Before the Committee on Transportation and Infrastructure
United States House of Representatives

Observations on FAA's Efforts To Implement Reforms and Modernize the National Airspace System

Statement of
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Chairman Shuster and Members of the Committee:

Thank you for inviting me to testify on the Federal Aviation Administration's (FAA) efforts to implement organizational reforms and modernize the National Airspace System (NAS). Since 1958, FAA has overseen the safe operation of the busiest and most complex air traffic system in the world. Over the past 2 decades, Congress has enacted legislation specifically aimed at making FAA more efficient and cost effective while expediting modernization projects. Congress has also provided the Agency with significant support to modernize the National Airspace System, most notably through its backing of the Next Generation Air Transportation System (NextGen)—a multibillion-dollar transportation infrastructure project intended to modernize our Nation's aging air traffic system.

Our past and ongoing work has examined FAA's implementation of its reform authorities as well as high-priority NextGen investments. My testimony today is based on this work and will focus on FAA's (1) efforts in implementing personnel, organizational, and acquisition reforms and (2) progress and challenges with FAA's NextGen efforts. Though my office does not make policy recommendations, I will also discuss how other countries have structured their aviation systems and highlight factors that this Committee may wish to take into account as it considers making changes to FAA's organizational and financing structures.

SUMMARY

Since 1995, FAA has implemented several reforms in response to congressional mandates to improve its operations, acquisition practices, technology delivery, and cost management. These include implementing a new employee compensation system, establishing an Acquisition Management System (AMS), and undertaking multiple reorganizations. However, these reforms have not achieved the expected cost and productivity outcomes. In addition, while FAA has reported that it improved its management of large-scale modernization projects and acquisitions, our work continues to find that several systemic issues impact FAA's ability to meet its overall cost, schedule, and implementation goals. FAA is making progress in implementing some high-priority capabilities for NextGen, such as working with industry to implement more fuel-efficient routes during takeoffs and landings. However, several risks remain to be addressed in delivering these priorities and achieving expected benefits, such as resolving complex technology integration issues. As Congress and the Administration consider changes to FAA's structure, other nations that have commercialized their air traffic navigation systems—such as Canada, the United Kingdom, France, and Germany—may serve as a helpful frame of reference. At the same time, policy makers will need to take into account other important factors, such as the unique scale and complexity of the United States NAS.

FAA REFORMS HAVE NOT ACHIEVED EXPECTED OUTCOMES

Over the past 2 decades, Congress has granted FAA authority to reform the Agency's operations, acquisition practices, technology delivery, and cost management. FAA has taken several steps in response, including major internal reorganizations to improve efficiency. Despite these reforms, however, FAA's total budget, operations budget, and compensation costs have nearly doubled, while the Agency has not realized corresponding cost and operational efficiencies. In addition, longstanding management problems have led to further delays with FAA's efforts to deliver new technologies and major acquisitions.

FAA Has Implemented Congressionally Mandated and Other Reforms

Since 1995, FAA has implemented congressionally mandated personnel and organizational reforms and established measures to improve its internal operations and reduce costs (see table 1). These efforts include establishing the Air Traffic Organization (ATO), implementing new performance-based compensation systems, negotiating collective bargaining agreements with its bargaining units, and implementing a cost accounting system.

Table 1. Summary of FAA Reforms

Legislation	Key FAA Reform Efforts
Personnel Reforms	
In 1995, legislation was passed that exempted FAA from most Federal personnel rules, allowing it to implement a new personnel management system with more flexibility in hiring, training, compensating, and assigning personnel. In 1996, additional legislation required FAA to negotiate pay with its bargaining units.	• 1996: FAA implemented the Core Compensation System (performance-based pay system). • 1998: FAA negotiated the first collective bargaining agreement with the National Air Traffic Controllers Association. It has since negotiated four more agreements (2003, 2006, 2009, and 2016).
Acquisition Reforms	
In 1995, legislation granted FAA relief from Federal acquisition laws and regulations and directed FAA to develop an AMS to meet its unique needs. FAA's AMS was designed to be less prescriptive and more flexible than the FAR by allowing procurement officials to use discretion to employ any procedures that are not captured in AMS.	• 1996: FAA implemented AMS. • 2004: FAA began using phases and segments* to budget for major acquisition systems to meet Office of Management and Budget (OMB) guidance and initiatives to improve acquisition management. • 2012: FAA created single points of accountability for contracting officers and program managers and an FAA-wide program management office for acquisitions.
Organizational Reforms	
In 1996, legislation was passed requiring FAA to establish a cost accounting system. In 2000, legislation required FAA to appoint a Chief Operating Officer (COO) to oversee daily operation and modernization of the air traffic control system. Later that year, an Executive Order created the ATO.	• 2003: The first COO was appointed. • 2004: FAA established the ATO. • 2006: FAA implemented a cost accounting system. • 2011: FAA moved the NextGen program office out of ATO and placed it under an Assistant Administrator to increase visibility for the program.

* OMB guidance states that agencies should break large acquisitions into smaller, more manageable segments for more efficient project and acquisition management purposes.

