AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

S. HRG. 113–669

NEXTGEN: A REVIEW OF PROGRESS, CHALLENGES, AND OPPORTUNITIES FOR IMPROVING AVIATION SAFETY AND EFFICIENCY

HEARING

BEFORE THE

SUBCOMMITTEE ON AVIATION OPERATIONS, SAFETY, AND SECURITY

OF THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION
UNITED STATES SENATE

ONE HUNDRED THIRTEENTH CONGRESS

SECOND SESSION

JUNE 25, 2014

Printed for the use of the Committee on Commerce, Science, and Transportation



U.S. GOVERNMENT PUBLISHING OFFICE

95–362 PDF WASHINGTON : 2015

For sale by the Superintendent of Documents, U.S. Government Publishing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2104 Mail: Stop IDCC, Washington, DC 20402–0001

SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED THIRTEENTH CONGRESS

SECOND SESSION

JOHN D. ROCKEFELLER IV, West Virginia, *Chairman*

BARBARA BOXER, California
BILL NELSON, Florida
MARIA CANTWELL, Washington
MARK PRYOR, Arkansas
CLAIRE MCCASKILL, Missouri
AMY KLOBUCHAR, Minnesota
MARK BEGICH, Alaska
RICHARD BLUMENTHAL, Connecticut
BRIAN SCHATZ, Hawaii
EDWARD MARKEY, Massachusetts
CORY BOOKER, New Jersey
JOHN E. WALSH, Montana

JOHN THUNE, South Dakota, *Ranking*
ROGER F. WICKER, Mississippi
ROY BLUNT, Missouri
MARCO RUBIO, Florida
KELLY AYOTTE, New Hampshire
DEAN HELLER, Nevada
DAN COATS, Indiana
TIM SCOTT, South Carolina
TED CRUZ, Texas
DEB FISCHER, Nebraska
RON JOHNSON, Wisconsin

ELLEN L. DONESKI, *Staff Director*
JOHN WILLIAMS, *General Counsel*
DAVID SCHWIETERT, *Republican Staff Director*
NICK ROSSI, *Republican Deputy Staff Director*
REBECCA SEIDEL, *Republican General Counsel and Chief Investigator*

SUBCOMMITTEE ON AVIATION OPERATIONS, SAFETY, AND SECURITY

MARIA CANTWELL, Washington, *Chairman*
BARBARA BOXER, California
BILL NELSON, Florida
MARK PRYOR, Arkansas
AMY KLOBUCHAR, Minnesota
MARK BEGICH, Alaska
BRIAN SCHATZ, Hawaii
CORY BOOKER, New Jersey
JOHN E. WALSH, Montana

KELLY AYOTTE, New Hampshire, *Ranking Member*
ROGER F. WICKER, Mississippi
ROY BLUNT, Missouri
MARCO RUBIO, Florida
DEAN HELLER, Nevada
TIM SCOTT, South Carolina
TED CRUZ, Texas
DEB FISCHER, Nebraska
RON JOHNSON, Wisconsin

CONTENTS

	Page
Hearing held on June 25, 2014	1
Statement of Senator Cantwell	1
Statement of Senator Ayotte	3
Statement of Senator Booker	32
Statement of Senator Begich	34
Statement of Senator Nelson	36

WITNESSES

Hon. Michael G. Whitaker, Deputy Administrator, Federal Aviation Administration	4
Prepared statement	6
Matthew E. Hampton, Assistant Inspector General for Aviation Audits, Office of Inspector General, U.S. Department of Transportation	9
Prepared statement	11
Paul Rinaldi, President, National Air Traffic Controllers Association	17
Prepared statement	19
Gary Beck, Vice President—Flight Operations, Alaska Airlines	25
Prepared statement	26

APPENDIX

Response to written questions submitted to Hon. Michael G. Whitaker by:	
Hon. John D. Rockefeller IV	43
Hon. Maria Cantwell	43
Hon. Amy Klobuchar	47
Response to written question submitted to Gary Beck by:	
Hon. Maria Cantwell	47
Hon. Amy Klobuchar	48

NEXTGEN: A REVIEW OF PROGRESS, CHALLENGES, AND OPPORTUNITIES FOR IMPROVING AVIATION SAFETY AND EFFICIENCY

WEDNESDAY, JUNE 25, 2014

U.S. SENATE,
SUBCOMMITTEE ON AVIATION OPERATIONS, SAFETY, AND SECURITY,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The Subcommittee met, pursuant to notice, at 10:30 a.m. in room SR–253, Russell Senate Office Building, Hon. Maria Cantwell, Chairman of the Subcommittee, presiding.

OPENING STATEMENT OF HON. MARIA CANTWELL, U.S. SENATOR FROM WASHINGTON

Senator CANTWELL. The Senate Committee on Commerce, Science, and Transportation will come to order. This is an Aviation Subcommittee, and we are having a hearing today on "NextGen: A Review of the Progress, Challenges, and Opportunities for Improving Aviation Safety and Efficiency."

I want to thank the witnesses for being here today, the Honorable Michael Whitaker, who is Deputy Administrator for the FAA. Welcome.

Mr. Matthew Hampton, Assistant Inspector General for Aviation Audits, in the Office of the Inspector General for the U.S. Department of Transportation.

Mr. Paul Rinaldi, President of the National Air Traffic Controllers Association. Welcome.

Mr. Gary Beck, Vice President—Flight Operations, Alaska Airlines. I do not know if that means you live in the Northwest, but if that is indeed the case, welcome, and thank you for being here.

Senator BOOKER. It does not matter where he lives, he has got a great haircut.

[Laughter.]

Senator CANTWELL. Just like yours. OK. Today, we are here to discuss the Next Generation Air Traffic System, more commonly known as "NextGen," and this program has been promised as a way to increase safety, improve efficiency, reduce fuel costs, by reforming our air traffic control system.

A fully implemented NextGen system is also critical for building capacity in our aviation system to meet the demands of a growing

middle class around the globe and the increase in air transportation.

There is a lot to do to achieve these goals. Five billion has been invested in NextGen thus far, and it has as the I.G. Report says produced some milestones being met, but as the report shows, there are also issues related to the ASD–B program, a cornerstone of the technology, and underlying problematic challenges, and an executable plan for coordinating many of the multiple programs and the technical issues.

So, we will look forward to hearing more from the IG Report.

We are expected to continue to invest $1 billion a year in NextGen, and there have been some delays in this implementation that we need to push beyond. It is unacceptable for us to continue to spend resources and not make more progress as it relates to the flying public.

We have asked the private sector, commercial air carriers, cargo and general aviation, to make real investments in helping us meet the promise of NextGen, but we have little data and metrics to assess the value of that investment.

We had created a NextGen Advisory Committee in the last FAA reauthorization bill to help the FAA get back on track. Thanks to many people, including Alaska Airlines' CEO, Bill Ayer, who have made progress on helping us keep the implementation of key priorities.

But a lot of work still remains. The NextGen Advisory Committee has said the FAA should focus on key areas, including runway operations, Performance Based Navigation, surface operations, and data communications.

These four priorities represent consensus between the industry and the FAA where optimum progress can be made in the shortest amount of time.

I cannot emphasize how important I believe that is. When you see the progress that has been made from Greener Skies, you certainly think why can we not get this as a model that could be replicated more quickly airport to airport or region to region, having learned all the pluses—challenges with implementation, thereby flattening some of those and making it easier for the next airport to implement. So, I certainly hope that this is one of the priorities we will move on faster.

This will deliver maximum return on investment for the taxpayers and the airline industry, and improve the service to the flying public.

The FAA has promised a report on the path forward for many of the priorities. We look forward to getting that, I believe this July, so we will have a chance to ask a little bit about that today, on data communications and the improvements that are supposed to be made between air traffic controllers and the commercial pilots, the Performance Based Navigation system, using GPS, the Automatic Dependent Surveillance-Broadcast, ADS–B, and a variety of other issues about the traveling public and their smoother, shorter flights.

Obviously, we know that NextGen has the promise of an estimated 1.6 billion gallons of fuel savings by 2020, and this will help airlines invest in newer, more fuel efficient, safer planes, which is

also good for domestic manufacturing, and good for our environment.

We all understand that investments must be made in infrastructure before associated capabilities and benefits are realized, and that is why, Deputy Administrator Whitaker, I appreciate your leadership and what you have brought to the agency to bring focus to this.

We know there are many challenges you face in implementing a whole new system in the existing culture.

So, we are all here to help focus on these issues today, and hope that we can prioritize some of these investments.

