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Subcommittee on Aviation
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Perspectives on the Progress and Actions Needed to Address the Next Generation Air Transportation System

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Mr. Chairman and Members of the Subcommittee:

We appreciate the opportunity to testify on the Federal Aviation Administration's (FAA) *Joint Planning and Development Office* (JPDO) and the plans for the next generation air transportation system.

The JPDO was mandated by Congress to develop a vision for the next generation air transportation system (NGATS) in the 2025 timeframe and coordinate diverse agency research efforts. This office was established within FAA; also participating are the National Aeronautics and Space Administration (NASA), the Department of Commerce, the Department of Defense (DOD), and the Department of Homeland Security. Thus far, we have focused primarily on the JPDO's air traffic management efforts that involve NASA, DOD, and Commerce.

There are a number of compelling reasons for moving toward the next generation air transportation system. The current air transportation system has served the nation well, but FAA reports that the current system (or business as usual) will not be sufficient to meet the anticipated demand for air travel. Last year, over 700 million passengers used the system, and this number is forecasted to grow to over 1 billion by 2015.

Because of the forecasted growth in air travel, the JPDO needs to continue to work on what can be done much sooner than the 2025 timeframe. It will also be important for the JPDO to show tangible benefits to airspace users from its efforts. We have made this point before, and it was a key theme of the JPDO/industry workshop on costs in April.

The JPDO's mission is critical given that FAA conducts little long-term air traffic management research and the fact the most of the Agency's current \$2.5 billion capital account goes for keeping things running. However, the cost of NGATS remains uncertain and much work remains to refine costs, align diverse agency budgets, and set expectations for airspace users with respect to milestones, equipage, and anticipated benefits. In addition, FAA and JPDO need to transition from planning to implementation, and we have identified a range of actions that will help them do so.

My remarks today will focus on three points:

- JPDO's critical role in leveraging resources in light of recent trends in FAA's Research, Engineering, and Development (RE&D) and Facilities and Equipment (F&E) accounts.
- JPDO progress to date in aligning agency budgets and plans, and

- Actions that will help the JPDO keep moving forward in both the short and long term and shift from planning to implementation.

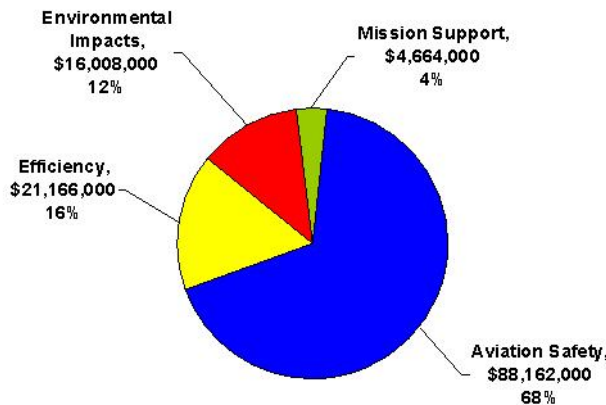
The JPDO Has an Important Role in Leveraging Resources for the Next Generation Air Transportation System

The JPDO is expected to develop a vision for the next generation system and has established ambitious, much needed goals to accommodate three times more air traffic and reduce FAA operating costs. The JPDO also expects a shift from today’s ground-based system to an aircraft-based system and to significantly enhance controller productivity through automation. To do so, a multi-agency approach—as outlined in Vision 100—is critical given the current deficit environment, competition for Federal funds, and FAA’s tight budget. Moreover, leveraging of scarce resources is essential because FAA does not conduct much long-term air traffic management research.

FAA’s Fiscal Year 2007 Budget Request for Research, Engineering, and Development

FAA is requesting \$130 million for fiscal year (FY) 2007, a decrease of \$6.6 million from last year’s appropriated level of \$136.6 million. This includes \$18 million specifically for the JPDO. Figure 1 illustrates the makeup of the FY 2007 RE&D request by major lines of effort.

Figure 1. FAA FY 2007 Budget Submission for R,E & D



As shown above, almost 70 percent of FAA’s research budget submission, or \$88 million, focuses on improving safety—not new air traffic management initiatives. This includes projects on fire safety and aging aircraft systems, which

focus on preventing accidents and making them more survivable. The remaining funds are requested for efficiency, environmental research, and mission support efforts.

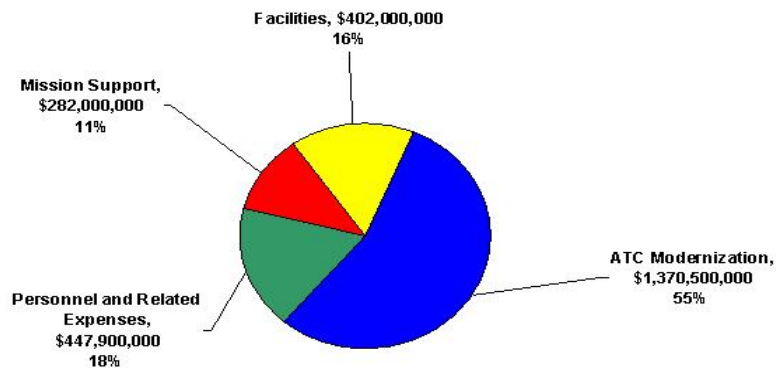
FAA is also requesting research funds from its airport account for safety and efficiency issues. FAA is requesting \$17.8 million in FY 2007 for research in areas of, among other things, airport pavement and airport markings. In addition, FAA is requesting \$10 million in FY 2007 for cooperative research projects with airports, including efforts to enhance safety and improve airport lighting.