In addition, FAA carried out multiple reorganizations to flatten its organizational structure and improve efficiency. For example, after establishing the ATO in 2004, FAA restructured the ATO's administrative and support functions in 2006 and consolidated nine regional service offices into three new service centers (Eastern, Central, and Western). In 2012, FAA created Deputy Chief Operating Officer and Chief of Staff positions and merged the terminal and en-route services units to form the Air Traffic Service Unit under a single vice president. FAA also eliminated four Senior Vice Presidents and combined the safety and technical training services units into one unit. These changes eliminated duplicate staff and reduced FAA's administrative overhead expenses by consolidating leases and implementing new processes for purchasing equipment and supplies.

FAA has also taken steps to reduce its costs. For example, in February 2005, FAA awarded a 10-year contract to Lockheed Martin to operate flight service stations in the continental United States, Puerto Rico, and Hawaii. Last November, we reported that FAA has achieved most of the anticipated cost savings from contracting out flight service operations—about $2.13 billion over a 13-year period.[1] FAA achieved these savings through reorganization of flight service operations, modernizing facilities and equipment, consolidating service stations, and reducing staff levels. Effective contractor oversight also contributed to savings, including 22 measures to evaluate contractor performance and input from pilots and other users. The Agency also implemented a broad-based set of initiatives intended to reduce costs such as communication and travel.

## Reforms Have Not Achieved Expected Cost and Productivity Outcomes

FAA's reform efforts have not slowed the Agency's overall cost growth or improved operational productivity as intended. Instead, between fiscal years 1996 and 2015, FAA's total budget grew by 95 percent,[2] its operations account increased by 110 percent, and its total personnel compensation and benefits (PC&B) costs doubled (see figure 1).[3] Despite the rise in FAA's PC&B budget, FAA's workforce levels have dropped over the past 2 decades, and the number of air traffic facilities the Agency operates has essentially remained the same.

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[1] *FAA Achieved Most of the Anticipated Cost Savings From Contracting Out Flight Service Stations, but Needs To Determine the Future Direction of the Program* (OIG Report No. AV2017015), November 16, 2016. OIG reports are available on our Web site at http://www.oig.dot.gov/.

[2] In 2000, Congress passed legislation that significantly increased funding for the Airport Improvement Program and Facilities and Equipment.

[3] Even when adjusted for inflation, the total budget increased 35 percent, the Operations account increased 45 percent, and PC&B cost increased 16 percent.

Figure 1. FAA's Total Budget, Operations Budget, and Total PC&B Costs, Fiscal Years 1996 Through 2015 (Dollars in Millions)
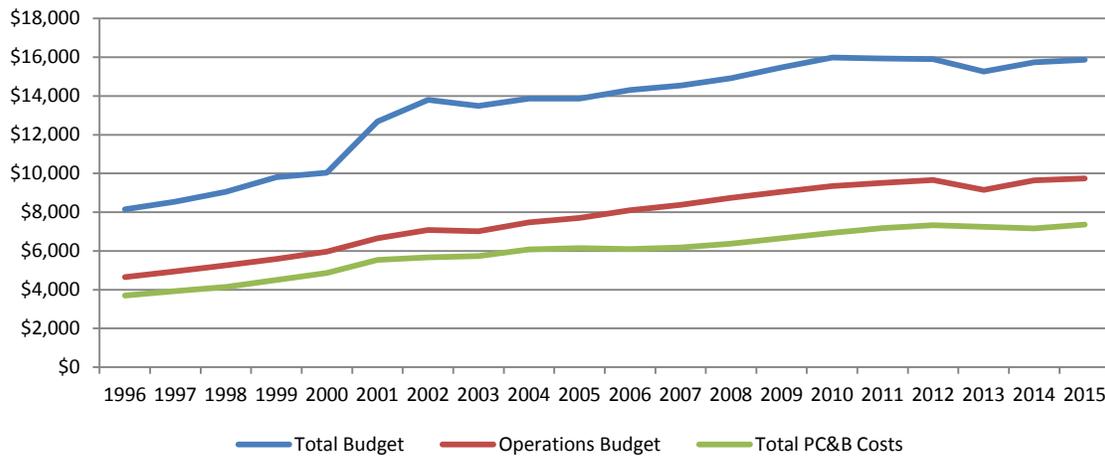
Note: Dollars shown are current dollars and have not been adjusted for inflation.
Source: OIG analysis of FAA data

Between fiscal years 1996 and 2015, the Agency's total number of full-time equivalents (FTE) decreased by nearly 9 percent, from 47,508 to 43,355. As of 2015, FAA's controller workforce stood at 14,143 FTEs. Over the last 20 years, its controller workforce has ranged up to 15,770 FTEs (see figure 2).

