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# NEXT GENERATION AIR TRANSPORTATION SYSTEM

## FAA Has Made Some Progress in Implementation, but Delays Threaten to Impact Costs and Benefits

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Chairman Petri, Ranking Member Costello, and Members of the Subcommittee:

I appreciate the opportunity to testify before you today on the current progress toward implementing the Next Generation Air Transportation System (NextGen). NextGen will impact nearly every aspect of air transportation and will transform the way in which the air transportation system operates today. It will do so, in part, by

- using satellite-based surveillance as opposed to ground-based radars,
- using performance-based navigation<sup>1</sup> instead of cumbersome step-by-step procedures,
- replacing routine voice communications with data transmissions, and
- organizing and merging the disjointed data that pilots, controllers, airports, airlines, and others currently rely on to operate the system.

The Federal Aviation Administration (FAA) has been planning and developing NextGen since 2003, and is now implementing near-term (through 2012) and mid-term (through 2018) capabilities. Over the years, concerns have been raised by the Congress and other stakeholders that despite years of effort and billions of dollars spent, FAA has not made sufficient progress in deploying systems and producing benefits. In past reports, we have made a number of recommendations to FAA to address delays in development and acquisitions, improve its processes, and focus on accountability and performance. Others have also made recommendations to FAA to improve its implementation of NextGen. For example, the Department of Transportation's Office of the Inspector General recently made recommendations regarding specific NextGen programs, and the NextGen Midterm Implementation Task Force—whose creation was requested by FAA—resulted in consensus recommendations from industry on specific capabilities FAA should

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<sup>1</sup>Performance-based navigation includes such things as Area Navigation (RNAV), which enables aircraft to fly on any path within coverage of ground- or space-based navigation aids, permitting more access and flexibility for point-to-point operations; and Required Navigation Performance (RNP), which, like RNAV, enables aircraft to fly on any path within coverage of ground- or space-based navigation aids, but also includes an onboard performance monitoring capability. RNP also enables closer en route spacing without intervention by air traffic control and permits more precise and consistent arrivals and departures.

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prioritize.<sup>2</sup> Over the last 2 years, FAA has taken several steps and instituted many changes to address several of these issues.

My statement today discusses (1) the results of NextGen programs and improvements to date and (2) ongoing issues that will affect NextGen implementation. This statement today is based on our NextGen-related reports and testimonies over the last 2 years;<sup>3</sup> ongoing work for this subcommittee that includes our analysis of selected NextGen acquisitions and our analysis of FAA's efforts to harmonize NextGen with air traffic control modernization efforts in Europe; our review of FAA's 2025 Strategic Plan, 2011 NextGen Implementation Plan, 2012 Budget Submission, and other documents; and selected program updates from FAA officials. The GAO reports cited in this statement contain more detailed explanations of the methods used to conduct our work. We performed our work in accordance with generally accepted government auditing standards.

In summary, FAA has improved its efforts to implement NextGen and is continuing its work to address critical issues that we, stakeholders, and others have identified over the years. In some areas, FAA has implemented NextGen capabilities that have demonstrated measurable benefits for system users, such as fuel savings. FAA has also made

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<sup>2</sup>The Task Force included representation from the four major operating communities—airlines, business aviation, general aviation, and the military—as well as participation from controllers, airports, avionics and aircraft manufacturers, and other key stakeholders. The Task Force issued its report on September 9, 2009.

<sup>3</sup>GAO, *NextGen Air Transportation System: Mechanisms for Collaboration and Technology Transfer Could be Enhanced to More Fully Leverage Partner Agency and Industry Resources*, [GAO-11-604](#) (Washington, D.C.: June 30, 2011); *Integration of Current Implementation Efforts with Long-term Planning for the Next Generation Air Transportation System*, [GAO-11-132R](#) (Washington, D.C. Nov. 22, 2010); *Aviation and the Environment: Systematically Addressing Environmental Impacts and Community Concerns Can Help Airports Reduce Project Delays*, [GAO-10-50](#) (Washington, D.C.: Sept. 13, 2010); *Next Generation Air Transportation System: FAA and NASA Have Improved Human Factors Research Coordination, but Stronger Leadership Needed*, [GAO-10-824](#) (Washington, D.C.: Aug. 6, 2010); *NextGen Air Transportation System: FAA's Metrics Can Be Used to Report on Status of Individual Programs, but Not of Overall NextGen Implementation or Outcomes*, [GAO-10-629](#), (Washington, D.C.: July 27, 2010); *Next Generation Air Transportation System: Challenges with Partner Agency and FAA Coordination Continue, and Efforts to Integrate Near-, Mid-, and Long-term Activities are Ongoing*, [GAO-10-649T](#) (Washington, D.C.: Apr. 21, 2010); *Next Generation Air Transportation System: FAA Faces Challenges in Responding to Task Force Recommendations*, [GAO-10-188T](#) (Washington, D.C.: Oct. 28, 2009).

