
Office of Inspector General

Audit Report

FAA LACKS A CLEAR PROCESS FOR IDENTIFYING AND COORDINATING NEXTGEN LONG-TERM RESEARCH AND DEVELOPMENT

Federal Aviation Administration

Report Number: AV-2016-094

Date Issued: August 25, 2016





Memorandum

U.S. Department of
Transportation

Office of the Secretary
of Transportation
Office of Inspector General

Subject: **ACTION:** FAA Lacks a Clear Process for
Identifying and Coordinating NextGen Long-Term
Research and Development
Federal Aviation Administration
Report No. AV-2016-094

Date: August 25, 2016

From: Matthew E. Hampton
Assistant Inspector General
for Aviation Audits

Reply to
Attn. of: JA-10

To: Federal Aviation Administrator

The Federal Aviation Administration's (FAA) Next Generation Air Transportation System (NextGen) is critical to modernizing the National Airspace System (NAS) and meeting the anticipated future demand for air travel. In 2003, Congress mandated that FAA establish the Joint Planning and Development Office (JPDO) to develop a plan for implementing NextGen by 2025 and coordinate research efforts with other Federal agencies. FAA's partner agencies for NextGen are the National Aeronautics and Space Administration (NASA), Department of Defense (DOD), Department of Homeland Security (DHS), and the Department of Commerce/National Weather Service (DOC/NWS).

In 2014, Congress, concerned that FAA had failed to establish a clearly defined role for JPDO or set expectations for leveraging research at other Federal agencies,¹ eliminated funding for JPDO,² stating that funds would be provided in FAA's operations account to absorb JPDO personnel and activities. Subsequently, FAA dissolved JPDO. In light of these changes, the Chairman and Ranking Member of the House Committee on Science, Space, and Technology, Subcommittee on Space, requested that we review how FAA will continue to conduct NextGen long-term planning.

Specifically, the leadership of the Subcommittee raised questions about FAA's ability to link its long-term vision with near- and midterm efforts, and the

¹ House Appropriations Committee Report 113-136. July 2, 2013.

² Consolidated Appropriations Act for 2014, Public Law 113-76.

Agency's efforts to identify high-priority research and development (R&D) to advance NextGen. They were also concerned about the level of FAA's coordination with partner agencies on leveraging key R&D since the dissolution of JPDO. Accordingly, our audit objectives were to determine (1) how FAA has reallocated JPDO's responsibilities for identifying high-priority R&D, and (2) whether FAA has developed an effective structure to coordinate high-priority R&D with other Federal agencies.

We conducted this audit in accordance with generally accepted Government auditing standards. Exhibit A details our Scope and Methodology, and exhibit B lists the organizations we visited or contacted.

RESULTS IN BRIEF

FAA reallocated JPDO's statutory responsibilities to its NextGen Office but lacks a clear process for identifying high-priority R&D to support NextGen, which was one of JPDO's key roles. In May 2014, FAA established an Interagency Planning Office (IPO), which assumed JPDO's responsibility for coordinating NextGen R&D across the Federal government. One of IPO's first tasks was identifying and prioritizing six high-priority R&D areas with the potential to advance NextGen capabilities, such as integrated weather surveillance and cybersecurity. However, these activities are only a starting point for identifying long-term R&D, and there may be other areas that require FAA attention. Moreover, these efforts have not been synchronized with any long-term vision³ for NextGen. Until FAA has a clear vision for the future of NextGen, the Agency will be unable to validate if these six selected capabilities support that vision or if there are higher-priority R&D needs.

FAA is in the process of developing a mechanism for coordinating NextGen R&D with other Federal agencies. While FAA has made progress in establishing interagency coordination through IPO, the Memorandum of Understanding (MOU) that codifies roles and responsibilities for FAA and its partner agencies has not been finalized, and there is no estimated deadline for completion. FAA and the partner agencies also lack an up-to-date integrated budget document to track, coordinate, and align each Agency's R&D efforts. In addition, FAA's relationships with its partner agencies vary in formality and structure. For example, FAA has established a structure for coordinating and transferring R&D with NASA that it developed in 2008, known as Research Transition Teams (RTTs). However, FAA has not updated its guidance for these teams since 2009, and the guidance lists positions, organizations, and RTTs that no longer exist. In addition, as we reported in 2010,⁴ FAA has a longstanding relationship with

³ For the purpose of this report, we will define "long-term" as those NextGen activities or capabilities that will be completed after 2025.

