



441 G St. N.W.
Washington, DC 20548

November 17, 2016

The Honorable Bill Shuster
Chairman
Committee on Transportation & Infrastructure
House of Representatives

Next Generation Air Transportation System: Information on Expenditures, Schedule, and Cost Estimates, Fiscal Years 2004 — 2030

Dear Mr. Chairman:

The United States National Airspace System (NAS), which is overseen by the Federal Aviation Administration (FAA), is generally considered not only the busiest and most complex such system in the world, but also the safest. FAA is leading the implementation of the Next Generation Air Transportation System (NextGen) a long-term initiative that is to transform the current radar-based air transportation system into one that uses satellite navigation, automated aircraft position reporting, and digital communications. NextGen is intended to, among other things, increase the air transportation system’s capacity, enhance airspace safety, and reduce delays experienced by airlines and passengers. Congress authorized the planning for NextGen in 2003,¹ with the goal of transforming the NAS by 2025. However, we and others have found that delays and cost increases in individual programs that FAA initiated prior to NextGen and on which NextGen is dependent, could affect FAA’s timelines and goals for NextGen implementation.² In recent years, in an effort to address questions raised by Congress and stakeholders over the pace of NextGen modernization efforts, FAA has emphasized NextGen improvements that it plans to implement by 2016. FAA has also made progress in implementing improvements it plans to complete in the mid- and long-term.³

You asked us to examine FAA’s expenditures, cost estimates, and time frames for completing NextGen. This report addresses:

1. How much has FAA reported investing in NextGen since fiscal year 2004?
2. When does FAA project that NextGen will be completed?
3. How have FAA's NextGen cost estimates changed since fiscal year 2004 and how much additional funding does FAA project will be required to complete NextGen?

¹ Vision 100—Century of Aviation Reauthorization Act Pub. L. No. 108-176, §§ 709-710, 117 Stat. 2490, 2582 (2003) established the Joint Planning and Development Office to manage the planning and development of the NextGen initiative.

² See, for example, GAO, *Air Traffic Control Modernization: Management Challenges Associated with Program Costs and Schedules Could Hinder NextGen Implementation*, [GAO-12-223](#) (Washington, D.C.: February 16, 2012).

³ Mid-term includes NextGen capabilities that FAA plans to implement by 2018. Long-term refers to FAA’s plans to implement and operate NextGen through 2025 and beyond.

To address these objectives we reviewed FAA's budget documents from fiscal year 2004 through fiscal year 2016, data on FAA's obligations from its financial management system Delphi, and FAA's NextGen planning documents.⁴ To assess the reliability of FAA's data, we reviewed available documentation and audit reports and interviewed FAA officials. We determined that the data were sufficiently reliable for the purposes of this report. We reviewed our prior reports on NextGen, as well as those prepared by the Department of Transportation (DOT) Office of Inspector General and the federally funded research and development center, MITRE. We also interviewed FAA officials, MITRE representatives, and members of the Radio Technical Commission for Aeronautics (RTCA).⁵ In addition, we compared NextGen cost estimates from 2006, 2007, and 2012 through 2016 to determine how they have changed over time and reviewed the 2016 estimate to determine how much funding FAA projects will be required to implement NextGen. We did not assess the reliability of the cost estimates in FAA's NextGen cost-benefit analyses, but did not need to in order to meet the objectives of this review.⁶ Due to time constraints, we did not provide a final draft of this product to DOT for formal comment. However, we did provide draft written material to FAA officials for review to confirm the accuracy and completeness of critical facts and findings. We conducted this performance audit from July 2016 through November 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.

Results in Brief

From fiscal year 2004 through fiscal year 2016, FAA has received from Congress approximately \$7.4 billion for programs and activities it identified as NextGen, according to our analysis of FAA budget documents. In addition to the funds FAA has received for programs and activities FAA identifies as NextGen, FAA has also received significant amounts for programs that are intended to modernize air traffic control (ATC) and on which aspects of NextGen are dependent. According to FAA's 2016 plans, major NextGen transformational programs will be in place by 2025, enabling the agency to meet high-level NextGen objectives, which include accommodating more air traffic, increasing airport access and operations efficiency, and improving air traffic control communications. FAA has identified six NextGen activities that it had previously planned to complete by 2025, but has now deferred until after 2030, due to infeasibility or changed operational needs, according to FAA officials. NextGen cost estimates have evolved from a limited, preliminary estimate in 2006 by an advisory agency before essential NextGen planning had been completed, to business cases produced by an interagency NextGen planning body in 2007 and by FAA from 2012 to 2016. FAA's 2016 business case estimate projected the agency's estimated cost at \$20.6 billion—\$2.6 billion more than the FAA projected in 2012 and within the range of the 2007 estimate of \$15 to \$22 billion. FAA's 2016 estimate of \$15.1 billion in costs for the aviation industry is about \$4 billion lower