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progress in streamlining its processes, improving its capacity to develop new flight procedures, and focusing its efforts on specific procedures that are needed in key metropolitan areas. Furthermore, we found that several NextGen-related acquisitions are generally on time and on budget. However, some acquisitions have been delayed, which has impacted the timelines of other dependent systems, and the potential exists for other acquisitions to also encounter delays. These delays have resulted in increased costs and reduced benefits. Going forward, FAA must focus on delivering systems and capabilities in a timely fashion to maintain its credibility with industry stakeholders, whose adoption of key technologies is crucial to NextGen's success. FAA must also continue to monitor how delays will affect international harmonization issues, focus on human factors issues,<sup>4</sup> streamline environmental approvals, mitigate environmental impacts, and focus on improving management and governance.

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## FAA Has Implemented Aspects of NextGen That Have Produced Measurable Benefits, but Delays Threaten to Increase Costs and Impact Overall Implementation

FAA has made progress in several areas to improve its implementation of NextGen. FAA has set performance goals for NextGen through 2018, including goals to improve the throughput of air traffic at key airports by 12 percent over 2009 levels, reduce delays by 27 percent from 2009 levels, and achieve a 5 percent reduction in average taxi-time at key airports. The setting of NextGen performance goals is a positive step, but much work remains in identifying measurable and reasonable performance metrics and targets for specific NextGen activities.<sup>5</sup>

FAA has undertaken a number of NextGen initiatives to improve system efficiency. For example, FAA has begun work to streamline its procedure approval processes—including its environmental reviews of new procedures—and has expanded its capacity to develop new performance-based navigation routes and procedures. In 2010, FAA produced over 200 performance-based navigation routes and procedures, exceeding its goal of 112. FAA reports thousands of gallons of fuel savings from the performance-based navigation routes in operation at Atlanta and the continuous descents being used into Los Angeles and San Francisco. However, aircraft operators have complained that FAA has not produced

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<sup>4</sup>Human factors is the study of how humans interact with the design of the equipment they use, environments in which they function, and jobs they perform.

<sup>5</sup>[GAO-10-629](#).

the most useful or beneficial routes and procedures to date. To address these concerns, FAA has undertaken thorough reviews in a number of areas. FAA has completed initial work to identify improvements needed in the airspace in Washington, D.C.; North Texas; Charlotte, North Carolina; Northern California; and Houston, Texas—focusing on routes and procedures that will produce benefits for operators. While the specific benefits from this work are not yet fully known, FAA expects to achieve measurable reductions in miles flown, fuel burn, and emissions from these actions. In addition, airport surface management capabilities—such as shared surface surveillance data and new techniques to manage the movement of aircraft on the ground—installed in Boston and New York have saved thousands of gallons of fuel and thousands of hours of taxi-out time, according to FAA.

With respect to the continuing implementation of NextGen systems and capabilities, our ongoing work has preliminarily found that some key NextGen-related programs are generally proceeding on time and on budget (see table 1).

**Table 1: Selected Baselined NextGen and Related Programs Cost and Schedule Performance**

Dollars in millions

Program	Description	Start date	Original Completion date	Projected completion date	Difference between original and projected completion dates (in months)	Original cost	Projected cost as of Aug. 2011	Difference between original and projected cost
Automatic Dependent Surveillance Broadcast (ADS-B)	A satellite-based information broadcasting system to enable more precise control of aircraft	Aug. 2007	Sept. 2014	Sept. 2014	0	\$1,682	\$1,726	\$45
Collaborative Air Traffic Management (CATM)- includes work packages 1-3	Encompasses the development of systems to manage airspace and flight information	Aug. 2005	Dec. 2015	Dec. 2015	0	561	561	0
System Wide Information Management (SWIM)-segment 1 <sup>a</sup>	The information management architecture for the national airspace system	July 2009	Sept. 2015	Sept. 2015	0	310	310	0

Dollars in millions

Program	Description	Start date	Original Completion date	Projected completion date	Difference between original and projected completion dates (in months)	Original cost	Projected cost as of Aug. 2011	Difference between original and projected cost
Time-Based Flow Management (TBFM)	Modernizes the Traffic Management Advisor (TMA) system aimed at integration of airport and air traffic control information	April 2010	Nov. 2014	Nov. 2014	0	115	115	0
En Route Automation Modernization (ERAM)	A new enroute air traffic control system for high altitude traffic	June 2003	Dec. 2010	Aug. 2014	44	2,155	2,485	330

Source: GAO analysis of FAA data.

