlines and general aviation operators—will have to follow through by equipping their aircraft to realize the benefits of the NGATS. Finally, the success of the NGATS will undoubtedly require support from Congress to obtain the resources and authority necessary to complete the planning and testing stage, acquire the necessary technologies, and develop procedures. Consequently, Congress will face difficult decisions on how to prioritize funding to support the NGATS with other national priorities. These responsibilities are substantial, but failure in any one of these areas will significantly affect JPDO's chances of achieving a three-fold increase in airspace capacity by 2025.

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 Acknowledgements

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