One of the areas I mentioned is the implementation of the Greener Skies initiative in Seattle where Alaska Airlines partnered with Seattle, Boeing, the FAA, and leveraged Alaska's pioneering efforts on NextGen and Performance Based Navigation.

Today, there are more Performance Based Navigation procedures in use than conventional routes, and Alaska's private investment in research in this field has benefited passengers throughout the nation, and it is critical that we continue to fund the research and development that will help achieve these technically complex capabilities and long-term goals.

I look forward to hearing from all the witnesses today on this important endeavor that we are undertaking. Again, thank you all for your contribution, and now I will turn to the Ranking Member, Senator Ayotte, for her opening statement.

STATEMENT OF HON. KELLY AYOTTE,
U.S. SENATOR FROM NEW HAMPSHIRE

Senator AYOTTE. Thank you. I want to thank the Chair of the Committee for holding this important hearing.

We can all agree that the Next Generation Air Transportation System, or NextGen, has the potential to significantly enhance our Nation's antiquated air traffic system by making our air traffic management more efficient, more environmentally friendly, and most importantly, safer for the traveling public.

There is no doubt that NextGen seeks to reform an extraordinarily complex air traffic management system. However, as we will discuss today, according to the U.S. Department of Transportation Inspector General, the Federal Government has already spent between $5 billion to $6 billion to build the foundational elements of NextGen, work that has been ongoing since 2003.

While recognizing that some progress has been made, I am concerned that we have yet to see many of the tangible results from these investments that we are all waiting to see and that we all support.

Specifically, I am concerned that programs critical to the foundation of NextGen have experienced cost increases, performance shortfalls, and have failed to meet scheduled deadlines.

In addition, while I appreciate that some airlines have already invested millions of dollars in equipping their aircraft for NextGen, it is concerning that they are still waiting to see the benefits of these forward thinking investments, and I think some people are sitting on the side lines in the airlines industry as well, because

those who have made investments have not yet seen the return on those investments.

While I look forward to discussing progress today, I also want to further identify areas that need improvement, so that we can work together toward swift and efficient implementation of NextGen.

I look forward to hearing from our witnesses today about how Congress, the FAA, and industry can work together to better address these challenges.

As we develop the next FAA reauthorization bill, it is critical that members of this committee, particularly this subcommittee, work together along with our House counterparts, and all the stakeholders involved with the FAA to get this right.

It is too important for the country that we move forward with NextGen implementation as fast as we can, that we really get back on track, and that we do all we can with all of the great benefits that we will see from updating this system.

So, I thank the Chair for holding this important hearing, and I thank the witnesses for being here.

Senator CANTWELL. Thank you, Senator Ayotte. Now, we will go to our witnesses. We will start with you, Mr. Whitaker, and just go down the line. You each have five minutes.

If you have a longer statement, we are happy to submit it for the record, and that will give us time to really get into the questions. So, thank you and welcome.

STATEMENT OF HON. MICHAEL G. WHITAKER, DEPUTY ADMINISTRATOR, FEDERAL AVIATION ADMINISTRATION

Mr. WHITAKER. Thank you, Chairwoman Cantwell and Ranking Member Ayotte, Senator Booker. I am pleased to have the opportunity to be here and highlight the progress the FAA and industry are making with NextGen.

On June 3, my one year anniversary as the agency's Chief NextGen Officer, I delivered my first annual report to Congress as required by the 2012 Reauthorization Act. The report discusses the significant progress we are making with NextGen foundational programs and underscores the benefits that NextGen is delivering now.

For example, this year we completed one of the most crucial foundational elements of NextGen: the installation of the ground infrastructure for Automatic Dependent Surveillance-Broadcast or ADS–B. This represents a key milestone in transitioning from a ground based radar system to satellite based GPS technology.

ADS–B enables us to determine an aircraft's location and track with far greater accuracy than radar. In turn, this allows us more precise and efficient spacing of aircraft, which enables airlines to take advantage of the fuel savings in NextGen procedures.

This technology is also improving our ability to perform life saving search and rescue operations. Air traffic controllers have better information about an airplane's last position, thus helping take the "search" out of "search and rescue."

We are also close to completing another major foundational element of NextGen, the software and hardware upgrades to our Nation's high altitude air traffic centers. The ERAM program will be

complete next spring, allowing us to decommission the Legacy system.

Similar upgrades in our approach centers, the TRACONs, also are on track and will be completed in the major TRACONs by 2016.

In all, we are on track and nearing completion of the foundational phase of NextGen, the technology upgrades that will enable future capabilities to more efficiently and safely manage existing traffic and incorporate new users into the airspace.

This puts us well on track to having all the ADS–B foundational technology completed well before the 2020 mandate for industry to equip with ADS–B Out.

Both the FAA and industry must be held accountable if NextGen is to succeed. We are fulfilling our part of the bargain. Airlines and general aviation pilots must do their part and equip by the deadline to use the system that we have built.

Let me be very clear. The 2020 deadline is not going to change. We are in a position to achieve this important milestone on time. The cost of equipment has come down considerably. There is sufficient maintenance capacity to allow all equipage to occur, in fact, waiting to equip might cost more if aircraft owners crowd repair stations to get work done on the eve of the deadline.

In addition to the foundational work, we have also made significant strives in working with the industry to deliver benefits now.

One of my first actions upon joining the agency was to task a NextGen Advisory Committee or NAC, to provide industry consensus on capabilities that may be delivered in the next one to three years.

The NAC responded with a list in September, and since then we have worked together to hone in on four NextGen areas that will be our priority—Performance Based Navigation, surface operations, multiple runway operations, and DataComm. Each of these areas can bring benefits to users in the near term.

We are working with industry to craft milestones, agree on metrics, and track our progress on these initiatives.

Much of this work has already been underway. Just last week, Secretary Fox and FAA Administrator Huerta announced the completion of the Houston Metroplex. The Obama administration selected this project as one of 14 high priority infrastructure projects, ideal for expedited completion. In 30 months working with industry, we were able to transform Houston's airspace, thanks to close collaboration with labor, environmental streamlining, and concurrent reviews.

We have flipped the switch on 61 new procedures that take advantage of the precision of GPS technology to untangle the congested airspace shared by multiple airports. These new procedures are estimated to save airlines three million gallons of fuel per year while reducing carbon emissions by 31,000 metric tons. That is the equivalent of removing more than 6,000 cars from the streets of Houston.

We plan to replicate or improve upon these benefits at more than a dozen other busy metropolitan areas across the country.

The FAA is focused on delivering benefits to airspace users today while also completing the foundational programs of NextGen. As these foundational programs are complete over the next 24 months,

we are also focusing on the years beyond—the deployment of surface DataComm through 2018, and full ADS–B equipage in 2020.

We are on track with NextGen, but it is important that we continue to work together, FAA, industry, and Congress, to keep NextGen funded and moving forward. By working together, we have the ability to transform our nation's airspace for the benefit of generations to come.

Thank you for the opportunity to be here and I look forward to your questions.

[The prepared statement of Mr. Whitaker follows:]

PREPARED STATEMENT OF HON. MICHAEL G. WHITAKER, DEPUTY ADMINISTRATOR, FEDERAL AVIATION ADMINISTRATION

Chairman Cantwell, Ranking Member Ayotte, members of the Subcommittee:

Thank you for the opportunity to appear before you today to discuss the Next Generation Air Transportation System (NextGen). Through NextGen, the FAA is changing the way the National Airspace System (NAS) operates to achieve greater efficiency and predictability in air travel. NextGen will improve safety and support environmental initiatives such as reducing congestion, noise, emissions and fuel consumption through increased efficiency. NextGen will also allow the NAS to expand to meet future demand, manage a more complex set of users, and support the economic viability of our country's aviation system.

NextGen was a key component of the 2012 FAA Reauthorization. We recently released the Chief NextGen Officer's Report to Congress detailing the progress we have made in NextGen programs and capabilities. Since I became Chief NextGen Officer in June 2013, the FAA has made significant progress toward completing the technological foundation that allows us to operate the NAS with greater efficiency and predictability and reduced environmental impact. We have strengthened our partnerships with key stakeholders, coming to an agreement on a set of near-term capabilities that both the FAA and industry will concentrate on over the next three years. And we have concrete evidence that demonstrates how NextGen works.

We are on the cusp of finishing several key programs that underpin NextGen. We have completed installation of the ground infrastructure for Automatic Dependent Surveillance-Broadcast (ADS–B), the new surveillance system that uses GPS signals to determine an aircraft's location. We are on track to have all 20 en route centers operating with En Route Automation Modernization (ERAM) by Spring 2015, which will replace HOST, the computer system the FAA has been using to control traffic in high-altitude airspace since the 1970s. ERAM enables many new NextGen capabilities that could not be accommodated by HOST.

