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Status of FAA's Efforts To Develop the Next Generation Air Transportation System

**Statement of
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Inspector General
U.S. Department of Transportation**



Mr. Chairman and Members of the Committee:

We appreciate the opportunity to discuss the status of the Federal Aviation Administration's (FAA) efforts to develop the Next Generation Air Transportation System (NextGen), which is targeted for the 2025 timeframe. In response to congressional direction, FAA created the Joint Planning and Development Office (JPDO) to develop a vision for NextGen and leverage research at other Federal agencies.

As the Committee is aware, there are a number of compelling reasons for moving forward with NextGen. The current air transportation system has served the Nation well over the years, but "business as usual" will not be sufficient to meet the anticipated demand for air travel or significantly reduce delays at already congested airports.

Currently, the U.S. airline industry is facing considerable financial uncertainty due to a softening economy and skyrocketing fuel prices. In response, airlines are reducing schedules and taking aircraft out of service. Notwithstanding the state of the industry, it is important to move forward with NextGen. FAA is revising its forecast but still projects that the demand for air travel will grow to more than 1 billion passengers by 2016.

NextGen goals are ambitious but important to the health of the U.S. air transportation system and the Nation's economy. NextGen is expected to triple capacity, boost controller productivity, reduce FAA operating costs, lessen impact of high energy costs, and reduce the environmental impact of aviation.

Developing NextGen is one of the biggest challenges facing FAA. It is a high-risk effort involving billion-dollar investments from both the Government (for new ground systems) and airspace users (for new avionics). FAA plans to spend \$18 billion for its capital programs between fiscal years (FY) 2008 and 2013, including \$5.6 billion specifically for NextGen. The challenges are multi-dimensional and involve complex software development and integration, adjustments to existing air traffic systems, technology transfer, workforce changes, and policy questions about aircraft equipage.

This past year, some stakeholders expressed concern that NextGen efforts lacked a sense of urgency and a clear plan for what could be done in the near, mid, and long term. The Secretary of Transportation is working to clarify NextGen benefits, accelerate efforts, and focus resources.

To its credit, FAA is working on what can be done in the near term. As part of these efforts, FAA is planning to use new routes that rely on existing avionics onboard aircraft and various demonstration projects. FAA has also made some organizational

changes, which included establishing a new Senior Vice President for NextGen Implementation and Operations Planning.

Costs for NextGen remain uncertain, however, and much work remains to set research agendas and priorities for a multi-agency approach, establish requirements for software-intensive acquisitions, determine steps to deliver NextGen capabilities, and develop realistic transition plans. The development and execution of NextGen will require sustained oversight and will therefore be a key issue for the next Congress and a top management challenge for the next administration.

My remarks today will focus on four points:

- First, FAA is at a crossroads with modernizing the National Airspace System (NAS) and faces considerable challenges in keeping existing systems on track, maintaining aging facilities, and developing and implementing NextGen initiatives. As we reported in April,¹ approximately 30 existing projects form “platforms” for NextGen, and FAA must make more than 20 critical decisions over the next 2 years that will have significant budgetary implications. For example, FAA will have to address what changes are needed to modernize its terminal facilities and whether it will pursue a “common automation platform” for terminal and en route environments in the future.

FAA faces complex integration issues (e.g., linking legacy and new systems) as it must manage interdependencies among diverse programs. To reduce risk and help bridge the transition from today’s system to a vastly different NextGen environment, we recommended that FAA conduct a “gap analysis” of the current and NextGen systems and develop an interim architecture (i.e., technical blueprint) for the 2015 timeframe. FAA is taking steps to address our recommendations.

- Second, progress has been made in coordinating budgets and plans among JPDO partner agencies. However, FAA and its partner agencies need to address significant issues related to resource alignment, research priorities, and policy questions that will materially affect the cost and schedule for NextGen. These issues focus on developing advanced NextGen software for boosting controller productivity; reaching agreement between FAA, the Department of Defense (DOD), and the Department of Homeland Security (DHS) on NextGen security and surveillance issues; reconciling differences on new weather systems; and effectively linking human factors research for controllers and pilots to ensure that NextGen capabilities can be safely implemented.

¹ OIG Report Number AV-2008-049, “Air Traffic Control Modernization: FAA Faces Challenges in Managing Ongoing Projects, Sustaining Existing Facilities, and Introducing New Capabilities,” April 14, 2008. OIG reports and testimonies are available on our website: www.oig.dot.gov.

- Third, how FAA is organized to manage and execute NextGen is an important matter given the high-risk nature of the effort and FAA's past problems with developing new technologies. While FAA's decision to place the JPDO within the Air Traffic Organization (ATO) could help in implementing NextGen capabilities, it also appears to reduce the JPDO in stature and importance. It is premature to judge the effectiveness of this change, but we found that FAA needs to clarify roles and responsibilities among offices (the JPDO and the new NextGen Office for Implementation and Integration). We also note that budget authority for NextGen efforts remains fragmented among FAA lines of business.

