TIMELY ACTIONS NEEDED TO ADVANCE THE NEXT GENERATION AIR TRANSPORTATION SYSTEM

Federal Aviation Administration

Report Number: AV-2010-068

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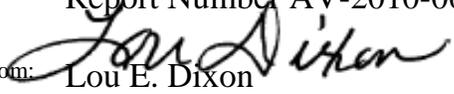# Memorandum

U.S. Department of Transportation

Office of the Secretary
of Transportation

Office of Inspector General

Subject: <u>ACTION</u>: Timely Actions Needed To Advance the Next Generation Air Transportation System Federal Aviation Administration Report Number AV-2010-068

Date: June 16, 2010

From: Lou E. Dixon
Principal Assistant Inspector General
  for Auditing and Evaluation

Reply to Attn. of: JA-10

To: Federal Aviation Administrator

The National Airspace System handles almost 50,000 flights per day and more than 700 million passengers per year. Historically, steadily increasing levels of air traffic have resulted in increasing delays. While the current demand for air travel is down, it is expected to return, which will require better air traffic management to reduce congestion and decrease delays. To meet this anticipated demand, the Federal Aviation Administration (FAA) is developing the Next Generation Air Transportation System (NextGen) to replace the current ground-based air traffic control system with a satellite-based system. FAA's goal for NextGen—to create a system that will handle up to three times more air traffic and reduce FAA operating costs—is ambitious and involves multibillion-dollar investments from both the Government and the airline industry. Since the effort began in 2005, we have repeatedly reported on the cost and schedule risks and operational and management challenges NextGen faces. These concerns prompted us to identify NextGen as one of the Department's top management challenges.[1]

The Chairmen and Ranking Members of the House Committee on Transportation and Infrastructure and Subcommittee on Aviation requested that we examine FAA's progress in transitioning to NextGen. This report provides the results of our review. Specifically, it addresses (1) key actions needed to successfully implement NextGen, (2) FAA and partner agencies' progress in leveraging resources and budgets, and (3) FAA's efforts to engage the private sector in shaping NextGen policy issues. In addition, we were asked to report on FAA's

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[1] OIG Report Number PT-2010-008, "DOT Top Management Challenges for FY 2010," November 16, 2009. OIG reports and testimonies are available on our website: www.oig.dot.gov.

progress in implementing our past NextGen-related recommendations, which is detailed at exhibit A. We conducted this performance audit from May 2008 to March 2010 in accordance with generally accepted government auditing standards. See exhibit B for a more detailed discussion of our scope and methodology.

RESULTS IN BRIEF

A number of critical actions are still needed to move NextGen from planning to implementation. FAA has yet to establish firm requirements to help guide cost and schedule estimates for adjustments to existing projects or new acquisitions. In addition, FAA has not modified its Acquisition Management System (AMS) so that it can gauge the impact of a single NextGen investment on multiple initiatives or manage efforts in an integrated way. FAA's tendency to focus on individual programs has also limited its ability to assess how it will concurrently implement multiple, interdependent programs and mitigate any associated risks. Finally, although FAA considers NextGen to be one of the most complex systems ever developed by the U.S. Government, FAA has not yet acquired the necessary skill sets and expertise to successfully implement NextGen. Not taking timely action on these issues now could delay FAA's plans to transition to NextGen.

FAA also faces challenges in developing an integrated budget to help ensure it leverages the right resources, pursues realistic goals, and secures adequate funding for projects. A multi-agency approach that allows for coordinating diverse research and aligning other agencies' resources to develop NextGen is not only required by law, but also important since FAA conducts very little long-term air traffic management research. However, with the exception of the National Aeronautics and Space Administration (NASA), partner agencies have not adjusted their research and development plans, existing budgets, or program requirements specifically to accommodate NextGen efforts. Additionally, FAA is missing opportunities to leverage other partner agencies' research and development efforts that could significantly enhance NextGen development and reduce costs. For example, FAA has yet to inventory the Department of Defense's (DOD) vast research base for NextGen or fully leverage ongoing work for an accurate satellite-based precision landing system and net centric operations.

While FAA has made some progress in engaging the private sector to develop NextGen and shape NextGen policy issues, several challenges remain. For example, FAA is working with a Government/industry task force to gain consensus on NextGen operational improvements that can be achieved in the midterm (2012 to 2018), but significant policy issues remain unresolved. Other FAA efforts also face challenges, such as better defining the role of the NextGen Institute. FAA established the Institute to ensure access to private sector expertise, but it has not lived up to expectations due to a lack of focus and clear priorities for its working groups. Further, while FAA has involved industry in NextGen

demonstration projects to validate concepts and procedures, stakeholders are concerned that these projects are not well coordinated or outcome-focused.

As part of this report, we are making recommendations to FAA to reduce implementation risks, strengthen the multi-agency approach, and improve coordination with the private sector in NextGen policy matters.

BACKGROUND

In 2003, Congress mandated[2] that FAA establish the Joint Planning and Development Office (JPDO) and that it create and carry out plans for implementing NextGen by 2025. Congress also mandated that the JPDO coordinate diverse research efforts of other Federal agencies to reduce the cost and risks of implementing NextGen by leveraging ongoing development efforts by partner agencies. These include DOD, the Department of Commerce, the Department of Homeland Security (DHS), as well as NASA. In developing and carrying out its plans, the JPDO was also tasked to consult with the public and ensure the participation of experts from the private sector, including representatives of commercial aviation, labor groups, and air traffic controllers.

We have testified on several occasions that FAA must make several critical decisions over the next several years to keep NextGen on track.[3] Specifically, we have noted that the cost of NextGen remains uncertain and much work remains to refine requirements and costs; align diverse agency budgets; and set realistic expectations for airspace users with respect to milestones, equipage, and anticipated benefits. In October 2009, we testified that FAA's transition from NextGen planning to implementation poses a number of operational and management challenges that must be addressed in the near and midterm. Additionally, our past audit reports have highlighted several areas of risk, such as complex software and development and systems integration issues, that FAA needs to address, and we recommended several actions to reduce cost and schedule risks.[4]

CRITICAL ACTIONS NEEDED TO SUCCESSFULLY IMPLEMENT NEXTGEN

FAA has made some progress in developing and shaping a vision for NextGen in the midterm and is working with stakeholders to develop priorities for the next

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[2] Vision 100—Century of Aviation Reauthorization Act, Pub. L. No. 108-176 (2003).

[3] OIG Testimony Number CC-2006-065, "Perspectives on the Progress and Actions Needed To Address the Next Generation Air Transportation System," July 25, 2006. OIG Testimony Number CC-2009-044, "Federal Aviation Administration: Actions Needed To Achieve Mid-Term NextGen Goals," March 18, 2009.

[4] OIG Report Number AV-2005-031, "Joint Planning and Development Office: Actions Needed To Reduce Risks With the Next Generation Air Transportation System," February 12, 2007.

2 to 3 years. However, FAA has yet to take timely action in a number of critical areas needed to move NextGen from planning to implementation. Specifically, FAA has yet to (1) establish firm requirements or reliable costs and schedules for adjustments to existing projects or new NextGen acquisitions, (2) modify its Acquisition Management System so it can manage initiatives as portfolios, (3) address key safety concerns related to increased throughput at congested airports and mixed equipage, (4) assess the ability to implement multiple capabilities concurrently, or (5) establish a viable plan to secure the expertise needed to manage a NextGen-driven workforce.

FAA Has Yet To Establish Firm NextGen Requirements for New and Existing Systems

FAA has updated its enterprise architecture for the National Airspace System that includes "road maps" for automation, communications, navigation, aircraft, and surveillance planned with NextGen. However, FAA has not established firm requirements that can be used to develop the cost and schedule estimates for modifications to existing programs or new acquisitions, such as performance attributes for systems that controllers will rely on to manage traffic at high altitudes and in the vicinity of airports.