⁴ Fiscal year 2004 was already underway when Congress authorized funding for the Joint Planning and Development Office in Vision 100.

⁵ RTCA, which includes representatives from industry and FAA, is a private, non-profit, U.S.-based organization that develops consensus-based performance standards for air-traffic control systems. It serves as an advisory body to FAA whose recommendations are the basis for a number of FAA's policy, program, and regulatory decisions.

⁶ We have previously evaluated FAA's cost estimates for several major programs and made several recommendations to improve their reliability. FAA has taken steps to address these recommendations. See GAO 12-223.

than its 2012 estimate. FAA's most recent estimate projects NextGen costs of \$14.8 billion from fiscal year 2015 to 2030. According to FAA, NextGen cost estimates for FAA have changed in part because, unlike earlier estimates, later estimates considered the cost of sustaining systems, while industry costs have lowered in part because the shift from smaller to larger aircraft decreased the number of aircraft to be equipped with NextGen technology.

Background

In December 2003, Congress authorized the creation of the Joint Planning and Development Office (JPDO) within FAA to plan for and coordinate the long-term transition from the nation's current air traffic control system to NextGen by 2025. JPDO began operating in 2004 with research and development funds from FAA and the National Aeronautics and Space Administration (NASA), producing its first plan for developing and implementing NextGen by the end of that year. Between 2004 and 2014, JPDO was responsible for developing an integrated plan for NextGen and facilitating collaboration between FAA and other federal agencies. However, FAA was largely responsible for implementing the policies and systems necessary for NextGen. In 2014, with NextGen implementation underway, Congress ended funding for JPDO, and FAA's Interagency Planning Office assumed the lead responsibilities for coordinating FAA's NextGen implementation with other agencies.

FAA began developing and implementing NextGen in 2007, although some research and programs that provided a foundation for NextGen began earlier. There are three different types of programs that relate to NextGen:

- *NextGen transformational programs:* According to FAA, the NextGen modernization involves a number of programs to transform the NAS from the current radar-based air transportation system, such as the Automatic Dependent Surveillance-Broadcast (ADS-B),⁷ System-Wide Information Management (SWIM), Data Communications (Data Comm), National Airspace System (NAS) Voice System, Common Support Services—Weather, and Collaborative Air Traffic Management Technologies. (See enclosure I for descriptions of these programs and FAA's planned implementation timeframe.)
- *Foundational programs that FAA does not consider to be NextGen:* FAA also manages a number of programs that are not considered part of NextGen, but are instrumental to achieving NextGen objectives, according to FAA officials. Many of these programs were conceived or underway prior to the inception of NextGen. One example is the Terminal Automation Modernization and Replacement (TAMR) program, which is modernizing terminal ATC automation systems.⁸ Another such program is the Wide Area Augmentation System which provides aircraft with more accurate position information for more direct flight paths and precision approaches to airports.⁹
- *Foundational programs that include one or more programmatic parts or "segments" that FAA transferred to NextGen:* For example, FAA also manages the En Route Automation

⁷ FAA also refers to this capability as Surveillance Broadcast Services Subsystem.

⁸ TAMR provides direct mission support to the FAA by ensuring the efficient flow of traffic of traffic through the NAS, principally in the terminal airspace domain.

⁹ The Wide Area Augmentation System is a satellite-based navigation technology that allows qualifying airports in the NAS to have vertical and horizontal guidance during all phases of a flight, regardless of weather conditions, without installing expensive legacy navigation systems at each runway.

Modernization (ERAM), which FAA initiated prior to NextGen. ERAM is a system which replaced the Host Computer System in early 2015.¹⁰ However, because ERAM is also critical to the delivery of certain NextGen capabilities and programs, FAA considers recent technical improvements to ERAM to be part of NextGen.