⁴ *Timely Actions Needed to Advance the Next Generation Air Transportation System* (OIG Report No. AV-2010-068), June 16, 2010. OIG reports are available on our Web site at <http://www.oig.dot.gov/>.

NASA, but the Agency currently lacks a similar relationship and experience with the other three partner agencies, and the level of coordination varies widely. As a result, there are significant opportunities to better leverage R&D, particularly in the areas of Unmanned Aircraft Systems (UAS) and cybersecurity—two increasingly important areas now and in the future of aviation.

We are making recommendations to FAA to improve the process and structure for identifying and coordinating long-term NextGen R&D.

BACKGROUND

After Congress created the JPDO in 2003, the FAA Modernization and Reform Act of 2012⁵ tasked JPDO with additional NextGen responsibilities, including better coordination of activities of the partner organizations, ensuring global interoperability, and establishing quantifiable implementation goals for NextGen.

However, FAA has acknowledged that it will not meet the original date of 2025 to transform the NAS as envisioned in its plans. As our office and industry experts have previously reported,⁶ FAA's plans have proven to be unrealistic, lacking stable investment priorities and requirements for NextGen systems. Additionally, our past work has shown⁷ that FAA was not always receptive to input from outside organizations other than NASA.

In 2010, we reported that⁸ JPDO was established to ensure a multi-agency approach to NextGen that would allow FAA and partner agencies to align diverse research such as weather, surveillance, and UAS. While the Department and FAA officials recognized the need to better define JPDO's mission, no definitive action was taken to determine what role, if any, JPDO would play in critical NextGen development issues, such as simulation and modeling, technology transfer, and prototype development. In 2014, Congress eliminated direct funding for JPDO, stating that FAA had failed to establish a clearly defined role for the office.

⁵ Public Law 112-95. February 14, 2012.

⁶ *Addressing Underlying Causes for NextGen Delays Will Require Sustained FAA Leadership and Action* (OIG Report No. AV-2014-031), February 25, 2014. See also: National Research Council, *A Review of the Next Generation Air Transportation System. Implications and Importance of System Architecture*, May 1, 2015; and MITRE Corporation, *NextGen Independent Assessment and Recommendations*, October 2014.

⁷ *Addressing Underlying Causes for NextGen Delays Will Require Sustained FAA Leadership and Action* (OIG Report No. AV-2014-031), February 25, 2014.

⁸ *Timely Actions Needed to Advance the Next Generation Air Transportation System* (OIG Report No. AV-2010-068), June 16, 2010.

FAA HAS NOT ESTABLISHED PROCESSES TO FULLY IDENTIFY NECESSARY RESEARCH AND DEVELOPMENT FOR NEXTGEN

FAA reallocated JPDO responsibilities (such as identifying and coordinating high-priority research and development) to the NextGen Office. This included creating the IPO, located within the NextGen Office, to take over the coordination of NextGen issues with the partner agencies. However, FAA has not established a formal process for identifying the R&D necessary to implement the Agency's longer term vision for NextGen.

FAA Reallocated JPDO Responsibilities to the NextGen Office and Established an Interagency Planning Office

After Congress eliminated direct funding for JPDO in January 2014, FAA moved JPDO's functions into the NextGen program office. The Assistant Administrator for NextGen assumed the JPDO Director's duties and responsibilities. In May 2014, FAA also created IPO to handle coordination with partner agencies. IPO's primary responsibility is to continue JPDO's work to coordinate and align partner agency NextGen research, including cross-agency R&D.

FAA allocated the other JPDO responsibilities, including much of the responsibility for identifying R&D needed for future NextGen capabilities and maintaining the NextGen Enterprise Architecture,⁹ within the NextGen Office. It remains to be seen whether these changes will result in improvements to NextGen long-term planning and the leveraging of partner agency R&D to meet FAA's air traffic needs. (See table 1 for a list of JPDO responsibilities transferred to the NextGen Office.)

Table 1. Reallocation of JPDO Responsibilities Within FAA

JPDO Responsibility	Responsible NextGen Office
Contracts and Administration	NextGen Management Services
Architecture and Technical Analysis	NextGen NAS Systems Engineering Services (With the Assistant Administrator for NextGen taking on the identification of long-term R&D needs)
Interagency Coordination	NextGen Interagency Planning Office
Public Private Partnership (i.e., The NextGen Institute, which sunset in December 2015)	NextGen Interagency Planning Office

Source: OIG analysis of FAA documents and interviews.

IPO is now tasked with coordinating the NextGen-related research efforts of FAA and its partner agencies and linking the Agency's vision with the partner agencies'

⁹The Enterprise Architecture is a blueprint for making sound investments across FAA's entire air traffic organization, including NextGen.