Perspectives on FAA’s Capital Account and Progress and Challenges with Key Modernization Projects

The Capital Account. FAA’s capital account—or the F&E account—is the principal vehicle for modernizing the National Airspace System. It represents about 18 percent of the Agency’s FY 2007 budget request of \$13.7 billion. For FY 2007, FAA is requesting \$2.5 billion for the F&E account, which is \$50 million less than last year’s appropriation. This is the fourth consecutive year that funding requests for the capital account are below authorized levels called for in Vision 100.

As we have noted in previous reports and testimonies, FAA’s increasing operating costs have crowded out funds for modernization. Further, only about 55 percent of FAA’s FY 2007 request for F&E (or \$1.4 billion) will actually go for acquiring air traffic control systems, while the remainder will be spent on personnel, mission support, and facilities. This is illustrated in Figure 2.

Figure 2. FAA’s FY 2007 Facilities and Equipment Budget Request



The majority of FAA's capital account now goes for keeping things running (i.e., sustainment), not new initiatives. A review of the top 10 projects by dollar amount in the FY 2007 request shows that while some projects will form the platforms for future initiatives, the bulk of funds are requested for projects that have been delayed for years and for efforts to improve or maintain FAA facilities or replace existing radars.

Over the last several years, FAA has deferred or cancelled a number of projects as funding for the capital account has remained essentially flat. This includes efforts for a new air-to-ground communication system, controller-pilot data link communications, and a new satellite-based precision landing system. FAA has also postponed making decisions on projects like the billion-dollar *Standard Terminal Automation Replacement System*.

In spite of a lack of clarity about the next generation system, FAA is requesting F&E funds for two projects that are considered "building blocks" for the next generation system. These are not new programs and have been under development or been funded in previous budgets.

- Automatic Dependent Surveillance-Broadcast (ADS-B) is a satellite-based technology that allows aircraft to broadcast their position to others. In FY 2007, FAA is requesting \$80 million for this. In prior budgets, ADS-B was funded under the *Safe Flight 21 Initiative*, which demonstrated the potential of ADS-B and cockpit displays in Alaska and the Ohio River Valley. FAA expects to award a contract for the ADS-B ground infrastructure in 2007. FAA has a lot of work ahead to quantify and set expectations for the benefits it and airspace users can expect from ADS-B.¹ Airspace users will have to equip with new avionics to obtain benefits, and FAA may have to rely on a rulemaking initiative to help speed equipage. This illustrates why the JPDO must address complex policy issues as well as research.
- System Wide Information Management (SWIM) is a new information architecture that will allow airspace users to access securely and seamlessly a wide range of information on the status of the National Airspace System and weather conditions. It is analogous to an internet system for all airspace users. FAA is requesting \$24 million for this program in FY 2007.

¹ The first phase of ADS-B implementation, known as *ADS-B out* is expected to replace many ground radars that currently provide surveillance with less costly ground-based transceivers. But implementing *ADS-B out* is just the first step to achieving the larger benefits of ADS-B, which would be provided by *ADS-B in*. *ADS-B in* would allow aircraft to receive signals from ground-based transceivers or directly from other ADS-B equipped aircraft— this could allow pilots to "see" nearby traffic and, consequently, transition some responsibility for maintaining safe separation from the controllers to the cockpit.

Progress and Challenges with Key Air Traffic Control Modernization Projects. We are not seeing the massive cost growth and schedule delays we have seen with FAA major acquisitions in the past because of this administration's more incremental approach to major acquisitions and decisions to defer several complex and challenging efforts.

Last year, we reported that 11 of 16 major acquisitions accounted for cost growth of \$5.6 billion.² Most of this cost growth occurred before the establishment of the Air Traffic Organization. The cost growth was also a reflection of efforts to re-baseline programs, which identified costs that had been pent up for years and were not reflected in prior cost estimates. We are updating our work on the 16 major acquisitions and the challenges they face.

Many efforts are maturing, and completing them within existing cost and schedule parameters is critical to allow room for future initiatives. Only one ongoing modernization project, *FAA Telecommunications Infrastructure*, has the potential to reduce FAA's operating costs, which is a top priority within the Agency. We would like to highlight two multi-billion-dollar programs that require attention.