The current architecture identifies more than 340 key decisions that FAA must make to reach envisioned mid-term capabilities. The Agency's most recent roadmap identifies a total of 51 decision points for fiscal year (FY) 2009. However, FAA only made a total of 11 decisions. One key decision that FAA failed to make was the Investment Analysis (projected program cost) for the NextGen Weather Processor, which is part of the Agency's efforts to significantly improve how weather information is used to reduce delays. FAA scheduled this decision for the fourth quarter of 2008 but failed to meet the milestone. FAA officials acknowledged that this could impact scheduling for other investment decisions for the program and delay NextGen weather systems.

According to FAA, pending decisions on several key design issues will determine NextGen capabilities, timing, and costs. These include:

- **Air/Ground Division of Responsibility:** FAA needs to decide how much responsibility will be delegated to pilots in the cockpit and what duties will remain with controllers and FAA ground systems for tracking aircraft.

- **Level of Automation:** The decision on the degree of human involvement in traffic management and separating aircraft is linked to the outcome of the division of responsibility between aircrew and controllers (and related ground systems). Possible options range from today's largely manual flight

management to a largely automated system centered on machine-to-machine exchanges with little controller involvement.

- **Facilities Consolidation:** A major determination of both capital and operating costs for NextGen is the degree to which the Agency eliminates or consolidates FAA facilities. FAA must make critical decisions on facility requirements that will significantly impact the type and number of systems needed to support NextGen.

In addition, FAA must still make several critical decisions for other core capabilities that will ultimately affect the budget and pace of NextGen in the midterm (see table 1).

Table 1. Examples of Critical Decisions Still Needed for Core Capabilities

Area	Critical Decisions Needed
Terminal Modernization	FAA recently approved dividing the Terminal Automation Modernization Replacement (TAMR) Phase 3 program into two segments. Segment 1 addresses modernization of existing terminal automation systems for the 2010 to 2013 timeframe to enable near-term NextGen capabilities at selected sites. Segment 2 will address all terminal systems for the mid-term beyond 2013. FAA plans Final Investment Decisions for Segments 1 and 2 for September 2010 and FY 2012, respectively. Delays in terminal automation modernization decisions could increase risk to implementation of NextGen capabilities.
En Route Automation	FAA expects to decide on capabilities for the remaining two software releases planned for the En Route Automation Modernization (ERAM) program. Delays could impact the schedule for incorporating future capabilities, such as the Data Communications and the System Wide Information Management efforts.
Data Communications	FAA plans to make the Final Investment Decision for the first segment of Data Communications in FY 2011. Costs are uncertain, but the Segment 1 investment decision is expected to include $400 million specifically for upgrades to ERAM.

Source: OIG analysis of FAA National Airspace System enterprise architecture roadmaps
Note: Cost projections for FAA projects have not been baselined.

In April 2008,[5] we recommended that FAA conduct a "gap analysis" of the National Airspace System to determine what would be required to transition from the existing architecture to NextGen in the midterm (2012 through 2018). FAA's work thus far shows that major gaps exist with respect to automation, such as new capabilities that will allow controllers to better manage traffic. According to FAA,

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[5] 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.

it may take 1 to 2 years to develop requirements for new automation systems for the mid-term timeframe.

Continued delays, however, in developing requirements and in making key program decisions will slow NextGen's progress. A recent NextGen portfolio analysis,[6] commissioned by the JPDO, already shows that some NextGen automated air and ground capabilities originally planned for 2025 may not be implemented until 2035 or later and could cost the Government and airspace users significantly more than the projected cost estimate of $40 billion.

FAA's Acquisition Management System Is Not Structured To Manage NextGen Mid-Term Initiatives as Portfolios

FAA will need to synchronize the development and implementation of multiple NextGen initiatives. NextGen will require greater integration of functions, interfaces, and capabilities of systems that are funded through multiple accounts to achieve expected benefits. Our work and an FAA study[7] show that FAA's current AMS—which establishes policy and guidance for lifecycle acquisition management—was not designed for managing NextGen investments as portfolios. Rather, FAA's acquisition system focuses on individual programs in line with the Office of Management and Budget guidance for program-specific budgets and baselines. Focusing on individual programs rather than the portfolio creates the risk that key strategic alternatives may not be considered or funded.

The FAA study also points out that although a benefit analysis is required for each acquisition program under the AMS, this analysis does not consider benefits involving integration between multiple programs. This creates a significant concern for NextGen programs because overall benefits and capabilities are cumulative and depend on multiple programs to achieve a new capability. For example, integration of NextGen programs, such as Data Communications[8] and Automatic Dependent Surveillance-Broadcast (ADS-B),[9] depends on the timely implementation of the En Route Automation Modernization (ERAM)[10] program. ERAM is critical to both programs due to, among other things, integration requirements for data sharing. FAA recently began adjusting the AMS by

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[6] The analysis is referred to as the NextGen portfolio or "trade space" analysis. FAA is continuing to update and revise the analysis. The study sought to examine the costs, risks, and benefits of the JPDO Integrated Work Plan targeted for 2025.

[7] "Independent Assessment of FAA Acquisition Management System," April 22, 2008.

[8] Data Communications will provide comprehensive data connectivity—including ground automation message generation and receipt, message routing and transmission, and aircraft avionics requirements—and will automate repetitive tasks and supplement voice communications with less workload-intensive data communications.

[9] ADS-B is a surveillance system that uses information from satellite-based systems to identify and track aircraft positions.

[10] ERAM is a $2.1 billion automation program that will replace the current HOST computer systems in 20 of FAA's En Route Centers that control high-altitude traffic in the National Airspace System. The system processes flight radar data, provides communications and generates display data to air traffic controllers.

establishing the Acquisition Executive Board, which the Agency believes will better address portfolio decision making within the AMS. Given the complexity of NextGen and the interdependencies of efforts, FAA recognizes that additional adjustments to the AMS will be required to manage the mid-term initiatives as portfolios. FAA has begun and is planning modifications to transition AMS to portfolio management.

FAA Has Not Fully Addressed Key Safety Concerns That Impact New Systems and Procedures

Before FAA can move from the current air traffic control system to NextGen, it must address key safety concerns. First, FAA must determine whether throughput at already congested airports can be increased. This is particularly important for airports with complex runway configurations, including closely spaced parallel or converging/intersecting runways (e.g., John F. Kennedy, Las Vegas, and Newark). Updated safety assessments, some of which are decades old, are also needed to ensure unanticipated hazards are not introduced, particularly during periods of low visibility. FAA points out that safety assessments are underway.

Second, FAA must develop plans to mitigate differences with aircraft equipage. Mixed equipage presents significant safety concerns for NextGen, as controllers will be expected to concurrently manage aircraft with different capabilities and procedures. FAA has acknowledged that until clearly defined procedures and support tools are in place, safety concerns could limit the value of new equipment on aircraft in a mixed-equipage environment. FAA points out that increased reliance on automation that supports the use of new avionics could degrade controllers' skill levels, which may in turn impact safety if the new automation fails.

As we testified in July 2009,[11] a prolonged mixed-equipage environment will likely increase—not decrease—controller workload. Experts believe that between 80 and 100 percent of aircraft at any given location will need to be equipped with new NextGen systems to realize benefits and limit the potential for introducing new hazards. Assessing and addressing the impacts of mixed equipage are important for several mid-term efforts, including performance-based navigation,[12] Data Communications for controllers and pilots, and ADS-B. To help ensure mixed equipage does not introduce safety risks, FAA will need to adjust existing air traffic control systems and develop training for controllers and pilots. FAA

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[11] OIG Testimony Number CC-2009-086, "Challenges in Implementing Performance-Based Navigation in the U.S. Air Transportation System," July 29, 2009.