R&D efforts. Since its inception, IPO has been coordinating functions from the former JPDO into its new organization, and completing actions previously directed by the NextGen Senior Policy Committee (SPC).¹⁰ SPC functions as an advisor to the Secretary of Transportation regarding transformation of the NAS.

For example, in November 2013, SPC tasked JPDO with identifying NextGen interagency research that could accelerate capabilities. JPDO established an interagency working group, which studied 31 initial candidate capabilities for NextGen R&D prioritization. The working group included members from FAA and each of the partner agencies. IPO has since assumed responsibility for coordinating the efforts of the interagency working group.

Since taking on these responsibilities, IPO has made some progress in identifying R&D priorities. For example, with assistance from IPO, SPC published a report in September 2014 with considerable focus on UAS technology and developed broad milestones to track the partner agencies' progress in completing eight UAS national objectives, such as defining, determining, and establishing acceptable levels of UAS usage in the NAS. The IPO-led working group also made recommendations for prioritizing six NextGen R&D efforts that have the potential to advance NextGen capabilities and that have medium or low technological maturity. The working group identified these six activities based on criteria that include expected benefits, partner agency involvement, costs, and risks. (See table 2 for a list of the six prioritized activities.)

¹⁰ SPC is required by Vision 100, the 2004 FAA reauthorization act (Public Law 108-176). It includes Cabinet-level officials from NextGen partner agencies or appointed designees, and the White House Director of the Office of Science and Technology Policy. SPC is required to meet semiannually.

Table 2. Six Prioritized Capabilities From the SPC Report Related to NextGen

Capability	Description	Lead Agency
Multifunction Phased Radar (MPAR)	A potential radar system to provide air surveillance and weather information for system stakeholders.	FAA
Aviation Cyber Security	An initiative to create standards to reduce NAS system-wide cyber security risks.	FAA
Alternative Positioning Navigation and Timing (APNT)	A backup capability designed to minimize impacts from GPS outages.	FAA
Integrated Arrival/Departure/Surface (IADS)	A suite of tools for improving aircraft schedule predictability to increase airport terminal area throughput and efficiency.	NASA
Applied Traffic Flow Management (Weather Integration and Oceanic)	An integrated TFM decision-making approach for domestic and oceanic airspace.	NASA
AutoMax	A project to identify and develop autonomous capabilities to meet future NAS needs, including increased capacity, mixed equipage, and flexibility.	NASA

Source: OIG analysis of FAA documents.

However, these activities are only a starting point for further identifying and coordinating high-priority research and development. Moreover, these areas were already in the process of being identified by JPDO before its dissolution and have varying levels of technical maturity. FAA and the partner agencies are still negotiating expected timeframes for completion of these activities, as well as what capabilities they will deliver and what level of investment will be made over the next several years.

Ultimately, much work remains before FAA can identify all of the R&D necessary to implement NextGen over the long term. For example, while identifying the six high-priority activities was important progress, our past work and analysis by JPDO have also identified other potential high-priority R&D areas that, if not addressed, could materially affect the pace of NextGen in the longer term. One example is the transition to the advanced applications of ADS-B *In*,¹¹ which could shift more responsibility from the ground to the aircraft and unlock congested

¹¹ ADS-B *In* is a component of the Automatic Dependent Surveillance-Broadcast (ADS-B) program that enables the display of satellite-based information on the location of aircraft in the cockpit of equipped aircraft. For additional information on the potential of ADS-B for air traffic usage, see *FAA Faces Significant Risks in Implementing the Automatic Dependent Surveillance-Broadcast Program and Realizing Benefits* (OIG Report No. AV-2011-002), October 12, 2010, and *ADS-B Benefits Are Limited Due to a Lack of Advanced Capabilities and Delays in User Equipage* (OIG Report Number AV-2014-105), September 11, 2014.

airspace. In addition, there are challenges associated with verifying and validating complex safety-critical air and ground components, as noted in our 2010 report and a 2009 JPDO assessment of NextGen issues.¹² There are also cross-cutting human factors issues for both controllers and pilots regarding how much automation can safely and reasonably be accommodated by the controller workforce and by pilots. For example, it is uncertain how specific NextGen technologies, such as Data Link Communications,¹³ will affect the size and productivity of the controller workforce. FAA cannot effectively manage advances in NextGen until these issues are addressed, which may require significant research and coordination.