By the end of 2016, we expect to have made substantial progress deploying Terminal Automation Modernization and Replacement (TAMR), a program that upgrades the automation platform used in FAA facilities that control low-altitude traffic approaching and departing from our Nation's airports. ERAM and TAMR will be coupled with ADS–B and other NextGen programs still in development, such as Data Communications and a suite of traffic management and decision support tools, to provide new ways to move users safely and efficiently through the NAS.

NextGen Benefits Are Being Delivered Today

Passengers are already enjoying the benefits of NextGen through shorter flights, better on-time performance and fewer missed connections. Air carriers are saving precious minutes and fuel and reducing aircraft exhaust emissions by taking advantage of more precise routing. General aviation pilots and other small aircraft operators are enjoying greater access to more airports across the country, particularly during poor weather. And air traffic controllers have access to new tools to help them make the critical decisions necessary to keep the world's busiest airspace system working as safely and efficiently as possible.

ADS–B

Automatic Dependent Surveillance-Broadcast (ADS–B) is a key component of NextGen, which will move air traffic control (ATC) from a radar-based system to a more precise satellite-derived aircraft location system. ADS–B equipment combines an aircraft's positioning source, aircraft avionics, and a ground infrastructure to create an accurate surveillance interface between aircraft and ATC. ADS–B pro-

vides air traffic controllers with more accurate information to help keep aircraft safely separated in the sky and on runways.

ADS–B consists of two different services: ADS–B Out and ADS–B In. ADS–B Out periodically broadcasts information about each aircraft operating within the NAS, such as identification, current position, altitude, and velocity, through an onboard transmitter. With ADS–B, controllers get an update of aircraft position almost continuously, compared to every five seconds or longer with radar. The real-time position information provided to controllers through ADS–B Out is, in most cases, more accurate than the information available with current radar-based systems. With more accurate information, ATC will be able to position and separate aircraft with improved precision and timing, which leads to enhanced safety, greater efficiency, and ultimately results in a smoother flow of air traffic.

All users operating in designated airspace must be equipped with ADS–B Out avionics by January 1, 2020. By that date, all aircraft flying in designated airspace must be equipped with avionics that meet performance requirements. The designated airspace includes Class A, B, and C airspace, as well as Class E airspace areas at or above 10,000 feet mean sea level (MSL) over the 48 contiguous United States and the District of Columbia, excluding the airspace at and below 2,500 feet above the surface. This airspace is more complex with relatively diverse users. The rule also requires that aircraft operating in the airspace within 30 nautical miles (NM) of the Nation's busiest airports be equipped with ADS–B Out capabilities. This will enhance safety, efficiency, and performance around those airports.

Since ADS–B relies on information transmitted from ADS–B Out equipped aircraft operating in designated airspace, all users operating in that airspace must be equipped in order for ATC to rely on it. That is why the FAA has set a firm date by which all aircraft operating in designated airspace must be equipped. We made a significant investment in ground infrastructure, and now that installation is complete and we are finalizing ADS–B connections to the air traffic control automation platforms, industry equipage is necessary for the full benefits of ADS–B technology to be achieved.

While only ADS–B Out is required under the rule, many users are seeing the benefits of universal equipage with *ADS–B In* and ADS–B Out. *ADS–B In* technology allows pilots to see what air traffic controllers see: displays showing the location of aircraft in the sky around them. This creates an environment of shared situation awareness that allows for greater safety and efficiency. Traffic and weather information is now being sent directly to the cockpit of properly equipped aircraft. This information alerts them to in-flight hazards and helps prevent accidents. The three types of ADS–B broadcast services now deployed are:

- Traffic Information Service-Broadcast (TIS–B): This air traffic advisory service provides the altitude, ground track, speed and distance of aircraft flying in radar contact with controllers and within a 15-nautical-mile (nm) radius, up to 3,500 feet above or below the receiving aircraft's position. An aircraft equipped with *ADS–B In* can also receive position data directly from other aircraft broadcasting on the same ADS–B Out frequency. In addition, TIS–B enables pilots to see aircraft equipped with transponders flying nearby even if those aircraft are not equipped with ADS–B Out.
- Automatic Dependent Surveillance-Rebroadcast (ADS–R): ADS–R takes position information received on the ground from universal access transceiver (UAT)-equipped aircraft and rebroadcasts it on the 1090 MHz frequency. Likewise, ADS–R rebroadcasts 1090 MHz data to UAT users. In concert with TIS–B, ADS–R provides all ADS–B In-equipped aircraft with a comprehensive airspace and airport surface traffic picture. ADS–R delivers traffic data within a 15-nm radius 5,000 feet above or below relative to the receiving aircraft's position.
- Flight Information Service-Broadcast (FIS–B): This service broadcasts graphical weather to the cockpit based on what ground-based weather radar is detecting. In addition, FIS–B broadcasts text-based advisories including Notice to Airmen messages and reports on everything from significant weather to thunderstorm activity. UAT-equipped general aviation aircraft can receive this information at altitudes up to 24,000 feet.

The costs of TIS–B and FIS–B services are absorbed by the FAA, so NAS users, unlike in the airspace controlled by other Air Navigation Service Providers around the world, do not pay any subscription or usage fees for traffic, weather, or aeronautical information services.

We are continuing to develop and deploy ADS–B capabilities that will benefit the aviation community and, by extension, the public in oceanic, en route and terminal airspace. In 2015, the FAA will implement ADS–B-enabled In-Trail Procedures in

oceanic airspace that will help airlines save fuel and reduce separation distances. ADS–B is already being used in the en route environment in Houston and Alaska. The last en route site will achieve ADS–B IOC by September 2015. Ground-based Interval Management-Spacing capitalizes on ADS–B to streamline traffic flows into terminal airspace while Flight Interval Management-Spacing uses ADS–B to enable more precise spacing between aircraft.

Performance Based Navigation

Performance Based Navigation (PBN) is a blanket term for more precise GPS-based navigation methods that allow optimal routing in all phases of flight. The FAA has been working with stakeholders for many years on PBN implementation, and today there are more PBN procedures and routes than there are conventional ones. The agency is now employing a more systematic and collaborative approach to PBN deployment through our Metroplex initiative. A metroplex is a geographic area with several airports and high volume air traffic that interact in the same airspace. The FAA is actively working to improve how air traffic flies into, out of and through 13 targeted metroplexes rather than dealing with airports one at a time. Lessons learned from this approach are now being applied to all PBN projects across the National Airspace System (NAS).

We are seeing concrete benefits through this approach. In the Denver PBN project, the FAA worked with aircraft operators and nine area airports to create one of the most comprehensive operational networks of NextGen satellite-based arrivals and departures in the Nation. This network enables more flexibility and better access to the airports, which the FAA estimates will save operators approximately 3.2 million gallons of fuel. Overall, approximately 80 percent of all aircraft that fly in and out of Denver International are equipped to take advantage of the new procedures, which includes 51 satellite-based procedures designed to provide more direct routes, de-conflict the airspace, save fuel and reduce emissions. The project introduced 21 arrivals procedures with optimized profile descents, which allow aircraft to reduce thrust and glide down to the runway using less fuel and creating less noise, and two GPS approaches. Twelve additional sophisticated approach procedures, known as Required Navigation Performance Authorization Required (RNP AR), went into operations in late June 2013. These RNP AR procedures provide a more stable but curved approach, equaling a shorter flying distance. Flying these approaches requires specific aircraft instruments that direct the aircraft in a very narrow and precise corridor of airspace. The FAA has seen an approximate 35 percent decrease in the number of go-arounds caused by aircraft coming in too high or too fast. Aircraft on the new arrival procedures are more stabilized on their final approach as they usually arrive on a more predictable course and speed. That is only one example of success using a collaborative and systematic approach to delivering PBN benefits.

We recently completed the Houston Metroplex project, which includes strategies to streamline the airspace and reduce complexity for air traffic controllers and flight crews. As part of the program, the FAA developed 61 new procedures and amended or canceled over 40 existing procedures to take advantage of the precision of GPS technology. These improvements will reduce flight miles, save fuel, and reduce carbon emissions.

In addition to the Metroplex and the large-scale projects, the FAA continues to implement PBN at other airports across the country, including Wide Area Augmentation System Localizer Performance with Vertical guidance procedures that increase access to airports in lower visibility conditions and are especially helpful to general aviation pilots.