Figure 2. FAA's Total Number of Direct-Funded FTEs and Air Traffic Controllers FTEs, Fiscal Years 1996 Through 2015
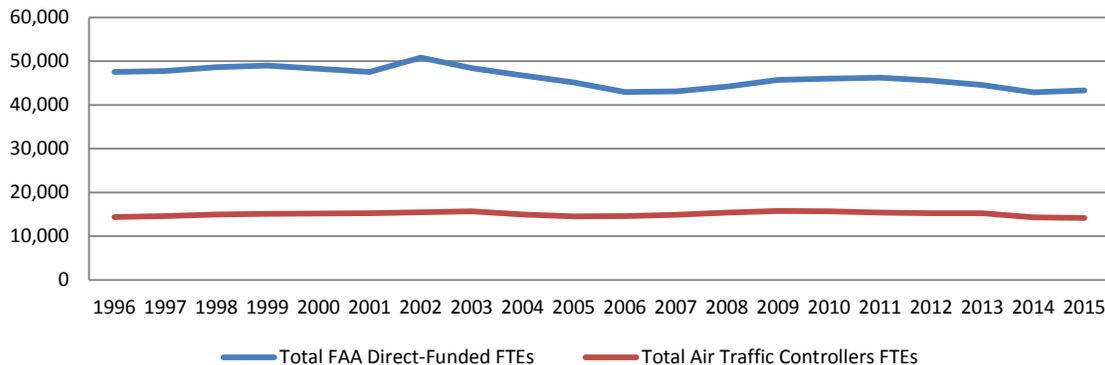
Source: OIG analysis of FAA data

FAA has not met the goals of its reform efforts largely because it has not taken full advantage of its authorities when implementing new personnel systems or used sound business practices to improve its operational efficiency and cost effectiveness. Our work has noted various opportunities FAA has missed to achieve the outcomes it intended for its reforms. For example:

- **FAA has not effectively leveraged personnel reform flexibilities.** While FAA is exempt from most Federal personnel laws and regulations covered by Title 5,[4] many of its personnel policies, such as premium pay, leave, and grievances, continue to mirror Federal rules—due in part to FAA's unionized workforce, which negotiated benefits and other personnel matters that are in line with Federal regulations. However, FAA did use its personnel reform authorities to change and expand the number of pay systems for its workforce. In addition, last January the National Academy of Public Administration reported that it was not possible to determine whether exempting FAA from Title 5 addressed the human resource challenges the Agency faced in the 1990s, such as attracting and retaining qualified staff and reassigning employees in response to changing needs.[5] The report also questioned whether the Agency had maximized these flexibilities in other areas, such as hiring and recruiting.

- **FAA has not demonstrated improvements in controller productivity.** Controller work rules that FAA and the National Air Traffic Controllers Association negotiated have not increased productivity or reduced the Agency's operating costs as intended. In 2014, we reported that FAA implemented 51 initiatives intended to increase controller productivity, reduce operating costs, and improve training and hiring practices.[6] However, only two of the initiatives resulted in measurable cost savings. Six initiatives increased Agency costs, and 43 lacked quantifiable baseline productivity and cost goals, making it difficult to assess their effectiveness. Moreover, according to a 2015 study, FAA's unit cost of service has increased by 71 percent since 1997, due largely to a decline in operations with no offsetting decline in operating expenses.[7] We also reported that FAA does not systematically collect or analyze controller workforce data to reduce costs or improve productivity, and FAA officials could not agree on which metrics are appropriate to measure controller productivity.

- **FAA has not taken advantage of opportunities to reduce facility costs.** Notably, since 2000 the Agency has not converted any of its FAA-operated towers to the Federal Contract Tower Program—despite its recognition of potential cost savings. As we reported in 2012, a contract tower costs on average about $1.5 million less to operate than a comparable FAA tower, mainly due to lower staffing and salary levels.[8]

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[4] Title 5 is the section of the U.S. Code that covers Federal personnel statutes.
[5] *Federal Aviation Administration: Personnel Reform Effectiveness Assessment*, National Academy of Public Administration, January 2017.
[6] *FAA Lacks the Metrics and Data Needed To Accurately Measure the Outcomes of Its Controller Productivity Initiatives* (OIG Report No. AV2014062), July 9, 2014.
[7] *Options for FAA Air Traffic Control Reform*, testimony of Dorothy Robyn before the House Committee on Transportation and Infrastructure, Subcommittee on Aviation, March 24, 2015.
[8] *Contract Towers Continue To Provide Cost-Effective and Safe Air Traffic Services, but Improved Oversight of the Program Is Needed* (OIG Report No. AV2013009), November 5, 2012.

These and other issues have stemmed from FAA's lack of basic business practices to oversee its operations and make decisions. While FAA has implemented systems, such as a cost accounting system, to operate more like a business, it does not regularly analyze the operational and cost data generated by these systems to determine if it could reduce costs or improve productivity. Several FAA officials and users have noted that while FAA successfully maintains one of the safest, most complex systems in the world, the Agency places limited focus on factors such as cost efficiency or productivity enhancement. This mindset also encourages managers to go with the "status quo" when making cost and operational decisions regarding the NAS, such as ineffectively using overtime at air traffic facilities.