[12] FAA defines performance-based navigation (PBN) as a framework for defining navigation requirements that can be applied to air traffic route, instrument procedure, or defined airspace. PBN comprises both Area Navigation (RNAV) and Required Navigation Performance (RNP) and provides a basis for the design and implementation of flight paths that can enhance capacity.

may also have to segregate specific airspace for aircraft with the required avionics to take advantage of the new capabilities.

FAA Lacks an Understanding of Risks Associated with Concurrently Implementing Multiple Capabilities

FAA has yet to determine what risks are associated with implementing multiple NextGen capabilities concurrently. To do so, FAA must examine critical interdependencies between systems, procedures, and training programs needed to deliver NextGen capabilities. FAA acknowledges that implementation decisions in the past were made on individual programs and that those decisions were not necessarily optimal from an operational change perspective. Therefore, FAA has staggered the implementation of key NextGen capabilities, such as data link communications, to wait for the completion of ERAM in 2012.

Conducting the risk assessment is time-critical because FAA plans to hire and train nearly 15,000 new controllers over the next decade to replace those who are now retiring. This new controller workforce will not only have to work with existing systems and procedures but will also be required at some point to transition to new roles and responsibilities—from controlling to managing air traffic—as envisioned for NextGen. Currently, about one-third of the controller workforce is composed of controllers in training.

Since 2004, we have issued a series of reports focusing on FAA's programs for developing the next generation air traffic controller workforce. FAA is taking steps to address our concerns, such as appointing a national director for training; however, our current work shows that continued management attention is still needed. Given the current state of the controller workforce and interdependencies between systems and procedures, FAA and airspace users need to establish realistic transition benchmarks that point to when new controller and pilot training, aircraft avionics and ground systems, and procedures must be in place at specific locations.

FAA Does Not Have the Necessary Skill Sets and Expertise To Manage and Execute NextGen

According to FAA, NextGen is one of the most complex systems ever developed by the U.S. Government. In response to a recommendation we made in February 2007, FAA commissioned the National Academy of Public Administration (NAPA) to assess the skill sets needed for NextGen implementation. In its September 2008 report, NAPA identified 26 competencies where FAA lacks the skill sets to successfully transition to NextGen.[13] These

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[13] Report by a panel of the National Academy of Public Administration, "Identifying the Workforce to Respond to a National Imperative - The Next Generation Air Transportation System (NextGen)," September 2008.

include program management, software development, contract administration, and systems engineering with an understanding of human factors considerations.

FAA recently completed an initial acquisition workforce plan to address workforce recommendations in the NAPA study—an important first step. However, the plan requires more development and clarification to be useful. For example, the plan is not specific with respect to how or when FAA will actually secure the necessary skill sets and expertise. FAA has estimated that it will require approximately 350 new hires through fiscal year 2011. We have work underway to examine FAA's plans for determining its acquisition workforce needs and FAA's progress in addressing them.

FAA HAS MADE LIMITED PROGRESS IN LEVERAGING PARTNER AGENCIES' RESOURCES TO ACHIEVE NEXTGEN GOALS

With the exception of NASA, partner agencies have not adjusted their budgets and ongoing research and development programs to demonstrate a relationship to NextGen efforts. The law that created the JPDO mandated a multi-agency approach to develop and implement NextGen and tasked the JPDO with coordinating research and development efforts among Federal partner agencies. However, FAA has yet to take full advantage of partner agencies' research base— particularly DOD's—which could reduce risks and costs of NextGen development.

Most Partner Agencies Have Not Adjusted Budgets or Made Program Changes To Support NextGen

FAA and the JPDO have been working on a NextGen integrated budget document (similar to the Office of Management and Budget Exhibit 300)[14] for more than 4 years with little to show for the effort. The JPDO, however, does not have the authority to adjust or redirect the research budgets or actions of other agencies. While partner agencies are generally supportive of NextGen, most have not adjusted their research and development budgets and programs or changed requirements specifically to accommodate NextGen efforts. Without a completed integrated budget document, it will be difficult for FAA and Congress to track involvement of partner agencies in NextGen and determine if JPDO is leveraging the right research, whether funding is adequate for specific efforts, or how projects will improve the air transportation system and at what cost.

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[14] The Office of Management and Budget Exhibit 300 is designed to ensure that the business case for investments are made and tied to agency mission statements and long-term goals.

We analyzed the JPDO's most recent efforts to develop a NextGen integrated budget. While the budget identifies NextGen-specific funding from FAA, NASA, and a token amount from Commerce, it does not yet quantify investments at DOD or DHS or the value of any research or capabilities that FAA and the JPDO could ultimately leverage for NextGen (see table 2).

Table 2. Partner Agency Combined NextGen Capital and Research and Development Budgets, Fiscal Years 2008 – 2013 (Dollars in Millions)

NextGen Investments by Agency							
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**Total**
Federal Aviation Administration	$212	$688	$1059	$1131	$1301	$1566	$5957
Department of Commerce	$3	$5	$5	$5	$5	$5	$28
National Aeronautics and Space Administration	$284	$285	$284	$287	$290	$297	$1727
Department of Homeland Security	To be determined						
Department of Defense	To be determined						

Source: OIG Analysis of Exhibit 300 - Next Generation Air Transportation System, September 10, 2007, submission

The lack of progress with the integrated budget document is traceable to a number of factors, which include complexity, the lack of a common method to identify NextGen-related budget items, and FAA's focus on running and maintaining the existing system. FAA officials recently stated that this responsibility has been elevated to the Department of Transportation's NextGen Senior Advisor for action by the Office of the Secretary. The Secretary's office has involved the Senior Policy Committee to solicit the partner agencies for data and to review all data submitted.

Significant Research and Development Issues Remain Unresolved

Ensuring partner agency initiatives are aligned with the operational improvements identified in the Integrated Work Plan is key to NextGen's success. A multi-agency approach for developing NextGen is critical because FAA conducts very little developmental air traffic research and historically has relied on NASA for its long-term air traffic management research needs. NASA is the lead agency for 43 out of 203 research and development activities identified in the NextGen Integrated Work Plan.[15] Initially, NASA planned to limit its NextGen work solely

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[15] The NextGen Integrated Work Plan (IWP) is intended to be a master planning document that depicts the collaborative efforts of the stakeholders responsible for implementing the NextGen vision.

to fundamental research,[16] requiring FAA to assume a larger than expected role to complete research and development for use in NextGen initiatives. However, NASA recently revisited this policy and, according to officials, is now tailoring its efforts on a case-by-case basis and is going beyond fundamental research to development and even to the prototype stage if warranted.

Coordination between FAA and its other partner agencies, however, has been lacking in several areas. A JPDO assessment also found similar research and development gaps that could materially affect the cost and schedule for NextGen.

- **Synchronizing Weather-Related Applications.** The Department of Commerce's 4D Weather Cube is expected to provide a common picture of weather for the entire country that airspace users may view and apply directly in flight route planning and automated decision aides for traffic flow management.[17] However, according to the JPDO, FAA and Commerce disagree on how to synchronize national weather-related applications of observed, forecast, and disseminated data, which could delay the Weather Cube's planned 2013 implementation.

  We also found that Commerce's work on its 4D Weather Cube focuses exclusively on its own requirements. According to officials from Commerce's National Oceanic and Atmospheric Administration (NOAA), NextGen-specific requirements are considered to be "extras," and NOAA expects FAA to fund or reimburse its costs related to NextGen development. Recognizing the need for better communication and coordination on implementing NextGen weather systems, the JPDO Board[18] has designated the NextGen Executive Weather Panel, chaired by the FAA Senior Vice President for NextGen and Operations Planning and the NOAA Assistant Administrator for Weather Services, to act as primary policy- and decision-makers. While this is an important first step, FAA has not defined requirements for the 4D Weather Cube or established a formal agreement between the agencies on NextGen weather systems.