- En Route Automation Modernization (ERAM) is intended to replace the Host computer network—the central nervous system for facilities that manage high-altitude traffic. FAA is requesting \$375.7 million for ERAM, which is this program's peak single-year funding level according to FAA's Capital Investment Plan. With an acquisition cost of \$2.1 billion, this program continues to be one of the most expensive and complex acquisitions in FAA's modernization portfolio. The monthly burn rate for ERAM will increase from \$28 million a month in FY 2006 to \$31 million per month in FY 2007. This year is critical for ERAM because the system is scheduled to begin real-world testing. Should ERAM experience cost increases or schedule slips, the problems would have a cascading impact on other capital programs and directly affect the pace of efforts to transition to the next generation system.
- FAA Telecommunications Infrastructure (FTI). FAA is requesting \$28 million in FY 2007 toward its effort to replace its entire telecommunications system for air traffic control, including radar and controller voice circuits. Between FY 2003 and FY 2006, the Congress

² OIG Report Number AV-2005-061, "Report on the Status of FAA's Major Acquisitions: Cost Growth and Schedule Delays Continue To Stall Air Traffic Modernization," May 26, 2005. OIG reports and testimonies can be found on our website: www.oig.dot.gov.

appropriated \$556 million for FTI (from the capital and operating accounts).

In our recent report to FAA, we concluded that FTI is a high-risk program—with a FAA reported lifecycle cost estimate of \$2.4 billion (\$310 million estimated acquisition costs and \$2.1 billion estimated operations costs) through 2017.³ Only months after being re-baselined in December 2004, the program fell behind its revised schedule and has not recovered.

The primary purpose of the FTI program is to lower operating costs. It also forms the basic infrastructure for NGATS initiatives, like SWIM, and is important for FAA's ongoing work with Lockheed-Martin on flight service stations. However, expected benefits from reducing operating costs are eroding because of schedule problems. For example, FAA did not realize \$32.6 million in expected savings in FY 2005 (due to the limited progress made in disconnecting legacy circuits). In addition, the estimated cost savings of \$102 million for FY 2006 is at risk.

In our April report, we found that FTI was not likely to meet its planned completion date, December 2007, because FAA had not developed a detailed, realistic master schedule for all critical steps, including identifying when each service will be accepted, when services will be cut over to FTI, and when existing (legacy) services will be disconnected. Without a realistic master schedule, it will be difficult to obtain a binding commitment from the FTI contractor, Harris Corporation, to complete the transition by any specific point in time.

We recommended, among other things, that FAA develop both a master schedule and an effective FTI transition plan and validate FTI cost, schedule, and benefits. FAA agreed with our recommendations and commissioned the MITRE Corporation⁴ to conduct an independent assessment of FTI's schedule and transition performance to date.

MITRE completed a limited assessment of FTI schedule risk and concluded FTI will not be completed as planned in December 2007, but is more likely to be completed later in 2008. Also, MITRE underscores the need to focus Harris' resources and FAA's field resources on achieving timely cutovers and increased disconnects of legacy services, both of which are important for realizing cost-savings. However, we have observed that a significant number of FTI services that have been accepted by FAA could not be

³ OIG Report Number AV-2006-047, "FAA Telecommunications Infrastructure Program: FAA Needs To Take Steps To Improve Management Controls and Reduce Schedule Risks," April 27, 2006.

⁴ The MITRE Corporation functions as FAA's federally funded research and development center.

cutover, thus requiring considerable re-work and causing an increased backlog.

We are currently reviewing FAA's effort to develop an effective transition plan and a realistic master schedule. We note that FAA's Joint Resources Council—FAA's decision-making body for major acquisitions—is planning to meet in August 2006 to review revised FTI cost estimates against a newly validated schedule. We see several key issues that FAA needs to address. They include determining the number of existing legacy circuits and the funding requirements needed to maintain those circuits until FTI is complete, improving coordination between Harris and FAA field offices, and updating cost and benefits based on actual and projected legacy and FTI network costs.

It is important to recognize that FAA's existing investments will heavily influence NGATS requirements and schedules. In fact, ongoing projects, like ERAM and FTI, will form important platforms for JPDO initiatives. Enclosure A provides details on selected modernization projects that will likely play a key role in moving toward the next generation system. *FAA will have to assess how JPDO plans affect ongoing projects and determine which ones need to be accelerated or re-scoped.*

Progress Is Being Made in Coordinating Diverse Agency Efforts but Considerable Work Remains To Align Agency Budgets and Plans

The law requires the JPDO to coordinate and oversee research that could play a role in NGATS. Central to the JPDO's mission—and making it an effective multi-agency vehicle—is alignment of agency resources. This is a complex task, and the law provides no authority for the JPDO to redirect agency resources. Enclosure B provides information on potential agency contributions to the JPDO and each agency's area of expertise.

The Department has played an important role in coordinating various efforts by chairing the Senior Policy Committee. This committee was established by Vision 100 and includes deputy secretary level representatives from the Departments of Commerce and Homeland Security, and the Secretary of the Air Force. It also includes the FAA and NASA Administrators. This committee provides high-level guidance, resolves policy issues, and identifies resource needs. Each participating agency conducts research tailored for its specific mission.