Management Problems Continue To Hinder FAA's Efforts To Deliver New Technologies and Major Acquisitions

FAA's reforms have also fallen short in improving its delivery of new technologies and capabilities. Major projects—including some critical to NextGen—have experienced cost increases and schedule slips. Our work continues to find that several systemic issues underlie FAA's problems in delivering new technologies on time and within budget. These include overambitious plans, unreliable cost and schedule estimates, unstable requirements, software development problems, poorly defined benefits, and ineffective contract and program management.

To help reduce cost and schedule risks, FAA now manages systems in phases, which the Agency says improves learning and management through the early identification of potential issues. While this approach can help move a program forward, it can also mask the overall cost, schedule, and capabilities of several large budget programs. For example, FAA has adopted a segmented approach to implementing its six "transformational" programs,[9] a multibillion-dollar set of initiatives required to implement NextGen and introduce new capabilities. As we reported in 2016, FAA has made some progress implementing these programs and has approved costs and schedules for their initial segments.[10] For example, FAA approved funding of $2 billion for the first segment of Data Communications (DataComm) and $2.7 billion for three segments of the Automatic Dependent Surveillance–Broadcast system (ADS-B), including the recently completed ground-based infrastructure and the ongoing rollout of ADS-B services and applications.[11] As of November 2016, cost estimates for the transformational programs (as currently envisioned) total over $5.7 billion (compared to $2.1 billion in 2012) and extend beyond 2020. However,

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[9] The six transformational programs are Automatic Dependent Surveillance–Broadcast (ADS-B), System Wide Information Management (SWIM), Data Communications (DataComm), NAS Voice System (NVS), Common Support Services-Weather (CSS-Wx), and Collaborative Air Traffic Management–Technologies (CATM-T).

[10] *Total Costs, Schedules, and Benefits of FAA's NextGen Transformational Programs Remain Uncertain* (OIG Report No. AV2017009), November 10, 2016.

[11] DataComm will allow controllers to send digital messages to pilots. ADS-B technology uses satellite-based GPS and is intended to allow FAA to transition from ground-based radar to a satellite-based system for improving surveillance and management of air traffic.

FAA has not fully identified the *total* costs, the number of segments, their capabilities, or completion schedules for any of the six programs.

In addition, FAA has not determined when the transformational programs will start delivering benefits or how they will improve air traffic flow or controller productivity. For example, FAA's ADS-B program currently focuses on the ADS-B *Out* capability (the broadcast of information to ground systems), which is mandated for airspace users to equip by January 1, 2020. ADS-B *Out* will only provide few benefits to airspace users except in airspace where radar is limited or nonexistent. FAA expects users could gain more widespread benefits through ADS-B *In,* which will enable display of the information in the cockpit. However, ADS-B *In* requirements continue to evolve.

These weaknesses are not limited to FAA's transformational programs. As we reported in January 2016,[12] 8 of FAA's 15 major system acquisitions that were ongoing as of September 30, 2013,[13] had cost increases and 8 had schedule delays. Overall, ongoing major system acquisitions experienced a cumulative cost increase of $3.8 billion beyond FAA's original estimates[14] and delays ranging from 7 to 174 months, with an average delay of 51 months. In response to our recommendation, FAA now annually identifies the total ongoing costs—including both open and closed segments—for each acquisition that involves multiple segments. However, it remains difficult to determine whether desired capabilities have been delivered as planned, in part because FAA's reporting does not always identify changes to an acquisition's scope.

Furthermore, FAA has demonstrated ineffective contract management and lack of internal controls in several acquisitions and agreements we have reviewed. For example:

- FAA has not done enough to reduce its use of sole-source[15] contracts, as directed by OMB in 2009. As we reported in May 2016, between fiscal years 2008 and 2014, FAA awarded 624 sole-source contracts with a total value of about $2.2 billion.[16] Also, FAA had not adequately conducted many pre-contract award practices required by AMS—such as procurement planning or developing

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[12] *FAA Reforms Have Not Achieved Expected Cost, Efficiency, and Modernization Outcomes* (OIG Report No. AV2016015), January 15, 2016.

[13] To evaluate the effectiveness of FAA's reforms on current acquisitions, we limited our review to all major acquisition systems that were active as of September 30, 2013—which was the latest fiscal year with available information at the time we started our audit.

[14] About $3.1 billion of the $3.8 billion cost increases for the eight systems were associated with the Standard Terminal Automation Replacement System (STARS) and the Wide Area Augmentation System—FAA's oldest active major acquisitions at the time. About $1.46 billion of the STARS and WAAS increase is associated with overruns to initial baselines, and $1.67 billion was due to technology refreshment and enhancements. Six other programs experienced combined cost increases of $692 million—of which $539 million was associated with cost overruns to initial baselines, and $153 million was due to technology refreshment.

[15] Sole-source contracts are negotiated without the benefit of competition and carry the risk of overspending.

[16] *FAA Lacks Adequate Controls To Accurately Track and Award Its Sole-Source Contracts* (OIG Report No. ZA2016065), May 9, 2016.

independent cost estimates to ensure reasonable prices. We projected that the total estimated value of sole-source contracts that did not fully comply with key AMS requirements is $962 million, or 51 percent of the total estimated value of contracts in our universe.