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[16] NASA officials define "fundamental research" as continued long-term, scientific study in areas such as physics, chemistry, materials, experimental techniques, and computational techniques that lead to a furthering of understanding of underlying principles that form the foundation of the core aeronautics disciplines as well as research that integrates the knowledge gained in these core areas to significantly enhance capabilities, tools, and technologies at the disciplinary (e.g., aerodynamics, combustion, and trajectory prediction uncertainty) and multidisciplinary (e.g., airframe design, engine design, and airspace modeling and simulation) levels.

[17] The Department of Commerce has the lead role in developing the single authoritative source of legally required weather information for National Airspace System operations. The 4D Weather Cube is to be a distributed, national database of gridded and interpolated weather observations and automated analyses, scaled consistently over time for any location above the continental United States. It is expected to provide observations with respect to latitude, longitude, altitude, and time.

[18] An adjunct to the Senior Policy Committee, the JPDO Board consists of senior representatives from participating Federal agencies.

- **Coordinating Joint Surveillance Requirements with DOD and DHS.** A key concern of DOD and DHS is the continuing need to track aircraft—a capability currently provided by FAA—to maintain security coverage for the United States, such as tracking aircraft designated as non-cooperative targets. With the implementation of ADS-B, FAA has plans to decommission an undetermined number of radar[19] that it will no longer need to conduct National Airspace System operations. If DOD or DHS determine that some of these secondary radar must remain in service to ensure security, they may need to assume maintenance and replacement costs. However, DOD and DHS have not established budgets or programs specifically identified for NextGen. Failure to coordinate and agree on surveillance requirements increases the potential for duplicative efforts or gaps in NextGen surveillance and security capabilities.

- **Researching NextGen's Human Factors Impact on Controllers and Pilots.** The NextGen concept of operations calls for significant changes to the roles of controllers and pilots. A focused "human factors" research effort on the impact of such changes, such as how highly automated systems will affect controllers, will ensure that new concepts and technologies can be safely implemented. However, FAA continues to lack a cross-agency research plan 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. FAA's inadequate attention to such research when implementing the Standard Terminal Automation Replacement System (STARS) resulted in significant cost increases and schedule slips.

- **Introducing Unmanned Aircraft Systems into the National Airspace System and NextGen.** Increased use of unmanned aircraft to perform missions not considered for manned aircraft has a number of safety implications for domestic airspace operations and NextGen. Current UAS are unable to sense and avoid traffic, creating significant risk of collisions in populated areas or busy airspace. While there are no established cross-agency requirements for UAS operations in the National Airspace System, the evolving use of this technology has become an important issue for FAA, DOD, DHS, and other agencies. Accordingly, it will be important to include UAS-related issues as part of NextGen development. FAA currently authorizes Government UAS operations on a limited basis after conducting a case-by-case safety review. However, the JPDO's annual cross-agency gap analyses have repeatedly stated the need for agencies to work toward developing UAS requirements, standards, procedures, and avionics. NASA has included an additional $30 million a year in its fiscal 2011 budget request to develop

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[19] We are referring to secondary radar that operate on the coded reply sent from the airborne radio beacon transponder to an aircraft in response to an interrogation sent from the ground station.

technologies that will allow unmanned aircraft routine access to the National Airspace System. This effort will focus initially on Government-owned and -operated UAS aircraft, followed by private-sector UAS.

Missed Opportunities Could Further Impact the Multi-Agency Approach for NextGen

FAA is missing several opportunities to coordinate with partner agencies and strengthen its ability to reduce NextGen cost and schedule risks. Of key concern is FAA's failure to coordinate with DOD to fully leverage its vast research and development base. Not only is a multi-agency approach for NextGen required by law, better coordination with DOD and other partner agencies could also facilitate technology transfer and capability verification and validation.

DOD is the lead agency in developing NextGen's network-centric operations[20] and is working with FAA and the JPDO on surveillance issues. DOD also contributes to NextGen as a member on various committees, boards, and working groups. However, neither FAA nor the JPDO have fully assessed DOD's vast research and development portfolio and existing capabilities to determine their applicability to NextGen. DOD's experience with enterprise architecture development, large-scale systems integration, net centric operations, and overall management of high-risk efforts could prove useful. For example, leveraging DOD's work on a satellite-based Joint Precision Landing System (JPALS)[21] could inform FAA's development of capabilities to meet NextGen requirements and potentially reduce costs. Other DOD research and development areas that could help FAA improve NextGen outcomes include surveillance and security of aircraft, communications, and navigation. While DOD officials have stated that the Department is willing to provide access to its existing capabilities and ongoing research and development, FAA has yet to conduct a meaningful inventory of DOD's research base. According to FAA officials, the Agency's failure to leverage these resources is due in part to a culture that is reluctant to embrace technologies not developed in-house.

Ensuring adequate mechanisms and funding to facilitate the transfer of technologies among NextGen partners may also be inadequate, according to an FAA/JPDO assessment. FAA has established research transition teams to address technology transfer issues with NASA and review plans for NextGen. Thus far these teams have reviewed plans and, on a limited basis, begun transferring technology between the two agencies. For example, NASA's research into improved arrival routes and an initial set of software algorithms for enhancing the

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[20] DOD's Network-Centric Operations is a robust network of information for geographically dispersed forces.

[21] The Joint Precision Approach and Landing System (JPALS) is a precision satellite-based landing system that will allow aircraft to land on any suitable land or sea-based surface worldwide, while minimizing the impact to airfield operations because of a low ceiling or poor visibility.

flow of air traffic is being transitioned to FAA for further testing. However, FAA has not formed similar teams or methods for other agencies, such as the Department of Commerce and DOD to accomplish technology transfer. We have found that "entrance and exit" criteria, with clearly defined hand-off points for research projects being developed by other agencies, will aid in determining what it will take to transition new concepts and technologies into daily operations. Additionally, JPDO officials have stated that while research transition teams make sense for the FAA/NASA relationship, this approach may not be ideal for transitioning research and development and technology from other partner agencies. We agree, but FAA must develop appropriate approaches to effectively obtain technologies or research from other partner agencies to support NextGen.

Finally, FAA has not coordinated with partner agencies to develop a framework for verifying and validating NextGen capabilities. Because concept and system validation could take more than 3 years after development is completed and before the acquisition cycle begins, coordination is needed to better ensure systems can fulfill their intended use in the National Airspace System. An FAA task force has developed some initial guidelines that will require agreement among JPDO partner agencies.

FAA FACES CHALLENGES IN ENGAGING THE PRIVATE SECTOR TO DEVELOP NEXTGEN AND RELATED POLICIES

FAA and industry have faced long-standing challenges in coordinating their NextGen efforts. FAA and the JPDO have worked to involve industry participants and representatives in key planning efforts, including the NextGen Institute, to gain access to private sector expertise. However, the Institute has not lived up to original expectations due to a lack of clear focus and priorities. While the large number of industry stakeholders and evolution of NextGen have made it difficult to reach consensus in NextGen planning and demonstration, successful implementation of NextGen depends on stakeholders' involvement in the development of NextGen policies, procedures, and decisions.

FAA Has Not Clearly Defined the Role of the NextGen Institute

In March 2005, FAA established the NextGen Institute to provide the JPDO with access to private sector expertise, tools, and facilities in developing NextGen. The Institute was also expected to be used as a contracting mechanism to accelerate the development of NextGen technologies outside of the traditional Government acquisition process. However, FAA has failed to clearly articulate the Institute's responsibilities, creating the potential for duplicative efforts between the Institute

and other private sector organizations, such as RTCA[22] and the MITRE Corporation.[23] FAA's reorganization of the JPDO, which placed it within FAA's Air Traffic Organization, has complicated FAA's attempts to better define the Institute's role. To date, FAA has not reassessed the Institute's role to, at a minimum, determine whether it is still needed or what role it should play in light of other private sector organizations' contributions.