How best to organize FAA is a policy call, but we believe that clear lines of accountability and authority will be critical for managing NextGen. FAA will have to revisit the overall governance of NextGen once it has a better picture of what it will ultimately take to deliver NextGen capabilities.

- Finally, a number of actions are needed from FAA going forward to help shift NextGen efforts from research to implementation. To focus budgetary resources and set expectations for NextGen, FAA must (1) establish priorities and include them in budget and planning documents, (2) focus much needed attention on technology transfer issues, (3) clearly define the roles of the ATO and JPDO and effectively use in-house resources, (4) place a high priority on relieving already congested airports, and (5) examine what can reasonably be implemented in given time increments.

I would now like to discuss these four areas in further detail.

CHALLENGES FACING FAA IN MODERNIZING THE NATIONAL AIRSPACE SYSTEM

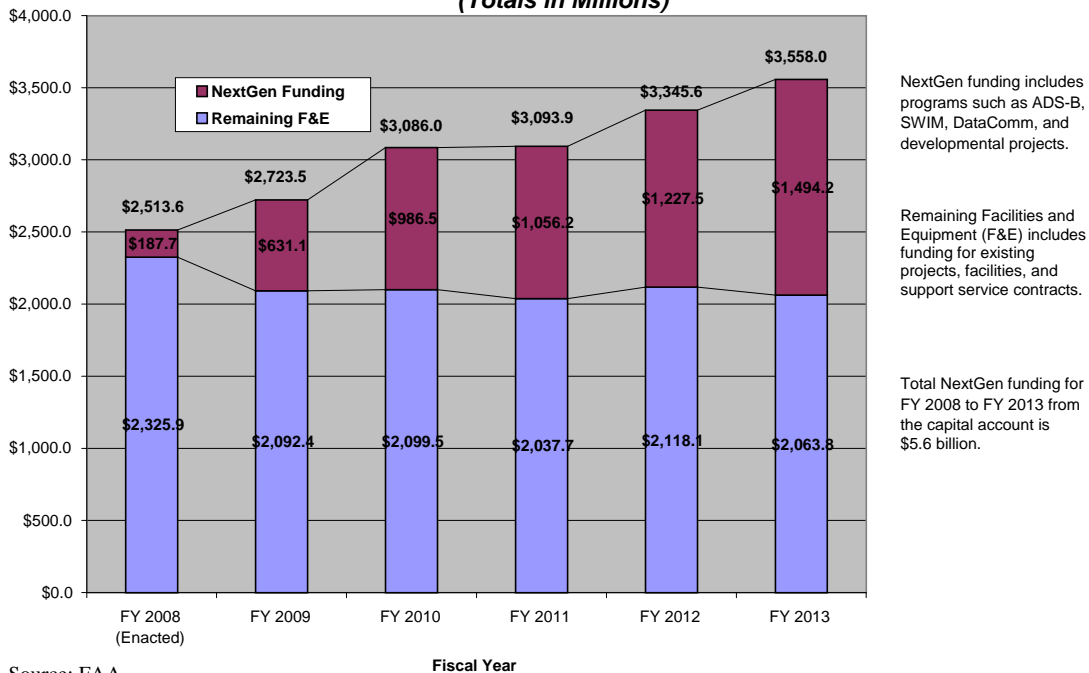
FAA is at a crossroads with its efforts to modernize the National Airspace System. The Agency will be challenged to keep ongoing projects on track, maintain aging facilities, and develop and implement NextGen initiatives. For FY 2009, FAA is requesting \$2.7 billion for capital funding—an increase of 8 percent over last year's enacted level.

FAA is starting a new chapter in modernization with NextGen, and the Agency's capital account is now being shaped by these initiatives. Between FY 2008 and FY 2013, FAA plans to spend \$18 billion for capital efforts, including \$5.6 billion specifically for NextGen. We note that much of the projected funding for NextGen will focus on developmental efforts, which are funded through the Engineering, Development, Test, and Evaluation portion of the capital account. These efforts are

projected to amount to \$3.4 billion through FY 2013—a significant portion of the amount dedicated to NextGen spending.

In FY 2009, more than \$630 million will be dedicated to NextGen-related programs, which include Automatic Dependent Surveillance-Broadcast (ADS-B) and System-Wide Information Management (SWIM). Of this amount, \$203 million is dedicated to eight new developmental initiatives, including NextGen system development, trajectory-based operations, and flexible terminals and airports. The figure below illustrates FAA’s planned investments in ongoing projects and NextGen initiatives from FY 2008 to FY 2013.

Figure. FAA Capital Funding for FY 2008 to FY 2013
(Totals in Millions)



Source: FAA

In addition to capital spending, FAA also plans to spend \$374 million in research, engineering, and development funds through FY 2013 for NextGen. These include air-ground integration, wake turbulence, and environmental research.