The JPDO's March 2006 progress report to Congress outlined various accomplishments to date, including the establishment of multi-agency teams and the NGATS institute (a mechanism for interfacing with the private sector) as well

as a demonstration of network-enabled operations for security purposes. However, the report did not provide details on specific ongoing research projects at FAA or funding that the JPDO expects to leverage at other agencies. Without this information, it is difficult to assess progress with alignment of budgets.

The majority of JPDO's work is done through eight Integrated Product Teams (IPTs) that focus on eight strategies, such as how to use weather information to improve the performance of the National Airspace System. The teams are composed of members from FAA, other Federal agencies, and the private sector. Enclosure C provides information on the JPDO's IPTs.

The National Research Council recently examined JPDO plans and was critical of the IPT structure.⁵ The Council's report found that even though the teams have multi-agency participation, they are functioning primarily as experts in specific disciplines rather than as cross-functional, integrated, multidisciplinary teams organized to deliver specific products. One of the report's recommendations was that the IPTs be reduced in number and made more "product driven." Although we have not reached any conclusions on how to best structure the IPTs, we do agree that a more product-driven focus would be an important step forward.

Our audit work on three IPTs shows that there is considerable coordination but little alignment of agency budgets to date. Moreover, the IPT leaders have no authority to commit agency resources to JPDO efforts and often have no products other than plans. The following illustrates progress and challenges to date with the three IPTs we examined in detail.

- The Weather IPT is led by the National Oceanic Atmospheric Administration (NOAA), an agency of the Department of Commerce. FAA, NASA, DOD, and NOAA are all conducting weather research tailored for their specific missions. Thus far, this team's efforts have focused on contributions to FAA's *Traffic Flow Management Program* (which assists traffic managers to optimize air traffic by working with airlines). NOAA is also helping the JPDO refine its concept of a fully automated system. Integrating new, up-to-date weather forecast systems into planned automation efforts will be challenging.

We note that JPDO has not yet determined if a considerable amount of applied research and development conducted by NOAA at the Office of Atmospheric Research and the National Environmental Satellite Data and Information Service could be leveraged for next generation initiatives. We

⁵ National Research Council, "Technology Pathways Accessing the Integrated Plan for a Next Generation Air Transportation System," 2005.

have shared our concerns about taking full advantage of weather research conducted by others with the JPDO, which recognizes it can do a better job.

- The Shared Situational Awareness IPT is led by DOD. All participating agencies are adopting network-centric systems.⁶ As noted earlier, FAA is developing its own network system called SWIM. While there are considerable opportunities for leveraging net-centric efforts, there is also potential for duplication of effort. Challenges here focus on taking an approach pioneered by DOD and applying it specifically to air traffic control to get benefits in terms of enhanced capacity and delay reduction.

An active role by DOD is vital because it is both a provider and a consumer of air traffic services. Thus far, work with this IPT has focused almost exclusively on maximizing agency network capabilities in DOD, such as the *Global Information Grid*, which is a net-centric communication system DOD is developing for global use. Moreover, DOD's real-world experiences and the lessons it has learned in sharing data (from air and ground systems) in actual operations and in real-time have not been fully tapped and will prove invaluable in reducing cost and technical risks in developing the next generation system.

Another area where DOD could provide expertise is with *sensor fusion*⁷ which is the integration of information on an aircraft's position from radar and non-radar sources, such as satellite-based systems. While fusion could help reduce separation between aircraft, it will be technically challenging to integrate radar and satellite-based systems (which have different update rates and levels of accuracy) to manage traffic in high volume airspace, particularly in the vicinity of airports. DOD expertise with target acquisition and sensor fusion for weapons targeting could prove helpful for the JPDO.

- The Air Traffic Management IPT is led by NASA. It is expected to play a key role by helping develop the automated systems to boost controller productivity. The bulk of this work will be funded by NASA, which has conducted the majority of long-term air traffic management research over the last few years.⁸ FAA has neither planned nor budgeted for this type of

⁶ A net-centric system uses internet protocols to transfer data.

⁷ For additional views on sensor fusion or fusion tracking see our audit report "Terminal Modernization: FAA Needs To Address Its Small, Medium, and Large Sites Based Upon Cost, Time, and Capability" (AV-2005-016, November 23, 2004).

⁸ For additional details on the FAA/NASA relationship and funding profiles, see our testimony entitled "Observations on the Progress and Actions Needed To Address the Next Generation Air Transportation System," (CC-2006-032, March 29, 2006).

research. Major challenges focus on establishing requirements and gaining a full understanding of the risks associated with developing and acquiring these new software-intensive systems before making financial commitments. This is important because future automation efforts will be a major cost driver for the next generation system.

Even though NASA is restructuring its aeronautical research program and spending less than in the past, the JPDO and NASA are working on several complex concepts for new automation systems (for monitoring multiple aircraft trajectories, tracking separation minima, and responding to weather events) and the timing of research efforts. This work will be funded through NASA efforts on airspace systems (with a FY 2007 requested funding level of \$120 million). However, experience shows that NASA will need a much clearer picture of FAA's requirements (i.e., performance parameters for new automated systems) to better support the next generation system.