Furthermore, the high-priority issues identified by IPO and its working group have not been validated by FAA's own Research, Engineering, and Development Advisory Committee (REDAC) or an outside expert such as the National Academy of Sciences. The REDAC was established by Congress in 1989, and provides advice and recommendations to FAA on the needs, objectives, and plans of the aviation research portfolio. Additionally, FAA has not implemented mechanisms to measure the effectiveness of its R&D efforts to determine whether the Agency is focusing on areas that are most critical to the implementation of NextGen. At the time of our audit, FAA did not have a deadline for developing or implementing such mechanisms.

FAA Has Not Established a Formal Process for Identifying R&D Support for Its Long-Term NextGen Vision

FAA lacks a clearly established process for identifying the R&D necessary for NextGen. While the Agency does publish the National Aviation Research Plan (NARP) on an annual basis, this is more of an informational document that highlights current research activities for all of FAA, including aircraft safety and airport research, and represents only a small portion of R&D needed for NextGen capabilities. In addition, FAA has not updated a NextGen-specific R&D plan that JPDO developed in 2007 that was expected to guide efforts in the fiscal year 2009–2013 period.¹⁴ The plan defined R&D needs from a multi-agency perspective for high-level capabilities, which included trajectory-based operations, collaborative air traffic management, and reduced impact of weather. It also outlined the specific research required, identified the lead agency on the research, proposed operational improvements that were supported by the research, and specified expected completion dates. However, the plan has not been updated in

¹² The 2009 analysis is referred to as the NextGen portfolio or “trade space” analysis. This study sought to examine the costs, risks, and benefits of the JPDO NextGen vision and what part of that vision could reasonably be achieved by 2025.

¹³ Data Link Communications (DataComm) will provide comprehensive data link communications between pilots and controllers that will automate repetitive tasks and supplement voice communications with less workload-intensive data communications.

¹⁴ JPDO, Research and Development Plan for the Next Generation Air Transportation System, August 31, 2007.

9 years since its initial release in 2007 and does not reflect changes to the long-term vision for NextGen. As a result, there is no current document that serves as a basic planning tool for all NextGen R&D requirements or that identifies critical path issues for NextGen.

FAA is currently focusing the bulk of its attention on its near-term goals of implementing the NextGen Advisory Committee's (NAC)¹⁵ recommended capabilities for NextGen regarding what should be accomplished by 2019. The investment priorities include performance-based navigation, closely spaced parallel runway operations, enhancing airport surface operations, and establishing data communications capabilities between the cockpit and air traffic control. This is a meaningful step because a short-term focus is necessary to meet the needs of the NextGen stakeholders. However, having a clear long-term vision better positions the Agency to plan for the future. Until it has such a vision, FAA will be unable to formally establish and validate how its six previously identified high-priority areas support that vision or whether any higher-priority R&D may be needed.

A longer-term vision is particularly important because the original vision for NextGen is not what is being implemented today. As the National Research Council (NRC) noted last year,¹⁶ NextGen has been redefined and not all parts of FAA's original vision will be implemented in the foreseeable future. In addition, our work—and a 2014 MITRE assessment of NextGen progress¹⁷—has shown that NextGen's success depends on FAA shifting from deploying infrastructure to transitioning new and enhanced operational capabilities into operational use. MITRE detailed many gaps between FAA's plan for NextGen and what can reasonably be accomplished by 2020. These gaps include, but are not limited to:

- Automation for controllers for metering, merging, and sequencing terminal airspace (i.e., in the vicinity of airports);
- Use of flight plan information to determine which routes best meet airspace user needs based on aircraft equipment and performance capabilities; and
- Complex, data-linked clearances to enable precise metering and four-dimensional trajectory management in both high altitude and terminal airspace.

¹⁵ The NAC is a Federal advisory committee that develops recommendations for NextGen portfolios. The NAC includes representation from affected user groups, including operators, manufacturers, air traffic management, aviation safety, airports, and environment experts.

¹⁶ National Research Council, *A Review of the Next Generation Air Transportation System. Implications and Importance of System Architecture*, 2015.

¹⁷ MITRE Corporation, *NextGen Independent Assessment and Recommendations*, October 2014.

As a first step to develop a longer term vision for NextGen, FAA released a high-level update to the Concept of Operations (ConOps) for 2025 called “The Future of the NAS” in June 2016. The document includes an emphasis on new entrants such as UAS, enhanced cybersecurity, and the need to maintain elements of the legacy system while implementing new capabilities. It also describes concepts that are no longer in the Agency’s plans for the 2025 timeframe.¹⁸

Now that FAA has published “The Future of the NAS,” the Agency needs to begin the process of identifying the R&D necessary to realize its plans for 2025. However, the Agency has not yet established a plan for doing so. In addition, FAA is not currently focusing on planning for post-2025 implementation, despite the lengthy timeframe often involved in developing and transitioning air traffic technology from research to implementation. During our review, the Assistant Administrator for NextGen¹⁹ stated that FAA plans to create a follow-on document to the ConOps update with a 20- to 30-year vision for the NAS, but this follow-on document is not expected to be completed until 2017 at the earliest.