FAA Is Engaging the Private Sector Through RTCA, but Significant Policy Issues Remain Unresolved

In an effort to gain stakeholder acceptance and solidify commitments from both Government and industry, FAA asked RTCA to undertake a new task force, the NextGen Mid-Term Implementation Task Force. The group was tasked with forging a consensus on the NextGen operational improvements planned for the 2012 to 2018 timeframe and to develop business cases to support and implement mid-term capabilities. RTCA delivered its final report to FAA on September 9, 2009.[24]

In addition to making 28 specific recommendations, the Task Force report noted the following key messages regarding its view of NextGen:

- Users are willing to support FAA Communication Navigation Surveillance infrastructure programs that require user investment only if those programs provide a clear and unambiguous path to immediate and tangible benefits to the users.

- FAA should primarily focus on delivering near-term operational benefits, rather than the delivery of infrastructure, as the best way for stakeholders to gain confidence in FAA plans and to encourage users to invest in NextGen equipage. Industry and FAA must agree on common metrics to measure achievement of benefits.

- FAA should be delivering benefits and assign responsibility, accountability, authority, and funding within the Agency to accomplish all the associated and necessary non-infrastructure tasks (i.e., development of procedures and policy) critical to achieving those benefits.

- FAA must continue to support the efforts of the Task Force and keep stakeholders as active participants in the planning, implementation, and measurement of the report recommendations.

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[22] The RTCA is a private, not-for-profit corporation that develops consensus-based recommendations regarding communications, navigation, surveillance, and air traffic management system issues.

[23] MITRE Corporation functions as FAA's federally funded research and development center.

[24] RTCA – "NextGen Mid-Term Implementation Task Force Report," September 9, 2009.

The task force findings and recommendations are consistent with our work and identify several new areas that will require FAA's attention, including adjustments to current Agency plans and budgets. Airspace users generally view the task force recommendations as a stepping stone for NextGen that will help FAA reduce risk and build confidence with stakeholders. FAA supports the task force recommendations and is developing an implementation plan.

NextGen Demonstration Projects Offer Potential To Reduce Risk, but Lack Coordination and Are Not Outcome-Based

The private sector is participating with FAA in several NextGen demonstration projects to validate NextGen concepts from research and development to implementation. While our work found that these projects have merit and can help reduce risk with NextGen, stakeholders have concerns that the demonstrations are not coordinated or outcome-focused, may not provide a clear path to implementation or fail to leave new capabilities behind.

For fiscal years 2008 through 2010, Congress provided a total of $112 million to fund demonstration projects. FAA is pursuing more than 10 demonstrations, excluding projects within other major efforts like ADS-B. These demonstrations are managed by FAA's Office for Research and Technology Development. FAA demonstrations include developing improvements for surface management through leveraging existing systems like FAA's Airport Surface Detection Equipment – Model X (ASDE-X). This demonstration relies on a system that was originally envisioned to help prevent accidents on runways. FAA is now relying on ASDE-X to help boost airport capacity by improving surface situational awareness and better managing the movement of aircraft on the ground. Some airlines are participating with FAA at John F. Kennedy International Airport and Memphis International Airport on this effort. However, while this project offers potential to improve surface operations, the key is ensuring research translates into meaningful information that can be shared with stakeholders and used to improve efficiency and reduce delays.

As we recommended in February 2007, with respect to NextGen demonstration projects, FAA needs to develop sufficient data to establish a path for certifying new systems and identify the full range of adjustments to policies and procedures to get benefits for airspace users. As FAA works to develop these data, it must also clearly define the expected outcomes from the demonstration projects for industry participants. Our analysis and discussions with FAA officials found that the Agency could gain valuable knowledge and concept validation from the demonstrations, but it remains unclear how these identified benefits will be transitioned from research and development to an operational capability that airspace users can benefit from at specific locations.

CONCLUSION

NextGen is the most complex effort FAA has embarked upon, and its success is vital to revolutionizing our aviation system. While FAA is making progress in addressing NextGen's challenges, a number of critical actions are still needed for successful implementation. Among them, and perhaps most important in the near term, is setting realistic expectations for what can be achieved in the midterm and assessing the associated risks. In addition, maximizing a multi-agency approach that leverages other agencies' research and aligns resources will pay dividends and help reduce costs. Until then, NextGen may not deliver the expected long-term benefits and ultimately puts billions of taxpayer dollars at risk.

RECOMMENDATIONS

We have made a number of recommendations over the years to reduce risk with FAA's major acquisitions in the areas of defining requirements, managing NextGen investments as portfolios, and determining the skill sets required to execute NextGen. We strongly encourage FAA to follow through on actions underway to address those recommendations. In this report, to further reduce risk, strengthen the multi-agency approach to systems development, and enhance collaboration with the private sector in policy matters, we recommend that FAA take the following actions to advance NextGen.

1. Conduct an assessment of risks associated with implementing multiple NextGen capabilities concurrently in the midterm and what can reasonably be accomplished. This assessment and risk mitigation plan should:

   a. Document interdependencies between systems, procedures, and training and include strategies to address them.

   b. Identify critical path issues or decisions in terms of airspace changes and changes in roles and responsibilities for controllers and pilots that directly affect achieving NextGen benefits.

   c. Set realistic benchmarks that establish when training for controllers and pilots on new aircraft avionics, ground systems, and procedures will be required and where they need to be provided.

2. Assess safety and implementation risks of mixed-equipage operations and develop corresponding mitigation strategies and policies.

3. Develop a plan to effectively review and identify research and technologies from DOD's research and development portfolio that can be used for NextGen efforts and establish a mechanism to coordinate and transfer this

information to the appropriate FAA program or development offices for consideration.

4. Expand the NextGen Research Transition Team concept that has been developed for NASA and FAA into mechanisms that perform the same function with other partner agencies.

5. Reassess the current role and continued need for the NextGen Institute. If it is determined as a needed resource, redefine the roles and responsibilities of the Institute to avoid duplication with other private sector organizations, such as RTCA.

AGENCY COMMENTS AND OFFICE OF INSPECTOR GENERAL RESPONSE

We discussed the results of our review with the Air Traffic Organization's Senior Vice President for NextGen and Operations Planning and the Director of the JPDO, and they agreed with our findings and recommendations. We provided FAA with our draft report on April 14, 2010, and received its formal response on May 26, 2010. FAA concurred with all five of our recommendations and proposed appropriate action plans but did not provide target completion dates for recommendations 1 and 4. FAA's response is included in its entirety as an appendix to this report.

With regard to recommendation 1, FAA stated that a number of actions are underway. These include developing and refining NextGen segment implementation plans in response to the recent RTCA Task Force report on NextGen operational improvements for the near and midterm. These plans will address interdependencies among programs, critical path issues, and transition segment benchmarks. FAA also stated that it is developing an enhanced cross-agency approach with a strong emphasis on systems engineering for allocating NextGen capabilities to various systems. We believe this approach—if properly implemented—has merit because it will help align NextGen plans, architecture development efforts, and various program offices that will be responsible for establishing new NextGen capabilities. However, to measure progress with these actions, FAA needs to provide our office with target action dates for finalizing and implementing this new approach and clarify which NextGen planning documents will identify critical path issues and transition benchmarks.

