United States Government Accountability Office

Report to Congressional Requesters

August 2013

NATIONAL AIRSPACE SYSTEM

Improved Budgeting Could Help FAA Better Determine Future Operations and Maintenance Priorities

GAO-13-693

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GAO Highlights

Highlights of GAO-13-693, a report to congressional requesters

Why GAO Did This Study

Through the NextGen initiative, FAA plans to transform the current ground-based radar air-traffic control system to a system based on satellite navigation, automated position reporting, and digital communications. The NextGen transition will be a complex, multi-year, incremental process. Decisions affecting how long the transition will take and the number of existing systems that will remain in operation during the transition have implications for FAA's existing systems, workforce, facilities, and budget.

GAO was asked to continue monitoring the progress and challenges associated with the NextGen transition and implementation. In this report, GAO examined (1) FAA's progress in addressing key challenges affecting its ability to execute the NextGen transition; (2) the performance and condition of current air traffic control system and facilities; (3) FAA's efforts to address maintenance requirements of its current systems and facilities; and (4) the extent to which FAA has planned for the financial resources for sustaining existing systems and facilities and the NextGen transition. In doing so, GAO analyzed FAA system performance data and documents and interviewed FAA officials and aviation stakeholders.

What GAO Recommends

To improve FAA's efforts to manage the transition, GAO recommends that FAA develop a strategy to improve planning of its operations budget and ensure sufficient data are available to support these efforts. DOT did not agree or disagree with this recommendation but provided technical comments.

View GAO-13-693. For more information, contact Gerald L. Dillingham at (202) 512-2834 or dillinghamg@gao.gov.

What GAO Found

The Federal Aviation Administration (FAA) has made some progress in addressing key challenges as it begins the gradual transition to the Next Generation Air Transportation System (NextGen). It has filled key leadership positions and developed tools to manage interdependent NextGen programs. FAA is working to address other identified challenges, including incentivizing aircraft operators to equip with NextGen technologies, identifying workforce roles under NextGen, and realigning and consolidating facilities. However, FAA has yet to make some decisions needed to move forward with these efforts. For example, FAA is evaluating realignment options to help realize efficiencies but has not yet identified which facilities will be consolidated or realigned.

FAA reports that operational availability of current air traffic control systems at the largest airports has exceeded 99 percent, and underlying data suggest increasing maintenance requirements for current systems and facilities, some of which may have to operate for many more years during the NextGen transition. For example, from fiscal years 2001 through 2012, planned, or scheduled, system outages doubled while unscheduled outages increased 45 percent, an increase due, in part, to the age and deteriorating condition of existing systems. FAA data on facilities and infrastructure condition, although limited, also suggest potentially increasing maintenance requirements. FAA is working to establish a new performance measure to publicly report on system condition and replace the operational availability measure, which was discontinued in 2012.

Recognizing that FAA's cost estimates for maintaining existing systems and facilities and implementing NextGen exceed anticipated funding levels, the agency is developing a plan to address its system and facilities maintenance issues, which it expects to complete by September 2013. In developing the plan, it recognizes that many unstaffed facilities, such as shelters and communication towers, face deteriorating conditions that can put employees maintaining these facilities at risk of injury. However, the process used to collect condition data does not facilitate an agency-wide priority assessment, as each location established its own priorities. Thus, FAA cannot target its limited resources on those projects in greatest need of repair and most critical to the national airspace system. FAA is also working to retire systems that are no longer needed as NextGen capabilities are deployed but will need to overcome challenges in securing stakeholder buy-in and funding.

FAA's budget planning does not fully account for future operations and maintenance needs and priorities of existing and NextGen systems. While FAA's capital plan identifies priorities based on 5-year funding projections, better data on FAA infrastructure could help prioritize competing resource demands of existing systems and facilities and NextGen deployment. FAA data on life-cycle operations and maintenance costs give some indication of future requirements, but FAA has not determined how these costs might be paid for, particularly if it has to maintain a growing number of existing systems as NextGen is deployed. FAA has identified improvements needed for its operations budget process and proposed to develop a 5-year operations plan that better links capital investments with future operations costs, but has yet to institute these improvements.

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Abbreviations

ADS-B	Automatic Dependent Surveillance Broadcast
AIP	Airport Improvement Program
ATO	Air Traffic Organization
CIP	Capital Investment Plan
CRS	Congressional Research Service
DME	Distance Measuring Equipment
DOD	Department of Defense
DOT	Department of Transportation
FAA	Federal Aviation Administration
GSA	General Services Administration
JPDO	Joint Planning and Development Office
JRC	Joint Resources Council
I2I	Ideas to In-Service
ICF	Integrated Control Facility
ILS	instrument landing system
LCMS	Learning Content Management System
NAS	National Airspace System
NATCA	National Air Traffic Controllers Association
NextGen	Next Generation Air Transportation System
NGIP	NextGen Implementation Plan
OEP	Operational Evolution Partnership
OMB	Office of Management and Budget
PASS	Professional Aviation Safety Specialists
PMO	Program Management Office
RTCA	Radio Technical Commission for Aeronautics
TRACON	terminal radar approach control
VOR	VHF omnidirectional radio range
VHF	very high frequency

U.S. GOVERNMENT ACCOUNTABILITY OFFICE
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August 22, 2013

Congressional Requesters

Through the Next Generation Air Transportation System (NextGen) initiative, the Federal Aviation Administration (FAA) plans to transform the current ground radar-based air-traffic control system to a system based on satellite navigation, automated position reporting, and digital communications. After almost a decade since Congress directed FAA to conceptualize and plan the initiative, the agency has been moving from planning to initial implementation of NextGen systems. The transition to NextGen—which encompasses multiple programs, procedures, and systems at different levels of maturity—will be a complex, incremental, multi-year process. Since 2006, we have monitored FAA's development of NextGen and identified a number of key challenges facing the agency's efforts to implement the transition. For example, we have reported that various investment and policy decisions, including what existing air traffic control systems and facilities will remain in the national air space system during the transition and for how long, have yet to be made.[1] For the systems and facilities that remain, FAA will have to monitor and maintain their performance and condition while the agency coordinates and implements the NextGen transition. In addition, some new systems that are being, or were scheduled to be, implemented to support the transition have experienced costly delays, which may require FAA to maintain existing systems and facilities longer than originally anticipated. Uncertainty about how long the transition will take and how long existing systems will remain in operation also has implications for FAA's workforce and facilities, including how and to what extent FAA will continue to train employees on aging air traffic control systems and facilities as well as on new NextGen systems, procedures, and upgraded facilities.

You requested that we continue to monitor the progress and challenges associated with the transition and implementation of NextGen. In response, this report addresses: (1) FAA's progress in addressing challenges we have identified that affect its ability to execute the

[1]GAO, *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) and *Next Generation Air Transportation System: FAA Faces Implementation Challenges*, GAO-12-1011T (Washington, D.C.: Sept. 12, 2012).

transition to NextGen, including preparing its workforce and facilities; (2) changes in the performance and condition of current air traffic control systems and facilities from 2001 through 2012; (3) FAA's efforts to address maintenance requirements of its current systems and facilities; and (4) the extent to which FAA has planned for the financial resources to sustain existing systems and facilities during the NextGen transition. To address these four objectives, we reviewed agency-provided documentation, including NextGen planning documents such as the 2012 and 2013 NextGen Implementation Plans, internal reports related to the agency's NextGen initiatives, air traffic control system performance and condition data, and FAA process and procedure documentation. We interviewed FAA officials from multiple offices within the NextGen Organization and Air Traffic Organization who have a key role in implementing NextGen, as well as those from offices responsible for maintaining the existing systems and facilities. We also interviewed a variety of stakeholders and experts with knowledge and experience related to NextGen implementation, including industry associations, the air traffic controllers union, and the bargaining unit representing the airway transportation system specialists—whom we refer to as technicians in this report. We conducted this performance audit from January 2012 through August 2013 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. For more information on our scope and methodology, see appendix I.

Background

Workforce and Infrastructure in the Current National Airspace System

FAA's primary mission is to provide the safest, most efficient aerospace system in the world. This system, known as the national airspace system, handles over 50,000 flights a day and more than 700 million passengers each year. As table 1 shows, FAA operates and maintains this system through (1) the FAA workforce that operates and maintains the NAS, including approximately 6,000 technicians and 14,000 air traffic controllers who work in airport towers, terminal areas, en route centers, oceanic air traffic control centers, and other facilities, and (2) air traffic control and other supporting systems and infrastructure, including ground-

based surveillance radar facilities, communication equipment, and automation systems and facilities that house and support these systems.

Table 1: FAA Workforce, Facilities, and Systems and Unstaffed Infrastructure Supporting and Operating in the National Airspace System, 2012

	Number
FAA workforce	
FAA air traffic controllers	15,454
FAA technicians	6,076
Other FAA employees	25,501
Total workforce	**47,031**
FAA staffed facilities	
En route control centers	23
Terminal radar approach facilities and towers[a]	402
Other staffed facilities[b]	148
Total staffed facilities	**573**[c]
FAA systems and unstaffed infrastructure	
Navigation systems and infrastructure[d]	13,484
Surveillance systems and infrastructure[e]	1,742
Communications systems and infrastructure[f]	18,903
Weather systems and infrastructure[g]	2,268
Other infrastructure[h]	23,536
Mission support[i]	4,344
Automation systems[j]	2,293
Total systems and unstaffed infrastructure	**66,570**

Source: FAA Facility, Service, and Equipment Profile database and FAA Administrator's Fact Book, June 2012.

[a]This number includes the 106 federal contract tower owned by the government but does not include the 137 federal contract towers that are owned by airport sponsors.

[b]This number includes government-owned facilities at the FAA Mike Monroney Aeronautical Center and William J. Hughes Technical Center as well as government-owned facilities that FAA uses under occupancy agreement with the General Services Administration (GSA).

[c]This number does not include the other staffed facilities that FAA leases or that GSA leases on behalf of FAA for FAA staff.

[d]This number includes various navigation systems, such as the 1,500 instrument landing systems and 967 very high frequency omnidirectional radio range (VOR) systems.

[e]This number includes FAA's radar systems, including 100 long-range radar systems, 250 terminal radar systems, and 50 surface surveillance radar systems.

[f]This number includes a wide range of communication systems, such as the 750 very high frequency/frequency modulation digital communication systems and nearly 500 voice recording systems.

[g]This number includes various weather systems, such as the 1,900 surface weather observation systems and 35 integrated weather systems.

[h]This number includes 2,400 support shelters and 3,400 fuel storage tanks.

[i]This number includes supporting infrastructure and systems, such as 380 closed circuit television systems.

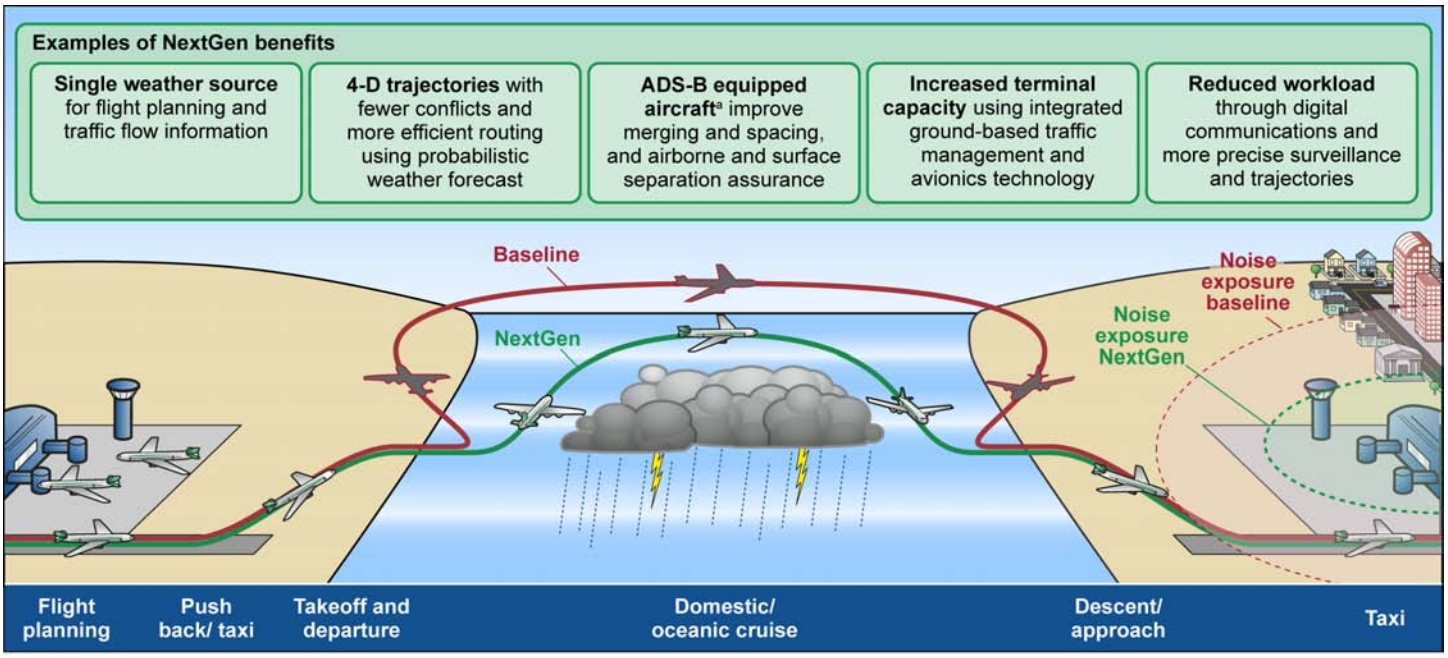
[j]Automation systems include the En Route Automation Modernization systems being installed in each of the 23 en route centers.