- FAA does not always ensure adequate oversight on its multiple award contracts. Our 2012 audit[17] of FAA's Systems Engineering 2020 (SE-2020) contracts, originally valued in 2010 at $7.3 billion,[18] found that unreliable cost baselines and overstated contract values may have affected the FAA's ability to manage total contract costs. Due to these concerns and the significant funding involved, we are conducting a follow-up audit of FAA's award and oversight of SE-2020 task orders to assess whether FAA's actions for awarding task orders and overseeing the SE-2020 acquisition program are sufficient to meet its program mission.

- FAA also did not effectively oversee procurements awarded with its Electronic FAA Accelerated and Simplified Tasks (eFAST)[19] program. We recently reported[20] that some of the contracting officer representatives responsible for overseeing eFAST procurements lacked required certifications and specific procurement expertise. We also found a lack of documented oversight plans.

- FAA is not adequately managing its use of other transaction agreements—which are not required to follow many laws, regulations, and policies that apply to more traditional acquisition and financial assistance instruments such as contracts and grants. Our ongoing review has identified concerns with incomplete file documentation, inadequate oversight, and funding and program vulnerabilities. We expect to report on FAA's oversight of other transaction agreements later this year.

Management weaknesses with major programs are also exacerbated by gaps in FAA's AMS guidance for acquisitions. When FAA implemented AMS in 1996, it believed that it would have increased flexibility to rapidly field systems at less cost. FAA's Administrator at the time stated that FAA's goal for AMS was to cut acquisition costs by 20 percent and acquisition schedules by 50 percent within 3 years, compared to earlier acquisitions implemented under the Federal Acquisition Regulation (FAR).[21]

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[17] *FAA's Contracting Practices Are Insufficient To Effectively Manage Its Systems Engineering 2020 Contracts* (OIG Report No. ZA2012082), March 28, 2012.

[18] FAA revised its estimate for the SE-2020 contracts to $1.1 billion, effective November 1, 2015.

[19] eFAST is the Agency's preferred vehicle for small business procurements, offering a broad range of professional and support services including research and development and engineering services.

[20] *Opportunities Exist for FAA To Strengthen Its Award and Oversight of eFAST Procurements* (OIG Report No. ZA2017046), May 8, 2017.

[21] The Federal Acquisition Regulations System is established for the codification and publication of uniform policies and procedures for acquisition by all executive agencies. The Federal Acquisition Regulations System consists of the Federal Acquisition Regulation (FAR), which is the primary document, and agency acquisition regulations that implement or supplement the FAR.

However, the gaps we have found in AMS policies and guidance are hindering effective implementation of major acquisition programs. For example:

- FAA has not implemented a recommendation from our January 2016 report to incorporate modular contracting requirements into AMS guidance. Recommended by the Federal Chief Information Officer, modular contracting emphasizes acquiring information technology investments in contractual increments, each of which produces a measurable result towards delivering the functionality for the investment, which can help reduce cost and schedule risks in large-scale programs.

- AMS also does not provide specific guidance to assist program managers in accepting large software intensive programs—such as the En Route Automation Modernization (ERAM) program that automated how controllers manage high-altitude traffic—which contributed to the acceptance of immature software and millions in increased development costs.[22]

In light of the organizational and program management changes FAA has made over the years, it is difficult to precisely determine how FAA's switch from the FAR to AMS has affected how it delivers acquisitions. However, FAA is currently reviewing industry best practices to determine how AMS can be improved.

FAA IS MAKING PROGRESS WITH HIGH-PRIORITY NEXTGEN INVESTMENTS, BUT CHALLENGES REMAIN IN MANAGING RISKS AND DELIVERING BENEFITS

Given the large scope of FAA's NextGen effort, establishing investment priorities is key to maximizing near-term benefits and securing stakeholder involvement. FAA has made progress working with industry in identifying and advancing investment priorities, such as new routes based on performance-based navigation (PBN). However, several risks remain to be addressed in delivering these identified priorities and achieving expected benefits.

FAA Has Made Progress in Implementing High-Priority Investments

FAA has successfully worked with industry to identify and launch key NextGen priorities. In 2013, FAA tasked the NextGen Advisory Committee (NAC) with reviewing FAA's NextGen plans and recommending priorities for investment. That same year,[23] the NAC identified four top priorities critical to delivering near-term benefits and advance NextGen: (1) advancing PBN, (2) improving access to closely spaced parallel runways (known as Multiple Runway Operations, or MRO), (3) enhancing airport surface operations, and (4) developing data communications for

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[22] *Weaknesses in Program and Contract Management Contribute to ERAM Delays and Put Other NextGen Initiatives at Risk* (OIG Report No. AV2012179), September 13, 2012.

[23] The NAC added the Data Communications program as its fourth priority in February 2014.

controllers and pilots. FAA and the NAC are in discussions to add a fifth priority—to focus on reducing congestion in the Northeast corridor.

In response to the NAC's report, FAA collaborated with industry representatives to develop an implementation plan for capabilities in the four original priority areas. FAA has since made progress and reported that it completed about 93 percent of its milestones between October 1, 2014, and March 31, 2017.