Congress appropriates most of the funding to FAA from the Airport and Airway Trust Fund,¹¹ which receives revenues from a series of excise taxes on airline tickets, aviation fuel and cargo shipments paid by users of the national airspace system. The remainder of FAA's appropriations comes from the General Fund of the U.S. Treasury. The Airport and Airway Trust Fund provides funding for FAA's capital accounts, including research, engineering and development (RE&D) and facilities and equipment (F&E). FAA obligates funds for NextGen from three of its four main budget accounts,¹² each of which receives separate appropriations: operations, F&E, and RE&D.¹³

According to FAA Budget Documents and Data, FAA Has Received \$7.4 Billion for NextGen since Fiscal Year 2004

From fiscal year 2004 through fiscal year 2016, FAA has received from Congress approximately \$7.4 billion for NextGen according to our analysis of FAA budget documents and data.¹⁴ That amount represents about 4 percent of Congress's total appropriations to FAA and 93 percent of the \$7.96 billion that FAA requested for NextGen in that time period. This amount encompasses funds for planning and implementation of NextGen transformational programs as well as for technology enhancements to some foundational programs, like ERAM, segments of which FAA now considers to be NextGen. According to FAA officials, operational costs of fully implemented NextGen programs are not included in these funds. In addition, officials said that FAA did not identify programs and activities as NextGen in its budget documents until 2008, but they were able to identify for us the three NextGen-related programs for which FAA received funds in fiscal year 2007. We compared our analysis of FAA budget documents and data to a summary of FAA's NextGen funding provided by FAA officials and found that the difference between the nominal budget totals is minimal.¹⁵

¹⁰ FAA used the Host Computer System at en-route centers to process radar data and allow controllers to monitor and separate traffic. In 2012, we found that earlier segments of FAA's ERAM program experienced cost and schedule delays. (See GAO-12-223.) Those segments were completed in 2015.

¹¹ 26 U.S.C. § 9502

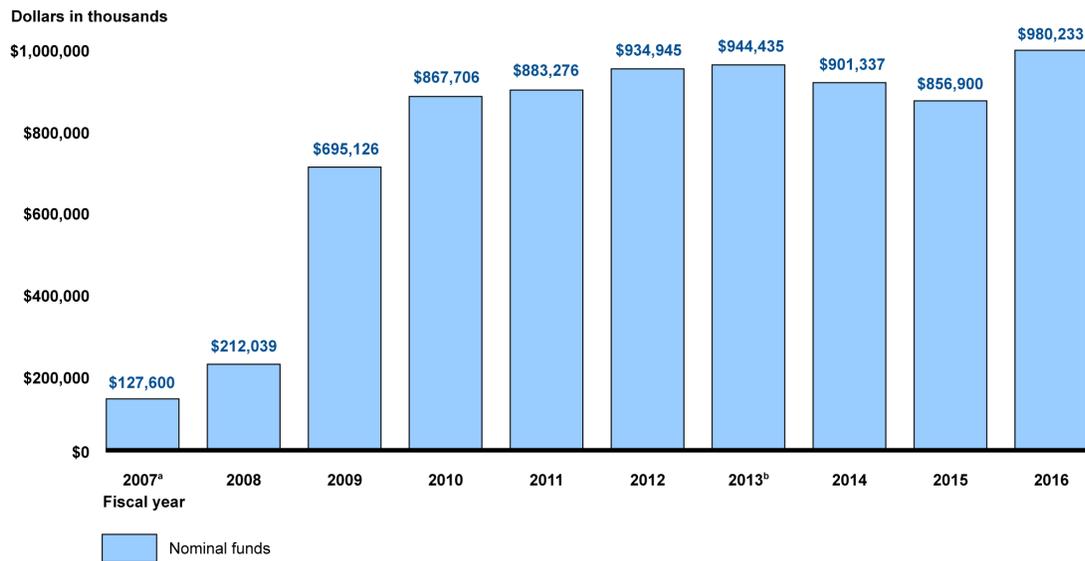
¹² The term obligation refers to a definite commitment by a federal entity that creates a legal liability to make payments immediately or in the future. Federal agencies incur obligations, for example, when they award grants or contracts to nonfederal entities.