<sup>a</sup>Schedule and cost for SWIM is subject to change due to rebaselining that will occur in 2011 or later.

Some key acquisitions may soon encounter delays, which can increase overall acquisition costs, as well as costs to maintain current systems. For example, delays in implementing the ERAM program is projected to increase costs by \$330 million, as well as an estimated \$7 to \$10 million per month in additional costs to continue maintaining the system that ERAM was meant to replace. Moreover, due to the integrated nature of NextGen, many of its component systems are mutually dependent on one or more other systems. For example, ERAM is critical to the delivery of ADS-B because ADS-B requires the use of some ERAM functions. ERAM is also pivotal to the on-time implementation of two other key NextGen acquisitions—Data Communications and SWIM. In part due to ERAM’s delay, FAA pushed the Data Communications program’s start date from September 2011 to February 2012, plans to revise the original SWIM-segment 1 cost and schedule plan, and delayed the SWIM-segment 2 start date from 2010 to December 2012. The long-term result of this decision is not yet known but it could delay certain SWIM capabilities and hinder the progress of other capabilities that depend, in turn, on the system integration that SWIM is intended to provide. Thus, looking more broadly, the implementation of NextGen—both in the midterm (through 2018) and in the long term (beyond 2018)—will be affected by how well FAA manages program interdependencies.

Delays in program implementation, as described above, and budget constraints have also affected FAA’s capital budget planning. The

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Administration has proposed reducing FAA's capital budget by a total of \$2.8 billion, or 20 percent, for fiscal years 2012 through 2015 largely due to governmentwide budget constraints. Most of this proposed reduction is on NextGen and NextGen-related spending, as reflected in FAA's revised 5-year Capital Investment Plan for fiscal years 2012 through 2016. Congress has not completed FAA's appropriation for fiscal year 2012, but current House and Senate appropriation bills propose to fund the agency near or above 2011 levels. FAA will have to balance its priorities to ensure that NextGen implementation stays on course while also sustaining the current infrastructure—which is needed to prevent failures and maintain the reliability and efficiency of current operations.

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## FAA Faces Several Ongoing Issues That Will Affect NextGen Implementation

To maintain credibility with aircraft operators that NextGen will be implemented, FAA must deliver systems and capabilities on time so that operators have incentives to invest in the avionics that will enable NextGen to operate as planned. As we have previously reported, a past FAA program's cancellation contributed to skepticism about FAA's commitment to follow through with its plans. That industry skepticism, which we have found lingers today, could delay the time when significant NextGen benefits—such as increased capacity and more direct, fuel-saving routing—are realized. A number of NextGen benefits depend upon having a critical mass of properly equipped aircraft. Reaching that critical mass is a significant challenge because the first aircraft operators to equip will not obtain a return on their investment until many other operators also equip.

Stakeholders have proposed various equipage incentives. For example, one such proposal is for a private equity fund, backed by federal guarantees, to provide loans or other financial assistance to operators to help them equip, with payback of the loans dependent on FAA meeting its schedule commitments to implement capabilities that will produce benefits for operators. In addition, the NextGen Advisory Committee<sup>6</sup> has begun to identify the specific avionics requirements for particular NextGen

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<sup>6</sup>The NextGen Advisory Committee is comprised of aviation stakeholders from the government and industry. The committee works to develop a common understanding of NextGen priorities in the context of overall NextGen capabilities and implementation constraints, with an emphasis on the near term and midterm. The committee primarily focuses on implementation issues, including prioritization criteria at a national level, joint investment priorities, and location and timing of capability implementation.

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capabilities through the midterm, as well as identifying who—in terms of which parts of the fleet operating in which regions—should be targeted for additional incentives to equip.

Our past and ongoing work examining aspects of NextGen have highlighted several other challenges facing FAA in achieving timely and successful implementation. For this statement, we would like to highlight a few specific areas: the potential effect of program delays on international harmonization efforts, the need for FAA to ensure that it addresses human factors and workforce training issues to successfully transition to a new air transportation system, the need for FAA to continue to address potential environmental impacts, and the need for FAA to improve the management and governance of NextGen.