FAA's Transition to NextGen

In 2003, recognizing the need for a transformation of the national airspace system, Congress directed FAA to conceptualize and plan NextGen.[2] NextGen was envisioned as a major redesign of the air transportation system to increase efficiency, enhance safety, and reduce flight delays that would entail precision satellite navigation and surveillance; digital, networked communications; an integrated weather system; and more. Figure 1 provides examples of changes and benefits that are expected to come from NextGen. This complex undertaking requires acquiring new integrated air-traffic control systems; developing new flight procedures, standards, and regulations; and creating and maintaining new supporting infrastructure. This transformation is designed to dramatically change the roles and responsibilities of both air traffic controllers and pilots and change the way they interface with their systems. In addition, the transformation requires FAA to have a sufficient number of skilled technicians to ensure that both the existing and new systems are properly maintained and certified throughout the transition. The involvement of airlines and other aviation stakeholders is also critical since full implementation of NextGen will necessitate investment by airlines and others in new technologies.

[2]Vision 100—Century of Aviation Reauthorization Act, Pub. L. No. 108-176, § 709, 117 Stat. 2490, 2582-2585 (2003). Vision 100 directed the creation of the Joint Planning and Development Office (JPDO) within FAA to create and carryout an integrated plan for developing NextGen and to facilitate collaboration between FAA and other federal agencies involved in the effort. In addition to FAA, federal partner agencies include the Departments of Commerce, Defense, Homeland Security, and Transportation; the National Aeronautics and Space Administration (NASA); and the White House Office of Science and Technology Policy.

Figure 1: Examples of NextGen Changes and Benefits



Source: GAO.

Notes: The baseline reflects an aircraft's flight path in the current air-traffic control system.

"Four-dimensional (4-D) trajectory" operations is an air traffic management concept in which every aircraft that is operating in or managed by the air traffic control system is represented in four dimensions—latitude, longitude, altitude, and with time.

[a]Automatic Dependent Surveillance-Broadcast (ADS-B) is a technology that enables aircraft to continually broadcast flight data—such as position, air speed, and altitude— among other types of information, to air traffic controllers and other aircraft.

FAA has a number of plans outlining the actions needed to execute the transition to NextGen over the next decade. Within these plans are decision points regarding which existing systems and facilities will remain in service and for how long. For example, FAA expects that as NextGen technologies come online, it will be able to make decisions in 2016 on whether to reduce some of the current predominant navigation aids in the

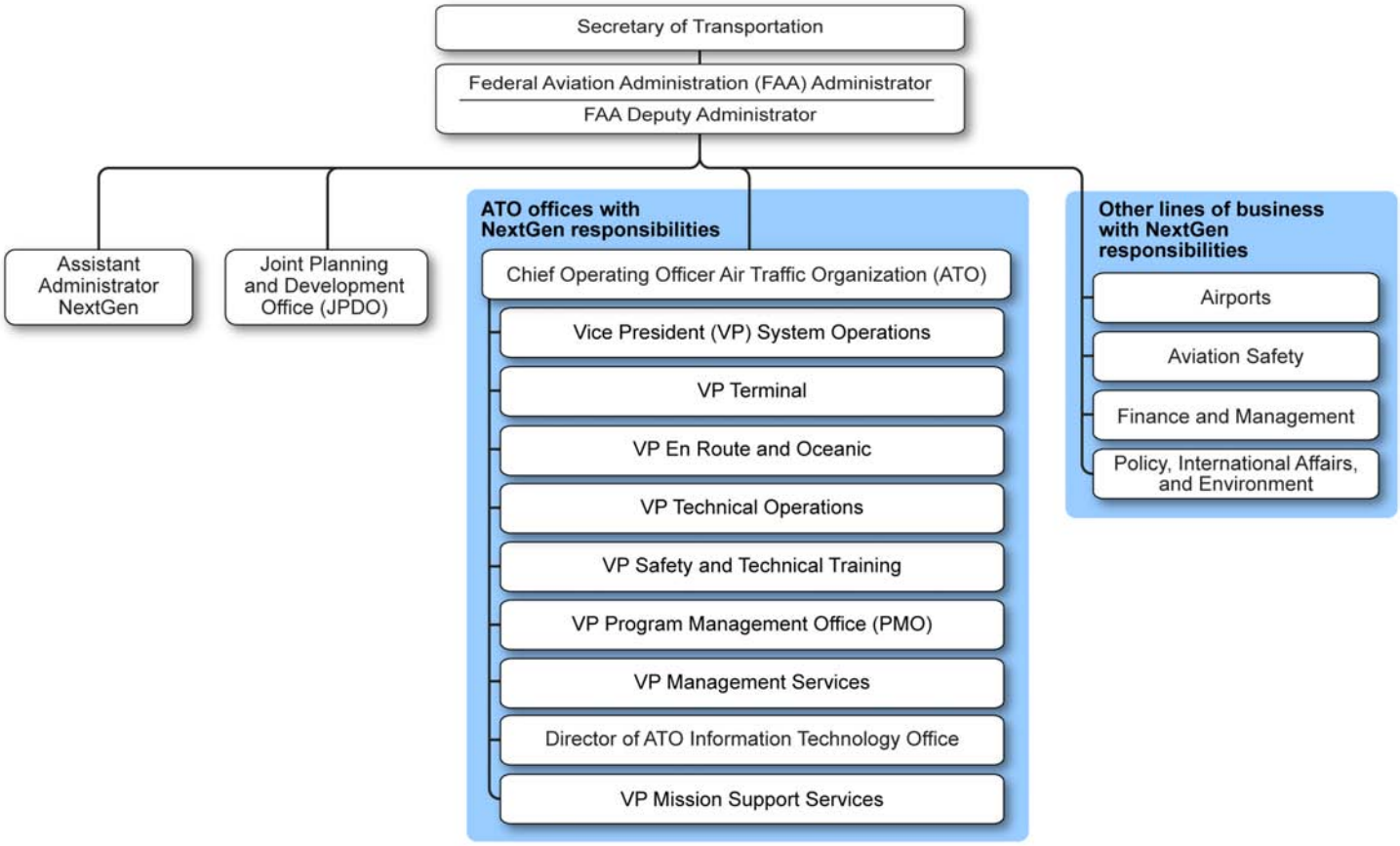
national airspace system—the instrument landing systems (ILS).[3] In another example, FAA has begun developing new air-traffic control voice communication infrastructure to replace its current inventory of 12 different voice switches. According to its plans, FAA expects to make decisions in the 2017—2019 timeframe on when it might be able to discontinue use of some of the existing voice switches.

FAA Organizational Structure

Various offices within FAA are involved in NextGen development and implementation (see fig. 2). FAA's Deputy Administrator is responsible for overseeing NextGen implementation and is supported by the Assistant Administrator for NextGen, who is responsible for planning and integrating NextGen systems and procedure deployment. The Air Traffic Organization (ATO) is responsible for the operations and maintenance of the air-traffic control system as well as implementing and managing NextGen programs and is led by the Chief Operating Officer, who is supported by 8 vice presidents responsible for different aspects of the air-traffic control system. One such vice president heads the Program Management Organization, which was created within ATO in 2011 to centralize oversight over all FAA program development, including NextGen programs. The Joint Planning and Development (JPDO) Director reports to the Deputy Administrator and is responsible for long-term NextGen vision and coordinating and collaborating across the federal government on cross-cutting NextGen issues, such as the integration of unmanned aerial systems in the national airspace system. Beyond these key leadership positions, successful NextGen implementation requires involvement of offices throughout FAA to facilitate the acquisition of integrated NextGen systems and the development of flight procedures, aircraft performance capabilities, and supporting infrastructure.

[3]An Instrument Landing System (ILS) provides aircraft with precision vertical and horizontal navigation guidance information during approach and landing. FAA's decision in 2016 will be on whether to begin to draw down its category I ground-based instrument landing systems. According to FAA, existing category II and III instrument-landing system precision approaches will be retained for the foreseeable future.

Figure 2: Current Federal Aviation Administration (FAA) Organizational Structure with Next Generation Air Transportation (NextGen) Responsibilities



Sources: FAA and JPDO.

Note: Other offices reporting to the FAA Administrator and Deputy Administrator include the Director for Audit and Evaluation, Assistant Administrator for Human Resource Management, Assistant Administrator for Civil Rights, Assistant Administrator for Communications, Assistant Administrator for Government and Industry Affairs, Assistant Administrator for Security and Hazardous Material Safety, Assistant Administrator for Commercial Space Transportation, and the Office of Chief Counsel.

FAA Budget and Funding

Annually, funds are made available to FAA for the following four accounts.

- **The operations account** funds, among other things, the operation and maintenance of the air traffic control system, including employee compensation and benefits and safety inspections. FAA received $9.6 billion for the operations account, which was 60 percent of FAA's total fiscal year 2012 funding.

- **The facilities and equipment account** funds technological improvements to the air traffic control system, including NextGen and existing systems and facilities. The funding in this account is tied to the annually updated Capital Investment Plan (CIP), which identifies planned capital investment in the national airspace system for the next 5 years consistent with the amount requested in the agency's annual budget submission. FAA's facilities and equipment account received $2.7 billion, or 17 percent of FAA's fiscal year 2012 funding.
- **The research, engineering, and development account** funds research on issues related to aviation safety, mobility, and NextGen systems. This account received $167 million, or 1 percent of FAA's fiscal year 2012 funding.
- **The Airport Improvement Program (AIP) account** provides grants for airport planning and development. For fiscal year 2012, AIP received $3.5 billion, or 22 percent of FAA's funding.

The Airport and Airway Trust Fund, which receives revenues from a series of excise taxes paid by users of the national airspace system, provides nearly all of the funding for FAA's capital investments in the airport and airway system. The trust fund also provides a substantial portion—between 43 and 84 percent over the last 10 years—of funding for operations with the remaining amount appropriated from general revenues.[4]

[4]As the Congressional Research Service (CRS) has reported, there has been general acceptance that there is a public interest component to the operation of the national airspace system, which is appropriated from the U.S. Treasury's general revenues. This compensates for what the military, government, and nonuser beneficiaries (also known as societal users) might have contributed if they had actually paid into the trust fund. See GAO, *Whether the Airport and Airway Trust Fund was created solely to finance aviation infrastructure*, B-281779 (Feb. 12, 1999) and CRS, *Aviation Finance: Federal Aviation Administration (FAA) Reauthorization and Related Issues* (Washington, D.C.: Apr. 21, 2008).

FAA Has Made Progress in Addressing Key Transition Challenges, but Significant Issues Remain to Be Addressed to Realize NextGen Benefits

Based on our prior work, we have identified five areas and related challenges facing FAA's long-term transition to NextGen: (1) sustained leadership; (2) managing NextGen interdependencies; (3) equipping aircraft with NextGen technologies; (4) preparing FAA's workforce; and (5) consolidating and realigning FAA's facilities. FAA has made progress in addressing these challenges, including filling NextGen leadership positions and developing tools to manage NextGen interdependencies. The agency is also working to address other identified challenges, including incentivizing aircraft operators to equip with NextGen technologies, identifying workforce roles under NextGen, and planning for facility consolidation and realignment, but has yet to make some decisions needed to move forward with these efforts.

More Recently, FAA Has Filled Key Leadership Positions

As we have previously reported, FAA has struggled to have the leadership in place to manage and oversee NextGen implementation, but more recently, has begun to fill these positions.[5] Since 2003, FAA has on several occasions adjusted the reporting lines for both its NextGen leadership positions and the JPDO Director. According to FAA, it has made various changes in response to industry and congressional concerns about fragmented authority over NextGen as well as a 2011 internal assessment of its organization structure. The FAA Modernization and Reform Act of 2012 elevates the JPDO Director—redesignating the JPDO Director as an Associate Administrator reporting directly to the FAA Administrator—a change that has not yet been fully implemented.[6] In June 2013, a new Deputy Administrator was appointed and designated Chief NextGen Officer, in response to a provision in the FAA Modernization and Reform Act.[7] Also, according to FAA officials, the agency is in the process of searching for qualified candidates for the Assistant Administrator for NextGen position, which has been vacant since January 2013.

While making organizational changes to improve coordination, accountability, and oversight of NextGen implementation are positive steps, leadership is a critical element of success for large-scale

[5]GAO-13-264.

[6]Pub. L. No. 112–95, § 208(a), 126 Stat. 11, 40.

[7]Pub. L. No. 112–95, § 204, 126 Stat., 37.

collaborative and system integration efforts like NextGen. As our work on interagency collaboration has shown, designating one leader—such as the Deputy Administrator's responsibility over NextGen—can be beneficial because it centralizes accountability and can speed decision-making. However, complex transformations, such as NextGen, require substantial leadership commitment over a sustained period, and transitions and inconsistent leadership can weaken the effectiveness of the internal and external collaboration required to successfully implement NextGen.[8] Now that FAA has a new Deputy Administrator that is also serving as the Chief NextGen Officer, it will likely be in a better position to resolve these leadership challenges.

FAA Has Established Processes for Overseeing NextGen Implementation to Help Address Challenges in Managing NextGen Interdependencies

We have previously reported that interdependencies among FAA's air traffic control acquisition programs have become more prominent as the NextGen program shifts from planning to implementation, so that cost increases and schedule delays in one program could have a cascading effect on other programs.[9] While FAA's acquisition management system was not designed for managing NextGen programs in an integrated way, FAA has developed processes for overseeing NextGen's program implementation. For example, beginning in February 2012, the Program Management Office established a biweekly program review process involving FAA Finance, Contracts, NextGen, and ATO staff to discuss and address program status, risks, and mitigation strategies.[10] In addition, the

[8]GAO, *Managing for Results: Key Considerations for Implementing Interagency Collaborative Mechanisms*, GAO-12-1022 (Washington, D.C.: Sept. 27, 2012).

[9]GAO-12-223.

[10]The Program Management Office within ATO combined acquisition programs into one organization. This change was part of a broader effort to reorganize FAA's NextGen efforts around its "Ideas to In-Service Management" (I2I) process. Also part of the I2I process, the ATO was divided into two branches: operations and NextGen program management. The operations branch focuses on the day-to-day management of the national airspace system, while the program management branch is responsible for developing and implementing NextGen programs while working with operations to ensure proper integration. According to FAA, this process was established to better manage the overall process of moving from concept and requirements to investment and implementation and to improve the interface between the NextGen organization and the program offices implementing NextGen technologies within ATO.