System Wide Information Management

System Wide Information Management (SWIM) is the digital data delivery backbone of NextGen, ensuring the right people have the right information at the right time. Since 2010, NAS users—particularly airline operations centers—have been accessing weather and other flight planning information via SWIM, enabling airline dispatchers and traffic managers to collaborate on the routing and rerouting of traffic based on real-time information. Users benefit by having access to a single, comprehensive data feed that contains management initiatives, airport runway configurations and which airports are in deicing.

In August 2013, Miami Terminal Radar Approach Control (TRACON) became the first facility to begin distributing data from the towers included in its coverage area to an airline via the SWIM Terminal Data Distribution System (STDDS). STDDS takes raw surface data and converts it into easily accessible information. The system sends surface information from airport towers to the corresponding TRACON, which makes the information available via SWIM messaging services. Airlines and

airports can use this information to streamline surface operations and increase efficiency. Ultimately, 136 airports will provide surface information via STDDS at 39 TRACONs to users via SWIM services. The FAA is planning to unveil several new SWIM capabilities next year, including Flow Information Publication, which provides subscribers with access to traffic flow information.

DataComm

Another exciting capability underway is Data Communications (Data Comm). Data Comm allows us to communicate through written instructions to pilots, which reduces the possibility of error with radio communications. More importantly, Data Comm allows us to communicate highly complex and lengthy clearances, which are currently conveyed over the radio with read-backs between controllers and pilots to verify accuracy, by automatically uploading the information digitally into the aircraft's flight management system. This will ultimately save operators time and money, and will improve the flexibility and efficiency of our operations. The FAA has awarded the Data Comm Integrated Services contract, which will provide for data communications between airport towers and appropriately equipped aircraft in 2016. Operational Data Comm trials for departure clearances are underway in Memphis and Newark.

Reporting NextGen Progress and The Future of NextGen

We have made consistent progress in delivering NextGen in key areas, first having laid the foundation with ADS–B, ERAM, and TAMR, and we will be deploying new capabilities through 2020. We will continue to work closely with stakeholders and industry to ensure that that we are delivering the operational benefits and taking their input into account as we set NextGen priorities. We have expanded our public reporting of NextGen performance through success stories and performance snapshots on our website. The FAA publishes NextGen-specific metrics at the local level in order to isolate and identify NextGen improvements at site-specific locations. Core airports, key city pairs, distance/time/fuel reduction, runway safety, the implementation and use of NextGen technology and procedures will continue to be important to understanding the value and benefits of modernization. Taken together, these metrics reveal the nationwide impact of NextGen development, which is already showing benefits.

Next year will be pivotal for the next stage of NextGen, as we make investment decisions, which are supported in our FY 2015 Budget and out-year planning documents. We look forward to working with you on NextGen planning and the upcoming Reauthorization.

Ms. Chairman, this concludes my prepared statement. I would be pleased to answer any questions you may have.

Senator CANTWELL. Thank you very much.

Mr. Hampton?

STATEMENT OF MATTHEW E. HAMPTON, ASSISTANT INSPECTOR GENERAL FOR AVIATION AUDITS, OFFICE OF INSPECTOR GENERAL, U.S. DEPARTMENT OF TRANSPORTATION

Mr. HAMPTON. Chairwoman Cantwell, Ranking Member Ayotte, and members of the Subcommittee, thank you for inviting me to testify today on the FAA's NextGen program.

As you know, FAA has faced considerable challenges with NextGen in this very complex effort. We believe FAA is now at an inflection point and must shift from planning to full implementation and focus on delivering benefits at specific locations.

My testimony today will focus on FAA's progress in three key areas. First, implementing NextGen related provisions of the FAA Reform Act. Two, responding to NextGen priorities recommended by the NextGen Advisory Committee, also known as the "NAC," and three, minimizing risk with implementing critical automation systems.

Without question, FAA has made progress by implementing more than half of the Act's 24 NextGen provisions. For example, last

year FAA appointed a much needed Chief NextGen Officer, Mr. Whitaker here, to oversee the agency's NextGen efforts and coordinating budgets and plans across the agency.

However, FAA has yet to meet key provisions aimed specifically at accelerating NextGen. For example, FAA is not yet in position to mandate that airspace users equipped with ADS–B In, a system that will display more precise satellite information to pilots in the cockpit. *ADS–B In* is considered a significantly beneficial game changer for unlocking congested airports, but it is uncertain when this capability can be implemented and at what cost.

FAA's inability to meet these provisions and deliver NextGen capabilities are due to a number of underlying challenges. These include a lack of an executable plan, evolving requirements, and unresolved complex technical and operational issues.

We believe some of FAA's difficulties in implementing NextGen can be addressed by responding to the recommendations that the NAC made last September. Focusing on NextGen investment priorities is a long overdue and much needed step, and a theme of our work over the last two years.

FAA is working with industry to develop milestones and implementing the prioritized capabilities, but significant challenges remain.

For example, as we reported last week, FAA has approved the use of some Performance Based Navigation initiatives, known as "PBN." These procedures can provide airspace users with significant benefits, such as more streamlined flight paths and greater fuel efficiency. However, at the 14 large airports where FAA has implemented advanced procedures, those with curved and segment approaches to runways, only about 2 percent of the eligible flights actually use them. This is in part because FAA lacks an updated policy and procedures for controllers to handle traffic using both PBN and conventional means.

FAA's near and mid-term goals for NextGen also depend on successfully deploying new automation systems that controllers use to manage air traffic. Despite some progress, FAA continues to face technical, cost and schedule risks with two programs that are needed to modernize both the en route and terminal environment.

For example, FAA is now using the ERAM system, the En Route Automation System, either full time or part time at 18 of 20 sites that manage high altitude traffic. FAA plans to complete this $2.5 billion program some time in 2015.

However, two recent major system outages at Los Angeles and Miami, which caused delays and cancellations of hundreds of flights, raised questions about the vulnerability and stability of the system that require urgent management attention.

Also, we are concerned about FAA's $500 million effort to modernize controller displays and computers that controllers use to manage airport arrivals and departures at 11 large airports, including seven of the most active facilities in the nation, including Atlanta and Dallas-Ft. Worth.

The current cost and schedule parameters are not reliable, and additional funds will be needed to complete this effort.

Going forward, FAA will need to provide a clear understanding of how agency priorities are linked to the budget, and develop a

transparent execution plan for moving forward with the investment priorities, sustained leadership with clear lines of accountability and authority will be key to achieving progress.

As the Committee begins deliberating FAA reauthorization, FAA will need to provide a clear understanding of how much funding is needed for NextGen, how much money is needed to sustain the existing NAS, and when that funding profile is needed.

Chairwoman Cantwell, this concludes my prepared statement. I would be happy to answer any questions you or Ranking Member Ayotte or other members of the Subcommittee may have.

[The prepared statement of Mr. Hampton follows:]

PREPARED STATEMENT OF MATTHEW E. HAMPTON, ASSISTANT INSPECTOR GENERAL FOR AVIATION AUDITS, OFFICE OF INSPECTOR GENERAL, U.S. DEPARTMENT OF TRANSPORTATION

Chairwoman Cantwell and Members of the Subcommittee:

Thank you for inviting me here today to testify on the Federal Aviation Administration's (FAA) progress and challenges in developing the Next Generation Air Transportation System (NextGen)—a multibillion-dollar transportation infrastructure project aimed at modernizing our Nation's aging air traffic system. Since the effort began almost a decade ago, we have reported on longstanding challenges and barriers that have limited FAA's progress in delivering NextGen capabilities, such as the Agency's inability to set realistic plans, budgets, and expectations, and clearly identify benefits for stakeholders.

The FAA Modernization and Reform Act of 2012 (the act) included 24 provisions intended to help FAA better manage NextGen. In addition, in September 2013, the NextGen Advisory Committee (NAC)—a joint Government-industry committee—delivered a report at FAA's request with recommendations for prioritizing NextGen activities.

My testimony today will focus on FAA's progress in (1) implementing NextGen-related provisions of the act, (2) responding to NextGen priorities recommended by the NAC, and (3) minimizing risks in implementing critical automation systems.