- **Effect of delays on FAA’s ability to collaborate with Europe.** Delays to NextGen programs, and potential reductions in the budget for NextGen activities, could delay the schedule for harmonization with Europe’s air traffic management modernization efforts and the realization of these benefits. FAA officials indicated that the need to address funding reductions takes precedence over previously agreed upon schedules, including those previously coordinated with Europe. For example, FAA officials responsible for navigation systems told us that FAA is restructuring plans for its ground-based augmentation system (GBAS) because of potential funding reductions.<sup>7</sup> While final investment decisions concerning GBAS have yet to be made, these officials said that FAA might have to stop its work on GBAS while Europe continues its GBAS development, with the result that Europe may have an operational GBAS, while FAA does not.<sup>8</sup> A delay in implementing GBAS would require FAA to continue using the current instrument landing system which does not provide the benefits of GBAS, according to these officials. Such a situation could again fuel stakeholder skepticism about whether FAA will follow through with its commitment to implementing NextGen, and in turn, increase airlines’ hesitancy to equip with NextGen technologies.

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<sup>7</sup>GBAS is designed to supplement satellites in providing aircraft positioning data to pilots and air traffic controllers as aircraft approach runways prior to landing.

<sup>8</sup>GBAS is currently in the research and development phase. At the completion of this phase, FAA will decide whether it will be the system to replace instrument landing systems and move it into its acquisition system.

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- **Need to address human factors and training issues.** Under NextGen, pilots and air traffic controllers will rely to a greater extent on automation, which will change their roles and responsibilities in ways that will necessitate an understanding of the human factors issues involved and require that training be provided on the new automated systems. FAA and the National Aeronautics and Space Administration (NASA)—the primary agencies responsible for integrating human factors issues into NextGen—must ensure that human factors issues are addressed so that controllers, pilots, and others will operate NextGen components in a safe and efficient manner. Failure to do so could delay implementation of NextGen. We recently reported that FAA has not fully integrated human factors into the development of some aviation systems.<sup>9</sup> For example, we noted that controllers involved in the initial operations capabilities tests of ERAM at an air traffic control center in Salt Lake City found using the system cumbersome, confusing, and difficult to navigate, thus indicating that FAA did not adequately involve controllers who operate the system in the system’s early development. In response to our recommendations in that report, FAA has created a cross-agency coordination plan in cooperation with NASA that establishes focus areas for human factors research, inventories existing facilities for research, and capitalizes on past and current research of all NextGen issues. In addition to integrating human factors research into NextGen systems, FAA and NASA will have to identify and develop the training necessary to address controllers’ and pilots’ changing roles, and have this training in place before NextGen is fully realized (when some aircraft will be equipped with NextGen systems and others will not).
  - **Need to address environmental impacts of NextGen.** Another challenge to implementing NextGen is expediting environmental reviews and developing strategies to address the environmental impacts of NextGen. As we stated in our recent report on environmental impacts at airports, with the changes in aircraft flight paths that will accompany NextGen efforts, some communities that were previously unaffected or minimally affected by aircraft noise will be exposed to increased noise levels.<sup>10</sup> These levels could trigger the need for environmental reviews, as well as raise community concerns. Our report found that addressing environmental impacts can delay the

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<sup>9</sup>GAO-10-824.

<sup>10</sup>GAO-10-50.

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implementation of operational changes, and indicated that a systematic approach to addressing these impacts and the resulting community concerns may help reduce such delays. To its credit, FAA has been working to develop procedures for streamlining environmental review processes that affect NextGen activities.

- **Need to improve management and governance.** FAA has embarked on an initiative to restructure a number of organizations within the agency. We have previously reported on problems with FAA's management and oversight of NextGen acquisitions and implementation.<sup>11</sup> Specifically, FAA plans to abolish and merge a number of committees to improve decision making and reduce time requirements of senior FAA executives. It also plans to make the NextGen organization the responsibility of the Deputy Administrator and to create a new head of program management for NextGen-related programs to ensure improved oversight of NextGen implementation. Further, the Air Traffic Organization will be divided into two branches: operations and NextGen program management. Operations will focus on the day-to-day management of the national air space and the program management branch will be responsible for developing and implementing programs while working with operations to ensure proper integration. While elimination of duplicative committees and focus on accountability for NextGen implementation is a positive step, it remains to be seen whether this latest reorganization will produce the desired results.

Chairman Petri, Ranking Member Costello, and Members of the Subcommittee, this concludes my prepared statement. I would be pleased to answer any questions that you may have at this time.

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<sup>11</sup>[GAO-10-629](#) and GAO, *Next Generation Air Transportation System: Status of Systems Acquisition and the Transition to the Next Generation Air Transportation System*, [GAO-08-1078](#) (Washington, D.C.: Sept. 11, 2008).

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## GAO Contact and Staff Acknowledgments

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