Program Management Office reports to the NextGen Management Board, which includes the heads of ATO and the key agency lines of business.[11]

In part, in response to our 2012 recommendation to develop an integrated master schedule for each major acquisition, FAA continues to develop its NextGen integrated master schedule—a key tool for overseeing implementation of the entire NextGen initiative. This tool, when fully populated, should capture and track the progress of key NextGen activities and milestones and provide portfolio-level monitoring of the overall NextGen effort, including how changes in one program's milestones may affect other programs and the timelines for NextGen implementation as a whole.[12] FAA has included implementation activities in its integrated master schedule that support the delivery of operational capabilities through 2015.[13] The agency is still further defining pre-implementation activities and their related schedules for 2015 through 2020, which will be required before it can use this tool to track program interdependencies and identify potential risks. According to FAA officials, the agency expects this work to be completed by December 2013. See appendix II for the status of NextGen acquisitions, as of June 2013, many of which are in the early stages of deployment.

[11]The NextGen Management Board is chaired by the FAA Deputy Administrator and currently consists of ATO's Chief Operating Officer as well as the Deputy Chief Operating Officer, the Deputy Associate Administrator for Aviation Safety, the Associate Administrator for Airports, the Assistant Administrator for Finance and Management, the Assistant Associate Administrator for Policy, International Affairs and Environment, the Deputy Associate Administrator of Commercial Space Transportation, the Acting Assistant Administrator of the NextGen Organization, the Director of JPDO, and the Acquisition Executive Other key stakeholder groups, including representatives from FAA's labor unions and the Department of Defense, are invited to send representatives to the meetings.

[12]FAA has organized NextGen into various portfolios of capabilities, each focusing on a series of related operational improvements that together will bring about midterm improvements. In March 2013, the Department of Transportation Office of Inspector General identified its recommendation to FAA to develop an integrated master schedule for implementing the six programs that will provide NextGen's foundational technologies and infrastructure as one of the top 10 highest priority open recommendations for DOT to implement.

[13]FAA previously indicated that implementation activities along with program interdependencies through 2018 would be included in the integrated master schedule by December 2012.

Creating Incentives for Aircraft Operators to Purchase NextGen Avionics Remains a Challenge

FAA continues to assess operational and financial options for incentivizing aircraft equipage, as recommended by an industry advisory group in 2009, but has yet to make final decisions on how to move forward with these efforts.[14] While some operational improvements can be made with existing aircraft equipment, a number of NextGen capabilities that may offer more significant NextGen benefits require a critical mass of properly equipped aircraft.[15] FAA estimates that the NextGen avionics needed on aircraft to realize significant NextGen benefits will cost private operators about $19 billion from 2011 through 2030.[16] We have previously reported that reaching a critical mass of equipped aircraft is a significant challenge because the first aircraft operators to equip will not obtain a full return on their investment until many other operators also adopt NextGen technologies.[17] In addition, we and others have reported that aircraft operators are hesitant to make these investments if they do not have confidence that benefits will be realized from their investments.[18] For example, while FAA is on track to install the ground infrastructure supporting the NextGen surveillance system—Automatic Dependent Surveillance-Broadcast (ADS-B)—by September 2014, FAA will not be able to realize important benefits from ADS-B capabilities until aircraft operators have purchased and installed

[14]In 2009, the NextGen Mid-Term Implementation Task Force—which was established to prioritize NextGen operational improvements that can be implemented and deliver benefits in the midterm (2013—2018) and to build support for long-term NextGen implementation—recommended that FAA incentivize equipage through financial incentives; streamlining operational procedure delivery; and incorporating a best-equipped, best-served strategy.

[15]GAO, *Next Generation Air Transportation System: Challenges with Partner Agencies 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) and *Transportation: 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).

[16]FAA, *The Business Case for the Next Generation Air Transportation System*, August 2012.

[17]An aircraft operator's return on investment can also depend on operator type and use and availability of the technologies.

[18]GAO, *Next Generation Air Transportation System: FAA Has Made Some Progress in Midterm Implementation, but Ongoing Challenges Limit Expected Benefits*, GAO-13-264 (Washington, D.C.: Apr. 8, 2013).

ADS-B Out in their aircraft.[19] While FAA has mandated that aircraft equip with ADS-B Out[20] by January 1, 2020, aircraft operators may delay purchase and installation of ADS-B equipment until the deadline because of uncertainty about both equipage costs and benefits.[21] According to FAA, the agency is addressing this concern by entering into cooperative agreements with airlines, aviation institutions, and avionics manufacturers to help validate the business case for early adoption of ADS-B. FAA officials stated that through its agreements with airlines, the agency would collect ADS-B data that will help FAA measure operational benefits, reduce uncertainty, and determine timeframes for aircraft operators to obtain a return on their investment.

The FAA Modernization and Reform Act requires FAA to report on options to encourage equipping aircraft with NextGen technologies, including a policy that gives priority to aircraft equipped with ADS-B technology, and the costs and benefits of each option.[22] In July 2013, FAA officials noted that this report—which was due in June 2012—is being reviewed and a timeline for its release has not yet been established. It is unclear whether this report will address the practical implications of establishing benefits for operators that do equip, such as granting those operators the use of preferred airspace, routings, or runway access. We have reported that designing operational incentives and analyzing how they can work in practice would present significant challenges.[23] For example, mechanisms would have to be created so that controllers know which aircraft are best equipped—and thus should receive the operational benefits—without adversely affecting controller

[19]ADS-B is a technology that will enable aircraft to continually broadcast flight data, such as position, velocity, and altitude, among other types of information, to air traffic controllers and other aircraft. As of February 2013, FAA had installed more than 500 of the 790 ADS-B ground stations—a key technology in moving toward improved surveillance—with the remaining ground stations to be installed by September 2014.

[20]The ADS-B system consists of ADS-B Out—the ability to transmit ADS-B signals, and ADS-B In—the ability to receive ADS-B signals from ground and other aircraft, process those signals, and display traffic and weather information to flight crews. FAA mandated that airplanes be equipped with ADS-B Out by January 1, 2020. As is the case for most NextGen equipment, aircraft operators are not required to install ADS-B In but may choose to do so.

[21]GAO-10-188T and RTCA.

[22]Pub. L. No. 112–95, §§ 211(c), 222, 126 Stat., 46, 54.

[23]GAO-10-188T.

workload or safety. In addition, we recommended in April 2013 that FAA include better information in its NextGen planning documents, such as forecast benefits for NextGen operational improvements by either location or usage, as well as anticipated implementation dates, to help aircraft operators better understand when and where they can expect to realize benefits, which would include those resulting from operational incentives. FAA concurred with the recommendation and is working to integrate its NextGen plans to provide additional details and connectivity and map interdependencies between planned operational improvements. It expects to complete this work by September 2014. In addition, according to FAA, the agency has been collaborating with aircraft operators and avionics developers to develop stakeholder knowledge and confidence in NextGen and encourage equipage.

In May 2012, FAA began the process of determining how to design and implement a public-private equipage-financing program.[24] In developing the program, FAA officials said that they reached out to other federal agencies—such as the Departments of Agriculture, Education, Energy, and the modal administrations of Transportation—to understand various options for establishing a loan-guarantee program. FAA proposed a minimum bundle of equipment and a bundle of optional equipment that could be financed under such a program, and then conducted outreach through public meetings, market surveys, and individual meetings with aviation representatives to get industry perspectives on the overall program structure and the proposed equipage bundles. FAA officials noted that they are continuing to develop the program and do not expect to be in a position to issue loan guarantees until at least 2014.

FAA Has Addressed Some Workforce Challenges, and Efforts Are Under Way to Address Others

FAA has worked to address longstanding challenges associated with involving its air-traffic controller (controllers) and technician workforce in developing and implementing NextGen systems, which is critical to the successful implementation of NextGen. As we have previously reported, the lack of stakeholder involvement—particularly, controllers—in air traffic

[24]The FAA Modernization and Reform Act authorized the creation of a program to facilitate public-private financing, such as loan guarantees and other credit assistance tools, for equipping general aviation and commercial aircraft with NextGen technologies. Pub. L. No. 112–95, § 221, 126 Stat., 54. Such programs must also meet the requirements established by the Federal Credit Reform Act of 1990, Pub. L. No. 101-508, § 13,201, 204 Stat. 1388-609 , amending title V of the Congressional Budget Act of 1974 and codified at 2 U.S.C. §§ 661-681.

control modernization efforts contributed both to the delayed implementation of new technologies and optimized flight routes and to cost increases.[25] Both the controller and technician labor agreements now include provisions that require representatives from both labor groups to be involved in developing and testing NextGen technologies. The involvement of FAA's workforce in the development of these systems will be critical in identifying and remedying operational challenges that may arise and obtaining workforce support for transitioning to the new technologies.

FAA efforts to align its workforce planning with controller, technician, and acquisition workforce needs under NextGen, however, remain a work in progress. During the NextGen transition, FAA will need a sufficient number of skilled controllers who are able to increasingly rely on automation and technicians who are able to properly maintain and certify both existing and NextGen systems. FAA will also require a sufficient acquisitions workforce, which is key to successfully acquiring NextGen systems and equipment. In 2011, we reported that FAA had just begun to consider how NextGen technology might affect its technician workforce and in 2013, found that FAA faced various challenges with its acquisition workforce. As described below, the FAA Modernization and Reform Act requirements related to assessing and improving FAA's workforce planning, in conjunction with the workforce planning efforts FAA has under way, may provide a more strategic focus to FAA's management of its workforce during the transition to NextGen.

- *Controller workforce:* FAA's 10-year controller workforce plan aligns the controller's staffing levels with anticipated traffic. However, these staffing projections do not take into account NextGen improvements, which FAA expects to lead to increased workforce productivity. FAA's plan explains that these improvements are not considered because the increased productivity from NextGen capabilities and its impact on workforce size and composition will evolve over time and, at this time, cannot be accurately projected. As required by the FAA Modernization and Reform Act, the National Academy of Science is conducting a study of the standards used to estimate FAA's controller staffing

[25]GAO, *Air Traffic Control: FAA Reports Progress in System Acquisitions, but Changes in Performance Measurement Could Improve Usefulness of Information*, GAO-08-42 (Washington, D.C.: Dec. 18, 2007) and GAO-13-264.

needs,[26] which it expects to complete in mid-2014. According to FAA officials, they will then assess and determine how to incorporate the findings of this study into their controller staffing models.

- *Technician workforce:* We recommended in 2010 that FAA develop a comprehensive, written strategy for its technician workforce that fully incorporates key leading practices in strategic workforce planning, such as determining the critical skills and competencies that will be needed to achieve current and future results.[27] FAA officials anticipate completing a technician-staffing model by December 2013. In June 2013, a National Academies of Science committee tasked with examining the model, however, cast doubts on FAA's ability to meet that timeframe given the complexities involved in developing and implementing a staffing model. The committee also reported that changes in the national airspace system, such as those from NextGen and unspecified policies on reducing existing systems and infrastructure, make the technicians' workload ambiguous and complicate FAA's task. For example, some NextGen technologies, like ADS-B, are being or are planned to be installed, owned, and maintained by a contractor while the services or data are or will be leased by FAA. While FAA technicians will not service and maintain this equipment, they will play a role in certifying the services provided by this equipment. A provision in the FAA Modernization and Reform Act requires that the administrator ensure that equipment, systems, or services meet appropriate certification requirements regardless of whether they are publicly or privately owned.[28] FAA policy had been to require technicians to certify only FAA-owned systems, subsystems, and services as well as provide oversight of systems owned by the military, other agencies, and non-federal entities. FAA has yet to determine how this change might affect its current maintenance policies and technicians' responsibilities for ADS-B or future equipment that is under a service contract. FAA officials indicated that they are developing a policy to provide additional oversight for leased services that would include periodic inspections and expect the policy to be in place later this year.

[26]Pub. L. No. 112–95, § 608, 126 Stat., 115.

[27]GAO, *Federal Aviation Administration: Agency Is Taking Steps to Plan for and Train Its Technician Workforce, but a More Strategic Approach Is Warranted*, GAO-11-91 (Washington, D.C.: Oct 22, 2010).

[28]Pub. L. No. 112-95, § 215, 126 Stat., 51.

- *Acquisition workforce:* As we reported in January 2013, FAA has also identified staffing challenges for segments of its acquisition workforce, including program/project management and research and engineering.[29] Challenges included an anticipated growth in workforce requirements, combined with expected retirements (e.g., 39 percent of FAA project/program managers are eligible to retire in 2015) and the difficulty in hiring experienced, highly qualified candidates. In addition, we found that some of FAA's estimates of acquisition workforce requirements may be understated because they were based on, or revised to reflect, budget realities, as opposed to the number of staff needed to do the work. FAA officials indicated that they are taking steps to address these challenges.

We previously reported that FAA must adjust its training strategy as NextGen capabilities are brought online, and the FAA Modernization and Reform Act called for assessments of and improvements in FAA's controller and technician training programs.[30] FAA is restructuring its training program to better align job tasks with course material and to improve overall course management. According to FAA officials, they have begun to develop a strategic training improvement plan for FAA's controllers and expect to complete a job task analysis by August 2013, but have not identified a timeline for completing its plan. As part of this effort, FAA is assessing the extent to which controllers' current job tasks align with the controller's training curriculum and determining whether the controllers' responsibilities would change based on NextGen technologies, automation, and procedures that are planned through 2018, thus necessitating curriculum changes. FAA also expects to complete by September 2013 a strategic training improvement plan for technicians, which we recommended in 2010.[31] However, while FAA is able to assess the extent to which technicians' current job tasks align with the technician training curriculum, FAA training officials noted that they cannot project future training needs because, as noted, the agency has not yet fully determined technicians' responsibilities under NextGen. FAA is also in the early stages of centralizing the management of its training curriculum

[29]GAO, *Acquisition Workforce: DOT Lacks Data, Oversight, and Strategic Focus Needed to Address Significant Workforce Challenges*, GAO-13-117 (Washington, D.C.: Jan. 23, 2013).

[30]Pub. L. No. 112-95, §§ 224, 605, 126 Stat., 55, 113.

