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Progress and Challenges in Developing and Transitioning to the Next Generation Air Transportation System

Statement of
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Mr. Chairman and Members of the Subcommittee:

Thank you for inviting me here today to testify on the Federal Aviation Administration's (FAA) progress in developing and transitioning to the Next Generation Air Transportation System (NextGen). As you know, NextGen involves a significant overhaul of the National Airspace System (NAS) to shift from ground- to satellite-based air traffic management. NextGen is FAA's most complex effort to date and will require multibillion-dollar investments from both Government and airspace users. Since the effort began in fiscal year (FY) 2004, we have reported on cost and schedule risks as well as challenges that FAA must resolve to successfully implement NextGen. In September 2009, a government-industry task force—established at FAA's request—made 32 recommendations for accelerating NextGen's deployment[1] (see exhibit A).

In response to the task force recommendations, FAA significantly adjusted its NextGen plans and budgets and established ways to collaborate with industry on planned actions. However, a number of program management challenges remain, including delivering near-term benefits and resolving problems with ongoing projects, all within a constrained budget environment. Today, I will discuss three challenges that will impact FAA's ability to manage NextGen's implementation and realize its benefits: (1) addressing concerns with FAA's timely execution of recommendations in five critical areas, (2) resolving technical and program management problems with the En Route Automation Modernization (ERAM) program, and (3) managing program costs and schedules with NextGen's transformational programs.

IN SUMMARY

The task force recommendations fall across several broad areas intended to enhance airspace capacity and alleviate congestion. To date, FAA has focused its attention in one critical area—improving airspace around major cities—because this effort can provide near term benefits to users by fully using equipment already onboard aircraft. However, industry and users are expressing concerns about the effort's pace and execution since FAA has yet to clarify timelines for improvements at key sites or integrate recommendations from other key areas that are critical to this initiative. Central to realizing benefits from this and other NextGen efforts, however, is the successful implementation of ERAM—a $2.1 billion system for processing flight data. Significant software-related problems have pushed ERAM's schedules well beyond original completion dates and increased costs by hundreds of millions of dollars. These problems have exposed a number of fundamental programmatic and contract management concerns. For example, despite cost and schedule deficiencies, FAA has continued to pay cost incentives to the contractor. In addition, FAA has not approved total cost, schedule, or performance baselines for any of NextGen's

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

transformational programs nor developed an integrated master schedule for managing and executing NextGen.

BACKGROUND

To accomplish NextGen's long-term goals, Congress mandated in 2003 that FAA establish the Joint Planning and Development Office (JPDO) and create a plan for implementing NextGen by 2025.[2] While FAA's initial planning focused on this timeframe, it has more recently emphasized near- and mid-term initiatives.

To solidify commitments from both Government and industry, FAA asked RTCA[3] to examine the NextGen operational improvements planned for the 2012–2018 timeframe and help develop business cases to support and implement mid-term capabilities. In September 2009, the RTCA task force delivered its final report to FAA, which identified the following key issues:

- Users are willing to support FAA communications, navigation, and surveillance infrastructure programs that require user investments only if those programs provide a clear and unambiguous path to immediate and tangible benefits to the users.

- Focusing on delivering near-term operational benefits, rather than on the entire infrastructure, would help gain operator confidence in FAA plans and encourage users to invest in NextGen. A key element for accomplishing this is obtaining industry and FAA agreement on common metrics to measure benefits.

- Assigning responsibility, accountability, authority, and funding within the Agency is critical to accomplish all associated and necessary non-infrastructure tasks (i.e., development of procedures and policy) and to achieve NextGen benefits.

The task force made 32 recommendations across areas to take advantage of existing technologies and on-aircraft equipment. These recommendations were intended to quickly generate user benefits, support cross-cutting improvements to air traffic management and communications, and encourage operator investment and confidence within the aviation community in FAA's ability to implement new capabilities.

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

[3] Organized in 1935 as the Radio Technical Commission for Aeronautics, RTCA, Inc., is a private, not-for-profit corporation that develops consensus-based recommendations regarding communications, navigation, surveillance, and air traffic management (CNS/ATM) system issues. It functions as a Federal Advisory Committee.