Progress and Problems With FAA Acquisitions

In our April 2008 report, we examined progress and problems with 18 major acquisitions valued at \$17.5 billion. Overall, we are not seeing the significant cost growth and schedule slips with FAA major acquisitions that occurred in the past. This is because FAA has taken a more incremental approach to managing major acquisitions. When comparing revised baselines, only 2 of the 18 projects we reviewed have experienced additional cost growth (\$53 million) and delays (5 years)

since our last report in 2005.² However, from program inception, six programs have experienced cost growth of nearly \$4.7 billion and schedule delays of 1 to 12 years.

While FAA's incremental approach may reduce risk in the near term, it has left several programs with no clear end-state and less visibility into how much they will ultimately cost. A case in point involves modernizing facilities that manage traffic in the vicinity of airports, which is commonly referred to as "terminal modernization."

In 2004, faced with cost growth of over \$2 billion for the Standard Terminal Automation Replacement (STARS) program, FAA rethought its terminal modernization approach and shifted to a phased process, committing STARS to just 50 sites at an estimated cost of \$1.46 billion. FAA's original plan was to deploy the system to 172 sites for \$940 million. FAA renamed this modernization effort the Terminal Automation Modernization-Replacement (TAMR) initiative.

In 2005, FAA approved modernizing displays through the TAMR program (referred to as TAMR Phase 2) by replacing legacy equipment at five additional small sites and replacing the aging displays at four large, complex facilities. However, this leaves over 100 sites still in need of modernization. FAA has not decided how it will modernize these sites, and costs remain uncertain. For FY 2009, FAA is requesting \$31.2 million for terminal modernization efforts.

There is no defined end-state for terminal modernization, and past problems with developing and deploying STARS leave FAA in a difficult position to begin introducing NextGen capabilities. Future terminal modernization costs will be shaped by (1) NextGen requirements, (2) the extent of FAA's terminal facilities consolidation, and (3) the need to replace or sustain existing (legacy) systems that have not been modernized.

Challenges With Key NextGen Programs

FAA has established initial cost and schedule baselines for the first segments of two key NextGen initiatives: ADS-B and SWIM. Both programs face considerable risks and require significant oversight as FAA begins integrating them with existing systems.

ADS-B: This program provides satellite-based technology that allows aircraft to broadcast their position to other aircraft and ground systems. For FY 2009, FAA is requesting \$300 million for ADS-B. In August 2007, FAA awarded a service-based contract for the ADS-B ground infrastructure worth \$1.8 billion (if all options are exercised). FAA estimates that ADS-B will cost about \$1.6 billion in capital costs for

² OIG Report Number AV-2005-061, "Status of FAA's Major Acquisitions: Cost Growth and Schedule Delays Continue To Stall Air Traffic Modernization," May 26, 2005.

initial implementation segments through 2014. These include completing a nationwide ground system for receiving and broadcasting ADS-B signals.

A key challenge facing FAA—and NextGen implementation—is realizing the full benefits of ADS-B. FAA plans to implement “ADS-B-Out” in the 2020 timeframe, which will require aircraft to broadcast their position to ground systems. However, most capacity and safety benefits from the new system will come from “ADS-B-In,” which will display information in the cockpit for pilots. The requirements for ADS-B-In are still evolving and have not been finalized.

FAA must address several risks to realize the benefits of ADS-B. These include: (1) gaining stakeholder acceptance and aircraft equipage, (2) addressing broadcast frequency congestion concerns, (3) integrating with existing systems, (4) implementing procedures for separating aircraft, and (5) assessing potential security vulnerabilities in managing air traffic.

ADS-B implementation is a long-term effort that will require significant investment from the Government and industry. Given FAA’s history with developing new technologies and its approach to ADS-B, in which the Government will not own the ground infrastructure, we believe this program will require a significant level of oversight. We will report on ADS-B later this year.

SWIM: This program provides FAA with a web-based architecture that allows information sharing among airspace users. For FY 2009, FAA is requesting \$41 million for SWIM. In June 2007, FAA baselined the first 2 years of segment 1 (planned to occur between FY 2009 and 2010) for \$104 million. FAA’s latest Capital Investment Plan cost estimate for SWIM is \$285 million.

Current challenges include the work to determine requirements and interfaces with other FAA systems, including the En Route Automation Modernization (ERAM) and Air Traffic Management programs. Moreover, FAA must integrate SWIM with other Federal agencies’ operations to realize NextGen benefits and develop a robust cyber security strategy and design. While FAA has begun initial efforts, it still needs to establish the architecture, strategy, and design. Additional SWIM segments have yet to be determined, and the cost to fully implement SWIM is unknown. Last month, we began a review of SWIM, which will focus on the strengths and weaknesses of FAA’s approach for developing the new system and assess risks that could affect nationwide deployment.