[31]GAO-11-91.

to reduce duplication of infrastructure, resources, and personnel resulting from its current decentralized processes. FAA is developing a Learning Content Management System (LCMS) to serve as a single database to help FAA administer, develop, track, report, and deliver training programs and to allow for increased collaboration with course development, which could help reduce course development time.

FAA Cannot Proceed with Realigning and Consolidating Facilities Until Key Decisions Are Made

In November 2011, FAA approved an initial plan to consolidate en-route centers and terminal radar approach control (TRACON) facilities into large, integrated facilities. This initial plan called for consolidation to occur over the next two decades (through 2034).[32] FAA planned to begin this consolidation effort by building a new integrated facility for managing airspace in the New York/New Jersey/Philadelphia metropolitan areas. This facility—referred to as the New York Integrated Control Facility (New York ICF)—would integrate the activities of two major facilities in the Northeast—the New York En Route Center and New York TRACON. The New York ICF is estimated to cost $235 million to construct, which FAA has requested in its fiscal year 2014-budget request.[33] However, FAA has yet to approve construction for this new facility—a decision originally scheduled for November 2012. FAA officials have stated that, in light of the current budget constraints, the agency is considering adjusting its current plans, further limiting project scope, and exploring different financing options, such as partnerships with local and other government agencies.

In a separate effort, FAA is still working to prepare a national-facilities realignment and consolidation report, which was required by the FAA Modernization and Reform Act to be completed by June 2012. This report is to include the agency's recommended realignment and consolidation actions along with justifications, projected costs and savings, and proposed timing for implementation of each recommendation.[34] In

[32]This long-term plan divided the national airspace system into six segments across the nation and realigned and consolidated facilities based on operations, airspace responsibility, and geographic location.

[33]The President's fiscal year 2014 budget request calls for an immediate $50 billion transportation initiative to finance upfront infrastructure costs, including the New York ICF. This funding request is in addition to DOT's current budget authority.

[34]Pub.L.112-95, §804, 126 Stat., 119.

September 2012, FAA chartered a collaborative working group with FAA management and the controller and technicians unions to recommend criteria for evaluating realignment and consolidation scenarios of FAA TRACON services and facilities based on an assessment of existing models and criteria. According to FAA officials, this collaborative approach had not previously existed. In July 2013, FAA officials noted that they had developed a process for identifying potential facilities for consolidation and realignment and were evaluating realignment options as required by the FAA Modernization and Reform Act, but had not yet identified which facilities would be consolidated or realigned or a time frame for developing such a list.[35]

FAA's efforts to establish assessment criteria could help it address prior challenges in presenting sound business cases for previous consolidation efforts.[36] For example, in a few instances in the past 3 years (e.g., attempts to consolidate Boise, Idaho, and Salt Lake City, Utah terminal facilities, as well as consolidation efforts in Texas), flawed estimates of cost savings and operational efficiencies slowed or halted FAA's consolidation efforts. Our work has shown that consolidation initiatives that are based on a clearly presented business-case or cost-benefit analysis, grounded in accurate and reliable data, can provide a data-driven rationale for why an agency is undertaking a particular initiative and show stakeholders that a range of alternatives has been considered.[37]

We have previously reported that once FAA develops a facility consolidation plan, it can identify which existing facilities to repair and maintain and, in doing so, potentially reduce overall facility repair and

[35]Additionally, FAA's contract with the air traffic controllers' union requires that FAA notify the union as soon as possible but not less than one year in advance of the closure of a facility, facility consolidation, or inter-facility reorganization requiring reassignment of employees. This provision, along with the status of FAA's realignment and consolidation efforts, suggests that it will be no less than 2 years before realignments and consolidations occur.

[36]A business-case analysis, a comparative analysis that presents facts and supporting details among competing alternatives, can help agencies ensure they are using public funds most effectively and preparing to meet future performance goals.

[37]GAO, *Streamlining Government: Questions to Consider When Evaluating Proposals to Consolidate Physical Infrastructure and Management Functions*, GAO-12-542 (Washington, D.C.: May 23, 2012.)

maintenance costs. Fully realizing the benefits of NextGen's capabilities requires reconfiguring facilities that handle air traffic control, but maintaining existing facilities will also be critical during the projected 20-year transition (2014–2034). While FAA's efforts to sustain and realign existing facilities and develop future facilities plans are under one FAA office, these efforts are not yet coordinated so that FAA can identify which existing facilities to continue to repair and maintain and for how long. FAA facilities officials emphasized that FAA's broader consolidation efforts are still undefined and that its plans for realignment have not yet been approved by external stakeholders. Officials expect that once its realignment plans are finalized, they will coordinate schedules and align timelines for facilities maintenance, replacement, and realignment evaluations. Making timely decisions on how best to realign and consolidate facilities—in addition to aligning those efforts with its current facilities maintenance plans—could help FAA avoid unnecessarily investing in facilities that may not be needed for NextGen.

Existing System Performance Remains High, but the Reported Measure Is Insufficient to Determine Overall System Condition

FAA data show high operational availability of its air-traffic control systems. Specifically, FAA's Performance and Accountability Reports in fiscal years 2004 through 2011 reported on how unscheduled, or unanticipated, outages affect the availability of air traffic control systems at the airports with the most air traffic control activity.[38] Since FAA started publicly reporting this measure in 2004, it has reported exceeding its goal of 99 percent operational availability for all years, except the first year—which was the only year that the measure's calculation included both scheduled and unscheduled outages (fig. 3).[39] FAA officials said that the agency changed the measure in fiscal year 2005 to eliminate outages due to airport or runway construction and equipment modifications and focus on FAA's ability to respond to unscheduled, or unplanned, outages. While some of the airports included in this measure have changed over time,

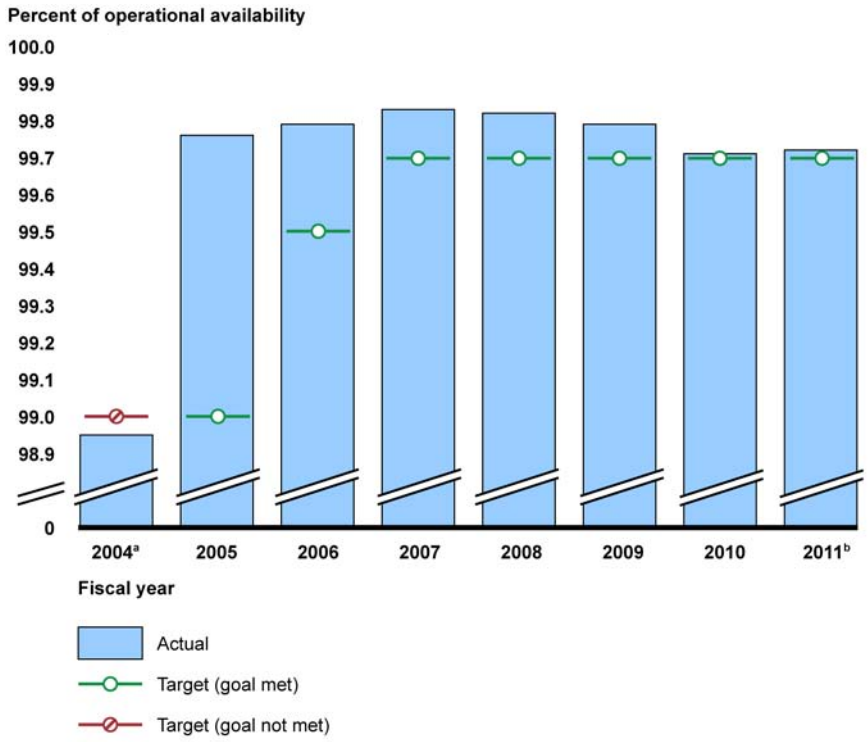
[38]FAA calculates adjusted operational availability as a ratio of maximum facility/service hours minus all unscheduled outage time over maximum facility/service hours, expressed as a percentage. According to the FAA NAPRS Order JO 6060.15E, an outage is based on a full interruption of 1 minute or more.

[39]In 2004, according to the FAA, it did not achieve 99 percent operational availability because of a 0.38 percent increase in scheduled downtime from improvement projects. In 2005, the formula was redefined to exclude scheduled outages. FAA then recalculated its fiscal year 2004 and found that it had exceeded 99 percent under this new measure definition.

the 30 airports that have been consistently included in the measure since 2004 enplane 63 percent of the country's passengers and account for 68 percent of air traffic operations, but include only 6 percent of the total national airspace systems.[40] According to FAA officials, the agency focuses on maintaining a high level of operational availability for the systems at these airports since loss of radar or communications equipment at these airports can affect overall system capacity and result in delays at airports across the national airspace system. According to FAA, such delays can cost millions of dollars per occurrence. FAA data also show that operational availability for all systems—including the remaining 94 percent of FAA systems not included in the publicly reported measure—also remains above 99 percent. FAA maintains redundancies in the system to keep operational availability high. For example, a radar may continue to provide service if one channel has failed because a redundant channel is capable of providing service.

[40]In 2004, this measure tracked the operational availability—i.e., the effect of scheduled and unscheduled outages on overall availability—for the 35 Operational Evolution Partnership (OEP) airports—defined as the U.S. airports with the most significant commercial activity. In 2005, FAA then began tracking "adjusted operational availability" for these same airports; adjusted operational availability excludes scheduled outages from the calculation. In 2011, FAA changed the metric again to report adjusted operational availability for the recently defined "Core 30" airports. FAA replaced the OEP airports with the "Core 30" airports because they represent the top 30 airports in terms of passenger activity.

Figure 3: Annual Reported Performance Measure for Air Traffic Control System Operational Availability for 30 Airports with the Most Activity, Actual and Target, Fiscal Years 2004–2011



Source: FAA performance and accountability reports.

Notes: 2004 is the only year that the measure's calculation included both scheduled and unscheduled outages. In 2004, according to the FAA, it did not achieve 99 percent operational availability because of a 0.38 percent increase in scheduled downtime from improvement projects. In 2005, the formula was redefined to exclude scheduled outages. FAA then recalculated its fiscal year 2004 and found that it had exceeded 99 percent under this new measure definition. According to the *Fiscal Year 2012 Performance and Accountability Report*, FAA discontinued its reporting of this measure after fiscal year 2011.

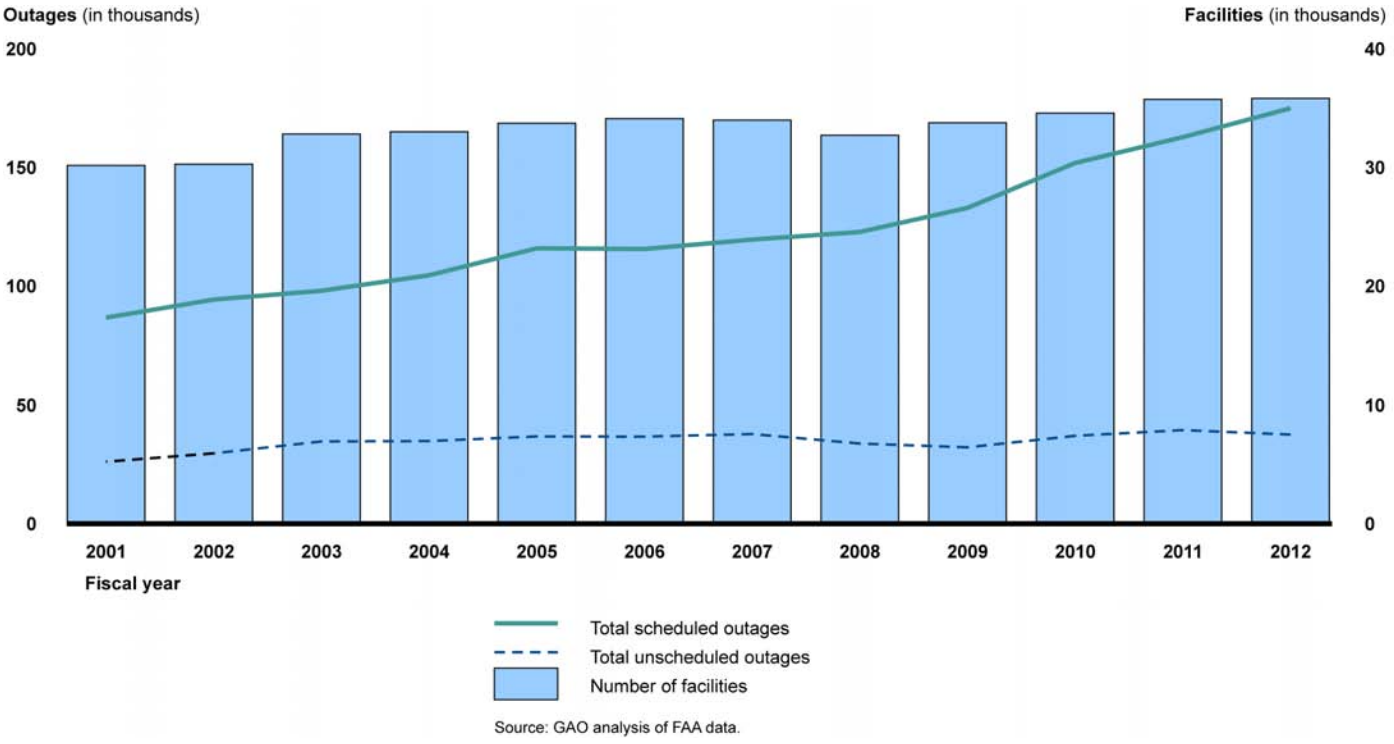
[a]As previously noted, FAA's 2004 measure included both scheduled and unscheduled outages. According to the FAA, it did not achieve 99 percent operational availability because of a 0.38 percent increase in scheduled downtime from improvement projects.

[b]The measure was revised in 2011 to include the "Core 30 airports," which represent the top 30 airport as measured by passenger activity.