DELAYS IN ADDRESSING KEY TASK FORCE RECOMMENDATIONS COULD DISCOURAGE INDUSTRY INVESTMENT IN NEXTGEN

FAA has primarily focused its efforts on one of the most critical areas—improving airspace efficiency around major cities. However, it has not defined when users will benefit from the effort. As a result, industry representatives have expressed concerns over FAA's execution with this and related projects—which will ultimately make them reluctant to invest in NextGen equipage and advance NextGen at key locations. Delays with this and other NextGen initiatives are likely to continue since FAA has not made critical, longer term design decisions on NextGen ground and aircraft systems.

FAA Is Responding to Task Force Recommendations but Has Made Only Limited Progress in Key Areas

FAA is addressing the RTCA recommendations, but its efforts are delayed in key areas, such as metroplex initiatives, surface operations, and data communications (see table 1).

Table 1. Status of Efforts To Address RTCA Recommendations in Five Key Areas

Metroplex Airspace - *Improve airspace affecting multiple airports near large metropolitan areas*
FAA has made the most progress in this area. FAA has identified 21 metroplex sites, developed a method to prioritize them, and completed 5 studies. However, a lack of available staffing and development of the metroplex project plan delayed the design and implementation phases for the first two sites.
Airport Surface Operations - *Improve management of airport taxiways, gates, and parking areas*
Surface demonstration studies ongoing but not integrated with FAA's metroplex plans. After 18 months, FAA is just now establishing an office for a single point of responsibility for surface.
Runway Access - *Improve the use of converging or closely spaced runways during low visibility conditions*
Runway studies ongoing. FAA adopted the task force dates and locations for closely spaced parallel operations projects but has not defined locations and dates for key recommendations (e.g., a precision surveillance system for runways and a new automated tool to maximize benefits of routes).
High-Altitude Cruise - *Improve high-altitude flight by better using available airspace to increase capacity and reduce delays*
FAA has not integrated an automated controller tool for managing aircraft with other Traffic Flow Management tools. The task force wants this completed in 2011, but FAA's target date is 2014.
Data Communications (DataComm) - *Enable more efficient use of available or forecast capacity*
FAA has already delayed this capability 2 years from 2016 to 2018. Industry needs assurance that the implementation date for en route services is solid.

Source: FAA and industry officials

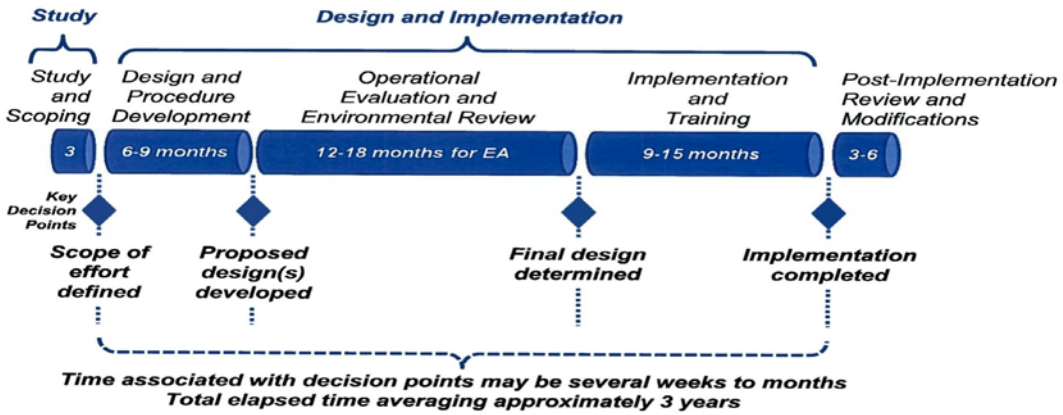
The task force remains concerned with FAA timelines for these projects. For example, the task force stated that if some DataComm capabilities are delayed to 2018, as FAA

has proposed, users will need to revisit their business cases and commitment to advance NextGen. Resolving timeline delays and location differences between FAA's plans and the task force's recommended sites will further slow progress in all of these key areas.

FAA Has Launched Its Metroplex Initiative, but Timelines, Benefits, and Methods To Integrate Key Initiatives Are Uncertain

The task force and FAA identified the metroplex initiative as a key initial area that could provide the most near-term benefits. This 7-year effort is intended to improve the flow of air traffic and reduce delays at congested airports in 21 major metropolitan areas. FAA has completed initial studies at 5 of the 21 metroplex locations and has 2 more sites under way. Work at each site will consist of study and design phases, which will take about 3 years (see figure 1). However, unresolved issues could slow its deployment, increase costs, and delay benefits. Specifically, FAA has not established definitive start dates or detailed milestones. Further, the current metroplex effort is limited and not what the task force recommended in terms of taking advantage of new technologies and more advanced procedures. As a result, airspace users are concerned about both the pace and execution of this effort. Task force and industry representatives want FAA to adopt an approach that integrates recommendations from other key areas, such as better managing surface operations at critical metroplex sites.