Much Work Remains To Determine How To Transition Existing Projects to NextGen

In February 2007, we recommended that FAA examine existing projects to determine if they were still needed and, if so, what adjustments would be required. FAA concurred with our recommendation and stated that it has begun this assessment. To date, however, FAA has not made major adjustments to modernization projects to accelerate NextGen.

According to FAA, approximately 30 existing capital programs will serve as “platforms” for NextGen. For example, the \$2.1 billion ERAM program, which provides new hardware and software for facilities that manage high-altitude traffic, is a linchpin for the NextGen system. Because ERAM is expected to serve as a foundation for NextGen, any program cost increases or schedule delays will affect the pace of introducing new capabilities. Currently, ERAM software requirements related to NextGen are still uncertain, but costs are expected to be in the billions of dollars.

Over the next 2 years, FAA must make more than 25 critical decisions about ongoing programs. These decisions have significant budget implications and will affect all major lines of the modernization effort with respect to automation, communications, navigation, and surveillance. For example, FAA will have to address what changes are needed to modernize its terminal facilities and whether it will pursue a “common automation platform” for terminal and en route environments in the future.

Sound investment decisions for NextGen can only be accomplished through a comprehensive enterprise architecture (i.e., technical blueprint) that outlines how the system will work and what changes to existing programs will be required. The enterprise architecture must establish a transition plan for existing NAS systems that identifies how each system currently functions and it will transition to NextGen. A central element will be outlining a path to develop both existing and proposed automation systems.

FAA has made progress in developing the NextGen Enterprise Architecture, which is planned to be implemented by 2025.³ FAA has also progressed towards technical roadmaps for the automation, communications, navigation, and surveillance lines of effort. However, planning documents we reviewed, including the NextGen Enterprise Architecture, lack detail with respect to requirements, particularly for automation, that could be used to develop reliable cost estimates and schedule. As we noted in our April report, in most cases, information in the NextGen Enterprise Architecture remained at too high a level to be effective.

³ The NextGen Enterprise Architecture is a blueprint that links FAA’s core programs and systems to the Agency’s mission. This includes the transition from the “as-is” to the “to-be” environment.

To help bridge the transition from the current NAS to NextGen, we recommended several actions to FAA in April, including the following:

- **Conduct a gap analysis of the current NAS and NextGen.** FAA’s NextGen architecture does not yet fully detail how FAA will transition from the present NAS and the future NextGen architectures, which are considerably different. Understanding this gap is important because one industry analysis we have seen suggests that FAA could face a \$50 billion software development effort with NextGen. Until FAA completes a gap analysis, it will not be possible to determine technical requirements that translate into reliable cost and schedule estimates for major acquisitions. The ATO has begun an analysis of existing modernization efforts and expects to complete it by February 2009.
- **Develop an interim architecture for what can be accomplished by 2015.** Because of the significant differences between the current system and the NextGen architecture and concept of operations, FAA should develop an interim architecture or “way-point” for the 2015 timeframe that is consistent with current NextGen plans. This would help to bridge the gap between current systems and plans for the future. It would also help FAA to determine reasonable goals, establish priorities, fully identify adjustments to existing projects, refine requirements for new systems, and understand complex transition issues. FAA has a mid-term requirements team that is due to report on its activities next summer.

FAA Needs To Address Significant Issues in Coordinating and Aligning JPDO Partner Agencies’ Budgets and Plans

The JPDO was mandated by law to coordinate research among diverse Federal agencies to develop NextGen in the 2025 timeframe. This is an important mission given that FAA conducts very little long-term air traffic management research. Central to making the JPDO an effective multi-agency vehicle is alignment of resources. This is a complex task, and the JPDO has no authority to adjust or redirect the research budgets of other Federal agencies.

We have seen some progress with the various “mechanisms of alignment,” including the NextGen Concept of Operations, the NextGen Enterprise Architecture, and the Integrated Work Plan⁴ since our February 2007 report.⁵ In addition, the JPDO now has a signed Memorandum of Agreement with all partner agencies and has published

⁴ The JPDO’s Integrated Work Plan is akin to a project plan and is meant to describe the capabilities needed to transition to NextGen from the current system and provide the research, policy, regulation, and acquisition timelines necessary to achieve NextGen by 2025.

⁵ OIG Report Number AV-2007-031, “Joint Planning and Development Office: Actions Needed To Reduce Risks With the Next Generation Air Transportation System,” February 12, 2007.

a NextGen research and development plan. An exhibit to our statement details the various mechanisms of alignment we reviewed.

However, the NextGen Enterprise Architecture and Integrated Work Plan continue to evolve and remain at a very high level. These documents are not yet mature enough to drive investment decisions or generate requirements for major NextGen acquisitions, particularly for new software-intensive systems. As noted by the National Research Council,⁶ these efforts still reflect a lack of top-level system engineering and clearly established priorities. JPDO officials told us that it will take a year or more for the documents to be effective tools for driving agency budgets, setting priorities, and managing research efforts.