Several Actions Are Critical for the JPDO To Make Progress in Both the Short and Long Term and Make the Transition From Planning to Implementation

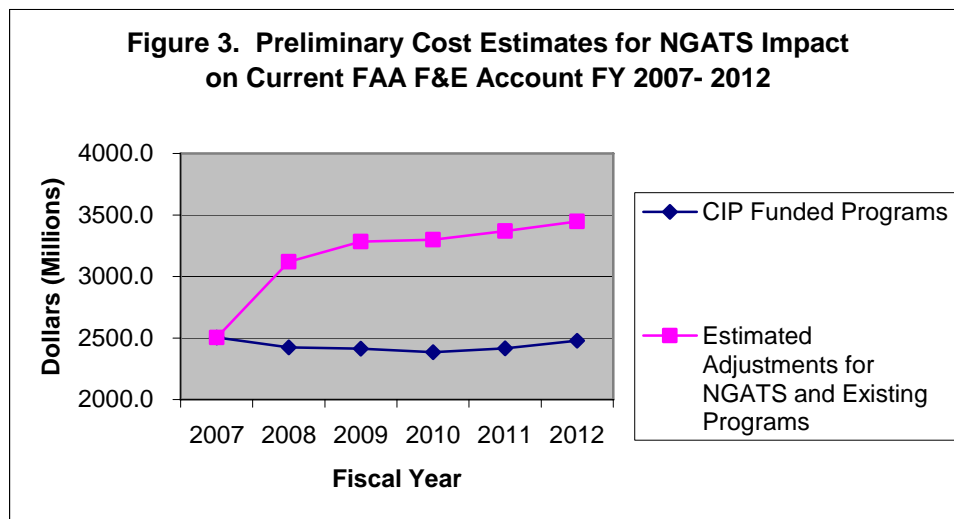
Key questions for FAA and the JPDO to focus on include what the new office can deliver, when, and how much this transition will cost. They are central questions in the discussion about how to best finance FAA and will shape the size, requirements, and direction of the capital program for the next decade.

Moving to the next generation system is important to meet the demand for air travel, change the way FAA provides services, and help control operating costs. However, it is also a high-risk effort. To make progress and successfully shift from planning to actual implementation, several steps are needed.

- Leadership. The position of the JPDO Director is currently vacant—FAA needs to find the right person to lead this effort. Leadership will be important to align diverse agency efforts and bridge the gap between the Air Traffic Organization's (ATO) near-term planning horizon and the JPDO's longer-term mission to transform the National Airspace System. We understand that FAA is interviewing candidates and will be making a selection very soon.
- Finalizing Cost Estimates, Quantifying Expected Benefits, and Developing a Roadmap for Industry. The JPDO's progress report to Congress did not address funding requirements and complex transition issues. Moving to the next generation system will require significant investments from FAA (new

ground systems) and airspace users (new avionics). FAA is conducting workshops with industry to develop program costs.

We have seen some preliminary estimates developed by the ATO and a working group of FAA's Research, Engineering, and Development Advisory Committee (REDAC), but they have not been finalized or approved by senior FAA management. There are considerable unknowns, and costs depend on, among other things, performance requirements for new automation and weather initiatives and to what extent FAA intends to consolidate facilities. The following Figure illustrates a very preliminary estimate of the implications for FAA's capital account from FY 2007 through FY 2012—the focus of the FAA reauthorization—from the April JPDO/Industry workshop.



Source: FAA Cost Projection Briefing, presented by Air Traffic Organization—Planning at the April 28, 2006 JPDO/Industry Cost Workshop

These ATO estimates presented that moving forward with NGATS would cost \$4.4 billion between FY 2007 and FY 2012 over and above the current CIP plan. These preliminary numbers do not distinguish between development efforts, adjustments to existing programs, or implementation of new initiatives.

A key short-term cost factor for NGATS is the level of development funding that will be required to take efforts from other agencies (like NASA) and successfully transition them into the National Airspace System and meet FAA's safety and certification requirements. The REDAC working group is raising concerns about this in light of NASA's restructuring of its aeronautics research portfolio and plans to focus on more basic research. To accommodate changes in NASA investments, the

REDAC working group estimated in its draft report that the JPDO will need approximately \$100 million annually for development.

FAA will have to analyze information from the JPDO/industry workshops and the REDAC working group and provide Congress with expected funding requirements and when the funding will be needed. When transmitting this information to Congress, FAA should provide cost data on three vectors—research and development needed (including demonstration projects), adjustments to existing projects and estimates for implementing NGATS initiatives. This will give decision-makers a clear understanding of NGATS costs.

An important theme from the recent JPDO workshop was the need for FAA to clearly define the expected benefits from NGATS initiatives, particularly for projects that require airspace users to install and equip with new avionics, such as ADS-B. Airspace users have a much shorter horizon for the return on investment from new systems than FAA, and incentives (i.e., tax incentives, financing options, or targeted deployments for users that equip early) will likely be needed to spur equipage.