Figure 1. Notional Timeline for Each Metroplex Site



Source: FAA

Achieving the goals of the metroplex initiative will also require timely deployment of more efficient flight procedures. However, as we noted in December 2010,[4] FAA's new flight procedures are mostly overlays of existing routes. Airlines advocate that

[4] OIG Report Number AV-2011-025, "FAA Needs To Implement More Efficient Performance-Based Navigation Procedures and Clarify the Role of Third Parties," December 10, 2010. OIG reports and testimonies are available on our Web site at http://www.oig.dot.gov/.

FAA should develop procedures that achieve maximum benefits, such as shorter flight paths and fuel savings. FAA's metroplex initiative focuses primarily on adding area navigation (RNAV)[5] procedures and optimizing climb and descent profiles for existing routes. FAA's plans do not focus on the more advanced required navigation performance (RNP)[6] procedures to take full advantage of equipment already onboard aircraft for curved approaches. To address these concerns, FAA completed a study[7] that identified numerous initiatives for streamlining the process for deploying new procedures; however, FAA estimates it may take as long as 5 years to implement the initiatives.

FAA Has Not Made the Decisions Needed To Move NextGen From Planning to Implementation

Task force industry representatives want FAA to move from NextGen planning and demonstration to actual implementation. However, this will be difficult in terms of making the internal Agency changes required for a new system as well as defining longer term plans for NextGen. First, FAA faces significant organizational, policy, logistical, and training challenges. For example, to successfully complete its planned actions, FAA will have to work across its diverse agency lines of business, but this has been difficult in the past. As we testified in July 2009, organizational barriers and fragmented efforts hindered FAA's process to approve new flight procedures.[8] Second, FAA has not yet addressed critical decisions that affect the cost and schedule of NextGen. These include (1) what new capabilities will reside in the aircraft or in FAA's ground-based automation systems, (2) the level of automation for controllers that can realistically and safely be achieved, and (3) the number and locations of air traffic facilities needed to support NextGen. All of these elements are crucial to the success of NextGen.

ONGOING PROBLEMS WITH ERAM'S IMPLEMENTATION HAVE CAUSED SIGNIFICANT DELAYS THAT IMPACT THE COST AND PACE OF NEXTGEN

FAA's primary goals for NextGen, such as increasing airspace capacity and reducing flight delays, depend on successfully implementing ERAM—a $2.1 billion system for processing flight data. FAA originally planned to complete ERAM by the end of 2010, but ERAM continues to experience software-related problems that have pushed schedules well beyond original completion dates and increased costs by hundreds of millions of dollars. ERAM's problems are the result of a number of fundamental

[5] RNAV is a method of navigation in which aircraft use avionics, such as global positioning systems, to fly any desired flight path without the limitations imposed by ground-based navigation systems.

[6] RNP is a form of RNAV that adds on-board monitoring and alerting capabilities for pilots, thereby allowing aircraft to fly more precise flight paths.

[7] FAA's Navigation (NAV) Lean Instrument Flight Procedures Report, September 2010.

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

programmatic and contract management concerns, and prolonged problems will directly impact the cost and pace of NextGen.

ERAM Continues To Experience Software-Related Problems, Causing Schedule Delays and Cost Overruns

Although ERAM passed testing at FAA's Technical Center and received Government acceptance,[9] testing at initial sites revealed significant software problems with the system's core capabilities for safely managing and separating aircraft. These problems include errors that display flight data to the wrong aircraft and hand-off problems between controllers at other facilities. FAA now plans to complete ERAM in 2014—a delay of 4 years—and estimates it needs an additional $330 million to complete deployment. However, a MITRE study and our analysis estimate that total cost growth could be as much as $500 million, with potential delays stretching to 2016.