FAA and its partner agencies need to address several fundamental issues related to policy questions and research priorities to ensure that research and development efforts are aligned and successfully transferred to the NAS. An internal JPDO assessment identified 27 single agency and cross-agency disconnects or gaps that will materially affect the cost and timeframes for developing NextGen. These include the following areas.

Development of Advanced Software and Flexible Airspace: The National Aeronautics and Space Administration (NASA) is taking the lead role in developing new software algorithms that will help boost controller productivity and provide more flexible airspace; these are key elements and cost drivers for NextGen. As we noted in our February 2007 report, NASA is spending less on aeronautics research than in the past and is concentrating on “fundamental research” instead of prototype development. This is in sharp contrast to NASA’s support of FAA’s Free Flight Phase 1 initiative, which introduced new automated controller tools at select locations in the 1998 to 2002 timeframe. FAA’s Research Engineering Development Advisory Committee⁷ suggested that \$100 million would be needed by FAA annually to accommodate changes in NASA investments and address this gap.

To address this concern, we recommended that FAA assess the maturity of NASA research and develop a contingency plan for how to conduct, manage, and pay for this research and development. FAA concurred and has established “research transition teams” to determine how best to advance NASA research.

The JPDO’s internal assessment showed that NASA research is fairly well-aligned. However, NASA research efforts fall short with respect to integrating weather

⁶ National Research Council of the National Academies, “Assessing the Research and Development Plan for the Next Generation Air Transportation System,” July 31, 2008.

⁷ The Research, Engineering and Development Advisory Committee was established in 1989 and advises the Administrator on research and development issues and coordinates the FAA’s research, engineering, and development activities with industry and other Government agencies. The committee considers aviation research needs in air traffic services, airport technology, aircraft safety, aviation security, human factors, and environment and energy.

information into new systems, validating new software algorithms, linking airport arrivals and departures, and creating flexible airspace in the vicinity of airports. Further, fundamental questions about how requirements should be allocated to ground automation systems and the cockpit remain unresolved.

NASA officials told us that they will consider advancing some NextGen research to a higher technology level on a case-by-case basis. Notwithstanding these efforts, the transition from NASA research to prototype development and ultimately implementation remains a key watch item and cost driver. We are assisting the NASA Office of Inspector General in examining NASA's contribution to NextGen, including the management of research projects and contracting vehicles. The NASA Office of Inspector General expects to complete its report later this year.

Surveillance and Airspace Security: FAA is developing new systems, such as ADS-B, that will decrease reliance on ground-based radar and instead rely on on-board systems to broadcast aircraft positions. While the new systems will be useful to DOD and DHS, they will not meet all of their needs with respect to identifying and monitoring unlawful flights. DOD is funding research and development for future radar and surveillance sensors. The JPDO assessment cautioned that surveillance and security efforts are not as synchronized as they should be and stated that the best methods for meeting the needs and requirements of various agencies have yet to be determined. Without networking and integration among different agencies, there is potential for duplicative efforts, gaps in airspace coverage, and inefficiency that could impede the integrated surveillance and security capabilities envisioned for NextGen.

Net-Centric Operations and Sharing Information: A key element of NextGen is sharing a wide range of information (weather information, flight data, and aircraft position) securely and seamlessly. The JPDO is seeking to leverage DOD's extensive experience in this area, and demonstrations have shown the potential for linking various agency systems—both old and new—for sharing data. However, several factors are impeding progress. As the JPDO's internal assessment points out, plans, standards, and execution paths for FAA, DOD, DHS, and the Department of Commerce to connect various networks do not yet exist. Further, no cross-agency plan exists for integrating agencies' net-centric efforts to ensure seamless operations.

Development of New Weather Tools and Concepts: The Department of Commerce has the lead role in developing the "4-D Weather Cube,"⁸ which is expected to provide a single authoritative source for weather observations and analysis. This tool is also expected to provide a common picture of weather for all airspace users.

⁸ The 4D Weather Cube is expected to be a distributed database on weather observations for the continental United States. It is expected to include observations with respect to latitude, longitude, altitude, and time.

The JPDO's assessment found that there is disagreement on synchronizing weather observations, forecasts, and dissemination efforts. This threatens current plans to implement the 4-D Weather Cube in the 2013 timeframe. The assessment also noted that several policy and funding issues need to be addressed; specifically, most of the Department of Commerce efforts that JPDO expects to rely on are not funded. In addition, there is disagreement on the legal responsibilities for providing weather information and requirements for new weather systems.

Human Factors for Controllers and Pilots: As we have noted in the past, a focused human factors research effort for NextGen is needed to ensure that new concepts and technologies can be safely implemented. This is important because the NextGen concept of operations calls for significant changes to the roles of controllers and pilots. We note that insufficient attention to human factors with STARS resulted in significant cost increases and schedule slips. Key issues for NextGen human factors research focus on what can reasonably be expected from new automation systems and cockpit displays.