¹³ The fourth account, which does not contribute funds to NextGen, is Grants-in-Aid for Airports.

¹⁴ According to FAA's budget documents and data from fiscal year 2004 through 2016, the sum of funds FAA has received for NextGen, including funds from F&E, RE&D and operations accounts, is \$7,368,468,000.

¹⁵ FAA officials said that FAA's enacted budget for all NextGen appropriations from fiscal years 2004 through 2016 totaled \$7.364 billion. This total includes a total of \$114.1 million for JPDO from fiscal years 2004 through 2013. According to FAA officials, the JPDO budget funded high-level planning and was not program specific.

Figure 1: Funds the Federal Aviation Administration’s (FAA) Has Received for Next Generation Air Transportation System (NextGen), Fiscal Years (FY) 2007 through 2016



Source: GAO analysis of FAA budget submission data. | GAO-17-241R

^a According to FAA officials, the agency did not identify programs and activities as NextGen in its budget documents until 2008, but officials were able to identify three NextGen-related programs that FAA has received facilities and equipment funds for in fiscal year 2007, in addition to research and development funds it distributed to the Joint Program Development Office (JPDO) for NextGen.

^b In 2013, as a result of sequestration, FAA received \$883,328 thousand for NextGen, but FAA officials noted that they also reprogrammed \$27,900 thousand to NextGen from another program.

Note: From 2004 through 2006, FAA distributed \$25,978,000 thousand of its research and development funds for JPDO to plan and coordinate the transition to NextGen.

In addition to reviewing funds FAA has received for programs and activities FAA identified as NextGen and NextGen-related, we also reviewed FAA’s NextGen obligations data. This data reflect a definite commitment to pay for goods or services. According to data from FAA’s financial management system, as of October 2016, FAA obligated nearly all of the funds it received for programs and activities it identified as NextGen.¹⁶ According to FAA officials, there is considerable variation in the obligation rates for facilities and equipment projects due to the diverse nature of their procurement cycles, but because F&E funds must be obligated within 3 years of an appropriation, the data on funds FAA has received provide an approximation of FAA’s investment in NextGen.

In addition to funds for NextGen, FAA has also invested in foundational programs that are intended to modernize the ATC and on which aspects of NextGen are dependent. In particular, according to FAA’s 2016 Capital Investment Plan, FAA estimates a total cost of approximately \$2.732 billion for ERAM and \$2.719 billion for TAMR.¹⁷

¹⁶ FAA obligated \$7,320,671,000 since fiscal year 2007.

¹⁷ ERAM’s original acquisition program date or start date was June 2003 and TAMR’s (STARS TAMR Phase 1) start date was February 1996.

FAA Plans to Implement Major NextGen Programs by 2025, but Planned Technology Enhancements and Implementation of Advanced Applications Extend beyond 2030

According to FAA's 2016 plans for NextGen,¹⁸ major NextGen transformational programs will be in place by 2025, enabling the agency to meet high-level NextGen objectives, which include:

- accommodating increased traffic, while improving operational efficiencies;
- increasing access to smaller airports and airports under low-visibility conditions while making surface operations more efficient for high density airports; and
- improving information sources, information sharing, and data integration within and among systems.

We have ongoing work looking at the status of FAA's implementation of NextGen and plan to issue our report in early 2017. According to FAA, current segments of NextGen programs are generally on schedule. In 2012, we found that FAA broke large, complex programs, like NextGen's SWIM, into smaller segments to reduce risk.¹⁹ This approach can improve program management by positioning FAA to make midcourse corrections, if necessary, and thus help FAA avoid costly late-stage changes. However, this approach can also increase the duration and possibly the total cost of the program.²⁰ For example, in 2015 we found that FAA has divided capital investments for Data Comm into small segments,²¹ raising questions from the aviation industry about when FAA will fully implement Data Comm.²² However, according to MITRE, the aviation industry has been able to leverage current ground-based and aircraft-based navigation capabilities to realize initial benefits of NextGen at key metroplex areas.²³

FAA anticipates that its planned NextGen transformational programs will be implemented by 2025. However, FAA officials have acknowledged that the aviation industry will not be able to use some of the more advanced capabilities that these programs are expected to provide until aircraft are equipped to use these capabilities.²⁴ According to FAA, our prior work on NextGen,²⁵ and MITRE, challenges to full implementation of NextGen include aircraft operator acceptance and equipage. According to MITRE representatives, it is not necessary to have all aircraft fully

¹⁸ *The Future of the NAS* (2016) is FAA's update to its *NextGen Mid-term Concept of Operations* planning document issued in 2011.