In response to recommendation 4, FAA states that the JPDO is applying the concept of research transition teams to other partner agencies beyond NASA, including the Department of Commerce for weather-related initiatives. Further, FAA stated that the JPDO will annually assess where research transition teams or

other mechanisms can be used. FAA believes this recommendation should be closed. While we agree that positive steps are being taken, FAA needs to provide specific dates for when it expects to establish mechanisms to successfully transition technologies from partner agencies. This is particularly important since FAA has not yet done a full inventory of DOD's vast research and development base. As noted in our report, technology transfer is critical to NextGen for reducing costs, limiting risk, and preventing duplicative efforts.

ACTIONS REQUIRED

FAA's planned actions for all five recommendations are responsive, and its target action dates for recommendations 2, 3, and 5 are appropriate. However, in accordance with DOT Order 8000.1C, we request that FAA provide our office, within 30 days of this report, with target action dates for recommendations 1 and 4. All five recommendations will remain open pending receipt of documentary evidence that appropriate corrective actions are complete.

We appreciate the courtesies and cooperation of FAA representatives during this audit. If you have any questions regarding this report, please contact me at (202) 366-1427, or Matthew E. Hampton, Deputy Assistant Inspector General for Aviation and Special Program Audits, at (202) 366-0500.

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cc: FAA Assistant Administrator for Financial Services/CFO
  FAA Deputy Administrator
  FAA Chief of Staff
  Anthony Williams, ABU-100
  Martin Gertel, M-100

EXHIBIT A. NEXTGEN PRIOR AUDIT RECOMMENDATION STATUS

JPDO: Actions Needed To Reduce Risks with the Next Generation Air Transportation System – February 12, 2007 Report Recommendations	Status
1. Report NextGen cost data along three vectors developmental efforts, adjustments to existing programs, and NextGen implementation—when reporting NextGen financial requirements to Congress and stakeholders. AV-2007-31	Costs to develop and implement NextGen remain uncertain. A recent analysis suggests that the cost of NextGen could be several times the projected estimate of $40 billion and some advanced capabilities would not be implemented until the 2035 timeframe. An integrated NextGen budget document that captures NextGen expenditures across all partner agencies is still under development. FAA has referred this action to the DOT NextGen Senior Advisor to the Secretary in coordination with the JPDO for development of the integrated budget with the partner agencies.
2. Determine the level of technical maturity of NASA's research projects developed for NextGen initiatives. If NASA will be unable to provide research projects at a level that FAA can quickly move to prototype development, then FAA will need to develop contingency plans for how this research and development will be conducted, managed, and paid for. AV-2007-31	FAA has worked with NASA and established Research Transition Teams to address the successful transfer of research and development work from NASA to FAA. NASA has changed its position of doing only fundamental research since our February 2007 report and has stated it will deliver projects at a more mature level on a case-by-case basis. While progress in developing the teams has advanced, the teams have yet to actually transfer research between the two agencies for further development or use in a major acquisition.
3. Review existing ongoing modernization programs to determine if they are still needed and, if so, what adjustments in cost, schedule, and performance parameters will be needed. AV-2007-31	FAA is still assessing NextGen impact on existing programs and efforts to identify initial requirements for future automation systems is still 1 to 2 years away. Further, FAA pointed out that after requirements are established, it will take at least an additional year to establish cost and schedule baselines before approval for acquisition of these new programs could begin.
4. Include information in the annual JPDO progress report on specific research projects with budget data for FAA developmental efforts as well as budget data of other agencies that are being leveraged and specify how the ongoing research is supporting the JPDO. AV-2007-31	FAA has not published a congressionally directed document since the FY 2006 Progress Report. The NextGen Integration and Implementation Office is currently producing an annual NextGen Integration Plan (formerly known as the Operational Evolution Plan), which the Agency maintains is a substitute for the progress report. FAA does not publish detailed budget data on partner agency contributions to NextGen.
5. Determine what skill sets and expertise, with respect to software development and system integration, will be required by the ATO and JPDO and how they will be obtained to manage and execute NextGen initiatives. AV-2007-31	FAA commissioned the National Academy of Public Administration (NAPA) to conduct a study to determine what skills would be required to implement NextGen. NAPA issued its final report in September 2008. The report identified the skills needed to design, develop, test/evaluate, integrate and implement NextGen programs. Some of these include, program/project management, systems engineering management, integration and verification, and contract administration.

Exhibit A. NextGen Prior Audit Recommendation Status

JPDO: Actions Needed To Reduce Risks with the Next Generation Air Transportation System – February 12, 2007 Report Recommendations	Status
6. In planned NextGen demonstration projects, develop sufficient data to establish a path for certifying new systems and identify the full range of adjustments to policies and procedures needed to get benefits. AV-2007-31	FAA received $28 million in FY 2009 and $34 million for FY 2010 specifically for NextGen demonstration projects. However, stakeholders are concerned that the demonstrations are not coordinated or outcome-focused, may not provide a clear path to implementation, and do not leave capabilities behind. FAA needs to clearly define the expected outcomes from the demonstration projects and develop data to establish a path for certification of new systems.
7. Continue to develop and refine procedures that address conflict of interest issues with JPDO initiatives and conduct annual reviews of the matter as the role of the JPDO evolves from planning to implementation. AV-2007-031	FAA and the JPDO continue to assess conflict of interest issues. FAA is providing annual refresher training to private sector participants. The placement of the JPDO within the ATO underscores the need to assess conflict of interest issues.
8. Use technology readiness levels in assessing the maturity of research conducted at other agencies to help speed technology transfer and the introduction of new capabilities into the National Airspace System. AV-2007-031	In addition to the RTT work described in recommendation 2 above, the JPDO expected to complete work with NASA and the Department of Commerce to define "exit criteria" for all supporting research activities by September 2009, to ensure appropriate level of maturity of research for transition from research to possible application development. In FY 2010, FAA will work on ensuring that "receiving criteria" (org. receiving completed research) is matched to research agency "exit criteria."
9. Fund targeted human factors research to ensure that the changing roles of controllers and pilots envisioned by the JPDO can safely be accommodated. This will require a re-prioritization of ongoing efforts at FAA and close cooperation with NASA, which also conducts human factors research. AV-2007-031	This was identified as a gap in 2008. FAA and NASA continue to pursue the work. However, efforts still need to be prioritized and aligned across partner agencies. Important questions about the role of automation for controllers and pilots remain unresolved. FAA cannot advance NextGen without an effective human factors effort.

Exhibit A. NextGen Prior Audit Recommendation Status

Traffic Control Modernization: FAA Faces Challenges in Managing Ongoing Projects, Sustaining Existing Facilities, and Introducing New Capabilities – April 14, 2008 Report Recommendations	Status
1. Develop written criteria for the selection of milestone metrics that are used for tracking progress with major acquisitions and reported in Agency plans and reports. AV-2008-049	FAA has developed standard operating procedures and documented the process and criteria for selecting programs for inclusion in the Flight Plan.
2. Develop and report on a new set of metrics for measuring progress with NextGen initiatives that focus on the delivery of a new capability with respect to enhancing capacity, boosting productivity, or reducing Agency operating costs. AV-2008-049	FAA has recognized the need for improved measures, but this remains a work in progress. FAA and the JPDO are working to develop a suite of performance measures for the safety, capacity, and productivity impacts of NextGen. FAA anticipates that the full suite of measures will be complete later in 2010.
3. Complete a gap analysis of the NAS enterprise architecture that closely examines current systems (the "as is") and the planned NextGen enterprise architecture (the "to be") and develop and establish priorities. AV-2008-049	FAA efforts to complete a gap analysis are underway. According to FAA, it may be another 2 years to establish firm requirements for NextGen automation efforts. FAA's analysis thus far shows that there are major gaps with respect for automation. We will continue to monitor FAA progress on the gap analysis and the development of the mid-term architecture.
4. Once the gap analysis is completed, develop an interim architecture that details what can be accomplished in the 2012 timeframe that will allow FAA to more accurately determine costs and other factors required for NextGen. AV-2008-049	FAA has developed a mid-term Enterprise Architecture for the 2018 timeframe, but cost and schedule for key efforts remain uncertain.
5. Use the interim architecture as the basis for an integrated program plan that establishes an executable program for the NextGen capabilities. This effort should include detailed cost, schedule, requirements, acquisition strategies, risk management, and the supporting organizational structures to execute the integrated program. AV-2008-049	FAA's mid-term Enterprise Architecture is being used to shape the Agency NextGen Implementation Plan. Plans thus far do not provide detail for cost, schedule, requirements, acquisition strategies, risk management, and the supporting organizational structures to execute the integrated program.