Because of problems with ERAM, controllers at the key sites have been forced to rely on a large number of "procedural workarounds,"[10] such as re-entering flight information for aircraft multiple times, that have increased their workload. These cumbersome workarounds pose the risk of data entry errors and, more importantly, take the controller's focus away from managing and separating aircraft. Problems with ERAM functionality are of particular concern at sites that have complex and congested airspace such as the Chicago and Los Angeles Centers. The airspace at these locations is divided into smaller and more heavily congested sectors that do not allow controllers time to use workarounds to compensate for ERAM's deficiencies.

ERAM's persistent problems have raised concerns about the overall design of the system, especially since we have found similar problems in another critical FAA system. Our work on the Standard Terminal Automation Replacement System (STARS),[11] which shares the same aircraft tracking software (tracker) with ERAM, found similar problems with tracking aircraft and pairing associated flight plan information that ERAM is currently experiencing. After discussing our concerns with FAA, the Agency tasked MITRE with examining the accuracy and performance parameters of the ERAM tracker. MITRE plans to complete its assessment next year.

FAA is taking action to address problems with ERAM. For example, FAA recently appointed a new Director of Program Operations, created a benchmarking process for

[9] Government acceptance of ERAM by the FAA Technical Center requires meeting specific criteria established for the project baseline. These criteria include successfully completing developmental testing activities per the Statement of Work, listing all problem trouble reports, demonstrating that all contractual requirements are satisfied, and completing both functional and physical configuration audits.

[10] A workaround is a method or series of steps used to correct or deal with a deficiency or faulty capability in the ERAM software. It must be executed each time the problem occurs.

[11] STARS is an air traffic control system in use by FAA and DOD air traffic controllers to control traffic in the terminal environment. The terminal environment controls aircraft taxiing, departing from and arriving at airports within the vicinity (up to 50 miles out) of an airport. For more details, see OIG Testimony Number CC-2001-127, "Efforts To Develop and Deploy the Standard Terminal Automation Replacement System," March 14, 2001.

identifying and resolving problems with ERAM, and established user groups of subject matter experts and controllers. Yet, ERAM continues to face substantial risk for cost growth, schedule delays, and performance shortfalls as the program is deployed to more complex sites. These risks will grow as FAA and its contractor continue to add new capabilities while attempting to resolve problems in earlier software versions.

Cost growth with ERAM will also impact FAA's budget for other programs. For example, delays in fielding ERAM required FAA to maintain aging systems longer, reprogram funds from other projects, and retrain controllers and maintenance technicians who must operate and maintain two different systems. In the current fiscally constrained environment, prolonged problems with ERAM and the associated cost escalations will affect FAA's capital budget and could "crowd out" other critical programs.

Problems With ERAM Exposed Fundamental Weaknesses in Program Management and Contract Oversight

Our ongoing work shows that problems with ERAM are directly traceable to weaknesses in program management and contract oversight. Specifically:

Program Management: FAA did not establish effective program management controls during ERAM's planning and deployment stages. As a result, when significant problems occurred, FAA was not well positioned to address them. For example:

- FAA and its contractor significantly underestimated the complexity in fielding ERAM. They were overly optimistic that it could be fielded to all 20 sites within 1 year and ignored early warning signs of trouble during initial site deployment.

- FAA did not effectively manage key site expectations to initially deploy and test the first ERAM software release. FAA could perform only limited software testing at its Technical Center and therefore did not have a full understanding of the maturity and stability of the software prior to deployment. As a result, the software was released to the key sites with significant defects.

- FAA did not implement required program management tools to ensure ERAM would achieve performance and schedule goals. Specifically, the program office did not review the ERAM budget when required, and FAA's risk management process did not begin to detect and mitigate significant risks until almost 3 years after software problems surfaced at Salt Lake Center, the key implementation site.

Contract Oversight: FAA is primarily relying on a cost-plus, incentive fee contract to develop and deploy ERAM, but it is not structured to effectively manage performance and control costs. In fact, FAA's contract management vehicle not only supports but rewards and incentivizes poor program management practices. For example:

- FAA did not structure the ERAM contract into small segments of deliverables. Typically, it is a best practice to divide large-scale information technology acquisitions into smaller segments that deliver requirements incrementally. This adds flexibility for managing schedule and costs. However, the ERAM contract instead called for major deliverables—such as initial software design, development, and testing—over multiple years. Also, the contract currently identifies work to be performed into units so large that FAA cannot track individual factors that are driving ERAM's cost overruns.