In Summary

FAA has implemented or is on target to implement more than half of the act's 24 NextGen-related provisions, including appointing a Chief NextGen Officer. However, FAA has yet to meet provisions intended to accelerate the development of critical NextGen technologies, including a key element of the Automatic Dependent Surveillance Broadcast (ADS–B) program—a cornerstone technology for FAA's goals to transform air traffic management. FAA's inability to meet these provisions and deliver NextGen capabilities is due to underlying programmatic challenges, such as the lack of an executable plan for coordinating among multiple programs, unresolved complex technical and operational issues, and ineffective collaboration with industry. FAA is also in the early stages of responding to the NAC's recommended investment priorities for advancing NextGen, including establishing performance-based navigation (PBN). Consistent with our work, the NAC confirmed the importance of PBN, which can provide significant near-term benefits to airspace users. However, obstacles such as a lack of updated controller policies and procedures make it uncertain when users can expect these benefits. Finally, FAA continues to face technical, cost, and schedule risks with its efforts to modernize or replace air traffic control automation systems that are fundamental to achieving NextGen benefits.

More Than Half of the Act's NextGen Modernization Provisions Have Been Implemented

As we testified in February 2014,[1] FAA has made progress implementing the act's NextGen provisions. As of June 2014, FAA has implemented or is on target to implement 16 of 24 NextGen-related provisions—including 3 provisions intended to ad-

[1] *FAA's Implementation of the FAA Modernization and Reform Act of 2012 Remains Incomplete* (OIG Testimony No. CC–2014–010), February 5, 2014. OIG reports and testimonies are available on our website at *http://www.oig.dot.gov/*.

vance new air traffic procedures and technologies and increase accountability. Specifically:

- In May 2012, FAA established a program that uses third parties to develop and test advanced navigation procedures at five mid-sized airports.
- In October 2012, the Agency completed a multi-agency NextGen Integrated Work Plan that defines the responsibilities of partner agencies—such as the Department of Defense and the National Aeronautics and Space Administration—for conducting NextGen-related research.
- In June 2013, FAA appointed its Deputy Administrator as the Chief NextGen Officer. The Deputy Administrator will oversee FAA's NextGen modernization efforts, including coordinating NextGen budgetary and planning activities across the Agency's lines of business and with partner agencies.[2]

Despite this progress, FAA and the Department have not implemented key provisions that are intended to accelerate the development of NextGen technologies and achieve the full range of NextGen benefits. Most notably, FAA has not carried out important provisions related to accelerating ADS–B—the foundation for shifting from today's ground-based radar to NextGen's satellite-based systems. Although FAA has mandated that all airspace users purchase and install *ADS–B Out*—onboard avionics for broadcasting flight information to controllers and FAA ground systems—it has not issued a mandate for *ADS–B In,*[3] which enables the display of the broadcast information in the cockpit. Moreover, the Department has not established a public-private incentive program to encourage users to install NextGen avionics equipment on aircraft.

The Act directed FAA to begin a rulemaking process for *ADS–B In,* with the goal of mandating the new technology by 2020 for aircraft operating in capacity-constrained airspace. However, technical requirements for *ADS–B In* continue to evolve, raising questions about whether the technology will be available by 2020. A report[4] by the *ADS–B In* Aviation Rulemaking Committee cautioned that the air-to-air[5] applications for *ADS–B In* were not mature and that the costs and benefits were uncertain. The report also stated that FAA lacks well-defined policy, equipment standards, certification and operational approval guidance, procedures, and ground automation—all prerequisites for a successful rulemaking effort. As a result, it is uncertain when FAA will be in position to mandate *ADS–B In* and enhance airport capacity.

While FAA explores options for NextGen rulemaking initiatives, the Agency has taken some near-term actions to advance ADS–B. FAA is providing funding for airlines to purchase ADS–B equipment, and has entered into partnerships with several U.S. airlines to develop and demonstrate *ADS–B In* applications and procedures. For example, U.S. Airways plans to install ADS–B systems in 20 Airbus A330 aircraft to assess the use of cockpit displays in maintaining proper spacing between aircraft on arrivals. FAA expects some elements of the demonstrations to be completed in 2017.

As we reported in February 2014,[6] FAA's failure to meet congressional and industry expectations for NextGen is largely due to a number of barriers, such as the lack of an executable plan for coordinating among multiple programs, unresolved complex technical and operational issues, and ineffective collaboration with industry. FAA's NextGen plans—which initially estimated completion by 2025 at a cost of $40 billion—lack sound strategies for implementing a system that could handle three times more traffic while reducing FAA's operating costs. Moreover, FAA's organizational culture—which is highly operational, tactical, and safety-oriented—has been slow to embrace NextGen's transformational vision. Gaps in leadership have further undermined the Agency's efforts to advance NextGen. These weaknesses have con-

---

[2] Recognizing the need to better position the Agency to execute NextGen, FAA announced a major reorganization in 2011. Specifically, FAA appointed an Assistant Administrator for NextGen, who reports directly to the FAA Deputy Administrator, and established a new Program Management Office.

[3] *ADS–B In* technology provides pilots with information transmitted from ADS–B ground stations as well as other aircraft. If an operator chooses to equip an aircraft with *ADS–B In* avionics, a compatible display is needed to view the information.

[4] "A Report from the ADS–B In Aviation Rulemaking Committee to the FAA," September 30, 2011.

[5] Air-to-air as it relates to ADS–B refers to communication of flight information between two or more *ADS–B In*-equipped aircraft to improve situational awareness while in flight.

[6] *Addressing Underlying Causes for NextGen Delays Will Require Sustained FAA Leadership and Action* (OIG Report No. AV–2014–031), February 25, 2014.

tributed to stakeholders' skepticism about NextGen's feasibility and airspace users' reluctance to invest in costly equipment.

The extent to which FAA realigns and consolidates the Nation's air traffic control facilities will be another important component of the Agency's NextGen efforts. In compliance with the act, in December 2013, FAA provided Congress with a plan for consolidating and realigning its air traffic facilities. The plan, developed collaboratively with the National Air Traffic Controller Association and Professional Aviation Safety Specialists, institutes a new process for evaluating and recommending realignments of its terminal facilities. However, the plan is less comprehensive than the Agency's previous plans that we reviewed in 2012,[7] as it does not include a process for realigning and consolidating facilities that manage high-altitude traffic.[8] Regardless, as we recommended in 2012, it will be important for the Agency going forward to establish sound metrics to determine whether facility realignments and consolidations will result in measurable cost savings, operational efficiencies, and productivity enhancements.

FAA Is Working With Industry To Implement High-Priority NAC Recommendations But Challenges Remain

The success of FAA's efforts to implement NextGen depends on the Agency's ability to set priorities, deliver benefits, and maintain stakeholder support. To address some of these challenges, FAA is working with industry to implement the prioritized NextGen capabilities recommended by the NAC, which include performance-based navigation (PBN)[9] due to its great potential for providing near-term benefits to airspace users. Although FAA has important PBN efforts under way, the Agency faces obstacles that make it uncertain when airspace users can expect widespread benefits.

FAA Is Working With Industry To Develop a Plan With Milestones for Implementing Prioritized NextGen Capabilities

In July 2013, FAA requested that the NAC[10] review the Agency's NextGen implementation plans and recommend investment priorities, citing uncertainty around funding for NextGen projects. The NAC delivered its report in September 2013 and identified industry's top NextGen priorities based on planned benefits and implementation readiness.

Consistent with our work, the NAC ranked PBN as the top activity that FAA should continue regardless of its budget situation. Introducing new PBN procedures, such as Area Navigation (RNAV) and Required Navigation Performance (RNP),[11] is critical to achieving near-term NextGen benefits, including more direct flight paths, improved on-time aircraft arrival rates, greater fuel savings, and reduced aircraft noise. Other activities that top the NAC's list include unlocking closely spaced parallel runway operations, enhancing airport surface operations through data sharing, and developing capabilities for merging and spacing aircraft to increase PBN use. These priorities are in line with prior NAC recommendations and a Government-industry task force.[12]

FAA is working jointly with industry to develop milestones for implementing the prioritized capabilities, which require operators to make changes to their aircraft and flight operations centers, as well as provide additional pilot training. Specifically, FAA and the NAC have established "integrated" work groups to identify specific locations for delivery, timelines for implementation, metrics for measuring benefits, and cost estimates for each of the capabilities. The work groups have been

---

[7] *The Success of FAA's Long-Term Plan for Air Traffic Facility Realignments and Consolidations Depends on Addressing Key Technical, Financial, and Workforce Challenges* (OIG Report No. AV–2012–151), July 17, 2012.

[8] En route centers guide airplanes flying at high altitudes through large sections of airspace.

[9] PBN is a blanket term for more precise GPS-based navigation methods that allow optimal routing in all phases of flight.

[10] The NAC is a Federal advisory committee that develops recommendations for NextGen portfolios with an emphasis on the midterm (through 2018). The NAC includes representation from affected user groups, including operators, manufacturers, air traffic management, aviation safety, airports, and environmental experts.