¹⁹ GAO, *Air Traffic Control: FAA's Modernization Efforts Past, Present, and Future*, [GAO-04-227T](#) (Washington, D.C.: Oct. 30, 2003) and [GAO-12-223](#)

²⁰ [GAO-04-227T](#) and [GAO-12-223](#)

²¹ The Data Comm program would supplement existing voice communications between pilots and air traffic controllers and serve as an enabler for the NextGen operational improvements

²² GAO, *Aviation Finance: Observations on the Effects of Budget Uncertainty on FAA*, [GAO-16-198R](#) (Washington, D.C.: November 19, 2015)

²³ A metroplex is a geographical area which includes either a major airport or several commercial and general aviation airports in close proximity.

²⁴ The aviation industry includes commercial aviation, general aviation, airports, manufacturers and labor.

²⁵ See, for example, GAO, *Next Generation Air Transportation System: Improved Risk Analysis Could Strengthen FAA's Global Interoperability Efforts*, [GAO-15-608](#) (Washington, D.C.: July 29, 2015); GAO, *Next Generation 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).

equipped, for example with Data Comm, in order for the aviation industry to obtain NextGen benefits.

After 2025, FAA plans to continue enhancing technology, and to implement advanced NextGen applications. According to FAA officials and MITRE representatives we spoke to, modernization of air traffic management is an ongoing process. For example, according to FAA officials, FAA needs to continually update technical products that are no longer commercially available, such as voice communication services. In addition to ongoing modifications and upgrades, FAA has identified six NextGen activities that it had previously planned to complete by 2025, but has now deferred until after 2030 due to technical or operational infeasibility or changed operational needs, according to FAA officials. FAA officials explained that these applications are not in progress, and may be continually deferred, redefined, or never implemented. For example, in 2011 FAA planned to implement automated conflict resolution aids—a mechanism to enable air traffic controllers to manage more aircraft while maintaining safety—in the mid-term (by 2018). However, FAA’s revised plan for NextGen has deferred implementation until after 2030, in part because NextGen programs FAA projects will be in place by 2025 will provide air traffic controllers with the tools to safely manage a sufficient number of additional aircraft, according to FAA officials. (See enclosure for descriptions of the other five deferred applications.)

NextGen Total Cost Estimates Have Evolved, but Not Increased Markedly since Fiscal Year 2004 and FAA Currently Projects Costs of \$14.8 billion from Fiscal Year 2015 to 2030

NextGen cost estimates have evolved from limited, preliminary estimates in 2006 to FAA business case estimates issued each year from 2012 to 2016. The first cost estimate for NextGen was developed in 2006, by an advisory committee to FAA—the Research, Engineering and Development Advisory Committee (REDAC). As we previously found,²⁶ this was a limited, preliminary cost estimate of FAA’s total budget requirements for developing, implementing, and operating the NAS with NextGen and was not endorsed by FAA.²⁷ The advisory committee estimated that pursuing NextGen would require an average total FAA budget of \$15 billion per year through 2025 (in 2005 dollars)—\$1 billion more than FAA’s total fiscal year 2006 appropriation of about \$14 billion.²⁸ However, this estimate had several limitations:

- It did not include the cost of intermediate technology development work—a key step in developing NextGen.
- It was developed before JPDO completed important planning documents.
- It did not include estimates of what implementing NextGen would cost other partner agencies (e.g., Departments of Commerce, Defense, and Homeland Security; NASA; and the White House Office of Science and Technology Policy.).

²⁶ GAO, *Next Generation Air Transportation System: Progress and Challenges Associated with the Transformation of the National Airspace System*, GAO-07-25, (Washington, D.C.: November 13, 2006)

²⁷ The REDAC estimate included a best case, base case, and worst case scenario, comparing estimates for FAA’s total budget requirements with NextGen versus the status quo (i.e., no NextGen). REDAC did not break out the estimated cost of NextGen separate from the costs of operating the NAS and implementing programs developed prior to NextGen.