At the April workshop, industry participants asked FAA for a “service roadmap” that (1) specifies required equipage in specific time increments, (2) bundles capabilities with clearly defined benefits and needed investments, and (3) uses a 4- to 5-year equipage cycle that links with aircraft maintenance schedules. It will be important for FAA to provide industry with this information.

- Establishing Connectivity Between JPDO Plans and ATO Efforts. This is important because the JPDO, as currently structured, is a planning and coordinating organization, not an implementation or program-execution office. At the April JPDO/industry workshop, industry asked for a much stronger link between ATO and JPDO plans.

Although the JPDO’s progress report discusses new capabilities such as ADS-B and SWIM, the ATO is responsible for managing those efforts and establishing funding levels, schedule, and performance parameters. The ADS-B and SWIM projects are not yet integrated into ongoing communications and automation efforts but need to be. If the JPDO and ATO are not sufficiently linked and clear lines of accountability are not established, cost and schedules for NGATS will not be reliable and expected benefits will be diminished or postponed.

Linking JPDO and ATO efforts is challenging because NGATS projects cut across the ATO's different lines of business (i.e., terminal and en route) and will require adjustments to ongoing projects managed by different ATO vice presidents.

For example, SWIM is envisioned as an Agency-wide effort, and planning documents show that SWIM will interface with at least 12 ongoing projects, including FTI which is managed by the Vice President for Technical Operations. Also, SWIM will need to be integrated with ongoing projects to revamp systems for controlling high-altitude traffic managed by the Vice President for En Route and Oceanic Services. Projects managed by the Vice President for Terminal Services (to modernize both controller displays used in the vicinity of airports and weather systems) will also be affected. It will be important to establish clear lines of accountability for linking JPDO efforts to ATO programs and resolving differences between the two organizations.

We shared our concerns about effectively linking the JPDO and ATO and establishing clear lines of accountability with the Chief Operating Officer and the Acting Director for ATO Planning earlier this year. They recognize the need for close coordination and are examining ways to better link the two organizations. One step that is underway is to adjust the *Operational Evolution Plan* (the Agency's capacity blueprint) to reflect JPDO efforts. This is an important matter that will require sustained management attention.

- Developing and Implementing Mechanisms for Alignment. As noted earlier, there is considerable coordination among JPDO participating agencies but little alignment of budgets and plans. There is a need for mechanisms to help the JPDO align different agency efforts over the long haul. This will help identify the full range of research that can be leveraged by the JPDO—not how much NGATS will cost to implement.

The JPDO recognizes that more needs to be done and is working with the Office of Management and Budget (OMB) to develop an integrated budget document that provides a single business case (a document similar to the “OMB Exhibit 300”) to make sure efforts are indeed aligned.⁹ As part of this, the JPDO has promised to provide OMB this summer with an architecture for the next generation system, as well as a specific list of programs in other agency budgets it intends to leverage.

⁹ OMB Exhibit 300 was established by OMB as a source of information on which budgetary decisions could be based so that they are consistent with Administration and OMB policy and guidance.

The JPDO's ongoing efforts to develop an enterprise architecture,¹⁰ or overall blueprint for the next generation system, will help in setting goals, supporting decisions, adjusting plans, and tracking agency commitments. The architecture will also show requirements from FAA and the Departments of Defense and Homeland Security and where various agency efforts fit in the next generation system. It will prove helpful in the future in resolving difficult policy decisions, including who pays for what elements of the system.

The JPDO is taking an incremental approach to architecture development and plans to have an initial version this summer. However, considerable work remains to link current systems with future capabilities and develop technical requirements, particularly for new concepts for automation.

Until these actions are taken, it will be difficult for the Congress and aviation stakeholders to determine if the JPDO is leveraging the right research, if funding is adequate for specific efforts, or how projects will improve the US air transportation system and at what cost. Therefore, we think the JPDO should include in its periodic reports to Congress a table of specific research projects with budget data for FAA developmental efforts, as well as budget data of other agencies it is leveraging and how that ongoing research is supporting the JPDO.

- Developing Approaches for Risk Management and Systems Integration. Given that the transition to NGATS is a high-risk effort potentially involving billions of dollars, the JPDO and FAA need to articulate how problems that affected past modernization efforts will be mitigated and what specific skill sets will be required. The JPDO's recent progress report did not address this issue.

The central issue focuses on what will be done differently from past modernization efforts with NGATS initiatives to ensure success and deliver much needed benefits to FAA and airspace users. FAA faces a wide range of risks, such as complex software development and complex systems integration and engineering challenges with NGATS initiatives and existing FAA projects.

¹⁰ Enterprise architecture links an organizations strategic plan to the programs and supporting systems in terms of interrelated business processes, rules, and information needs. This includes the transition from the "as-is" to the "to-be" environment.

To help manage the transition to the next generation system, FAA is considering whether or not a lead systems integrator—a private contractor who would help link new and existing systems and help manage other contractors—will be required. DOD has relied on this approach to guide its development of complex weapon systems. Models for using a lead system integrator throughout the Government differ with respect to roles and responsibilities. We note that FAA has relied on systems engineering and integration contractors in the past to help integrate modernization projects, but questions about the roles, responsibilities, and expected costs will need to be examined before a decision is made.