However, the reported high operational availability levels do not fully illustrate the underlying performance and condition of FAA's air traffic control systems, some of which have experienced increasing outages. To obtain a fuller picture of overall system performance and maintenance requirements, we analyzed trends in the underlying number and duration of unscheduled and scheduled outages for almost 36,000 systems in the

national airspace system from fiscal years 2001 through 2012. As figure 4 shows, while the number of systems has increased by approximately 19 percent from fiscal year 2001 to fiscal year 2012, the total scheduled and unscheduled outages greatly outpaced the increase in systems during this time period. From fiscal year 2001 to fiscal year 2012, scheduled outages doubled while unscheduled outages increased 45 percent. In addition, the total duration of unscheduled outages increased 132 percent from fiscal year 2001 to fiscal year 2012 while total duration of scheduled outages increased 172 percent from fiscal year 2001 to fiscal year 2012.

Figure 4: Number of Systems and System Outages throughout the National Airspace System, Fiscal Years 2001–2012



Source: GAO analysis of FAA data.

FAA cited a number of factors contributing to these generally increasing trends in scheduled and unscheduled outages, as well as to increases in scheduled and unscheduled outage time, including:

- the age of the existing systems;
- the agency's 2006 changes to its maintenance policy, including moving to more centralized reporting of outages; and

- the agency's 2007 effort to tighten its reporting procedures for unscheduled outages.

In addition, the increased outage time may indicate, in part, that maintenance and troubleshooting activities are requiring more effort and longer periods of time. FAA officials expect the number and duration of outages to increase in fiscal year 2013 because of required budget reductions.[41]

Furthermore, according to FAA, many of the existing systems that have to be maintained for many years face growing agency concerns about parts availability and technology obsolescence, as well as the need for continued upgrades to extend their service life through the transition. For example, one of FAA's navigation systems—the Distance Measuring Equipment (DME) system—has obsolete parts that require reengineering and remanufacturing of existing parts for system repairs.[42] According to FAA, while individual repairs of DMEs are infrequent, these repairs are becoming more expensive because of the effort required to develop parts for repairs. FAA also determined that further extending the service life of DMEs would require "cannibalization" of old DME equipment that has been decommissioned.[43] In another example, under current FAA plans, one of FAA's primary radar systems, which was originally installed in 130 locations between 1989 and 1994, is expected to remain in service through 2025. Following service life extension of this system in 2008 and 2010, FAA is making further modifications to these radar systems to upgrade the current hardware, which is beyond its current service life and integral to continuous operation of the national airspace system.

[41]According to FAA officials, when fiscal resources became constrained in fiscal year 2013, FAA began focusing on maintaining equipment at airports with the most significant air traffic control activity and impact on overall operations in the national airspace system and applying a "run-to-fault" maintenance approach for supporting systems at the remaining airports. These officials noted that FAA was able to adjust its approach once The Reducing Flight Delays Act of 2013 was enacted granting the agency flexibility to transfer funds. Pub. L. No. 113-9, § 2, 127 Stat. 443, 444 (2013).

[42]DME provides the pilot with direct positioning information between the aircraft and the DME.

[43]Cannibalization means that pieces of a discarded part are reclaimed and re-assembled to create a functional part and is typically used a last-resort support option.

Additionally, FAA internally tracks the maintenance needs of the facilities and infrastructure that support these systems, which suggest potentially increasing deferred maintenance.

Staffed facilities: According to FAA estimates for fiscal year 2012, the deferred maintenance backlogs for the 23 en-route facilities and 134 terminal facilities that had been inspected were $98 million and $82 million, respectively.[44] These estimates do not include the 409 terminal facilities, which have not been inspected.[45] We have a separate ongoing job that is assessing FAA staffed facility condition and the statistical method used to estimate the condition of its uninspected terminal facilities and plan to report our final results later this year.

Unstaffed infrastructure and facilities: According to FAA assessments, half of the agency's over 28,000 unstaffed infrastructure and facilities—which include shelters, roofs, towers, heating ventilation and cooling systems, interior electrical distribution, and security fences—is at or beyond the end of its service life and requires modernization or replacement that, if not addressed, could affect this infrastructure's support of ensuring reliable operations in the national airspace system. For example, FAA found in 2008 that many towers and platforms associated with its surveillance facilities, as well as many of its communication towers, do not meet federal occupational health and safety protection standards, making it difficult for FAA technicians to safely maintain the related systems.

FAA's data on deferred maintenance levels also suggest deteriorating conditions of the unstaffed infrastructure, but given the limited universe of data, this estimate may not be an accurate reflection of the true level of

[44]For its en-route and terminal facilities, FAA defines deferred maintenance as the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime as of the forecast year. FAA does not include preventative maintenance and minor repairs in its deferred maintenance calculations.

[45]FAA uses a technical consultant to annually inspect a portion of its en-route and terminal facilities. The consultant inspects each en route facility approximately once every 4 to 5 years, and "roll-up" reports for these facilities contain actual inspection results for each of the 23 facilities. For terminal facilities, "roll-up" reports contain actual inspection results from facilities inspected over the most recent 6-year period. FAA's most recent terminal facility "roll-up" report, for example, contains information from 134 facilities inspected—which reflect less than one quarter of all terminal facilities—from January 2007 through December 2012.

deferred maintenance, which we discuss later in this report. Table 2 shows almost $3 billion in total deferred maintenance for some of FAA's unstaffed infrastructure and system, based on the most recently available FAA capital-funding estimates. FAA used its 2008 survey of about 34 percent of its unstaffed infrastructure and facilities to estimate that deferred maintenance of its entire unstaffed infrastructure would double from about $212 million in 2008 to about $446 million in 2012.[46] At current funding projections, FAA estimates that the total deferred maintenance for this infrastructure will grow by an average annual rate of roughly $27 million and reach approximately $715 million by 2022. While FAA states that it is striving to reduce the backlog of deferred maintenance, a substantial deferred maintenance backlog can increase the risk for operational failures and premature equipment replacement. For example, a leaking landing system shelter roof could affect either the electronics housed inside, thus creating an outage, or the heating and cooling systems, which are vital to ensuring the continued performance of the housed hardware and software.

[46]Between 2006 and 2008, FAA conducted condition assessments on roughly 34 percent of its unstaffed infrastructure and facilities to collect information on their condition. FAA used the results of this non-random sampling of facilities to extrapolate an estimate for the remaining unstaffed infrastructure and facilities.

Table 2: The Federal Aviation Administration's (FAA) Capital Plan and Deferred Maintenance Levels for Selected Unstaffed Air Traffic Control Infrastructure and Systems

Other air control facilities	2013-2017 Capital Plan (in millions)	Deferred maintenance (in millions)	Difference (in millions)
Long-range radar	$15.0	$114.0	$99.0
Fuel storage tank replacement and monitoring	58.4	181.8	123.4
Unstaffed infrastructure sustainment	151.2	444.6	293.4
Airport cable loop systems support	78.7	2,000.0	1,921.3
Electrical power systems sustainment	468.0	992.0	524.0
Total	**$771.3**	**$3,732.4**	**$2,961.1**

Source: FAA.

Note: According to FAA, this list reflects the unstaffed infrastructure and systems with the largest estimated deferred maintenance levels in 2012.

While FAA has various internal metrics showing the deteriorating condition of the current systems, it no longer reports on a measure that communicates the condition of its existing systems. According to FAA, its goals, such as those in the annual Portfolio of Goals and the *Performance and Accountability Report,* are intended to assist managers and policy makers and inform the public on what the agency has accomplished with its available resources. However, *FAA's 2012 Performance and Accountability Report* did not include the operational availability measure, though FAA still tracks this internally for trending and performance management purposes. When we asked FAA Technical Operations officials why the adjusted operational availability measure was removed, they told us that the measure was prematurely removed from the report and that efforts are under way to identify a better measure of FAA's national airspace services. FAA officials did not provide details on the factors being considered in establishing a new publicly reported measure or a time frame for this effort. We reported in April 2013 that FAA is currently conducting an agency-wide effort to review and harmonize its performance metrics to bring order, consistency, and accuracy to metrics reporting across its business lines and that it has made progress in developing various performance metrics, including those that respond to the FAA Modernization and Reform Act requirements and to recommendations we made in 2010.[47] We also emphasized the

[47]GAO-13-264.

importance of continued progress in this area. Additional information on current system condition could help FAA stakeholders, such as Congress, assess and make decisions about how to fund and monitor FAA's efforts, particularly in light of current budget constraints and continued investments in NextGen, as we discuss later in this report.

FAA's Efforts to Develop a Long-term Systems and Facilities Maintenance Strategy Could Be Hampered by Limited Data on Condition

Recognizing that its cost estimates for sustaining current systems, facilities, and infrastructure and implementing NextGen exceed anticipated funding levels, FAA is developing a plan to address maintenance and sustainment issues for both existing FAA systems and facilities. According to FAA officials, the plan will help decision makers understand the funding levels needed to address the maintenance and sustainment issues of the current systems and facilities. In November 2012, FAA began developing this plan to address facilities sustainment issues. To help prepare this plan and the fiscal year 2015 budget, FAA is developing a standardized process that would prioritize sustainment projects for all types of facilities, including towers, en-route centers, TRACONs, and unstaffed infrastructure. This approach differs from prior years where facility sustainment activities were decentralized, with different offices within ATO individually prioritizing their facilities' sustainment projects. According to FAA officials, they plan to use a new two-tier process where program officials rank their projects first and then those projects are prioritized by operational need, risk, employee safety, mission critical needs, and environmental requirements across all facilities types. In January 2013, FAA decided to expand its facilities maintenance and sustainment plan to also include system sustainment issues. To support this effort, FAA Technical Operations officials noted that they are developing a "get well" plan for national airspace systems that will include specific goals, measures, and outcomes. In developing this plan, officials noted that they have developed a prioritization process for systems maintenance and sustainment to support efforts to "right size" the national airspace system, reduce costs, and simplify complexity to support the transition to NextGen. FAA expects to complete its planning effort by September 30, 2013, in line with its fiscal year 2013 business plan.

In developing the plan, FAA will be considering issues that may prove difficult to resolve. In particular, FAA noted that there has been a funding imbalance between staffed and unstaffed facilities, with many unstaffed facilities facing deteriorating infrastructure issues that put employees at risk of injury when they perform maintenance. However, FAA lacks sufficient data on the condition of these facilities to identify the size of the

deferred maintenance backlog and the potential resources needed to maintain that infrastructure. FAA is using data from its 2008 assessment of unstaffed infrastructure—which was a non-random sample that covered 34 percent of this infrastructure—to begin developing an asset database to help track the age and replacement dates for its unstaffed infrastructure inventory. FAA has not determined time frames or methods for either collecting condition information on the remaining 66 percent of the unstaffed infrastructure or developing estimates that more accurately represent the condition of those facilities, but the agency recognized the need to accurately survey its unstaffed infrastructure and is currently examining the best and most cost effective means to survey these facilities.[48] FAA uses a decentralized approach—similar to what had been used for facility sustainment prioritization—to identify unstaffed infrastructure sustainment projects where field technicians or engineers prepare project requests, which are based on type of project and mission criticality. However, because FAA's project priorities are being established at the individual program office level and not against established criteria from an agency perspective—a leading practice for making capital investment decisions—FAA cannot ensure that identifying those projects that are most critical to operating the overall national airspace system.[49] FAA also recognized that without an accurate number and facility condition, the agency cannot identify the financial needs, priority list, or remediation strategies for these structures. In addition, as FAA deploys new NextGen technologies, there may be opportunities to consolidate equipment onto fewer pieces of unstaffed infrastructure. Without more complete data, however, FAA will be challenged to identify consolidation opportunities and realize the potential cost savings that might come from consolidating unstaffed facilities and infrastructure. In the meantime, the office overseeing unstaffed infrastructure is working to coordinate with the NextGen program schedule to avoid having to remove and reinstall equipment to upgrade or replace navigation and landing

[48]FAA currently relies on service support center managers assigned to a certain geographic area to identify and submit unstaffed infrastructure condition issues as part of their work in the field. FAA facilities officials noted that one approach to identifying unstaffed infrastructure condition would be for technicians to collect the information as part of their regularly scheduled system maintenance. However, officials recognize that if they were to apply such an approach, they would need to determine whether technicians would know what to look for and would have the additional time to assess infrastructure condition as part of their duties.

[49]GAO, *Federal Buildings Fund: Improved Transparency and Long-term Plan Needed to Clarify Capital Funding Priorities*, GAO-12-646 (Washington, D.C.: July 12, 2012).

infrastructure. In addition, FAA recognizes that some reductions in NextGen programs or other projects may be necessary to shift funding to sustain existing systems and facilities, and FAA will need to merge the priorities established in its maintenance plan with the NextGen implementation plan in order to understand and make the necessary trade-offs given overall resource levels. As we discuss in the next section, under current budget estimates, FAA could face reduced budget levels in the coming years, making the agency's efforts in developing this plan critical in identifying how it will sustain all systems and control costs over the long term in a constrained budget environment.

FAA also plans to discontinue the use of systems facing significant sustainment issues or that are no longer needed as NextGen capabilities are deployed.[50] While FAA discontinues the use of equipment from the national airspace system on a regular basis, these efforts have been more limited than the full-scale initiatives that are expected to occur during the NextGen transition. FAA's NextGen plans identify dates for when the agency will make decisions on discontinuing certain existing systems and facilities, such as navigation aids like the 1,500 Instrument Landing Systems, as well as surveillance, weather, and communication systems. FAA's first major effort is to discontinue half of the 967 very high frequency omnidirectional radio range (VOR) systems (see fig. 5), between 2014 through 2020 and establish a minimal operating network of VORs.[51] According to FAA data, the number of unscheduled outages for VORs increased 130 percent between fiscal years 2001 and 2011, and 9 out of 10 VORs are beyond their useful service life. Because parts for this system can no longer be procured, FAA has to reengineer and construct new parts from existing VOR parts, which is a time- and resource-intensive process. Current costs for operating and maintaining VORs exceed $110 million per year and are increasing, in addition to the costs

[50]A review of FAA Handbook 7031.3 appears to draw no clear distinction between discontinuance and decommissioning of a navigational service, but discussion with FAA personnel appeared to distinguish between discontinuance of a service as opposed to decommissioning of a facility.