[11] RNAV is a method of navigation in which aircraft use avionics, such as Global Positioning Systems, to fly any desired flight path without the limitations imposed by ground-based navigation systems. RNP is a form of RNAV that adds on-board monitoring and alerting capabilities for pilots, thereby allowing aircraft to fly more precise flight paths.

[12] In 2009, an FAA-commissioned RTCA task force made 32 recommendations to advance NextGen and stated that focusing on delivering near-term operational benefits, rather than major infrastructure programs, would help gain industry confidence in FAA's plans and encourage users to invest in NextGen. RTCA, Inc. is a private, not-for-profit corporation that functions as a Federal advisory committee.

meeting since April 2014 and are working toward an interim report in July 2014, followed by a master implementation plan in October 2014 that will include commitments from both FAA and industry for the next 1 to 3 years.

However, reaching these commitments may prove difficult as airspace users focus on "capabilities," while FAA focuses on programs and infrastructure. Airspace users also want near-term operational benefits but FAA's delays in defining NextGen benefits have deepened industry's reluctance to invest. Moreover, FAA has not always provided a clear understanding of how it will manage and execute implementation and what it will take to deliver these efforts—particularly in managing complex interdependencies among programs, such as PBN and controller automation systems, to minimize risk.

According to FAA officials, the Agency does not plan to adjust its budgets since the current capital funding level will accommodate these investment priorities without trade-offs at this time. We will continue to monitor FAA's efforts with setting NextGen priorities in our ongoing review of the Agency's progress in responding to the NAC's recommendations.[13]

FAA Faces Obstacles in Implementing New PBN Flight Procedures To Optimize Near-Term Benefits

As it works to develop milestones for implementing the NAC's priority capabilities, particularly PBN, FAA will need to continue its efforts to implement recommendations we made to address barriers identified by our office, FAA, and the NAC. Although FAA has introduced more than 100 RNP procedures at large airports, preliminary data[14] indicate that RNP use is low, particularly at busy airports, such as those in the New York City area. Notably, at the 14 large airports[15] where FAA has implemented advanced PBN procedures with curved approaches to runways,[16] only about 2 percent of eligible airline flights[17] actually used them.

Several obstacles have undermined FAA's efforts to increase use of PBN procedures. For example, according to a March 2012 FAA internal study and a June 2013 NAC report,[18] controllers at busy metroplex locations lack automated tools to manage mixed operations—that is, merging aircraft using straight-in approaches with those on curved paths. Other reported obstacles include the lack of clearly defined operational goals for designing PBN procedures, outdated controller procedures, and the lack of standard training for pilots and controllers. In 2012, FAA tasked a team with developing an action plan to address these obstacles, but it remains unclear as to when they will issue a report on the team's plan.

Further, it is uncertain when airspace users can expect widespread benefits. In 2010, FAA launched its metroplex initiative—a 7-year effort to improve the flow of traffic and efficiency at congested airports in 13 major metropolitan areas.[19] While FAA is in the study or design and implementation phase at 9 of 13 metroplex locations, it has only recently implemented new PBN procedures for one location—Houston, TX. According to FAA, airline procedure design and other issues have caused delays at other metroplex sites ranging from 2 months to over 1 year.

According to FAA, the launch of new procedures at Houston in May 2014 was a success; however, the Agency will not know the extent of benefits realized until it completes its 6-month post-implementation assessment. As we reported in August 2012,[20] industry representatives expressed concerns that FAA's metroplex initiative

---

[13] OIG Audit Announcement, "Review of FAA's Response to the NextGen Advisory Committee's (NAC) Recommendations on NextGen Priorities," February 27, 2014.

[14] FAA tasked MITRE to obtain and analyze data to measure the use of PBN procedures and quantify their benefits. MITRE Corporation manages a research and development center for FAA, the Center for Advanced Aviation System Development.

[15] The 14 large airports are Baltimore-Washington International, Chicago Midway, Denver International, Fort Lauderdale International, Hartsfield-Jackson Atlanta International, JFK International and LaGuardia in New York, Memphis, Minneapolis/St. Paul International, Newark Liberty, San Francisco, Seattle-Tacoma, and Dulles and Reagan National in Washington, D.C.

[16] Curved approaches to runways improve the use of airspace by allowing aircraft to avoid critical areas of terrain or conflicting airspace, thus increasing capacity.

[17] An eligible flight is one in which (1) the aircraft was authorized to fly the RNP procedure and (2) the flight was in a position to join the procedure.

[18] NextGen Advisory Committee in Response to Tasking from the Federal Aviation Administration, "Recommendation for Increased Utilization of Performance Based Navigation (PBN) in the National Airspace System (NAS)," June 2013.

[19] The 13 metroplex locations are: Atlanta, Boston, Charlotte, Chicago, Houston, Memphis, Northern California, North Texas, Phoenix, Southern California, Washington, D.C., Cleveland/Detroit, and South/Central Florida.

[20] *Challenges With Implementing Near-Term NextGen Capabilities at Congested Airports Could Delay Benefits* (OIG Report No. AV–2012–167), August 1, 2012.

will not maximize benefits because the Agency has not integrated efforts from other related initiatives, such as better managing airport taxiway, gate, and parking area operations. They also stated concerns that FAA has not provided enough advanced PBN procedures—specifically, those that regularly allow for more precise and curved approaches.

As we reported last week,[21] efforts to introduce more advanced routes have been impeded by the lengthy development and approval process for new PBN procedures. In September 2010, FAA reported numerous problems with the process, such as the lack of an expedited method for approving procedures that require only minor revisions, inaccurate interpretations of environmental policies and guidance, and data inconsistencies. To address these problems, FAA made 21 recommendations for streamlining the process for deploying new procedures in an internal review—the NAV Lean project.[22] In June 2011, FAA issued its plan for executing the 21 recommendations and to date has implemented 9. However, FAA does not expect to complete the entire NAV Lean initiative until September 2015. Ultimately, industry will not get the full benefits of NAV Lean—to decrease the time it takes to implement new procedures by more than 40 percent—until all recommendations are implemented.

We made three recommendations to help mitigate barriers to PBN implementation and expedite the development of new procedures, including completing an action plan, establishing firm requirements and schedules, and measuring benefits regularly.

Significant Risks Remain In Implementing Critical NextGen Automation Systems

FAA's goals for NextGen in the near-and mid-term also depend on the success of its ongoing efforts to deploy new automation systems that controllers use to manage air traffic. However, despite recent progress, FAA continues to face technical, cost, and schedule risks with both its En Route Automation Modernization (ERAM) program—an over $2.5 billion system for processing en route flight data—and the Terminal Automation Modernization/Replacement (TAMR) program—FAA's effort to modernize terminal air traffic control facilities.

FAA Made Progress With ERAM But Recent Outages Have Exposed Vulnerabilities

FAA's long-term NextGen goals, such as increasing airspace capacity and reducing flight delays, depend on fully implementing the ERAM program. ERAM, which processes flight data to allow controllers to manage traffic at en route air traffic facilities, is a key foundation for realizing the benefits of NextGen's transformational programs, such as new satellite-based surveillance systems and data communications for controllers and pilots.

Following extensive software-related problems that resulted in significant delays and cost increases, FAA has made progress with ERAM over the last 2 years. The Agency is now using ERAM at 18 of FAA's 20 en route air traffic facilities either on a full- or part-time basis—a significant step forward given the extensive problems at the 2 initial sites. FAA plans for all 20 sites to achieve full operational capability and to decommission[23] the legacy system by 2015.

However, as FAA continues to deploy ERAM to the Nation's busiest facilities, such as those in New York City and Washington, D.C., it expects to identify new problems that could further impact cost and schedule. FAA is currently spending about $10.4 million a month on the ERAM contract.[24] Also, FAA has already approved an additional $160 million for ERAM enhancements through 2016 to help address site-specific issues.

In addition, controllers and experts continue to raise concerns about ERAM's capabilities. While these issues are not expected to delay ERAM's expected 2015 completion date, they will need to be addressed for the system to support most NextGen initiatives. Two capabilities raise most stakeholder concerns:

- *Flight Plan Trajectory Modeler*—This capability models aircraft flight paths to predict aircraft conflicts and to ensure accurate handoffs between controllers as

[21] *FAA Faces Significant Obstacles in Advancing the Implementation and Use of Performance-Based Navigation Procedures* (OIG Report No. AV–2014–057), June 17, 2014.