- FAA's use of contract incentives did not adequately manage schedule and costs or achieve desired program outcomes. For instance, the ERAM contract pays out a cost incentive if the contractor keeps costs below a targeted ceiling. However, these incentives did not motivate the contractor to manage costs because when requirements grew, FAA simply increased the targeted ceiling for the contractor. At the time of our review, FAA had paid the contractor over $150 million of the total available cost incentives even though ERAM was at least $330 million over budget.

Continued Problems With ERAM Pose Risks to NextGen Initiatives

Despite the significant program risks and unresolved issues associated with ERAM, FAA has not conducted a detailed assessment of ERAM's interdependencies or impact on other programs' costs and schedules. Our work shows that ERAM's continuing problems could also cause significant cost growth and delays with other systems key to FAA's overall NextGen effort. These systems include DataComm, the System Wide Information Management (SWIM), and ADS-B. FAA plans to allocate about $600 million to integrate and align these systems with ERAM. ERAM delays will also affect FAA's ability to develop NextGen-related improvements (e.g., trajectory-based operations[12]) and develop and transition to a common automation platform for terminal and en route operations. In addition, ERAM delays will push back future software enhancements to add new NextGen capabilities, such as flexible and dynamic airspace redesign. These enhancements are estimated to cost over $1 billion.

[12] Trajectory-based operations focus on more precisely managing aircraft from departure to arrival with the benefits of reduced fuel consumption, lower operating costs, and reduced emissions.

COSTS, SCHEDULES, AND BENEFITS ARE UNCERTAIN FOR NEXTGEN'S TRANSFORMATIONAL PROGRAMS

Costs, schedules, and benefits are uncertain for three of the six NextGen transformational programs—ADS-B, SWIM, and DataComm. These programs will provide critical technologies and infrastructure for NextGen and allow for more efficient data sharing among airspace users, a key NextGen goal. FAA plans to spend almost $2 billion between FY 2012 and FY 2016 on these three transformational programs. However, FAA has not yet approved the programs' total cost or schedule baselines nor developed an integrated master schedule to manage and coordinate NextGen's implementation.

FAA Has Not Fully Addressed ADS-B Requirements and System Risks

ADS-B is a satellite-based surveillance technology that combines the use of aircraft avionics and ground-based systems. As we noted in our October 2010 report,[13] to realize the full range of ADS-B benefits FAA must address a number of critical issues. These include: (1) finalizing requirements for capabilities to display traffic information in the cockpit, (2) modifying the systems controllers rely on to manage traffic, (3) addressing broadcast frequency congestion concerns, (4) implementing procedures for separating aircraft, and (5) assessing security vulnerabilities. While FAA is planning to implement ADS-B in four segments, thus far it has only approved funding for the initial 2 segments to deploy the system's ground infrastructure. FAA has deployed 275 of the planned 800 radio ground station and also published a final rule mandating that airspace users equip ADS-B avionics by 2020.

FAA Faces Challenges in Establishing Clear Lines of Accountability for Managing SWIM

SWIM is expected to form the basis for a secure network that manages and shares information more efficiently among the air traffic systems that will comprise NextGen. Key benefits expected from SWIM are streamlined data communications and real-time information that will improve air traffic management, enhance airspace capacity, reduce flight delays, and decrease costs for FAA and aviation users.

As we reported in June,[14] FAA faces significant challenges with SWIM because it has not established clear lines of accountability for overseeing how SWIM is developed and managed. This has made it difficult to implement requirements and control the program's cost and schedule. As a result, FAA has already increased costs for SWIM's first segment by more than $100 million (original estimate was $179 million) and delayed its completion by at least 2 years. Without stable and consistent

[13] OIG Report Number AV-2011-002, "FAA Faces Significant Risks in Implementing Automatic Dependent Surveillance-Broadcast System and Realizing Benefits," October 12, 2010.

[14] OIG Report Number AV-2011-131, "FAA's Approach to SWIM Has Led to Cost and Schedule Uncertainty and No Clear Path for Achieving NextGen Goals," June 15, 2011.

requirements and clearly defined program priorities, FAA will not be able to define how much it will cost or how long it will take to deploy all three SWIM segments and realize expected benefits.

FAA Faces Industry and User Concerns With DataComm Plans

DataComm will provide two-way data communications between controllers and pilots that is similar to wireless e-mail. Developing and implementing DataComm will be a complex, high-risk effort, and industry officials have expressed skepticism about FAA's ability to deliver the program. Like ADS-B, DataComm faces the challenge of integrating with multiple FAA automation systems. FAA has already delayed plans to deploy DataComm's en route capabilities from 2016 to 2018. Total acquisition costs are uncertain, but FAA estimates that they could be as much as $3 billion.