[51]A VOR is a ground-based system radiating Very High Frequency (VHF) radio signals to compatible airborne receivers, providing pilots a direct indication of location relative to the facility.

associated with maintaining the flight procedures needed to operate with this technology.[52]

Figure 5: Very High Frequency Omnidirectional Radio Range (VOR) Station

Source: FAA.

While FAA anticipates developing an agreed-upon list of VORs to discontinue and the dates when they will be discontinued by September 2014, the agency will first need to overcome challenges in obtaining stakeholder buy-in and securing funding. FAA's efforts to discontinue other existing systems will involve these same types of steps and will likely face similar difficulties. For example, decisions on discontinuing radar sites will involve coordination with the Departments of Defense and Homeland Security and other aviation stakeholders to ensure that FAA's surveillance network, among other things, can detect, identify, and track aircraft.

[52]The cost for operating the VORs is being validated as FAA develops its business case for the VOR's minimum operating-network implementation program.

- *Stakeholder buy-in:* FAA has encountered difficulties in obtaining agreement on exactly which VORs to retain and whether those selected will provide sufficient backup service. As part of its effort to develop a minimum operating network of VORs, FAA released a high-level plan outlining the transition from current navigation aids to performance-based navigation services under NextGen. In commenting on this plan, several stakeholders—while supportive of the transition—raised concerns about the timing of the VOR network reduction, questioning whether aircraft operators would have the necessary equipment to transition from using VORs to performance-based navigation as a primary means of navigation by 2020. For example, the Department of Defense (DOD) raised concerns that only about 30 percent of its fleet of 14,600 aircraft have performance-based navigation capabilities and initially estimated that increasing that equipage rate to approximately 75 percent would cost approximately $3.7 billion.[53] DOD noted that FAA's goal to discontinue navigation aids, such as VORs, by 2020 did not provide DOD sufficient time to budget, modify, test, and certify fleet aircraft to meet the potential new equipment standards.[54] According to FAA officials, they asked DOD to identify where the department would need VOR coverage in the national airspace system and agreed to address those requirements, although FAA anticipates that it could affect fewer than 50 VORs. In addition, according to FAA's disposition of comments on the proposed strategy, of the 330 comments received, a number of those comments expressed concerns about whether a reduced VOR network would provide the necessary backup service in the event of interference or disruption with satellite-based systems. General aviation stakeholders agreed that while the number of VORs should be reduced, they want more details on how FAA would make this transition—including the specific VORs that would be retained or discontinued and whether adequate flight approach procedures would continue to be available or impacted by the drawdown. FAA is developing a communications plan to guide its efforts in soliciting stakeholder input, which could help address these

[53]DOD noted that due to the interrelationship between en route and terminal approach equipage requirements, portions of this cost estimate include performance navigation upgrades beyond what might be needed to operate in a reduced VOR network.

[54]DOD also noted in its comments that as the industry will be making modifications to aircraft navigation systems to comply with the ADS-B Out mandate by 2020, FAA must properly synchronize the discontinuance of navigation systems to minimize disruptions of aircraft upgrade schedules and prevent multiple aircraft modifications.

concerns. FAA also has to obtain agreement among the 18 FAA offices and two bargaining units affected by the VOR reduction and, to do so, has begun vetting a list of potential VORs to discontinue within the agency. Later in 2013 or early 2014, FAA anticipates releasing for external stakeholder input an agency-vetted list of potential VORs to retain.

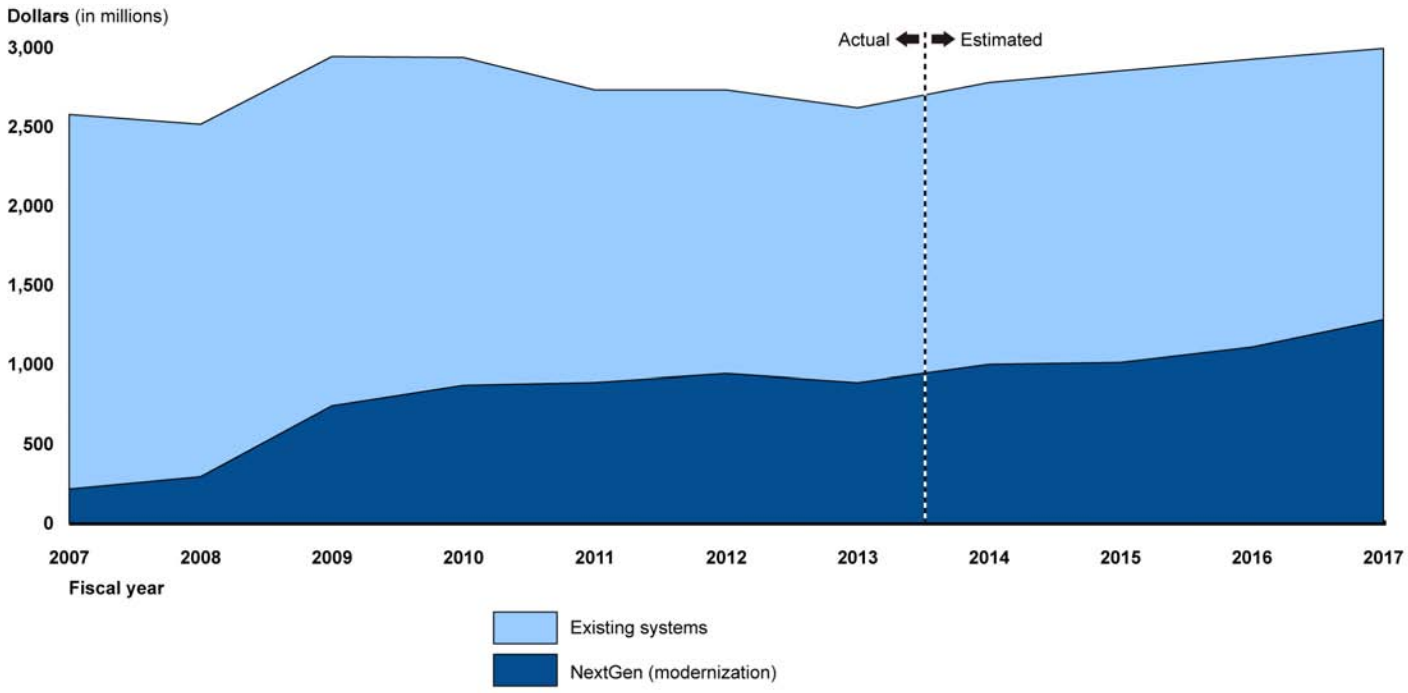
- *Funding:* Concurrent with its efforts to identify the VORs to maintain, FAA officials with the navigation program are developing a business case for obtaining the $6 million in annual funding between fiscal years 2014 and 2020 to execute the plan. These officials noted that if the agency were not able to secure funding, the current timeframe for reducing the VORs would not be achievable. Additionally, if these dates were to slip, FAA officials noted that parts availability for maintaining existing VORs would become an increasing problem, further challenging FAA's ability to maintain this aging equipment.

FAA's Budget Process Lacks Sufficient Data to Determine Future Operations and Maintenance Needs and Priorities

Better Data Could Help FAA Prioritize Competing Deferred Maintenance and NextGen Resource Demands

As figure 5 shows, the funding for NextGen capital improvements has generally been growing since fiscal year 2007, while funding for existing systems has gradually decreased (fig. 6). According to FAA's latest facilities and equipment funding estimates for fiscal years 2014 through 2017, FAA expects funding for existing systems to continue to decline, accounting for about 57 percent of the total funding for its capital plan in fiscal year 2017.

Figure 6: Estimated and Actual Facilities and Equipment Funding Levels for NextGen and Existing Systems, Fiscal Years 2007–2017



Source: GAO analysis of FAA data.

Note: Data for fiscal years 2007 through 2013 reflect the appropriated amounts while the data for fiscal years 2014 through 2017 are the latest available budget estimates.

While FAA's capital plan reflects the agency's priorities based on the facilities and equipment funding that it receives in a given year, better data on the condition of its infrastructure, as previously noted, could help FAA prioritize the competing resource demands of existing systems and facilities and NextGen deployment. Through its annual capital planning efforts, FAA determines how it will prioritize investments, given available funding.[55] This plan, however, does not include data on the breadth of

[55]FAA annually prepares a comprehensive capital investment plan, as required by provisions in legislation. This plan describes the planned capital investments for the next 5 years consistent with the amount requested in the President's annual budget submission and outyear funding estimates. As of July 2013, FAA has yet to release its fiscal years 2014—2018 capital investment plan. According to FAA officials, the plan is under review, but there is no timetable for its release.

deferred maintenance facing those systems and infrastructure that will have to be maintained for many years during the transition to NextGen. FAA's efforts to develop a plan to address significant deferred maintenance for both existing FAA systems and facilities could provide a more complete picture on FAA's deferred maintenance and sustainment priorities through the transition to NextGen. As we previously mentioned, more sufficient data on FAA's infrastructure could support efforts to establish maintenance priorities as well as facilities and equipment investment decisions. Furthermore, if the agency is faced with reduced funding levels—a possibility given the current fiscal environment and the Balanced Budget and Emergency Deficit Control Act[56]—then FAA efforts to establish priorities would become critical in mitigating budget shortfalls. Recently, FAA tasked the NextGen Advisory Committee to review current FAA plans and activities that have an effect on NextGen implementation and develop a prioritized list of activities, which can assist in the agency's efforts to prioritize resources in a constrained budget environment.[57]

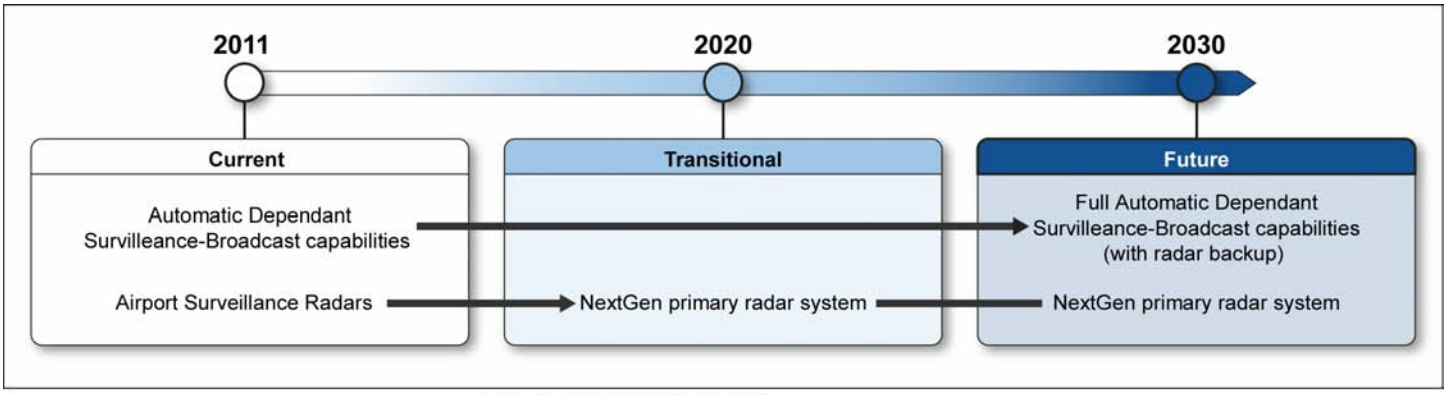
Weighing the priorities of existing systems and facilities and NextGen programs, however, could become increasingly difficult as FAA's decisions on how long to maintain existing systems are evolving and could require investment in these systems for longer than initially anticipated. For example, FAA plans to maintain more existing radar sites for a longer time frame than it originally anticipated. Specifically, FAA initially planned to retain all of its primary surveillance radar sites for national security purposes and decommission all of its secondary surveillance radars and surface surveillance radar sites once ADS-B was deployed. However, after FAA completed a study examining alternative backup strategies for ADS-B in 2008, the agency decided that it would need to maintain roughly half of its secondary surveillance radar sites as backup for ADS-B. This decision was based on safety and security concerns—GPS signals can be susceptible to disruptions from atmospheric effects, signal blockage from buildings, and interference from

[56]The Balanced Budget and Emergency Deficit Control Act (BBEDCA) established discretionary spending limits for fiscal years 2012 to 2021. 2 U.S.C. § 901, as amended.

[57]The NextGen Advisory Committee is comprised of aviation stakeholders from the government and industry. The committee works to develop a common understanding of priorities in the context of overall NextGen capabilities and implementation constraints, with an emphasis on improvements through 2018. The committee primarily focuses on implementation issues, including prioritization criteria at a national level, joint investment priorities, and location and timing of capability implementation.

communications equipment, as well as from deliberate acts—and FAA plans to design, test, and deploy a new generation radar to serve as backup. As a result, the agency expects to continue operating approximately 420 primary radar sites through at least 2020 and maintain many of its ground-based radar sites as a backup system beyond 2030 (see fig. 7). FAA will then face decisions on whether and for how long to continue upgrading existing radar sites or when and how many new generation radars will need to be deployed to serve as a system back-up. In addition, if FAA does not obtain stakeholder buy-in or funding for its efforts to reduce the VOR network within planned timeframes, the agency will have to continue maintaining this network until these issues are resolved. As previously noted, decisions related to upgrading and modernizing existing equipment and facilities will have to be balanced with NextGen and ATO Program Management Organization priorities, all of which could be competing for potentially declining resources in future years. Over the past 2 years, competing resource demands have resulted in FAA's delaying investment in the development, testing, and evaluation of some NextGen and NextGen-related programs, a deferral that could ultimately lead to delaying the implementation of various NextGen systems that depend on those programs.

Figure 7: Federal Aviation Administration's Planned Transition for Surveillance Capabilities, 2012



Sources: FAA NextGen plans and GAO.