[22] NAV Lean was a cross-agency project to streamline policies and processes used to implement instrument flight procedures in response to a 2009 joint FAA-industry task force report recommendation. FAA used the "Lean Management Process" to identify areas of waste.

[23] Decommissioning involves the disconnection, removal, and disposal of the HOST legacy computer system once ERAM has been declared operationally ready at a site.

[24] This includes both capital and operations funding but does not include NextGen efforts, which are also funded against the same contract.

they communicate with pilots who transition to airspace controlled by another facility. However, the modeler software has often required adjustments to change the flight plan trajectory to ensure accurate handoffs. According to controllers, improvements are needed to support current operations and NextGen capabilities that use trajectory-based operations.[25]

- *Aircraft Tracking and Sensor Fusion*—This capability allows ERAM to integrate—or "fuse"—multiple radars and satellite-based information for controllers. However, thus far, controllers have not been able to take advantage of this improved capability because of problems accurately integrating radar and satellite data. A MITRE analysis found that the ERAM tracker will require adjustments to use ADS–B and radar together to manage air traffic.

Moreover, two recent major system outages at two sites exposed new vulnerabilities in the ERAM system. The more severe outage occurred on April 30, 2014, at the Los Angeles Center and resulted in a significant disruption in air traffic control operations that impacted thousands of travelers. According to FAA, the outage was triggered by a flight plan for an Air Force aircraft flying at an extremely high-altitude—60,000 feet—far above normal airline travel. This situation triggered an ERAM software glitch that caused the system to attempt to alter other aircraft flight plans, which overloaded the system for about 2 hours. Though less severe, ERAM also experienced an outage at the Miami center in February 2014 that caused delays or cancellations of hundreds of flights.

FAA is working to address the root causes of these outages, has made emergency modifications to the ERAM software, and plans to include a more permanent fix in the next software release due later this year. Nevertheless, these outages raise questions about the long-term stability and security of the system, as well as its ability to support NextGen capabilities. It remains uncertain when ERAM will be stable enough to remove the back-up legacy system as FAA intends.

FAA Faces Significant Cost, Schedule, and Technical Risks in Modernizing or Replacing Automation Systems at Terminal Facilities

FAA's TAMR program aims to modernize or replace all of the automation systems that controllers rely on to manage traffic at terminal facilities with a single automation platform—the Standard Terminal Automation Replacement System (STARS). If effectively implemented, TAMR is expected to reduce Agency costs and facilitate the implementation of NextGen capabilities. TAMR's current effort involves modernizing automation systems at 11 terminal facilities, 7 of which are the largest and busiest in the Nation. FAA estimates this effort will cost $438 million and will be completed between 2015 and 2017.

However, as we reported in May 2013,[26] the Agency faces significant cost, schedule, and technical risks to modernize these facilities. Specifically, FAA has yet to identify and finalize all software and hardware requirements that are needed to successfully replace the existing automation system[27] with STARS. Finalizing these requirements involves extensive software development and testing—a lengthy and potentially costly process should issues arise during testing. FAA is currently developing software to address 94 requirements gaps but anticipates identifying more gaps once it begins transitioning to STARS at the busiest facilities. Moreover, because full STARS capability at the 11 terminal facilities is still years away, FAA continues to add new capabilities to existing systems at select facilities to support air traffic operations. The longer FAA maintains and updates existing systems at these sites, the greater the implementation and cost risk because FAA will have to add the same capabilities to STARS.

Furthermore, FAA's current cost and schedule estimates for its TAMR effort are not reliable. For example, FAA's approved program schedule does not include detailed milestones for software testing and implementation, and was not assessed for risk per Agency requirements. In addition, FAA's experience deploying STARS at the first site at Dallas Fort Worth Terminal Radar Approach Control (DFW TRACON) facility is proving more difficult than expected. According to FAA, DFW TRACON achieved initial operating capability (IOC),[28] however, software require-

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

[26] *FAA's Acquisition Strategy for Terminal Modernization is at Risk for Cost Increases, Schedule Delays, and Performance Shortfalls* (OIG Report Number: AV–2013–097), May 29, 2013.

[27] Common Automated Radar Terminal System (CARTS–IIIE) is the existing automation system currently at the 11 large terminal facilities.

[28] Initial Operating Capability (IOC) is the milestone in which controllers begin to use the system on a limited basis to manage traffic.

ments remain unstable. FAA has identified 46 additional requirements that will be needed to ensure STARS provides at least the same capabilities as the existing system at the site. FAA also determined that meeting the unique needs of the other 10 sites requires more enhancements or modifications than originally planned. As a result, the true timelines and costs to modernize terminal automation systems remain unknown, and FAA will likely have to secure additional funds for the program.

We made a number of recommendations to better and more cost-efficiently manage FAA's terminal modernization efforts. FAA generally agreed with our recommendations and has begun working to address them.

Conclusion

NextGen is a complex undertaking that will continue to pose challenges to FAA for years to come—challenges that have been exacerbated by unrealistic plans, budgets, and expectations for key NextGen programs. Going forward, FAA will need to provide a clear understanding of Agency priorities to decisionmakers and stakeholders and how the priorities are linked to its budgets. Most importantly, FAA must develop a reasonable and transparent action plan with firm commitments on milestones and metrics for measuring benefits—essential for building stakeholder confidence. Sustained leadership with clear lines of accountability and authority will be key to accelerating NextGen progress. We remain committed to monitoring FAA's NextGen efforts and identifying opportunities to improve implementation.

Chairwoman Cantwell, this concludes my prepared statement. I am happy to answer any questions you or other members of the Subcommittee may have.

Senator CANTWELL. Thank you, Mr. Hampton. We certainly appreciate your report. It is very helpful, so we will have questions for you.

Mr. Rinaldi?

STATEMENT OF PAUL RINALDI, PRESIDENT, NATIONAL AIR TRAFFIC CONTROLLERS ASSOCIATION

Mr. RINALDI. Thank you, Chairwoman Cantwell, Senator Ayotte, members of the Committee for the opportunity to testify before you today.

My name is Paul Rinaldi. I am the President of the National Air Traffic Controllers Association, NATCA. NATCA represents 20,000 air traffic controllers, engineers, aircraft certification specialists, and other aviation safety professionals.

As the working men and women who make up our nation's air traffic control system, our members are dedicated to furthering the public's interest and preserving and promoting and continuing to run the world's safest, most efficient airspace system.

Our dedication is evident in our long history of supporting new technology, modernization, and enhancing our nation's complex and diverse aviation system.

NATCA is a strong supporter of NextGen modernization projects currently underway, and we believe that these programs provide much needed improvements in enhanced efficiency and increase in safety of the national airspace system.

NATCA is proud to be an active, involved stakeholder and applauds this committee for including stakeholder involvement provisions in the 2012 FAA reauthorization bill. The success of collaboration with the FAA and other aviation stakeholders on the NextGen Advisory Committee and RTCA has greatly improved the efficiency of the NextGen modernization process to the point that we are now seeing tangible results.

So, the good news is there is progress out there, and it is benefiting the users of the national airspace system. Some of the high-

lights—optimization of airspace and procedures in the Metroplex, we call "OAPM."

The FAA has recently implemented 61 new procedures through the OAPM process in Houston. These procedures will affect all aircraft around the Houston Metroplex and allow aircraft to be flown more efficiently with fewer altitude holds and speed restrictions.

This will save millions of dollars in fuel each year, reducing the carbon footprint and eliminating noise on the environment. These procedures are comparative to you being on the highway setting your car at 55 miles an hour and never hitting the brakes until you get to your destination.

This was a monumental task with a complete collaborative effort between the airlines, the pilots, the controllers, and FAA.

Another area we are seeing success is re-categorization of wake turbulence separation standards, we call "RECAT." Experts in wake turbulence, safety, and risk analysis have determined the decrease of separation between similar type aircraft is as safe or safer than current standards. RECAT has the capacity of enhancing safety, reducing delays, saving fuel, and reducing aviation's environmental impact.

Memphis was the first facility to apply these new standards on November 1, 2012. Federal Express Airlines has been pleased with the results. Departure delays were reduced by 74 percent within the first week of implementation. Controllers have been very supportive of this technology and the tools that help them identify the weight categories of each airplane.

We have rolled RECAT out to three other airports and we are seeing similar type benefits, and we look to expeditiously roll it out across the country.

These are just a few examples of the benefits of NextGen, but I must say the aviation community and the FAA all see valuable benefits of modernization, and we believe if they continue the current practice of stakeholder collaboration, especially with the front line workforce, we will continue to see timely progress on many of these NextGen projects and improve the safety and efficiency of the national airspace system.