FAA HAS NOT FULLY DEVELOPED A MECHANISM FOR COORDINATING HIGH-PRIORITY R&D WITH PARTNER AGENCIES

FAA and its partner agencies are still in the process of developing mechanisms for coordinating high-priority R&D. The agreement between the partner agencies that defines the structures, roles, and responsibilities of those agencies has been drafted but not yet finalized. In addition, while FAA has continued interagency coordination since JPDO’s dissolution, particularly with NASA, the Agency has not yet developed a structure for coordinating high-priority R&D with the other partner agencies.

FAA and Its Partner Agencies Have Not Finalized an Agreement on Interagency NextGen Planning and Development

Since JPDO’s dissolution, FAA has continued multi-agency coordination through work groups, meetings, and workshops with the partner agencies. However, FAA has not finalized an updated agreement that formalizes the coordination with its four partner agencies on NextGen R&D. Each of the partner agencies has different priorities and areas of interest, along with different levels of involvement in the NextGen R&D process. Some of the areas overlap, which requires the agencies to work together on programs and capabilities, such as enhanced cybersecurity,

¹⁸ These discontinued or delayed concepts include the ability to dynamically shift airspace assignments between controllers, as conditions warrant, and automated resolution of potential conflicts between aircraft.

¹⁹ The official who made this statement has since left FAA. The role of Assistant Administrator for NextGen is now filled by a different person.

Integrated Arrivals/Departures/Surface Operations,²⁰ and Traffic Flow Management procedures.²¹ Table 3 identifies the shared areas of interest between FAA and the partner agencies.

Table 3. NextGen Partner Agency Areas of Interest Shared With FAA

Shared Areas of Interest	DOD	DHS	NASA	DOC/NWS
CyberSecurity	*	*		
Unmanned Aircraft Systems	*	*	*	
Integrated Surveillance	*	*		
Alternate Position Navigation/Timing	*	*		
Integrated Arrivals/Departures/Surface			*	
Traffic Flow Management			*	
Weather (Visibility/Ceiling)				*

Source: OIG analysis of FAA documents.

To provide guidance and establish parameters for interagency coordination, FAA and its partners rely on a joint MOU. The first NextGen MOU between the five partner agencies was signed by all parties in 2008. It identified the requirement for establishing a “joint planning office” (which was JPDO) and identified the governance, objectives, and organization of NextGen efforts, including SPC and the JPDO Board.²² The MOU also identified the high-level responsibilities of the partner agencies.

However, FAA and its partner agencies have still not finalized an updated MOU that specifies the current NextGen interagency structure and responsibilities. The current MOU still refers to JPDO and does not reflect the current responsibilities of FAA’s NextGen office or the existence of IPO.

Completing the MOU is important to establish a clear understanding of the current organizational structure, requirements, and delineation of responsibilities for NextGen, with FAA continuing to lead the effort. According to FAA, a new draft MOU is currently in the process of being reviewed by the partner agencies; however, it has not yet been signed, and there is no deadline for its completion.

In addition, to help coordinate and align diverse agency R&D efforts, FAA and JPDO worked to develop an integrated budget document for NextGen that was requested by the Office of Management and Budget (OMB). As we noted in 2007, this was important to determine whether FAA was leveraging the right research,

²⁰ Integrated Arrivals/Departures/Surface Operations are a set of capabilities designed to help move aircraft in and out of congested airspace.

²¹ Traffic Flow Management procedures are designed to ensure that available airspace capacity is used efficiently.

²² The JPDO Board is now called the NextGen Executive Board.

whether funding was adequate for specific efforts, how projects would improve the air transportation system, and at what cost. Developing this integrated budget document has proved difficult for a number of reasons, including the lack of a common method to identify NextGen-related items while running and maintaining the existing system. Since JPDO was disbanded, SPC has made progress and has published a report related to R&D budgets. The report shows investments from FAA, DOC/NWS, DHS, and DOD in areas such as air traffic control modernization and UAS integration. However, it does not provide a comprehensive assessment of what could be leveraged for NextGen, and it is unclear if IPO will be able to quantify R&D from either organization that could be leveraged for future NextGen initiatives and prevent duplication of effort.