Exhibit A. NextGen Prior Audit Recommendation Status

EXHIBIT B. SCOPE AND METHODOLOGY

At the request of the Chairmen and Ranking Members of the House Transportation and Infrastructure Committee and the House Aviation Subcommittee, we initiated a review on FAA's progress in transitioning to NextGen. Specifically, we focused on (1) key actions needed to successfully implement NextGen, (2) FAA and partner agencies' progress in leveraging resources and budgets, and (3) FAA's progress in engaging the private sector in shaping policy issues. We were also asked to report on FAA's progress in implementing our past NextGen-related recommendations.

To review key actions needed to successfully implement NextGen, we reviewed documents related to NextGen implementation, such as the National Airspace System Enterprise Architecture, the NextGen Implementation Plan, and the NextGen Integrated Work Plan. We also reviewed pertinent NextGen legislation such as FAA Reauthorization Act of FY 2004 (Vision 100) and current proposed reauthorization legislation. We reviewed independent studies on NextGen issues commissioned by FAA from the National Academy of Public Administration and Price Waterhouse/Coopers. We also interviewed officials from FAA Air Traffic Organization (ATO)'s NextGen and Operations Planning service unit responsible for NextGen implementation. The service unit offices include the JPDO, the NextGen Integration and Implementation Office, and the Research and Technology Development Office.

To determine FAA and partner agencies' progress in leveraging resources and budgets, we reviewed FAA budget documentation pertaining to NextGen, such as recent budget submissions, capital investment plans, and research and development plans. We also interviewed ATO Finance officials to gain insight on FAA budget formulation and NextGen partner agencies to gain insights into their NextGen research and capital activities. The partner agencies were the National Aeronautics and Space Administration, the Department of Commerce's National Oceanic and Atmospheric Administration, the Department of Homeland Security, and the Department of Defense.

To determine FAA's efforts to engage the private sector in shaping NextGen policy issues, we interviewed a cross-section of key organizations based on their participation in JPDO NextGen working groups. These organizations included airline industry associations, aircraft manufacturers associations, and aircraft trade unions. We also interviewed officials from the JPDO's NextGen Institute and coordinated with major FAA advisory bodies such as RTCA Inc, and the ADS-B Aviation Rulemaking Committee.

To assess FAA's progress towards our earlier recommendations on NextGen implementation, we conducted interviews with JPDO officials to obtain status information on their progress in addressing nine recommendations from a DOT OIG report on the JPDO issued on February 2007 and similar recommendations from a DOT OIG report on air traffic control modernization issued April 2008.

We conducted this performance audit from May 2008 through March 2010. We performed our work in accordance with Government Auditing Standards as prescribed by the Comptroller General of the United States and included such tests as we considered necessary to provide reasonable assurance of detecting abuse or illegal acts.

Exhibit B. Scope and Methodology

EXHIBIT C. ACTIVITIES VISITED OR CONTACTED

DOT/OST

NextGen Senior DOT Advisor to the Secretary

FAA

Air Traffic Organization Offices
Chief Operating Officer
Data Communications
En Route Automation Modernization Program Office
FAA Chief Architect
Investment and Planning Analysis
NAS Chief Scientist
NextGen Integration and Implementation Office
NextGen Research &
  Development/Demonstrations
NextGen Portfolio Management
Senior Vice President, NextGen
  Operations and Planning
Terminal Automation Modernization and
  Replacement
Wide Area Augmentation System

Joint Planning and Development Offices
Director, JPDO
JPDO Chief Architect
Modeling and Analysis Team
NextGen Institute
Research Transition Teams

Other FAA/Unions
National Air Traffic Controllers Association
Professional Airways System Specialists

FAA Contractors/JPDO Partners
CAASD/MITRE
Department of Homeland Security

Exhibit C. Activities Visited or Contacted

Department of Defense
National Aeronautics and Space Administration
National Oceanographic and Atmospheric
   Administration
National Weather Service
RTCA

Industry Groups

Industry Associations
Aerospace Industries Association
Aircraft Owners and Pilots Association
Air Line Pilots Association
Air Transport Association
Aviation Electronics Association
Aviation Management Associates
Helicopter Association International

Companies
Garmin
Lockheed Martin
Raytheon

Other Stakeholders
Colorado Division of Aeronautics
Office of Management and Budget

Exhibit C. Activities Visited or Contacted

EXHIBIT D. MAJOR CONTRIBUTORS TO THIS REPORT

Name	Title
Matthew E. Hampton	Deputy Assistant Inspector General for Aviation and Special Program Audits
Barry DeWeese	Program Director
Kevin Dorsey	Program Director
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Ryan Sanders	Analyst
Arthur Shantz	Technical Advisor for Aviation Research and Acquisitions
Andrea Nossaman	Writer/Editor

APPENDIX. AGENCY COMMENTS

Federal Aviation Administration

Memorandum

Date: May 26, 2010

To: Lou Dixon, Assistant Inspector General for Aviation and Special Program
                Audits

From: Ramesh K. Punwani, Assistant Administrator for Financial Services/CFO

Prepared by   Anthony Williams, x79000

Subject: OIG Draft Report: Timely Actions Needed To Advance the Next Generation
                Air Transportation System

NextGen is a comprehensive overhaul of our national airspace system to make air travel more convenient and dependable, while ensuring flights are safe and secure. It will make air travel more predictable, with fewer delays, less time waiting on the ground and holding in the air, as well as provide more flexibility to get around weather problems.

FAA recognizes the complexities of NextGen design and implementation, and from the very beginning has been working to identify system risks and to develop strategic plans to address those risks. The FAA released the annual update to its NextGen Implementation Plan in March 2010. The plan provides an overview of the FAA's ongoing transition to NextGen, laying out the agency's vision now and into the mid-term, which is defined as 2012-2018. It further identifies the FAA's goals for technology and program deployment and the commitments FAA has made in support of that vision.

The FAA remains confident it will achieve the vision set out in the NextGen plan, and is prepared to face the challenges that will come with making NextGen a reality. Undertaking NextGen is extremely complex, in part because systems in various stages of development and maturity are interdependent and will be implemented in a variety of time frames. NextGen's increasing dependence on aircraft-centric capabilities means that we must rely on operators' willingness to equip. We believe there is a solid business case for air carriers to equip their aircraft but we continue to investigate possible ways to incentivize equipage. The true benefits of NextGen will not be realized until a sufficient percentage of aircraft have the necessary equipment.

The following is FAA's response to each of the recommendations.

OIG Recommendation 1: Conduct an assessment of the risks associated with implementing multiple NextGen capabilities concurrently in the mid-term and what can reasonably be accomplished. This assessment and risk mitigation plan should:

a. Document interdependencies between systems, procedures, and training and include strategies to address them.

FAA response: Concur. In response to the complexity of the NextGen implementation, the FAA improved its ability to analyze and manage interdependencies from a strategic, enterprise level to the programmatic level. The mid-term enterprise architecture contains the interdependences between systems, procedures, training and pacing issues that are used to develop the NextGen and individual program plans. The FAA continues to refine detailed programmatic plans. The planning for the midterm is divided into sequential segments for implementation. These mid-term implementation plans address the recommendations from RTCA NextGen Implementation Task Force. These plans include the associated costs and benefits. The plans also document the policy, training, and procedural implications as they are known at the time.