The following are some notable examples of FAA's progress:

- **MRO:** FAA implemented Wake Recategorization (RECAT), a capability that safely reduces separation between aircraft on arrivals and departures, at 11 airports nationwide, including Hartsfield-Jackson Atlanta International Airport, George Bush Houston Intercontinental Airport, and John F. Kennedy International Airport.

- **PBN:** FAA fully deployed PBN procedures at the Northern California Metroplex during the second calendar quarter of 2015, about 3 months ahead of schedule. FAA conducted a phased implementation of 44 routes covering the greater San Francisco Bay Area and Sacramento.

- **Airport Surface Operations:** FAA reported early implementation of the System Wide Information Management Surface Visualization Tool at five Terminal Radar Approach Control facilities. This system allows controllers to better monitor congestion and plan for changes on airport runways and taxiways, especially during inclement weather.

- **DataComm:** FAA reported making strides with DataComm, implementing the capability for departure clearance at 3 key airport towers in 2015 and at a total of 55 towers by December 2016. At the request of the NAC, FAA agreed to accelerate DataComm deployment ahead of the original schedule. To its credit, the Agency is implementing DataComm at specified towers across the Nation about 30 months ahead of schedule.

Yet, full implementation of all capabilities—and the realization of benefits—remains years away. Of the 156 milestones FAA reported as completed through March 2017, most were attributed to the implementation of Wake RECAT and DataComm at airport towers. Significant work remains to deploy new PBN procedures to capture airspace efficiencies and boost arrival rates, develop surface technologies to enhance capacity on crowded runways and taxiways, and install DataComm in the high-altitude environment to allow pilots and controllers to, among other things, reroute air traffic around bad weather.

Significant Risks Remain That Could Impact Implementation and Slow Delivery of Benefits

To continue progress toward major program milestones, FAA will need to resolve key risk areas that will materially affect the delivery, capabilities, and benefits of its NextGen priorities (see table 2).

Table 2. Key Risks to NextGen Priorities Implementation and Benefits Delivery

Priority	Key Risk Areas
MRO	• Timely completion of safety analysis • Aircraft fleet mix at specific airports
PBN	• Community outreach to reduce concerns about aircraft noise • Mixed equipage • Implementation of new automated controller tools to help controllers manage traffic in the vicinity of airport and limit the impacts of mixed equipage, beginning in 2019 • Effective controller training and use of time based approaches at all air traffic facilities
Surface Operations	• Execution of the Terminal Flight Data Manager program for electronic flight strips and other surface management technologies • Complex systems integration issues across all phases of flight
DataComm	• Industry cooperation with purchasing and installing new avionics aircraft equipage • Resolving avionics issues with over 700 Boeing 757 and 767 aircraft • Displaying information on controller displays at facilities that manage high altitude traffic beginning in 2019
All Priorities	• Training for controllers and flight crews • Measurement and realization of benefits • Interdependencies between capabilities

Source: OIG analysis of FAA reports and studies

Examples of key risk areas impacting potential schedules and benefits include the following:

- **Addressing community concerns and implementing controller tools for PBN.** PBN has been delayed due to community concerns over aircraft noise. While regulations did not require FAA to fully assess the impact of aircraft noise, it could have anticipated this issue due to high public interest at other airports implementing similar procedures. This issue, along with others identified in FAA and industry reports—such as controllers' need for automated support tools to better manage aircraft in the vicinity of airports—poses a risk to PBN's long-term success. FAA does not plan to begin implementing new tools for controllers that manage traffic in the vicinity of airports until the 2019 timeframe.

- **Modifying controller equipment and resolving avionics issues with DataComm.** FAA is working to modify controller displays and computers so that controllers managing high-altitude traffic can begin to exchange datalink messages with pilots beginning in 2019. FAA and the airlines cannot reap the expected benefits of rerouting aircraft in bad weather until modifications to controller

displays and related equipment are made and fully tested. Also, FAA and industry are working to resolve technical problems with over 700 Boeing 757 and 767 aircraft avionics that cannot broadcast some datalink messages while airborne. FAA reports that over 2,800 aircraft out of about 7,000 U.S. commercial transport aircraft are now equipped to exchange DataComm messages.

- **Introducing and integrating electronic flight strips for controllers at airport towers.**[24] Surface operations are critical to a more efficient NAS, because inefficiencies on the ground can negate efficiencies gained in the air from new PBN routes and improved multiple runway operations. The centerpiece of FAA's surface efforts is the integration of Terminal Flight Data Manager, a new $795 million surface management system designed to introduce electronic flight strips into FAA towers and integrate other surface surveillance technologies into one efficient system. FAA plans call for the electronic flight strips to be installed at 89 airport towers between 2020 and 2028. According to FAA officials, risks to the program include evolving requirements, an aggressive schedule, and complex integration issues with diverse air traffic control systems used through all phases of flight.[25] Our work shows that the lessons learned from previous prototype efforts with electronic flight strips (and the resolution of technical issues, such as frozen screens) will be valuable in mitigating risks and speeding implementation of the new technology.