FAA Has Not Established a Structure To Coordinate R&D Transfer With All Partner Agencies

A key aspect of coordinating R&D with other agencies is developing a structure to transfer technology between agencies once it reaches a sufficient level of maturity. So far, FAA has established a transfer structure with NASA but lacks a similar structure with other agencies. Specifically, with NASA, FAA integrates NextGen R&D and facilitates transfer between agencies using Research Transition Teams (RTTs). The RTT structure between FAA and NASA was initiated by JPDO in 2008 to address technology transfer issues and to review plans for NextGen.

FAA and NASA officials responsible for long-term R&D coordination stated that in their view, R&D coordination between them has gone smoothly. More specifically, in our discussion with NASA management, they stated that the RTT process between FAA and NASA is effective. In addition, they stated that the RTTs allow FAA to focus on shorter term goals, while NASA can focus on a longer vision (typically about 7 years).

According to FAA and NASA, RTTs provide a structured process for personnel from both agencies to work together and ensure that the results of NASA research are understood by all parties. RTTs also ensure that R&D results will not be transferred to FAA until they are at a level of readiness that allows FAA to complete development and implement the capabilities into the NAS. An example of a transfer of technology via an RTT is the Terminal Spacing and Sequencing (TSS) capability, which supports sequencing and spacing of aircraft in the vicinity of airports. NASA conducted the preliminary research for TSS, and then transferred the research to FAA in July 2014. FAA plans to begin implementing the capability in 2019.

There are currently six RTTs between NASA and FAA for air traffic management work. Three RTTs have been in place for some time, while the three newest RTTs

were created as a direct result of the SPC report recommendations. Table 4 lists the current FAA/NASA RTTs.

Table 4. Research Transition Teams Between FAA and NASA

	RTT	Description
Existing RTTs	Efficient Flow in Congested Airspace	A project working with industry partners for near-term efficiency and reduced environmental impact of arrival operations under constrained airspace conditions.
	Safe Autonomous Systems Operations	A project to identify a justifiable and optimal combination of autonomous characteristics for management of future airspace operations. For example: Safely enable low altitude UAS operations.
	Data Management	A project including data mining, analysis, and deliverables along with overseeing the data flow across agencies for operations and safety research.
New RTTs	Integrated Arrivals/Departures/Surface	A suite of tools for improving aircraft schedule predictability to increase airport terminal area throughput and efficiency.
	Applied Traffic Flow Management with Weather Integration	An integrated TFM decision-making approach for domestic and oceanic airspace.
	AutoMax	A project to identify and develop autonomous capabilities to meet future NAS needs, including increased capacity, mixed equipage, and flexibility.

Source: OIG analysis of FAA documents.

Despite this relationship with NASA, FAA lacks an effective process for establishing coordination structures that are similar to RTTs with its other partner agencies, and does not have a plan to transfer any technologies or capabilities to or from DOD and DHS in the near term. While FAA created guidance in 2009 that could help initiate similar RTTs at other agencies, the guidance is out of date, limiting its usefulness for other agencies. Specifically, FAA’s RTT guidance for NASA coordination²³ includes a mechanism for identifying the need for an RTT, potential RTT activities and products, and how to transition NASA research to FAA. However, the guidance has not been updated in over 6 years and lists positions and organizations that no longer exist, personnel identified with specific responsibilities but who are no longer in those roles, and RTTs and team leads that are out-of-date. As a result, its usefulness as a planning tool or as guidance is limited should other partner agencies want to establish RTTs.

²³ Federal Aviation Administration. “Charter and Guidance for Research Transition Teams,” September 9, 2009.

Without such an established structure, the level of coordination between FAA and other agencies besides NASA varies widely. For example, while DHS officials meet periodically with the NextGen Office and participate in monthly IPO meetings, there are no formal mechanisms for leveraging and transferring research between FAA and DOD or DHS. JPDO, before its dissolution, had also not established any formal coordination structure for the transfer of R&D or developed capabilities with the other partner agencies, although there were some efforts by DOD to do so. In response to a recommendation that we made in our 2010 report, DOD officials developed a process with JPDO to identify DOD research activities that could be leveraged specifically for NextGen. Based on that progress, we closed our recommendation related to DOD coordination efforts. However, since the dissolution of JPDO, progress on leveraging DOD's extensive research base for FAA has stalled.