In addition, FAA's resolution of how NextGen service contracts will be treated in the budget could also put pressure on FAA's future facilities and equipment resource demands, adding to the agency's challenges in establishing funding priorities. For example, two key NextGen programs—ADS-B and Data Communications (DataComm)[58]—are in varying stages of development and deployment and are under performance-based service contracts. These two key programs are currently funded through FAA's facilities and equipment account since the programs are still being developed and installed. According to FAA officials, the agency is still determining how these contracts will be treated in the budget after these systems are deployed and operational. Under FAA's accounting procedures, even after a program under a service contract has been deployed, the vendor's operation and maintenance cost attributed to the equipment are paid from the facilities and equipment account. FAA currently estimates the life cycle operations and maintenance costs for both ADS-B and DataComm will be roughly $141 million to $175 million per year once these systems are deployed.[59] Paying these costs from the facilities and equipment account—which, as previously noted, received $2.7 billion in fiscal year 2012—however, may limit the availability of funding for new capital acquisitions.

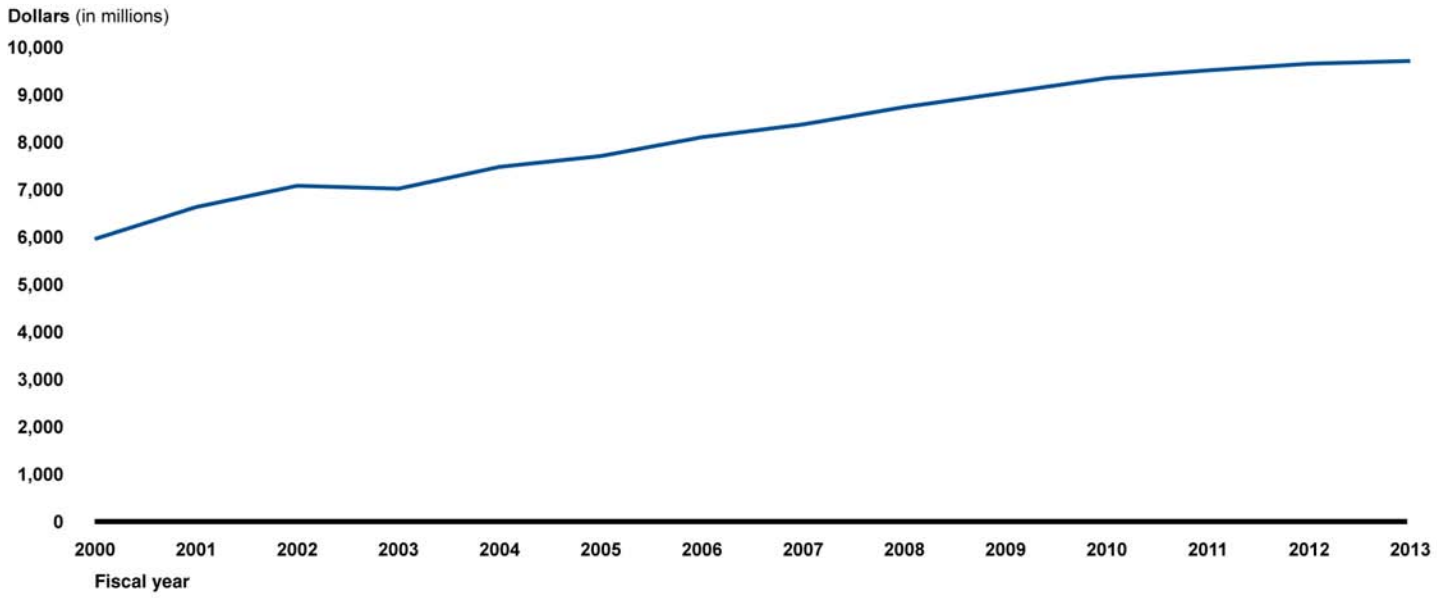
FAA's Budget Process Does Not Adequately Plan for the Costs of Operating and Maintaining Two Systems through the Transition

FAA's operations account—which pays for the ongoing operations and maintenance of the existing systems—grew $3.6 billion, or 62 percent, from fiscal years 2000 through 2013 (fig. 8). However, the authorized levels for FAA's fiscal years 2013 through 2015 operations funding roughly maintain the fiscal year 2012 levels—around $9.5 billion to $9.7 billion.

[58]DataComm is planned provide capabilities for pilots and controllers to transmit digital messages and will eventually replace the analog voice communication system currently in use.

[59]FAA estimates that the recurring life cycle operations and maintenance costs for both ADS-B and DataComm to be $141 million per year for 2015 through 2019 and $175 million for 2020 through 2024.

Figure 8: The Federal Aviation Administration's (FAA) Enacted Budget Authority for the Operations Account Fiscal Years 2000–2013



Source: GAO analysis of FAA data.

Note: Budget authority is authority provided by federal law to enter into financial obligations that will result in immediate or future outlays involving federal government funds. GAO, *A Glossary of Terms Used in the Federal Budget Process,* GAO-05-734SP (Washington, D.C.: Sep. 2005).

Unlike for the capital plan, FAA does not generate projections of future operating costs for its annual operations account. FAA's life-cycle cost estimates for its major acquisitions—which FAA requires as part of its acquisition process—provide some indication of how FAA's operations and maintenance costs are expected to grow in the coming years.[60] For example, as shown in figure 9, FAA estimates that operations and maintenance costs for existing systems for fiscal years 2013 through 2017 will be 20 times greater than the operations and maintenance for

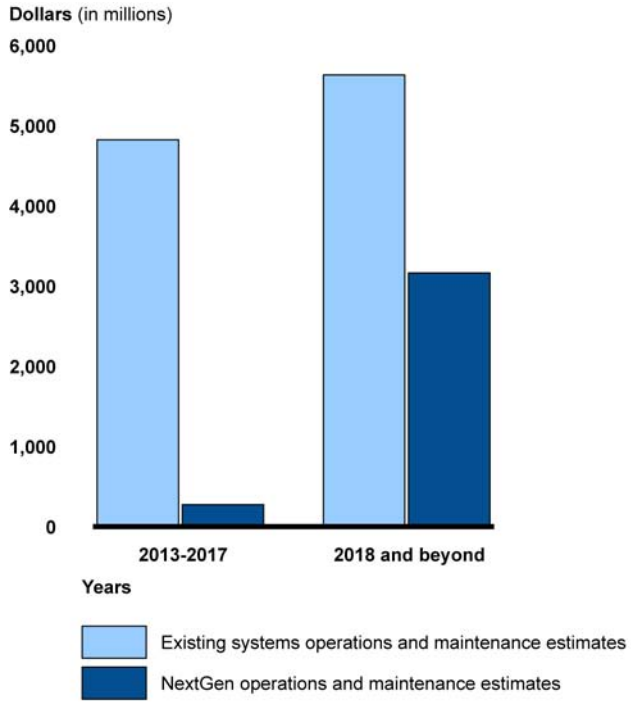
[60]As we found in 2012, the Office of Management and Budget prepares estimates of FAA's outyear budget authority for each account, including operations. Since these estimates are based on inflation adjustments and other factors, the estimates for FAA's fiscal years 2016 to 2021 expenditures was projected to increase roughly at the forecast rate of GDP growth—around 2.3 percent to 2.5 percent annually. GAO, *Airport and Airway Trust Fund: Factors Affecting Revenue Forecast Accuracy and Realizing Future FAA Expenditures*, GAO-12-222 (Washington, D.C.: Jan. 23, 2012).

NextGen systems over that same time period, given that few NextGen systems will be operational through 2017. However, as more NextGen systems become operational, the associated operations and maintenance costs of those systems will add to the amounts shown.[61] FAA expects operations and maintenance costs for existing systems to continue for the foreseeable future since current NextGen plans do not show significant discontinuing or decommissioning of existing systems at least through 2025.[62]

[61]These estimates only include those NextGen programs that have been "baselined" (i.e., those programs whose estimated schedules and budgets have received FAA executive approval), meaning that the operations and maintenance costs, particularly for the out-years, could be higher.

[62]According to FAA's plans, FAA is not making any additional decision on discontinuing or decommissioning existing systems until 2016 when it may decide how many instrument landing systems to maintain. Once those decisions are made, it can take years to develop and implement plans to discontinue these systems.

Figure 9: The Federal Aviation Administration's (FAA) Projected Operations and Maintenance Costs for Baselined Existing and NextGen Programs, Fiscal Years 2013–2017 and 2018 and Beyond



Source: GAO analysis of FAA data.

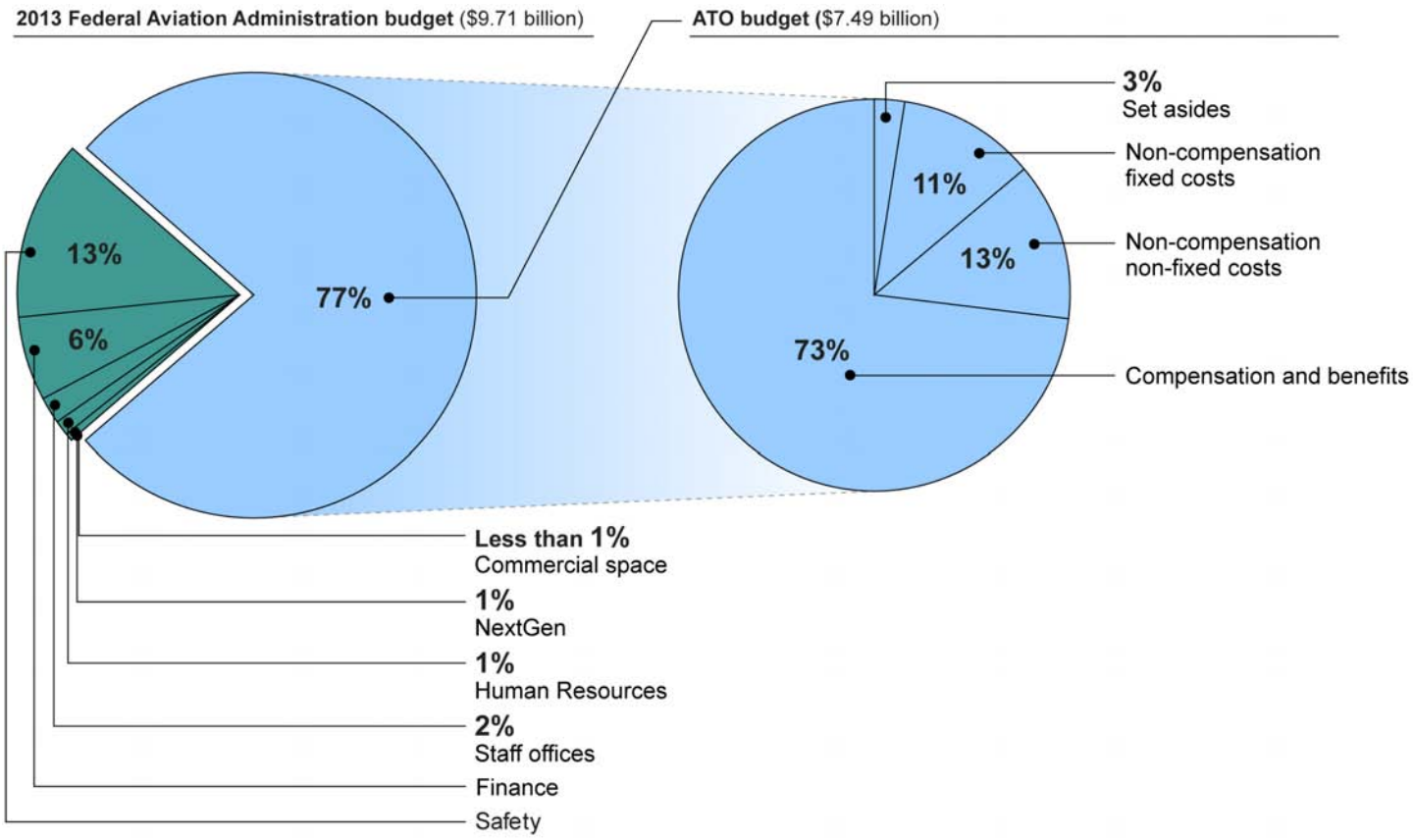
Note: These estimates reflect the operations and maintenance lifecycle costs of acquisition programs that have been baselined as of May 2013. A baselined program refers to a program with an estimated schedule and budget that has received FAA executive approval. The NextGen operations and maintenance lifecycle cost estimates do not include future NextGen systems, such as NextGen Weather and Voice Switch, because these programs are in the early stages of development and the acquisition process. Also, because programs have different lifecycle timeframes, FAA's data does not identify a specific ending date because the data are aggregated across numerous programs.

While the data on lifecycle operations and maintenance costs give some indication of future operation and maintenance costs, FAA has not determined how these costs might be absorbed, particularly if it faces slow growing or reduced budgets in the years to come and has to maintain a growing number of systems as NextGen is deployed. In fiscal year 2012, over three-fourths, or $7 billion, of FAA's operations account went to ATO to operate and maintain the national airspace system (see fig. 10). Within ATO's portion, nearly 90 percent went to compensation and benefits costs ($5 billion) and fixed costs ($1.2 billion), such as building leases, utilities, and telecommunications costs. The remaining

roughly $600 million went to non-fixed costs, including system and facilities maintenance and engineering services. According to FAA officials, when budget reductions occur, non-fixed costs, including those for maintenance, are reduced in order to continue funding fixed costs, which cannot be immediately adjusted because of the potential need for contract renegotiations with third parties outside FAA, transition and termination costs, and coordinated reductions for related system requirements. For example, when resources became constrained in 2013, FAA officials noted that they focused on maintaining equipment at the airports with the most significant activity and impact on the national airspace system and reduced its preventive maintenance and equipment support for all equipment in the national airspace system, until the agency was provided flexibility to transfer resources.[63]

[63]The Reducing Flight Delays Act of 2013 allowed DOT to transfer funds from AIP to avoid air traffic controllers' furloughs and reduce the impacts of other reductions. Pub. L. No. 113-9, § 2, 127 Stat. 443, 444.

Figure 10: The Federal Aviation Administration's (FAA) Operations Funding and the Air Traffic Organization's (ATO) Portion of This Funding, Fiscal Year 2012



Source: GAO analysis of FAA data.

Note: FAA's operations account funds the recurring cost of annual administrative, operating and maintenance expenses for conducting the agency's business, which includes the operation and maintenance of the air-traffic control system, employee compensation and benefits, and safety inspections. As noted in the report, ATO's non-compensation fixed costs include building leases, utilities, and telecommunications costs while its non-compensation, non-fixed costs include system and facilities maintenance and engineering services, among other expenses. Also, according to FAA, ATO set asides reflect operational budget items that are centrally billed and monitored and are not distributed throughout the ATO service units' budgets.