This remains a major risk area for NextGen. The JPDO assessment noted a lack of linkage between planned human factors research and key issues that needs to be resolved. This includes the impact of highly automated systems on controllers. We are concerned because there is no cross-cutting, interagency plan for identifying and addressing NextGen human factors issues that (1) establishes an agreed-upon set of initial focus areas for research, (2) inventories existing facilities for research, and (3) capitalizes on past and current research.

Observations on FAA's Recent Reorganization of NextGen Efforts

The question of whether or not FAA is properly organized to implement NextGen is important because it will drive the success of the effort. As we have previously noted, the development of NextGen cuts across all lines of the ATO. It also involves FAA's airport and certification offices. Further, NextGen efforts will need to be managed as integrated "portfolios" to achieve expected benefits. We believe that clear lines of accountability and budget authority will be essential for managing NextGen.

The overall governance of the NextGen effort has been the subject of debate, and stakeholders have raised concerns that FAA is not properly organized to manage or execute a multibillion-dollar effort. Furthermore, there has been—and continues to be—friction between the ATO and JPDO, which is due in part to vastly different planning horizons. The ATO is an organization that operates constantly but has a short planning horizon. The JPDO, on the other hand, is focused on introducing cutting-edge technologies and transforming the NAS by the 2025 timeframe. It will be important to reconcile these differences to successfully implement NextGen.

In May 2008, FAA announced a reorganization of its NextGen efforts, which included establishing a Senior Vice President for NextGen and Operations Planning within the ATO; this individual reports to the FAA Chief Operating Officer. FAA is also establishing an office for NextGen Implementation and Integration to support the Senior Vice President.

Under this framework, the JPDO now reports to the Senior Vice President for NextGen and Operations Planning. In the past, the JPDO reported directly to the FAA Administrator and the Chief Operating Officer. While FAA believes the change will help move NextGen concepts closer to implementation, it could also give the appearance that the JPDO has been reduced in stature and importance.

This recent reorganization is still undergoing changes, and it is too early to determine its effectiveness; however, we do have the following initial observations:

- First, the roles and responsibilities of the JPDO and the ATO office for NextGen Implementation and Integration are not clearly defined. According to FAA, the JPDO will focus on long-term planning and interagency cooperation while the ATO will focus on more short-term efforts and other implementation issues. However, it will be difficult to establish clear demarcation lines because implementing NextGen capabilities depends heavily on modifying existing modernization projects. Both offices will have budget functions, considerable modeling and simulation capabilities, and architecture staffs. Because both offices will help to shape research and development plans, it will be important to establish clearly defined roles and responsibilities.
- Second, while the ATO's Senior Vice President for NextGen and Operations Planning will manage demonstration projects, other ATO Vice Presidents will manage major modernization projects considered to be essential platforms for NextGen. For example, the Vice President for En Route Services manages multibillion-dollar efforts like ERAM and ADS-B. SWIM, however, will be managed by the Vice President for Technical Operations. Similarly, the Vice President for Terminal Services manages efforts to modernize controller displays and computer equipment located in the vicinity of airports. However, airports—which play a key role in NextGen—are managed by a different FAA office that is outside the ATO. Thus, budgetary authority for FAA modernization efforts remains fragmented across various offices.

The Senior Vice President for NextGen and Operations Planning stated that she will be responsible for the integration and implementation of all NextGen elements even though most elements will be managed and executed by other ATO service units and lines of business. The NextGen and Operations Planning Office will rely on coordination and a commitment monitoring process across multiple areas. This approach, however, has not been fully implemented or tested for

linking budgets and plans for diverse programs. Given the complex nature of NextGen development, FAA's approach to determining budget authority and managing interdependencies among legacy and new programs will be important watch items for this Committee.

- Third, the new structure will be challenged to deal with complex, cross-cutting Government issues. In our opinion, it will be difficult for an office within the ATO to work out agreements with DOD and DHS on major decisions affecting surveillance and airspace security.

It remains to be seen how DOD, NASA, Commerce, and other JPDO partner agencies will view the reorganization and how it will affect participation in NextGen efforts. FAA must clearly demonstrate that this change is neither a demotion for the JPDO nor a decrease in the Agency's commitment to a multi-agency approach for developing NextGen.

FAA will likely have to revisit the question of NextGen governance once it has a better picture of what will be required to develop and implement NextGen. As we have noted in the past, FAA will have to address other NextGen management issues, such as deciding whether a "lead systems integrator" will be needed to address the complex system engineering challenges in linking legacy and new systems.

We note that the House Reauthorization proposal (HR 2881) would establish an Associate Administrator for NextGen who would report directly to the FAA Administrator. How to organize FAA is a policy call for Congress, but we believe such an approach has merit as the cross-cutting nature of the NextGen effort will require close coordination of multibillion-dollar investments from industry and other Federal agencies.