In addition, FAA has not yet taken advantage of opportunities to benefit from other agencies' R&D in certain key areas that are critical to the future of aviation. For example, there is the potential for increased interagency coordination to prevent duplication of efforts and to leverage R&D, particularly between DOD and DHS in an area such as UAS, where both agencies have a significant interest. FAA and DOD are still working to establish a mechanism for leveraging DOD's extensive R&D portfolio, focusing mainly on enhancing aviation cybersecurity. There are also significant opportunities to build upon DOD's efforts with phased array radar, which could help reduce FAA's costs and risks with a new Next Generation surveillance and weather radar program.²⁴ In addition, DOD's research with respect to UAS, fusing radar and non-radar information, and internal navigation systems could prove useful to FAA's NextGen efforts.

To its credit, FAA and the partner agencies have recently made advances in coordinating some areas since the dissolution of JPDO and formation of IPO. For example, in response to a 2010 recommendation we made, FAA and DOC/NWS recently established the first RTT on weather issues called "Ceiling and Visibility" to improve real-time meteorological analysis for short-term forecasts. Both agencies have also formally established the NextGen Executive Weather Panel, which is designed to guide and review planning, budgeting, and implementation of required NextGen weather capabilities. DOD is also part of this weather initiative. In addition, IPO has facilitated the creation of a cross-agency team designed to promote coordination and consistency on issues related to cybersecurity for the NAS, but this has not yet advanced to the stage of a formal RTT.

²⁴ FAA's fiscal year 2017 budget request contains \$8 million for the development of new air traffic management requirements. This includes the development of requirements and a test plan for phased array radar.

CONCLUSION

Enhancing the capabilities of the NAS to meet future air traffic needs will require considerable research and development and the successful transfer of technology between Federal agencies and the private sector. Therefore, meeting FAA's long-term NextGen goals depends on an effective strategy for conducting, prioritizing, and coordinating R&D. Moreover, effective interagency coordination is essential for maximizing research investments and preventing duplication of effort. While FAA has taken steps since the dissolution of JPDO to integrate some of the functions in the NextGen Office, further work is still needed to ensure that FAA has effective policies, processes, and mechanisms in place to facilitate interagency coordination on R&D to advance NextGen and modernize the NAS. Until FAA has a clear vision for the future configuration of NextGen, the Agency will continue to face challenges in identifying and coordinating its R&D needs with other Federal agencies.

RECOMMENDATIONS

To improve the process and structure for identifying and coordinating long-term NextGen R&D, we recommend that the Federal Aviation Administrator:

1. Establish and document a process with clear roles and responsibilities for identifying and prioritizing long-term R&D for air traffic management and related efforts.
2. Link the long-term vision for NextGen, once completed, with current R&D efforts to identify any additional R&D that may be required.
3. Finalize the MOU that establishes the organizational structure and responsibilities for FAA and its partner agencies.
4. Update the Research Transition Team document to include:
 - a. Assignments by position instead of by name;
 - b. Updated organization names and roles; and
 - c. Current projects in an annex rather than in the main document to allow for easier updates.
5. Have SPC's six high-priority NextGen capabilities validated by an entity, such as the REDAC, to ensure that they are on the critical path for NextGen development as well as ensure that no other areas warrant additional attention.

AGENCY COMMENTS AND OFFICE OF INSPECTOR GENERAL RESPONSE

We provided FAA with a copy of our draft report on July 11, 2016, and received its response on August 4, 2016, which is included in its entirety as an appendix. In its response, FAA concurred with all five of our recommendations and proposed planned actions and completion dates. The Agency stated that it will complete work on recommendation 4 by December 31, 2016, and on recommendations 1, 3, and 5 by September 30, 2017. We consider these four recommendations to be resolved but open, pending completion of FAA's proposed actions.

For recommendation 2, FAA stated that it is working on linking the long-term vision for NextGen with its current R&D efforts. However, the Agency stated that many of the elements and the associated research have been delayed due to budget shortfalls, while others have proven to be more complex, requiring more time. FAA continues to work on accomplishing this task and will provide an update to OIG by September 30, 2017. While we consider this recommendation to be resolved, we will reevaluate its status following the September 30, 2017, update.

We appreciate the courtesies and cooperation of FAA representatives during this audit. If you have any questions concerning this report, please call me at (202) 366-0500.