FAA plans to implement DataComm in at least three segments and make a final investment decision for the first segment in FY 2012. Until FAA resolves these issues, however, users are likely to remain skeptical and reluctant to equip since FAA abandoned the similar Controller-Pilot Data Link Communications program in 2005. FAA did so due to concerns about cost growth and schedule delays resulting from unplanned, additional integration requirements that posed a risk to the program as well as concerns over how quickly airlines would equip with the avionics.[15]

FAA Has Yet To Develop an Integrated Master Schedule To Manage NextGen

FAA's approach of baselining smaller segments of larger programs, such as these three transformational programs, may reduce some risks in the short-term. However, as requirements continue to evolve, programs are left with no clear end-state and decision makers lack sufficient information to assess progress. Moreover, delays with one program can significantly slow another, since the programs have complex interdependencies with FAA's existing automation and communications systems. While FAA recognizes the need for an integrated master schedule to manage the implementation of these NextGen capabilities, it has not yet developed one. Without a master schedule, FAA will continue to face the challenges of fully mitigating operational, technical, and programmatic risks, and prioritizing trade-offs among its NextGen programs.

CONCLUSION

FAA's multibillion-dollar effort to enhance the flow of air traffic continues to experience management issues, leaving the costs, schedule, and expected benefits of NextGen initiatives uncertain. The RTCA task force's recommendations are an

[15] OIG Report Number AV-2004-101, "Observations on FAA's Controller-Pilot Data Link Communications Program," September 30, 2004.

important stepping stone to NextGen and a way for FAA to build confidence with users in its ability to deliver much needed benefits. Yet, much work remains for FAA to effectively implement the RTCA's recommendations and achieve promised near-term benefits. Unless FAA can effectively address RTCA's recommendations at already congested airports, resolve problems with ERAM, and address challenges to its transformational programs, the Agency's ability to meet NextGen goals and safeguard taxpayers' investment remains at risk.

Regardless of the funding levels Congress provides for NextGen, FAA must focus its attention on (1) NextGen budget priorities, detailed milestones, and performance goals and metrics; (2) problems with ERAM; and (3) an integrated master schedule for all NextGen programs. FAA needs to take actions now to advance NextGen and protect taxpayers' interests.

That concludes my statement. I would be happy to address any questions that you or the other Members of the Subcommittee may have.

EXHIBIT A. KEY RTCA TASK FORCE RECOMMENDATIONS FOR NEXTGEN'S MID-TERM PHASE

Rec's	Area	Recommended Capability
4	Airport Surface Operations	Improve the management of airport taxiways, gates, and parking areas by revamping systems for sharing information between FAA, airline operations centers and airports. Candidate locations include all major airports beginning with the New York area airports.
5	Runway Access	Improve the use of converging or closely spaced runways during low visibility conditions. Candidate airports include Kennedy, Las Vegas, and Newark.
4	Metroplex Airspace	Improve the capacity of airspace that affects multiple airports near large metropolitan areas, including Chicago, New York/New Jersey, and Southern California.
4	High-Altitude Cruise	Improve high-altitude flights by, among other things, increasing the availability of real-time data on the status of airspace used jointly by civilian and military aircraft. The first candidate location is Minneapolis Center.
2	Access to the National Airspace System	Improve service at smaller airports by implementing more precision approaches and departures and expanding ways to track aircraft in non-radar airspace. Full range of candidate locations is still under development.
	Cross-Cutting	
4	Integrated Air Traffic Management	Create an Integrated Air Traffic Management System that leverages new technologies and collaboration with users and implement solutions to traffic flow problems that are effectively integrated across air traffic control domains to achieve service providers' and users' efficiency goals.
5	Data Communications	Improve cruise and transition operations by using data communications to enable more efficient use of available or forecast capacity in the National Airspace System. Increase the ability to better adapt to changing conditions through improved dissemination of tactical reroutes around weather forecast and congestion.
	Overarching	
1		Achieve existing separation standards.
1		Incentivize equipage.
1		Streamline the operational approval and certification processes for new flight procedures.
1		Establish institutional mechanisms for transparency and collaboration in the planning, implementation, and post-execution assessments.
Total: 32		

Source: OIG