²⁸ REDAC estimated that pursuing the status quo (i.e., no NextGen) would also require an average FAA budget of \$15 billion per year through 2025 (in 2005 dollars).

- The advisory committee’s report provided cost estimates for FAA’s entire budget, but did not provide transparency as to how much NextGen itself would cost. As a result, this cost estimate is not comparable to later estimates.

Moreover, REDAC’s preliminary cost estimates were predicated on the assumption that FAA would experience 20 years of consistent and stable funding, management, and oversight. Since then we have reported on how, according to FAA officials, past budget uncertainty has affected FAA’s ability to implement NextGen, although current segments of NextGen programs are generally on budget.²⁹

In 2007, JPDO produced a business case—a planning document that assesses the estimated costs and benefits of NextGen—that projected that through fiscal year 2025, FAA’s total NextGen cost would be between \$15 billion and \$22 billion and that costs to the aviation industry would be between \$14 billion and \$20 billion. A number of uncertainties contributed to the range of estimates. According to the JPDO business case, in estimating costs from 2007 to 2025, earlier costs were more certain as FAA had already submitted its NextGen development and implementation budget request for fiscal year 2008. However, the business case noted that the specificity and detail of the estimate for fiscal years 2012 to 2025 was still a work in progress, in part because JPDO had just released a NextGen enterprise architecture—a long-term strategic plan for NextGen—and completed its NextGen integrated work plan.

In 2012, FAA issued a new NextGen business case and has updated it annually (see table 1). According to FAA officials, the agency’s business case estimates costs and benefits in years beyond FAA budgetary planning. These estimates include capital expenditures, as well as research and operations, but do not include the cost of FAA staff and training. In each year’s business case, FAA found that the benefits of NextGen exceeded the costs to both FAA and the aviation industry.

Table 1: Federal Aviation Administration (FAA) Business Case Estimates of the Cost of the Next Generation Air Transportation System (NextGen) for Fiscal Years 2007 – 2030

Year Estimate was Made	Estimated Cost to FAA ^a	Estimated Cost to the Aviation Industry ^b	Estimated Cost to FAA and the Aviation Industry
2012 (in 2011 dollars)	\$18 billion	\$19 billion	\$37 billion
2013 (in 2012 dollars)	\$20 billion	\$19 billion	\$39 billion
2015 (in 2014 dollars)	\$20.5 billion	\$15.1 billion	\$35.6 billion
2016 (in 2015 dollars)	\$20.6 billion	\$15.1 billion	\$35.7 billion

Source: GAO analysis of FAA’s *Future of the NAS*, 2016 | GAO-17-241R

^a According to FAA officials, FAA business case estimates are intended for the purpose of cost-benefit analyses and therefore estimate costs in years beyond FAA budgetary planning. These estimates include capital expenditures, research and operations, but do not include the cost of FAA staff and training.

^b FAA’s estimation of aviation industry costs reflects anticipated avionics equipage for Automatic Dependent Surveillance-Broadcast (ADS-B), Data Communications, and Required Navigation Performance—NextGen programs that require the aviation industry to equip aircraft in order to realize the benefits of NextGen.

Note: In 2014, FAA’s update to the NextGen business case calculated cost estimates for a different time frame (specifically, from fiscal years 2013 through 2030). FAA’s estimated cost for that time frame was \$13.6 billion (in 2012 dollars); while the aviation industry’s estimated cost was \$15 billion, for a total of \$28.6 billion.

²⁹ [GAO-16-198R](#)

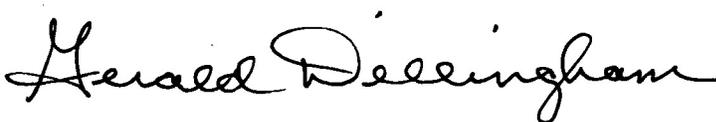
FAA's most recent estimate projects NextGen costs of \$14.8 billion from fiscal year 2015 to 2030. FAA's 2016 business case estimate projected the agency's estimated cost at \$20.6 billion—\$2.6 billion more than it projected in 2012 and within the range of JPDO's 2007 estimate of \$15 to \$22 billion. Of the \$20.6 billion in estimated costs, FAA's business case indicated that the agency had already expended \$5.8 billion through fiscal year 2014— approximately 28 percent of the estimated cost of NextGen. FAA's 2016 estimate of \$15.1 billion in costs for the aviation industry is about \$4 billion lower than its 2012 estimate.