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cc: DOT Audit Liaison, M-1
FAA Audit Liaison, AAE-100

EXHIBIT A. SCOPE AND METHODOLOGY

We conducted our work from January 2015 through July 2016 in accordance with generally accepted Government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

The House Committee on Science, Space, and Technology and its Subcommittee on Space requested that we assess whether congressional expectations will continue to be met with regards to linking the long-term vision with the near- and mid-term efforts, identifying high-priority research and development needed to advance NextGen, and coordinating research and development efforts with other Federal agencies. Accordingly, our audit objectives were to determine (1) how FAA has reallocated JPDO's responsibilities for identifying high priority research and development and (2) whether FAA has developed an effective structure to coordinate high priority research and development with other Federal agencies.

To determine how FAA has reallocated JPDO's responsibilities for identifying high-priority research and development, we reviewed and analyzed FAA's plans to reallocate the functions and responsibilities of JPDO. We interviewed officials from the NextGen Organization that absorbed JPDO responsibilities to determine what documentation or guidance FAA will use for planning and coordinating the NextGen effort along with any changes that have occurred to the plans for the implementation and development of NextGen as a result of these changes. To gain an understanding of how JPDO functioned since its inception we interviewed the former Deputy Director of JPDO. We reviewed FAA documents and interviewed appropriate officials to examine FAA's processes to identify and select appropriate research for future capabilities.

To determine whether FAA has developed an effective structure to coordinate high priority research and development with other Federal agencies, we reviewed documents and correspondence, such as Memorandums of Understanding and Research Transition Team guidance, between FAA and the partner agencies. To understand the impact of the dissolution of JPDO on planning activities with the partner agencies, we interviewed officials from NASA, NOAA, DHS, and DOD. We interviewed FAA officials to determine what FAA is doing to plan for long-term NextGen initiatives and the impact near- and midterm plans will have on long-term NextGen planning. We also interviewed officials from the NextGen Institute to determine its relationship with the partner agencies.

EXHIBIT B. ORGANIZATIONS VISITED OR CONTACTED

FAA NextGen Organization

- Assistant Administrator for NextGen
- Office of the Chief Scientist for NextGen
- NAS Systems Engineering Integration Office
- Portfolio Management & Technology Development Office
- Interagency Planning Office
- Research and Development Management Division

Other FAA Organizations

- FAA Program Management Office

Partner Agencies

- Department of Homeland Security
- Department of Defense
- National Aeronautics and Space Administration
- National Oceanic and Atmospheric Administration

Other Organizations

- NextGen Executive Board
- NextGen Institute
- Former Employees of the Joint Planning and Development Office

EXHIBIT C. MAJOR CONTRIBUTORS TO THIS REPORT

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Federal Aviation Administration

Memorandum

Date: August 4, 2016

To: Matthew Hampton, Assistant Inspector General for Aviation Audits

From: H. Clayton Foushee, Director, Office of Audit and Evaluation, AAE-1

Subject: Federal Aviation Administration's (FAA) Response to Office of Inspector General (OIG) Draft Report: Identifying and Coordinating NextGen Long-term Research and Development

The FAA is moving steadily toward the successful establishment of the Interagency Planning Office (IPO) to redistribute key functions of the former Joint Planning and Development Office throughout the NextGen organization. As noted by the OIG in its draft report, our work with the NextGen Segment Implementation Plan, National Aviation Research Plan, and the 2020 Vision update will continue to provide a solid foundation for future R&D prioritization. The IPO has fostered effective partnerships with NextGen partner agencies in key areas such as aviation cybersecurity, research, and weather. Some accomplishments in these areas include:

- Established the FAA, Department of Defense (DoD), and Department of Homeland Security Interagency Cyber Core Team to promote and enable consistent multi-agency coordination on aviation cybersecurity.
- Expanded the Research Transition Team (RTT) process to include other partner agencies beyond the FAA and the National Aeronautics and Space Administration (NASA) as appropriate, with regular reporting to the NextGen Executive Board.
- Regenerated the FAA, DoD, Department of Commerce (DOC), and NASA NextGen Executive Weather Panel to collaborate on NextGen weather-related research and development (R&D), policy, and implementation activities.

We reviewed the draft report and concur with the OIG's recommendations, which support FAA's ongoing efforts toward long-term R&D prioritization. The FAA will complete work on recommendation 4 by December 31, 2016, and for recommendations 1, 3 and 5 by September 30, 2017. For recommendation 2, an effort is currently under development linking the long-term vision for NextGen with current R&D efforts, but many of the elements and the associated research have been delayed due to budget shortfalls, while others have proven to be more complex, requiring

more time. The FAA continues to work on accomplishing this task and will provide an update by September 30, 2017.

We appreciate this opportunity to offer additional perspective on the OIG draft report. Please contact H. Clayton Foushee at (202) 267-9000 if you have any questions or require additional information about these comments.