In addition, the FAA has identified the need to put additional system engineering focus on the inter-program, inter-domain issues. The FAA is developing an enhanced cross-FAA approach to refining the identification, analysis, and recommended resolution of the allocation of NextGen capabilities to systems. This updated approach will support the NextGen Integration and Implementation Office, the Enterprise Architecture, and the program offices in the planning and the execution of the cross-system or cross-domain engineering.

The FAA has developed the detailed programmatic planning for the initial segment and will continue to refine it as we move forward. This initial segment will address programmatic, training, and procedural dependencies as they are now. The programmatic, training and procedural development will be refined as individual programs complete investment analysis and enter solution implementation. The development of the second sequential segment is underway.

b. Identify critical path issues or decisions in terms of airspace changes and changes in roles and responsibilities for controllers and pilots that directly affect achieving NextGen benefits.

FAA response: Concur. While there are no foreseen changes in roles and responsibilities for controllers and pilots such as self-separation airspace or fully automated air traffic control now through the mid-term, there are major changes to the methods and support mechanisms by which pilots and controllers will operate. These changes include the use of data communications for trajectory operations, the increased use of the flight management system (FMS) and flight deck systems in executing merging and spacing, the delivery of conflict resolution advisories to the controller by the automation, and the use of 3D RNAV/RNP. As part of the NextGen portfolio, there are ongoing activities in the NextGen R&D and the NextGen Pre-Implementation Solution Set Activities to address for example the human factors, display, certification, and training issues related to these new methods and tools. The NAS Enterprise Architecture "green lanes"- the support and mission activity portions of the roadmaps- are used to link these activities to NAS investment decisions and the integration tables of the architecture are used to identify key linkages and requirements.

These critical path items and decisions are being further refined in the more detailed NextGen segment implementation plans discussed above.

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c. Set realistic benchmarks that establish when training for controllers and pilots on new aircraft avionics and ground systems, and procedures will be required and where they need to be provided.

FAA Response: Concur. The NextGen operational requirements describing NextGen capabilities in the mid-term are documented in the NextGen segment implementation plans. The plans incorporate timelines for systems acquisition and implementation, procedure and airspace development, certification and training. Also, recently a representative from the National Air Traffic Controllers Association was added to the NextGen Integration & Implementation Office to provide technical expertise and assist in identifying areas where increased controller involvement is warranted.

Schedule information for benchmarks and training are documented as part of the NextGen segment implementation plans. The plan for the first five years has been developed and will continue to be refined. Benchmarks, procedures and training locations are part of the acquisition process and will be addressed by each program.

OIG Recommendation 2: Assess safety and implementation risk of mixed-equipage operations and develop corresponding mitigation strategies and policies.

FAA Response: Concur**.** The FAA operates under a Safety Management System (SMS) which requires the assessment of all changes before they become operational. The Associate Administrator for Aviation Safety and the Chief Operating Officer chair an SMS implementation Steering Committee to ensure the proper application of the SMS process.

FAA is further supplementing this process with regard to NextGen implementation with an integrated safety assessment process to further mitigate potential implementation risks. A cross-agency team, led by an individual assigned to the NextGen Integration and Implementation Office, is responsible for coordinating a consistent approach, as well as the timely integration and execution of safety assessments.

The FAA will develop a mixed performance/equipage strategy to define aircraft performance requirements, parameters, risks and sensitivities that need to be addressed when controllers and pilots are asked to perform in a mixed performance/equipage environment. The document will be available by January 2011.

OIG Recommendation 3: Develop a plan to effectively review and identify research and technologies from DOD's research and development portfolio that can be used for NextGen efforts and establish a mechanism to coordinate and transfer this information to the appropriate FAA program or development offices for consideration.

FAA Response: Concur. The Joint Planning and Development Office (JPDO) has existing mechanisms in place to facilitate the exchange of research related information relating to NextGen through the Air Force Lead Service Organization (LSO), which is responsible for Department of Defense (DoD) NextGen activities. As such, the Air Force LSO has the responsibility for interactions between DoD and NextGen, including those with regard to technology transfer. The DoD also has designated a Chief Architect who participates in JPDO Interagency Architecture Engineering and Net-Centric Operations planning. These contacts are intended in part, to enable NextGen to benefit from research activities at DoD.

Appendix. Agency Comments

The JPDO, together with the FAA and the Air Force LSO, will enhance its efforts to ensure that NextGen benefits from related research at DoD. Specifically, JPDO will outline its plan by September 2010 to collaborate with DoD to capitalize on its research portfolio and determine which technologies may be relevant to NextGen. This plan will include a process to identify key DoD research, development and acquisition activities such as capabilities for tracking of non-cooperative aircraft and information data sharing.

OIG Recommendation 4: Expand the NextGen Research Transition Team concept that has been developed for NASA and FAA into mechanisms that perform the same function with other partner agencies.

FAA Response: Concur. The JPDO is already applying the Research Transition Team (RTT) concept to other partner agencies in an effort to expedite the implementation of Next Gen. The current NASA research program responds to the NextGen Concept of Operations and the research needs identified by the JPDO. Four NASA RTT's were established to facilitate the transition of NASA research to the FAA in a way that would expedite NextGen implementation. The RTT documents the FAA's plan for integrating the research results to be delivered into its NextGen implementation program. This documentation includes identifying any additional research or pre-operational work that is envisioned beyond the NASA research, so that the FAA can plan and budget for it in a timely manner.

The JPDO is expanding the use of this concept now, working with the Department of Commerce through the National Oceanic and Atmospheric Administration, FAA and DoD on developing a vision for aviation weather management that is focused on the aviation user. The JPDO facilitates the NextGen Executive Weather Panel, which oversaw the development of a joint program plan. FAA and NOAA will work out the specific technical requirements and handoff under this joint plan. The JPDO will annually assess where RTT's or other types of transition mechanisms can be utilized to transition research. While these actions will be conducted on a continuous basis, we maintain that actions to date demonstrate FAA's commitment to this process, and believe this recommendation can be closed.

OIG Recommendation 5: Reassess the current role and continued need for the NextGen Institute. If it is determined as a needed resource, redefine the roles and responsibilities of the Institute to avoid duplication with other private sector organizations, such as RTCA.

FAA Response: Concur. The NextGen Institute was developed to provide a streamlined mechanism for private sector collaboration with the JPDO in NextGen planning. The primary mechanism for collaboration is through pro-bono participation of subject matter experts in domain specific working groups (for example - safety, security, aircraft, airports, etc.). This mechanism provided substantial and unique value in the development of the NextGen Concept of Operations and the integrated plan. While private sector engagement is a key element in the development of NextGen, the FAA is in full agreement with the need to revisit the roles and responsibilities of the NextGen Institute.

NextGen is entering the program implementation phase. Therefore, our model for private sector collaboration will also change. Subject matter experts will now be needed in cross-functional studies, which blend expertise from airports, aircraft and operations, in order to identify the full range of possibilities within NextGen concepts or policies. The JPDO has briefed this transition to

Appendix. Agency Comments

the Institute Management Council that oversees the NextGen Institute and plans to work with the Council to evaluate the best approach to private sector collaboration on interagency research, concept and policy development. The JPDO is also working with the FAA to fully assess a range of stakeholder engagement forums, including the RTCA, to ensure that appropriate means of engagement are available for both near- and long-term NextGen activities. The JPDO assessment will be conducted this summer so that changes can be implemented in fiscal year 2011.

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We appreciate this opportunity to review and comment on the OIG draft report. Separately, we provided the OIG with specific and technical comments on the draft report.

Appendix. Agency Comments