Several Actions Are Needed Going Forward To Help Focus NextGen Efforts

Moving forward with NextGen will be a central issue for the next Congress and a top management challenge for the new administration. FAA is at a critical juncture with its NextGen efforts and needs to set expectations and budgetary priorities.

This chapter in air traffic modernization is different from previous efforts because NextGen concepts rely heavily on airspace users to invest billions of dollars in new avionics. The current state of the airline industry requires FAA to determine where investments in new technology can have the most benefit in reducing costs and alleviating delays, the underlying causes of consumer dissatisfaction with air travel.

We have made numerous recommendations to FAA and the JPDO to help them move forward with NextGen. These include developing an interim architecture, assessing

the skill mix with respect to necessary systems integration and contracting, and focusing human factors research to ensure concepts can be safely implemented. FAA agreed with all of our recommendations and has begun addressing our concerns. At this time, we believe FAA needs to take the following actions.

- **Establish priorities and reflect them in budget requests and plans.** It remains difficult for decision makers to determine what to invest in first from the wide range of operational improvements in NextGen planning documents. FAA has taken some steps to begin shaping priorities, such as integrating weather data into new systems. Nevertheless, more work is required to set priorities and identify the proper sequencing of efforts. FAA should provide this Committee with a clear understanding of how it will prioritize research and development, how it is addressing various research gaps, and how it will update priorities when research results become available or when national priorities change.
- **Develop a strategy for transferring technology.** As we noted in our February 2007 report, the movement of technology from one organization to another is critical given the JPDO's mandate. However, the JPDO's internal assessment noted that mechanisms and funding to transition research into the NAS may be inadequate. To address technology transfer issues with NASA, FAA has established "research transition teams." FAA has not, however, formed similar teams for other agencies, such as the Departments of Commerce and Defense. JPDO officials pointed out that "entrance and exit" criteria with clearly defined hand-off points for research projects would aid in determining what it will take to transition new concepts and technologies into daily operations.
- **Clearly define the roles of the ATO and JPDO and focus the considerable resources at the Agency's disposal.** Agency resources that are key to NextGen development include the MITRE Corporation (FAA's federally funded Research and Development Center), the NextGen Institute⁹ (a mechanism for the private sector to cooperate with the JPDO on NextGen), and RTCA (an industry/Government forum that functions as Federal Advisory Committee for FAA). Because there is considerable potential for duplicative efforts, FAA officials agree that it is an appropriate time to re-examine work plans, assess resources, and review roles of these various organizations.

All of these organizations can help validate NextGen concepts and establish requirements. Understanding the impact of many changes will require extensive analysis, modeling, simulation, and work with airspace users to examine trade-offs

⁹ The NextGen Institute was established in March 2005 by joint agreement between the National Center for Advanced Technologies (NCAT) and the Federal Aviation Administration "as the mechanism through which the JPDO will access private sector expertise, tools, and facilities for application to NextGen activities and tasks."

and assess benefits. Clearly defined roles for each of these organizations would help better define investment decisions and foster consensus among stakeholders.

- **Focus attention on airport issues and the relief that various NextGen technologies can provide to already congested airports in major metropolitan areas, like New York and Chicago.** Reducing congestion at airports should be a top priority for FAA. An important metric for NextGen is to what extent FAA can improve *airport arrival rates* under various weather conditions. FAA recognizes the importance of this and is shifting resources to this issue. However, FAA's efforts to examine "high density operations" are in the very early stages, and planning documents and budget requests thus far do not detail how individual NextGen systems can specifically boost airport capacity and reduce delays. Decision makers and stakeholders need to know what elements—ADS-B, new routes, and data link communications for controllers and pilots—are essential for improving capacity at already congested airports.
- **Develop a realistic plan for implementing ADS-B and realizing the air-to-air benefits of the new technology.** This is important because FAA has a contract in place and has published a Notice of Proposed Rulemaking (NPRM). The NPRM calls for users to equip with ADS-B-Out in the 2020 timeframe. FAA has received comments from 177 organizations or individuals about the details of the NPRM. While most agree that ADS-B is an important part of the future, some raised concerns about requirements, the cost of equipage, and lack of clear benefits—all legitimate issues that will need to be resolved. FAA will likely have to make significant changes to its plans for implementing ADS-B in the United States.
- **Assess "implementation bandwidth" and develop transition benchmarks.** FAA's ability to implement multiple capabilities in a given time period needs to be assessed. There are limits to what can be accomplished given the scope of change envisioned and efforts currently underway. For example, FAA has staggered key NextGen capabilities, such as data link communications, to wait for the completion of ERAM in the 2012 timeframe. FAA must clearly identify how various efforts will be sequenced. Further, FAA and industry need realistic transition benchmarks that point to when new training (for controllers and pilots), equipment (new avionics and ground systems), and procedures need to be in place at specific locations.

Mr. Chairman, this concludes my statement. I would be happy to answer any questions that you or other Members of the Committee might have.