FAA has begun efforts to improve its operations account formulation. In 2012, the ATO established an operations review board consisting of staff from various ATO offices to develop and institutionalize a more centralized, program-oriented, and repeatable operations budget process, beginning with the fiscal year 2013 operations budget. According to FAA officials involved with the board's process for fiscal year 2013, this

process enabled officials to identify a number of additional issues with FAA's operations budget process, including uncoordinated and poorly planned decisions that lead to future budget liabilities. In September 2012, the board made several recommendations to the ATO Chief Operating Officer, including:

- developing a 5-year operations budget that will include operations estimates for all capital programs to ensure a better link between the capital and operations portions of the budget;
- implementing controls to strengthen budget formulation and execution, such as mandating that all decisions on requirements that create operations budget liabilities beyond the current fiscal year be made at an executive level;
- requiring the board's review of capital programs going to FAA's Joint Resources Council[64] for final investment decision or baseline change;
- better integrating NextGen life-cycle-planning costs with operations budget formulation; and
- establishing spending plans and periodically reporting on spending levels.

FAA has yet to institute these recommended changes that could help the agency better link its capital plans with future operations costs and mitigate potential budget shortfalls. As of March 2013, FAA officials said that they had done some work on planning for their fiscal year 2014 operations budget and started work on formulating their 2015 operations budget but put these efforts on hold while working to address sequester activities.[65] Officials were unclear when they would address the issues the board identified. Our prior work has noted the importance of developing information on long-term operations and maintenance resource needs to help decision makers determine whether these needs are adequately

[64]The Joint Resources Council is an FAA executive body consisting of associate and assistant administrators, acquisition program executives, the Chief Financial Officer, the Chief Information Officer, and legal counsel. The JRC makes executive-level decisions, including those that determine whether a program meets a mission need and should proceed.

[65]BBEDCA also required the Office of Management and Budget to calculate, and the President to order, a sequestration, i.e., cancellation, of budgetary resources on March 1, 2013. *See* 2 U.S.C. § 901a. For fiscal year 2013, the President ordered a sequestration of about $85 billion. *Sequestration Order for Fiscal Year 2013 Pursuant to Section 251A of the Balanced Budget and Emergency Deficit Control Act, As Amended*, 78 Fed. Reg. 14633 (Mar. 6, 2013).

planned for and funded.[66] Without a more visibility into current and future operations resource estimates, such as that envisioned in the board's recommendations, FAA cannot effectively help Congress weigh priorities and assess budget trade-offs, such as those related to concurrently operating and maintaining existing and NextGen systems, if faced with declining budget resources.

Conclusions

After almost 10 years of planning and developing NextGen, FAA is implementing key NextGen systems and capabilities. Both the magnitude of the multi-year transition itself, as well as the numerous efforts under way throughout FAA to effectuate that transition, will require FAA to manage all aspects of NextGen in a strategic, timely, and coordinated fashion. To support a more coordinated and strategic approach, FAA needs to clearly define NextGen leadership roles and follow through on its efforts to fully populate the NextGen integrate master schedule—which can support real-time monitoring of the overall NextGen effort. FAA's efforts to identify the roles its facilities and workforce will play in NextGen and determine how best to train its personnel to undertake new or changed responsibilities are also ongoing. Addressing these transition challenges is important not only to the successful transition to NextGen, but also to avoid extended reliance on the aging legacy equipment and systems. Specifically, FAA must follow through on planned efforts to integrate near- and long-term efforts to realign and consolidate facilities with its plans to maintain existing facilities as well as discontinue the use of systems facing significant sustainment issues or that are no longer needed as NextGen capabilities are deployed. Failure to follow through on these efforts means that FAA will miss potential opportunities to reduce its overall maintenance costs at a time when resources needed to maintain both systems will become scarcer, particularly if some facilities and systems are not discontinued or decommissioned.

Meanwhile, FAA reports that it continues to maintain the current air traffic control system at an operational availability level that exceeds 99 percent. However, this metric does not really illustrate the underlying performance and condition of all of FAA's air traffic control systems, some of which have experienced increasing outages, yet need to be maintained for

[66]GAO, *Embassy Construction: State Has Made Progress Constructing New Embassies, but Better Planning Is Needed for Operations and Maintenance Requirements*, GAO-06-641 (Washington, D.C.: June 30, 2006).

another 10 years or more. FAA collects additional metrics and information on the entire system that shows that its existing equipment is aging and has mounting maintenance requirements, but this information is limited, and the condition of the majority of FAA's unstaffed infrastructure and facilities is unknown, and therefore, the costs of deferred maintenance for these systems is only known within a rough order of magnitude. Without more information on the condition of its existing infrastructure and the size of its maintenance backlog, FAA is limited in its ability to estimate or control the costs to operate and maintain the existing systems during the NextGen transition, particularly since systems that were initial planned to be discontinued could continue on for many years, due to delays in NextGen implementation as well as difficulties associated with obtaining agreement from stakeholders to shut down those systems.

Since 2000, FAA has seen about a 60 percent growth in its overall budget, driven by a roughly 60 percent growth in its operations budget, but current law suggests reduced federal spending levels going forward are possible. Should FAA face reduced funding, while its operations and maintenance costs rise, along with its funding needs to support NextGen implementation, FAA will face difficult choices about how to allocate its available resources. FAA has a capital plan that outlines projects and related funding over a 5-year period that it adjusts on an annual basis to changes in funding levels. FAA does not, however, have a similar plan to help the agency plan for operating costs in future years, including the potential impact of future systems that will be deployed and the need for continued operations and maintenance of existing systems. FAA's ATO operations review board recognized the limitations in FAA's management of its operations budget and made several recommendations to FAA's ATO Chief Operating Officer to improve FAA's budgeting process, including developing a 5-year operations plan. However, FAA officials have delayed implementation and have not identified a timeframe for returning to the board's recommendations. Better planning of the operations budget could help FAA position itself to make effective decisions on how to balance the maintenance costs required to continue operating existing systems during the transition to NextGen as well as fund the operations and maintenance costs associated with the new NextGen systems that will be deployed. In addition, improved budget planning and more sufficient data on infrastructure condition could help Congress better understand the funding requirements of existing systems and facilities and facilitate FAA's efforts to support the agency's mission of continuing to operate a safe aviation system along with the longer-term goal of transforming the system to NextGen.

Recommendation for Executive Action

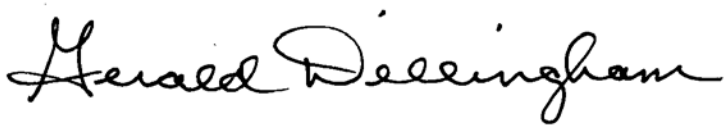
To improve FAA's efforts to manage the transition between the existing air traffic control and NextGen systems, GAO recommends that the Secretary of Transportation direct the Administrator of FAA to develop a strategy for implementing the ATO operations review board recommendations, such as developing a 5-year operations plan that better identifies the operations and maintenance costs associated with existing and NextGen systems, establish a timeline for this effort, and ensure that sufficient data, including data on the condition of unstaffed infrastructure, are available to support establishing agency priorities.

Agency Comments

We provided the Department of Transportation (DOT) with a draft of this report for review and comment. DOT responded by email and did not agree or disagree with our recommendation, but provided technical clarifications, which we incorporated into the report as appropriate.

As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies of this report to the Department of Transportation, the appropriate congressional committees, and other interested parties. In addition, the report will be available at no charge on the GAO website at http://www.gao.gov.

If you or your staff members have any questions about this report, please contact me on (202) 512-2834 or at dillinghamg@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 are listed in appendix III.



Gerald L. Dillingham, Ph.D.
Director, Physical Infrastructure Issues

List of Requesters

The Honorable John D. Rockefeller IV
Chairman
Committee on Commerce, Science, and Transportation
United States Senate

The Honorable John Thune
Ranking Member
Committee on Commerce, Science, and Transportation
United States Senate

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

The Honorable Frank A. LoBiondo
Chairman
Subcommittee on Aviation
Committee on Transportation and Infrastructure
House of Representatives

The Honorable Rick Larsen
Ranking Member
Subcommittee on Aviation
Committee on Transportation and Infrastructure
House of Representatives

The Honorable Lamar Smith
Chairman
Committee on Science, Space, and Technology
House of Representatives

The Honorable Eddie Bernice Johnson
Ranking Member
Committee on Science, Space, and Technology
House of Representatives

The Honorable Ralph Hall
House of Representatives

The Honorable Thomas E. Petri
House of Representatives

Appendix I: Scope and Methodology

To determine the Federal Aviation Administration's (FAA) progress in addressing past challenges affecting its ability to execute the transition to the Next Generation Air Transportation System (NextGen), we reviewed prior GAO reports to help identify key challenges that FAA has faced in developing and implementing NextGen, including (1) sustained leadership; (2) managing NextGen interdependencies; (3) equipping aircraft with NextGen technologies; (4) preparing FAA's workforce; and (5) consolidating and realigning FAA's facilities sustained leadership. To identify FAA's efforts to address these challenges, if any, we assessed FAA's NextGen planning documents, including the NextGen Enterprise Architecture and the 2012 and 2013 NextGen Implementation Plans, relevant legislation, and other agency-provided documentation on its NextGen acquisitions, workforce planning, and facilities consolidation efforts. We interviewed FAA officials from various offices within the Air Traffic Organization (ATO) and NextGen Organization to clarify our understanding of the information presented in these documents and identify any actions that the agency planned to take in response to these challenges. We also interviewed representatives with the National Air Traffic Controllers Union (NATCA) and Professional Aviation Safety Specialists (PASS)—the employee unions representing FAA controllers and technicians—to discuss FAA's efforts to address workforce challenges.

To identify changes in the performance and condition of existing air traffic control systems and facilities, we reviewed *FAA's annual Performance and Accountability Reports* to identify FAA's publicly-reported performance measure—operational availability of the air-traffic control system—and changes in the performance of that measure. To obtain a fuller picture of overall system performance, we obtained and analyzed data on the number and duration of unscheduled and scheduled outages for FAA's air traffic control systems for fiscal years 2001 through 2012. We also obtained data from FAA on the condition of its staffed and unstaffed facilities and infrastructure supporting these systems. We reviewed agency-prepared documents, such as assessments on the condition on system performance and maintenance requirements for individual air traffic control systems, and interviewed FAA officials in Washington, D.C., and Oklahoma City, Oklahoma, responsible for maintaining FAA's air traffic control systems and facilities to understand FAA's measures of system performance and facility and infrastructure condition and reasons for any changes in these measures. We also assessed the reliability of the system performance and infrastructure condition data by reviewing relevant documentation, such as procedures and controls for collecting and verifying the data, and interviewing agency

officials. Except where noted in the presentation of the data, we determined these data were of sufficient quality to be used for the purposes of this report. To determine FAA's efforts to address maintenance requirements of existing systems and infrastructure, we reviewed FAA maintenance policies and other documents describing the agency's approach to maintaining existing systems and facilities and discontinuing obsolete systems and facilities. We interviewed FAA officials responsible for the maintaining these systems and facilities, FAA officials responsible for developing plans to discontinue the use of obsolete systems, NATCA, and PASS to further discuss FAA's approach.

To determine the extent to which FAA has planned for the financial resources to sustain existing systems and facilities and the NextGen transition, we analyzed FAA budget data from fiscal year 2000 through fiscal year 2012 to identify trends in FAA's capital and operations funding. We reviewed FAA's budget justifications and the latest version of FAA's capital improvement plan for fiscal years 2013 through 2017 to identify projected capital spending levels. We also analyzed FAA's life-cycle cost estimates for its major acquisition programs to identify potential future operations and maintenance costs. We reviewed FAA briefings and other documents and interviewed FAA ATO, budget, and financial officials on FAA's capital and operations budget planning efforts, including the efforts of the ATO operations review board. We updated our prior assessments on the reliability of the budget and acquisition data by reviewing relevant documentation and determined that these data were of sufficient quality to be used for the purposes of this report.

We conducted this performance audit from January 2012 to August 2013 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.

Appendix II: Status of NextGen Acquisition Programs, as of June 2013

Table 3: Status of NextGen Programs with Baselined Segments

Program	Segment/Phase	Projected cost (in millions)	Start date	Completion date	On time and budget per FAA?
Automatic Dependant Surveillance-Broadcast	Segment 1-2	$1,726	2007	2014	Yes
Collaborative Air Traffic Management Technologies[a]	Work package 1-3	$567	2005	2015	Yes
Data communications	Segment 1, phase 1	$741	2012	2019	Yes
System Wide Information Management System[b]	Segment 1-2A	$430	2009	2017	Yes

Source: GAO analysis of FAA documents.

Note: A "baselined" program refers to a program with an estimated schedule and budget that has received FAA executive approval. This information is based on the most recent information from FAA and is subject to change.

[a]Work package 4 is estimated to begin in 2015.

[b]Segment 2B is estimated to begin in 2014.

Table 4: Status of NextGen Programs without Baselined Segments

Program	Estimated start date as of June 2013
Common Support Services—Weather[a]	2014
NextGen Future Facilities, Segment 1	To be determined[b]
National Airspace System Voice Systems, Segment 2[c]	2014
NextGen Weather Processor	2014

Source: GAO analysis of FAA documents.

Note: Cost and completion date information is not available until the program has officially started.

[a]This program was previously known as NextGen Network Enabled Weather.

[b]As previously noted, in light of current budget constraints, FAA is assessing options for moving forward.

[c]According to FAA, the first segment of this program involves testing that will be used to conduct the investment analysis activities to support the final investment decision for segment 2.

Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

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Staff Acknowledgments

In addition to the individual named above, Heather Krause, Assistant Director; Kevin Egan; Carol Henn; Bert Japikse; Delwen Jones; Bonnie Pignatiello Leer; SaraAnn Moessbauer; Dominic Nadarski; and Josh Ormond made key contributions to this report.