NextGen total cost estimates have evolved, but have not increased markedly since fiscal year 2004. According to FAA, NextGen cost estimates have changed in part because earlier estimates considered the cost of upgrades and enhancements, but over time estimates have also considered the cost of sustaining systems, performance-based navigation procedures, and recently, the costs associated with integrating unmanned aircraft systems into the NAS. As noted above, FAA's current estimated total cost for the aviation industry to equip for NextGen-capable avionics is lower than earlier estimates. FAA officials explained that the new estimates are lower in part because smaller aircraft are being replaced by new, larger, and better equipped aircraft, reducing the number of aircraft in the commercial fleet. According to MITRE representatives, several factors have contributed to the lower aviation industry cost estimates, including changes in assumptions for the expected volume of commercial traffic, modifications to cost of equipage and reduction in uncertainty about what equipage aircraft would need.

We will send copies of this report to the appropriate congressional committees and to the Secretary of Transportation. This report will also be available at no charge on the GAO website at <http://www.gao.gov>.

Should you or your staff have questions concerning this report, please contact me at (202) 512-2834 or dillingham@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report were Ed Laughlin (Assistant Director), Jaclyn Nelson (Analyst in Charge), Kevin Egan, Carol Henn, David Hooper, Delwen Jones, Hannah Laufe, Tom McCabe, Sara Ann Moessbauer, Malika Rice, and Kelly Rubin.

Sincerely yours,



Gerald Dillingham, Ph.D.

Director, Civil Aviation Issues

Enclosure – 1

cc: cc list
Enclosure

Description of NextGen Programs and Summary of FAA Implementation Time Frames

According to FAA's 2016 plans, the aviation industry should be able to use at least some of the available capabilities from the following major NextGen transformational programs by 2020 and most of the capabilities by 2025. According to FAA, these programs currently provide or will provide the following capabilities:

- *Collaborative Air Traffic Management Technologies*: Collaborative Air Traffic Management Technologies will use automated systems to provide air traffic controllers and FAA traffic managers with more accurate and timely information that enables a more collaborative environment. CATMT aims to reduce delay associated with disruptive events in the NAS such as severe weather, resource outages and heavy traffic volume.
- *Data Communications (Data Comm)*: The Data Comm program will supplement existing voice communications with pre-scripted email-like messages to provide data communications between air traffic control (ATC) facilities and aircraft and serve as an enabler for the NextGen operational improvements. Data Comm is needed to bridge the gap between the current voice-only ATC and the data-intensive NextGen.
- *Automatic Dependent Surveillance-Broadcast (ADS-B)*: ADS-B is an advanced surveillance technology that provides highly accurate and more comprehensive aircraft location tracking. Aircraft position is determined using the Global Navigation Satellite System and processes this position information typically once a second, to airborne and ground-based ADS-B receivers.
- *System Wide Information Management (SWIM)*: SWIM is the information management and data sharing system for NextGen. SWIM will expand system capacity, increase predictability, reduce costs for aviation, provide shared situational awareness, and enable collaborative decision-making between aircraft dispatchers and air traffic controllers.
- *Common Support Services— Weather*: formerly known as NextGen Network Enabled Weather, Common Support Services – Weather, will establish an aviation weather publishing capability for the NAS. It will enable universal access and standardization of weather information.
- *NAS Voice System*: The NAS Voice System will provide voice communications to Air Traffic Control Specialists, supervisors, ancillary ATC operators, and pilots in support of continuous ATC operations in the terminal, en route domains and the NAS. Connectivity will be provided through access to intra-facility and inter-facility Ground-to-Ground voice circuits or equivalent network connections.

According to FAA's 2016 plans, the following NextGen activities that FAA originally envisioned for the mid-term have been deferred beyond 2030 because, according to FAA officials, the activities are not needed or are infeasible—either technically or operationally.³⁰ FAA officials explained that these applications are not in progress, and may be continually deferred, redefined, or never implemented.