- Clarifying and Updating Approaches for Industry Participation as the JPDO Evolves. The JPDO established the NGATS institute specifically to allow for industry participation in shaping the next generation air traffic management system. Currently, industry representatives are participating in JPDO IPTs. For example, the JPDO’s progress report noted that over 140 industry and private sector participants (from 66 organizations) are involved in IPT planning efforts.

Industry has expressed concern that participation in JPDO activities might preclude them from bidding on future FAA acquisitions related to NGATS because it may create an organizational conflict of interest. Generally speaking, FAA’s Acquisition Management System precludes contractors from competing on production contracts if the contractor either participated in or materially influenced the drafting of specifications to be used in future acquisitions for production contracts or had advanced knowledge of the requirements.

FAA is aware of industry’s concern and is working to ensure that industry participation does not result in organizational conflicts of interest. Recently, the JPDO revised the contracting mechanism with the institute to address this issue. Specifically, the JPDO and the institute have committed to develop procedures related to organizational conflict of interest concerns, and methods to avoid them. Putting these procedures in place will help get and sustain the desired expertise from industry and help prevent problems in the future.

We think the JPDO needs to continue to foster awareness of potential conflicts of interest among IPTs and its contractors to identify information that might later lead to conflicts of interest. It will be particularly important for FAA and the JPDO to monitor these matters as the role of the JPDO evolves and various efforts shift from planning to implementation.

- Examining and Overcoming Barriers to Transforming the National Airspace System That Have Affected Past FAA Programs. Our work on many major acquisitions shows the importance of clearly defined transition paths, having expected costs (for both FAA and airspace users), and determining benefits in terms of reduced delays. This is particularly the case for initiatives that require airspace users to equip with new avionics.

For example, FAA cancelled the controller-pilot data link communications program specifically because of uncertain benefits, concerns about user equipage, cost growth, and the impact on the Agency's operations account. The inability to synchronize data link with other modernization efforts, such as the multi-billion-dollar ERAM program, was also a factor.

Other important barriers to be overcome include how to ensure new systems are certified as safe for pilots to use and getting the critical expertise in place at the right time. Problems with FAA's multi-billion-dollar *Wide Area Augmentation System* were directly traceable to problems in certifying the new satellite-based navigation system.

FAA's certification workforce has participated in IPT meetings, but considerable work remains to determine how air and ground components will be certified and the corresponding impact on requirements. This is a complex task. *We agree with industry that FAA's certification workforce needs to be actively engaged with JPDO initiatives.*

- Developing a Strategy for Technology Transfer. Technology transfer—the movement of technology from one organization to another—is a central issue for the JPDO because the law envisions new capabilities developed by other Federal agencies (or the private sector) being transitioned into the National Airspace System. The JPDO will have to pay greater attention to this matter as it moves forward to reduce development times with NGATS initiatives.

Our past work shows that FAA has experienced mixed results in transitioning systems developed by others into the National Airspace System. For example, FAA ultimately abandoned work on a new controller tool developed by NASA (the Passive Final Approach and Spacing Tool) for sequencing and assigning runways to aircraft because of complex software development and cost issues.

As we noted in our review of FAA's Free Flight Phase 1 Program, the use of "technology readiness levels" could be useful to help assess maturity of

systems and ease issues associated with the transfer of technology.¹¹ Both NASA and DOD have experience with categorizing technical maturity. This could help reduce cost, schedule, and technical risk with implementing JPDO initiatives.

- Conducting Sufficient Human Factors Research To Support Anticipated Changes. The JPDO is planning to make fundamental changes in how the system operates and how controllers manage traffic to accommodate three times more aircraft in the system. Currently, the union that represents controllers is not yet participating in JPDO efforts for a variety of reasons but needs to be.

History has shown that insufficient attention to human factors can increase the cost of acquisition and delay much needed benefits. For example, problems in the late 1990s with FAA's *Standard Terminal Automation Replacement System* were directly traceable to not involving users early enough in the process.

The need for focused human factors research extends well beyond the traditional computer-machine interface (such as new controller displays) and has important workforce and safety implications. For example, FAA expects the controller's role to change from direct, tactical control of aircraft to one of overall traffic management. There also will be significant human factors concerns for pilots, who will be expected to rely more on data link communications. It will be important to have sufficient human factors analysis and studies to ensure that the changes envisioned by the JPDO can be safely accommodated.

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

¹¹ OIG Report Number AV-2002-067, "Free Flight Phase 1 Technologies: Progress to Date and Future Challenges," December 14, 2001.