Recognizing these risks with its priority areas, FAA recently adjusted its plans and established a 3-year rolling implementation plan that will be updated at the beginning of each fiscal year to focus on high-benefit, high-readiness capabilities. FAA and industry have also agreed on ways to increase communication on these issues. We are currently assessing FAA's process for managing the implementation risks for the four prioritized capabilities and plan to issue a report later this year.

OTHER COUNTRIES' AVIATION SYSTEMS PROVIDE ALTERNATIVE STRUCTURES

As Congress considers possible changes to FAA's structure, examining other nations' air traffic systems could provide a valuable frame of reference. This Committee asked our office to review how other countries operate, modernize, and finance their air navigation services and infrastructure and to compare these structures to FAA's. In 2015 we reported on our review of four nations—Canada, the United Kingdom, Germany, and France—and found that they had some common operational and

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[24] Electronic flight strips replace today's paper flight progress strips with modern, real-time data-sharing displays for tower controllers. With today's paper strips, tower controllers must physically hand off a flight progress strip from controller to controller, whereas an electronic version is distributed automatically, reducing controller workload and operational complexity.

[25] The Terminal Flight Data Manager program will need to be fully integrated with a wide range of systems that controllers use to manage traffic, such as STARS for traffic in the vicinity of the airport and ERAM for high-altitude traffic.

financing characteristics and also conducted smaller-scale modernization efforts.[26] Ultimately, any change to FAA's structure will need to take into account several key factors, including the unique characteristics of the United States NAS and safety concerns.

Other Nations' Systems Have Common Operational and Financing Characteristics

The four countries we reviewed have separated their air traffic control functions from the safety oversight and regulatory functions. While safety and regulatory functions remain government-controlled, each nation has commercialized[27] its air traffic control function into an air navigation service provider (ANSP) using various organizational structures. These structures include a private, not-for-profit, non-share corporation in Canada; a for-profit, public-private partnership in the United Kingdom; a government-owned limited liability company in Germany; and a government agency in France.

According to officials overseeing these systems, these countries commercialized their air traffic control functions to address issues such as rising national deficits, operational and cost inefficiencies, the government's inability to modernize its air transportation systems, and stagnant wage growth for government employees. While operations have been commercialized, the safety oversight and regulatory functions remain under the control of the respective governments and are separate from the ANSPs.[28] The foreign ANSPs are also financially self-supporting and finance their operations primarily through user fees. Users are charged fees for services such as navigation and surveillance activities in high-altitude and terminal environments, communications, and aeronautical and meteorological information. The ANSPs in Canada, Germany, and the United Kingdom also earned a small portion of their revenue from developing and selling aviation technology developed in-house, such as air traffic management systems. In addition, the ANSPs have the ability to finance their infrastructure and modernization efforts by issuing long-term bonds and other debt instruments, which are backed by the revenues earned by the ANSPs.

Modernization Efforts in Other Countries Are Smaller in Size and Use Different Methods To Develop and Implement New Technologies

Other key differences between FAA and foreign nations' air navigation structures pertain to how they undertake modernization efforts. Unlike FAA, the ANSPs do not

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[26] *There Are Significant Differences Between FAA and Foreign Countries' Processes for Operating Air Navigation Systems* (OIG Report No. AV2015084), September 2, 2015.

[27] According to the International Civil Aviation Organization, "commercialization" is the ability of an organization to operate like a commercial business. In discussions about air navigation services, the term is often used interchangeably with other terms, including restructuring, privatization, outsourcing, and corporatization.

[28] Under guidelines from the International Civil Aviation Organization, it is the responsibility of individual countries to ensure the safety of their aviation systems. In Europe, the European Aviation Safety Administration (EASA) regulates and oversees all aspects of aviation safety, and European governments must ensure that operators in their respective countries comply with EASA regulations.

embark on large modernization efforts or conduct extensive aviation research and development. Rather, they implement new technologies incrementally, using a variety of methods. For example, Nav Canada used a phased-in approach to develop and introduce a new system known as Controller/Pilot Data Link Communications (CPDLC).[29]

In lieu of developing modernization systems and software, three of the four ANSPs modify commercial-off-the-shelf products to meet their operational needs. For example, Nav Canada uses in-house staff to develop automation and other software-intensive systems mostly by tailoring commercial products to fit their operation. In addition, all four ANSPs form joint ventures and other partnerships with private companies, such as Nav Canada's joint venture with a company to develop an ADS-B surveillance system, initially for use in the oceanic airspace.

In addition, the United Kingdom, Germany, and France have joined other European countries in a large-scale effort to modernize and improve Europe's air navigation system to increase airspace capacity and overall efficiency. The associated modernization program—Single European Sky ATM Research, or SESAR—is similar to NextGen and is a public-private partnership intended to define and develop common aviation technologies for use across Europe.