³⁰ Mid-term includes NextGen capabilities that FAA plans to implement by 2018.

- *High Altitude Exclusionary Airspace:* FAA envisioned a high altitude airspace that would be exclusively high-performance based (Area Navigation or Navigation Performance plus data communications) in which pilots might exchange information about trajectory or trajectory intent with air traffic control to allow airspace users with more efficient route options.
- *Future NextGen Facilities:* FAA envisioned modifications to airport facilities' size to reduce the overall number of air traffic control facilities and gain additional benefits from NextGen (e.g. to support Big Airspace concept below), including accommodating NextGen capabilities that provide expanded services, improved flexibility and service continuity.
- *Dynamic Airspace:* As proposed by FAA, Dynamic Airspace would develop the requirements and algorithms for tools to enable air traffic managers to move airspace boundaries to match the overall level of activity in the facility's airspace and dynamically manage restrictions on travel as needed. According to FAA officials, FAA determined that this degree of flexibility was not necessary or operationally feasible at this time, but FAA will pursue a modified version of this concept in the next several years.
- *Big Airspace:* FAA envisioned Big Airspace as a way to provide an integrated approach to arrival and departure management throughout major metroplex areas by incorporating terminal and transition airspace procedures into one service volume.³¹
- *Staffed NextGen Tower for Large Air Traffic Control Towers:* FAA envisioned the concept of providing tower services for several airports at a centralized location without the traditional "out the window" view. According to FAA officials, although staffed NextGen towers are not technically or operationally feasible for large towers at this time, FAA is supporting two state-sponsored initiatives (i.e., Virginia and Colorado) for applying a remote tower service concept for small airports.
- *Automated Conflict Resolution:* FAA envisioned this activity as a way to enable air traffic controllers to manage more aircraft based on pilot-preferred flight trajectories while maintaining safety.

(101031)

³¹ A service volume is a defined volume of airspace in the National Airspace System within which a set of Automatic Dependent Surveillance-Broadcast services is available and has achieved required performance levels.

This is a work of the U.S. government and is not subject to copyright protection in the United States. The published product may be reproduced and distributed in its entirety without further permission from GAO. However, because this work may contain copyrighted images or other material, permission from the copyright holder may be necessary if you wish to reproduce this material separately.

GAO's Mission

The Government Accountability Office, the audit, evaluation, and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through GAO's website (<http://www.gao.gov>). Each weekday afternoon, GAO posts on its website newly released reports, testimony, and correspondence. To have GAO e-mail you a list of newly posted products, go to <http://www.gao.gov> and select "E-mail Updates."

Order by Phone

The price of each GAO publication reflects GAO's actual cost of production and distribution and depends on the number of pages in the publication and whether the publication is printed in color or black and white. Pricing and ordering information is posted on GAO's website, <http://www.gao.gov/ordering.htm>.

Place orders by calling (202) 512-6000, toll free (866) 801-7077, or TDD (202) 512-2537.

Orders may be paid for using American Express, Discover Card, MasterCard, Visa, check, or money order. Call for additional information.

Connect with GAO

Connect with GAO on [Facebook](#), [Flickr](#), [Twitter](#), and [YouTube](#).
Subscribe to our [RSS Feeds](#) or [E-mail Updates](#). Listen to our [Podcasts](#).
Visit GAO on the web at www.gao.gov.

To Report Fraud, Waste, and Abuse in Federal Programs

Contact:

Website: <http://www.gao.gov/fraudnet/fraudnet.htm>

E-mail: fraudnet@gao.gov

Automated answering system: (800) 424-5454 or (202) 512-7470

Congressional Relations

Katherine Siggerud, Managing Director, siggerudk@gao.gov, (202) 512-4400,
U.S. Government Accountability Office, 441 G Street NW, Room 7125,
Washington, DC 20548

Public Affairs

Chuck Young, Managing Director, youngc1@gao.gov, (202) 512-4800
U.S. Government Accountability Office, 441 G Street NW, Room 7149
Washington, DC 20548

Strategic Planning and External Liaison

James-Christian Blockwood, Managing Director, spel@gao.gov, (202) 512-4707
U.S. Government Accountability Office, 441 G Street NW, Room 7814,
Washington, DC 20548



Please Print on Recycled Paper.