Key Platforms

System	Status and Key Issues
<p>Terminal Modernization: Standard Terminal Automation Replacement System (STARS), Common Automated Radar Terminal System (Common ARTS): Controller workstations that process surveillance data and display it on the screen to manage air traffic in the terminal environment.</p>	<p>FAA has struggled with how to complete terminal modernization. STARS, which so far has cost \$1.3 billion for only 47 sites, was envisioned as the centerpiece of terminal modernization. Because of technical problems and schedule delays with STARS, FAA decided to deploy another system, Common ARTS, as an interim solution at over 140 facilities in several configurations. FAA is rethinking its approach to terminal modernization and recently decided to field STARS to only five additional sites. A decision affecting the remaining 100-plus sites has been postponed for over a year. FAA needs to address problems with aging displays at four large sites, including Chicago and Denver, and resolve how it will complete terminal modernization and what additional capabilities will be needed as it works with the JPDO.</p>
<p>En Route Automation Modernization (ERAM): Replaces the Host computer hardware and software (including the Host backup system) and associated support infrastructure at 20 En Route Centers.</p>	<p>With an estimated cost of \$2.1 billion, ERAM is one of the largest and most complex acquisitions in FAA’s modernization portfolio. Progress is being made with the first ERAM deliverable—a backup system for the Host computer. However, the bulk of the work focuses on development of the first major ERAM software release, which involves developing over 1 million lines of code. A number of new capabilities (e.g., dynamic airspace management and data link) depend on future enhancements to ERAM that have yet to be defined or priced.</p>

Key Platforms (continued)

System	Status and Key Issues
<p>FAA Telecommunications Infrastructure (FTI): Replaces existing telecommunications networks with one new network.</p>	<p>FTI is FAA's effort to transition from multiple telecommunication networks to a single new network for the purpose of reducing operating costs at more than 4,400 facilities. As of May 31, 2006, FAA reported 5,925 FTI services completed with 14,555 remaining. According to a recent MITRE study, FTI is not likely to be completed by December 2007. Moreover, FAA is still in the process of determining the number of existing service requirements that will need to be maintained until FTI is complete. As a result, expected FTI benefits with respect to savings are eroding. Key issues for FAA include developing an effective transition plan and realistic master schedule, negotiating a contract extension for the existing legacy system with Verizon, and revising and validating FTI cost and benefit estimates.</p>
<p>Traffic Flow Management (TFM) modernizes the hardware and software used to manage the flow of air traffic.</p>	<p>Traffic Flow Management Infrastructure products and services are designed to support the Traffic Management Specialists and Traffic Management Coordinators to optimize air traffic flow across the National Air Space System. The specialists and coordinators analyze, plan, and coordinate air traffic flow through continuous coordination with the airlines and the use of surveillance sources, weather information, automation, and display subsystems.</p>

Potential Agency Contributions

The following table provides perspectives on the wide range of research being conducted at agencies that participate in the JDPO for their specific missions. We note that only some of the ongoing research will be applicable to the JPDO's efforts.

Agency	Key Area of Leverage
DOD	DOD has an extensive and diverse Research and Development (R&D) base, including research in new aircraft, composites, imaging systems, and data exchange systems for all services. DOD has requested \$73 billion overall for R&D in FY 2007. The JPDO is particularly interested in DOD's broadband communication networks, such as the <i>Global Information Grid</i> . DOD planned upgrades to the Global Positioning System Constellation will be critical to civil aviation.
Commerce / NOAA	Commerce is requesting \$1.1 billion for research in FY 2007. NOAA is a part of Commerce and is responsible for the National Weather Service; the National Environmental Satellite, Data and Information Service; and Oceanic and Atmospheric Research. NOAA requested \$533 million in FY 2007 for R&D. The JPDO is seeking from NOAA probability weighted forecast capabilities, a national uniform weather database of forecasts and observations, and transparent automatic adjusted traffic management for weather.
NASA	For years, NASA has conducted the majority of long-term Air Traffic Management research, including automated controller tools and human factors work. NASA has requested \$724 million for aeronautical R&D in FY 2007. The JPDO is looking to NASA to develop automated aircraft metering and sequencing and dynamic airspace reconfiguration.
Department of Homeland Security (DHS)	DHS contributes expertise in the areas of security and net-centric initiatives. The Agency has requested \$1 billion in FY 2007 for Science and Technology R&D. FAA is looking to DHS to develop automated passenger and cargo screening, hardened aircraft security, and flight control overrides.

Integrated Product Teams

IPTs are multi-agency teams that are defining the specific concepts and capabilities and are coordinating the actions necessary to make possible the transformation in each of the eight strategies articulated in the NGATS Integrated Plan. The following provides a listing of the JPDO's IPTs and the agency responsible for leading each team.

1. Develop Airport Infrastructure To Meet the Future Demand – led by FAA
2. Establish an Effective Security System Without Limiting Mobility or Civil Liberties – led by DHS
3. Establish an Agile Air Traffic System – led by NASA
4. Establish User-Specific Situational Awareness – led by DOD
5. Establish a Comprehensive Proactive Safety Management Approach – led by FAA
6. Develop Environmental Protection That Allows Sustained Aviation Growth – led by FAA
7. Develop a System-Wide Capability To Reduce Weather Impacts – led by Commerce/NOAA
8. Harmonize Equipage and Operations Globally – led by FAA