Additional Factors To Consider When Examining Possible Changes to FAA's Organizational Structure

As Congress and other policy makers examine possible changes to FAA's organizational and financing structures, they may wish to consider several differences between the U.S. aviation system and other countries. These include the following:

- **System Size and Complexity:** The United States has the largest and most complex air transportation system in the world. ATO controls more than 2.5 times the airspace of the United Kingdom—the largest airspace of the four ANSPs we examined. The United States also has more operations than the total of all the foreign ANSPs we examined and has a larger general aviation community. To manage the U.S. airspace, FAA operates more air traffic facilities and employs more controllers than the foreign ANSPs combined (see table 3).

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[29] CPDLC is used to supplement voice communication between pilots and controllers and provides benefits such as automating routine tasks and improving safety by reducing workload and communication errors.

Table 3. Comparison of Air Navigation Service Providers

	ATO (United States)	NATS (United Kingdom)	NAV CANADA (Canada)	DSNA (France)	DFS (Germany)
Total Airspace	75,110,000 km²	29,180,000 km²	18,000,000 km²	1,000,000 km²	394,000 km²
Annual IFR[b] Movements (2011) ✈ = 1,000,000 IFR Movements	15,539,009	2,106,689[a]	3,855,947	3,009,230	3,061,000
Number of General Aviation Aircraft (2015)	210,030	19,924	36,440	34, 506	21,213
Number of Operational Air Traffic Controllers (2012)	18,001	1,480	1,689	3,964	1,716
Number of Air Traffic Facilities	317	18	49	91	20
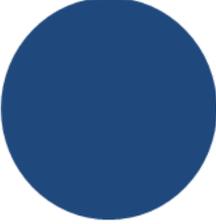
[a] Data from 2010; [b] Instrument Flight Rules
Source: OIG analysis of Civil Aviation Air Navigation Services Organization and General Aviation Manufacturers Association Data

- **Capital Budgets:** Given the differences in size and complexity, the capital budgets for ANSPs are significantly smaller than FAA's capital budget. For example, FAA's Facilities and Equipment annual budget is $2.6 billion, with several projects expected to cost billions of dollars to complete. Nav Canada's capital budget is approximately $120 million annually, and it considers a large acquisition to be $10 million.

- **Airport Funding:** U.S. airports are funded through Federal programs, such as the Airport Improvement Program, and Passenger Facility Charges. However, as with the foreign ANSPs, airports in each of the four countries we examined are generally self-supporting, autonomous entities. In addition, the foreign ANSPs do not include airport development and maintenance costs in their user fee calculations.

- **Aviation Research and Development:** FAA conducts a wide range of aviation research in areas such as evaluating and testing NextGen concepts; conducting runway, fuel, and other safety analyses; and studying human factors in the air traffic control environment. However, none of the ANSPs we examined conduct the level of aviation research that FAA conducts or operates a technical development complex like FAA's Technical Center in Atlantic City, NJ.

Regardless of these differences, other nations' experiences in separating their aviation function—as well as studies we reviewed—have led to several lessons learned. These include the following:

- **Safety:** Studies we reviewed, including a 2014 report commissioned by FAA,[30] indicate that separating air navigation and safety/regulatory functions has not impacted safety. However, the report noted that if a government is planning to separate its safety oversight organization from an ANSP, it needs to establish a clear division of roles between the safety organization and the ANSP, ensure that a sufficient safety and regulatory workforce is in place, and verify that mechanisms are in place to properly fund the safety organization.

- **Transition Issues:** Officials in the countries we visited noted that they had to resolve several transition issues to commercialize their air navigation functions, including determining which functions to transfer, the timing of the transition, and how the government would conduct safety oversight and work with the newly created entity. There were also transition issues for employees moving to the commercialized entity. For example, Nav Canada and its union officials noted that there were contentious labor-management relations for the first several years after the transition.

- **Financial Considerations:** Separating the air traffic function from FAA would require resolving several financial issues, including determining which assets would be transferred to the new air traffic entity, such as air traffic facilities and equipment, as well as the value of those assets and the air traffic system. Properly assessing the value of the air traffic control system and the associated assets will be important. According to the Auditor General of Canada, Transport Canada did not properly estimate the value of its air navigation system before transferring over to Nav Canada. This resulted in the government receiving significantly less for the system than what it was worth.[31]

CONCLUSION

Our work continues to demonstrate that while FAA has taken some action to implement the reform authorities Congress granted almost 2 decades ago, it has not

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[30] *CAA International Structures*, MITRE Corporation, October 2014.
[31] *Transport Canada – The Commercialization of the Air Navigation System*, Office of the Auditor General of Canada, October 1, 1997.

achieved the large-scale efficiencies, productivity enhancements, and cost savings intended for these reforms. Should Congress, the Administration, and aviation stakeholders decide to pursue different approaches to organizing and financing our Nation's air traffic control system, there are several significant policy questions that would influence decisions, given the unique characteristics of the U.S. system. At the same time, many of the key risk areas and management challenges we have identified will persist, regardless of potential changes to FAA's structure. Ultimately, safety will continue to be the United States' and the Department's top priority in overseeing our National Airspace System, and strong controls and oversight on the part of FAA will continue to be crucial to providing the public with a safe, efficient, and innovative transportation system.

This concludes my prepared statement. I will be happy to answer any questions you or the other Members of the Committee may have.