EXHIBIT. MECHANISMS FOR RESOURCE ALIGNMENT

Mechanism	Status
NextGen Enterprise Architecture (Blueprint)	The JPDO published the first version of the NextGen Enterprise Architecture (EA) in April 2007. In June 2007, the JPDO released version 2.0. An October 2007 MITRE Corporation assessment of the EA highlighted unresolved technical issues and gaps between the NextGen EA and the NextGen concept of operations. MITRE found that, in most cases, information in the NextGen EA remained at too high of a level to be effective.
Memorandum of Understanding (MOU) Between NextGen Partner Agencies	The MOU formalizes agreements among partner agencies to achieve NextGen. In addition, it commits the agencies to provide resources and to establish procedures to align budgets and plans. The effort to complete the MOU began in 2004 and was finally signed by all partner agencies in June 2008. Emphasis must now shift to gaining approval for the MOU annex, which will establish processes for reporting agency contributions, making decisions, and clarifying matters relating to private sector involvement in NextGen activities.
NextGen Research and Development Plan (R&D)	The August 2007 plan represents the first effort between the JPDO and the partner agencies to identify NextGen research and development efforts. The analysis, debate, and negotiation that have culminated in this plan represent a baseline to refine the needs of this complex effort. In the coming months, the JPDO plans to fully incorporate and synchronize the R&D plan with the NextGen Integrated Work Plan and the EA. The R&D plan is a work in progress, and next steps focus on establishing priorities and addressing airport issues. We think future versions should also include funding data.
NextGen Integrated Work Plan (IWP)	The current IWP, version 0.2, reflects the NextGen vision as defined by the NextGen Concept of Operations (ConOps) and the NextGen Enterprise Architecture. JPDO officials acknowledge that the IWP does not fully describe operational concepts and functions of NextGen, and the JPDO plans to continue to refine the document over the next few years. These refinements will include identifying priorities, benefits, risks, costs, and technology maturity, which will be required to support investment decisions. The JPDO plans to release another version of the IWP, version 1.0, in September 2008. This version is expected to include an avionics “road map” that will identify the expected aircraft capability and avionics packages envisioned for NextGen.
Concept of Operations (ConOps)	The NextGen ConOps provides a common vision for how NextGen will operate in 2025 timeframe. It forms a baseline that is intended guide the development of policy and research agendas needed to move forward with NextGen. The JPDO has released the ConOps for stakeholder comment. The updated version of the ConOps is planned for release in FY 2009.
Consolidated Multi-Agency Office of Management and Budget Exhibit 300 for NextGen	The current Office of Management and Budget Exhibit 300 is the first effort to combine the portfolios of capital, research, and development investments of all partner agencies required to support NextGen from FY 2009 to FY 2013. This document is still evolving and does not yet capture DOD’s potential contributions to NextGen. The JPDO is working to more accurately reflect the efforts of all partner agencies for future budget submissions.

The following page contains textual versions of the graphs and charts included in this document. This page was not in the original document but has been added here to accommodate assistive technology.

Status of FAA's Efforts To Develop the Next Generation Air Transportation System

Section 508 Compliant Presentation

Figure. The Federal Aviation Administration's Capital Funding for Fiscal Year 2008 to Fiscal Year 2013

(Note: NextGen funding includes programs such as ADS-B, SWIM, DataComm, and developmental projects. Total NextGen funding for fiscal year 2008 to fiscal year 2013 from the capital account is \$5.6 billion. Remaining Facilities and Equipment (F&E) includes funding for existing projects, facilities, and support service contracts.

- For fiscal year 2008, the NextGen funding enacted is \$187,700,000, and the remaining funds enacted for Facilities and Equipment is \$2,325,900,000. Total capital funding enacted for fiscal year 2008: \$2,513,600,000.
- For fiscal year 2009, the NextGen funding projection is \$631,100,000, and the remaining funds projected for Facilities and Equipment is \$2,092,400,000. Total capital funding projection for fiscal year 2009: \$2,723,500,000.
- For fiscal year 2010, the NextGen funding projection is \$986,500,000, and the remaining funds projected for Facilities and Equipment is \$2,099,500,000. Total capital funding projection for fiscal year 2010: \$3,086,000,000.
- For fiscal year 2011, the NextGen funding projection is \$1,056,200,000, and the remaining funds projected for Facilities and Equipment is \$2,037,700,000. Total capital funding projection for fiscal year 2011: \$3,093,900,000.
- For fiscal year 2012, the NextGen funding projection is \$1,227,500,000, and the remaining funds projected for Facilities and Equipment is \$2,118,100,000. Total capital funding projection for fiscal year 2012: \$3,345,600,000.
- For fiscal year 2013, the NextGen funding projection is \$1,494,200,000, and the remaining funds projected for Facilities and Equipment is \$2,063,800,000. Total capital funding projection for fiscal year 2013: \$3,558,000,000.

Source: Federal Aviation Administration