The bad news is we are very concerned about the inconsistency and the unstable funding. In the past year alone, the government shutdown and mandatory sequester cuts have resulted in furloughs at the FAA and slowed and halted several essential NextGen projects, including ERAM and TAMR.

ERAM and TAMR are the backbone of NextGen modernization. They are our platforms, and without updating our platforms, nothing else will work. When they are delayed, it is a domino effect, and all other programs will be delayed.

Funding uncertainty has created a stop and go pace at the FAA. When you don't know what you are going to have three months from now, six months from now, or even trying to plan year to year, this causes delays and adds cost overruns to many projects.

Along with stable funding, we would also like to see streamlining of the rulemaking process at the FAA. This is needed to be a priority, to take advantage of new procedures and equipment of NextGen. The long, laborious process currently in place wastes valuable time.

NATCA believes these changes of stable funding and streamlining the rulemaking process along with continued stakeholder involvement are needed in order to successfully implement NextGen across this country.

Madam Chairwoman, I thank you for the opportunity to testify in front of you today. I look forward to answering any questions you or the Committee may have.

[The prepared statement of Mr. Rinaldi follows:]

PREPARED STATEMENT OF PAUL RINALDI, PRESIDENT, NATIONAL AIR TRAFFIC CONTROLLERS ASSOCIATION

The National Air Traffic Controllers Association (NATCA) is the exclusive representative of close to 20,000 aviation safety professionals, including more than 14,000 air traffic controllers serving the Federal Aviation Administration (FAA), the Department of Defense (DOD) and the private sector. In addition, NATCA represents FAA's Alaska flight service specialists, FAA engineers, traffic management coordinators, aircraft certification professionals, agency operational support staff, regional personnel from FAA's logistics, budget, finance, acquisitions, and information technology divisions, as well as agency occupational health specialists, and medical program specialists.

Air traffic controllers are dedicated to ensuring that our National Airspace System (NAS) is the safest and most efficient in the world. In order to maintain that safety and efficiency, our controllers work to improve safety procedures, modernize the NAS, and promote new technology. We have professional controllers involved in nearly every modernization and Next Generation Air Transportation System (NextGen)-related program the FAA is currently working on. Controller skills are put to work every day as they handle an impressive volume of flights—air traffic controllers separate more than 70,000 flights each day, safely moving nearly two million passengers through our skies daily. Air traffic controllers handle these flights in the busiest and most complex airspace in the world with roughly 5,000 planes in the sky at any given moment.

Executive Summary

NATCA is a strong supporter of the NextGen modernization projects currently underway. We believe these programs are much-needed improvements that will increase the safety and efficiency of the NAS. NATCA is proud to be an actively involved stakeholder, and applauds this Committee for its work in including a stakeholder involvement provision in the 2012 FAA Reauthorization Act. The success of our collaboration with the FAA and other aviation stakeholders has greatly improved the efficiency of the NextGen modernization process.

At the same time, NATCA is concerned about the lack of stable funding for these important NextGen modernization projects. In the past year, mandatory sequestration cuts have resulted in furloughs at the FAA that slowed and halted several essential NextGen projects, including En Route Automation Modernization (ERAM), Data Communications (DataComm), and Terminal Automation Modernization and Replacement (TAMR). ERAM is the backbone of NextGen modernizations. When ERAM is delayed, other projects are also delayed in a domino effect. Funding uncertainty has also created a stop-and-go pace that adds cost overruns as air traffic controllers must be retrained each time a project is halted—lost time becomes lost money, and lost opportunity to reap the benefits of these modernizations.

Today we would like to highlight the immediate effects that unstable funding has had on NextGen. Specific projects such as ERAM, TAMR, DataComm, and Performance Based Navigation (PBN) have all faced setbacks in the last year due to the April 2013 furloughs and the October 2013 government shutdown. These projects rely on stable funding in order to plan for test dates, training, and implementation of new procedures. Without stability, they lose time and money.

This testimony will also provide an overview of several NextGen projects that are already showing beneficial results. NATCA believes that with the benefit of stable funding we will continue to reap the benefits of NextGen modernization projects, such as: the Optimization of Airspace & Procedures in the Metroplex (OAPM); Automatic Dependent Surveillance-Broadcast (ADS–B); Wide Area Multilateration (WAM); PBN; Re-Categorization of Separation Standards (RECAT); DataComm; and the Equivalent Lateral Spacing Operations (ELSO).

The successes of these projects demonstrate the benefits of NextGen and why Congress should prioritize stable funding that allows for the projects to be com-

pleted. For example, Houston has successfully implemented a total of 61 new procedures through OAPM (this includes 50 new procedures and 11 modified or amended procedures). These procedures will affect the airspace around Houston and allow aircraft to be flown more efficiently with fewer altitude holds and speed restrictions. The airlines' fuel savings from the implementation of Houston's OAPM are projected to be $9.2–$26 million each year.

ADS–B in the Gulf of Mexico is already improving safety and efficiency. Controllers and pilots have benefitted tremendously from ADS–B. Aircraft flying westbound from Florida have been able to reduce delays because they can now remain in radar control when deviating south of course due to weather. In addition, helicopters flying to the oil platforms in the Gulf are delayed less frequently during poor weather because controllers are able to see them on radar now instead of working a manual non-radar grid system.

Newark Airport has been conducting a trial of issuing clearances via DataComm. We anticipate benefits such as more efficient communication between pilots and controllers, fewer mistakes, and faster communication time, which saves valuable time when an aircraft is being rerouted.

Again, NATCA believes that NextGen will increase the safety and efficiency of the NAS, and hopes that Congress adequately funds the programs so all aviation stakeholders reap the benefits of modernization.

Next Generation Air Traffic Control System

NextGen is the FAA's effort to modernize the Nation's air traffic control system. NATCA fully supports NextGen modernization, which will allow the FAA to meet increased demand while improving the safety and efficiency of the NAS, reducing delays, and protecting the environment. According to the FAA's vision, NextGen will enable more aircraft to safely fly closer together on more direct routes, reducing delays, carbon emissions, fuel consumption, and noise.

NextGen projects are transforming the national air transportation system by using new and existing technologies including satellite navigation and control of aircraft, advanced digital communications, and enhanced connectivity between all components of the NAS.

NATCA is proud to be involved in all aspects of the process as an essential stakeholder. NATCA and the FAA both recognize that stakeholder involvement is the key to continued success to NextGen. We applaud the Committee for their efforts to ensure this collaboration through the stakeholder involvement provision in the 2012 FAA Reauthorization Act. In addition to being present on NextGen projects, NATCA is represented as a member of the RTCA, the FAA Management Advisory Council (MAC), and the NextGen Advisory Committee. Our presence, as well as that of other industry leaders, has been an important addition to the discussion on modernization.

Full Funding Is Essential for NextGen

NATCA supports NextGen modernization projects and believes controllers and end users, including the traveling public and airlines, are already seeing benefits from these projects. Recent improvements in collaboration among all aviation stakeholders have resulted in smoother planning, development, testing, and implementation of many projects.

However, while collaboration has greatly improved, it cannot overcome the negative consequences of unstable funding. We continue to see cost overruns and delays, which are certainly compounded when Congress is unable to provide stable, predictable funding. The April 2013 furloughs, created by sequestration-mandated across the board budget cuts, created significant delays not just to aircraft, but also to important NextGen projects. The October 2013 government shutdown further compounded those delays. In order to continue benefiting from these modernization projects and seeing the results, Congress must provide stable and predictable funding to the FAA.

In addition to unstable funding, NextGen is also hindered by an aging physical infrastructure. The FAA has had difficulty keeping up with repairs for the physical air traffic control towers, and lagging maintenance creates difficulties to teams working to develop and deploy NextGen technology.

Between the week-long furlough of employees at the FAA in April 2013 and the Federal Government shutdown in October 2013, the FAA lost time and money on several of its key projects. In both cases the FAA was required to suspend activities on many key programs, sending controllers working on these projects back to their facilities to work traffic or in some cases furloughing them. Timetables had to be pushed back, which increased costs and delayed other project timelines.

Specific Delays Due to Funding Lapses in 2013

- *En Route Automation Modernization (ERAM):* ERAM, which is the backbone of NextGen modernization, will replace the 40-year-old En Route Host computer and backup system used at 20 FAA Air Route Traffic Control Centers nationwide. The FAA has been spending a significant amount of money to maintain and update two systems simultaneously in order to continue running the NAS at full capacity. ERAM was initially scheduled to fully replace the old system in August 2014. As a result of the April 2013 furloughs, that completion date has been pushed to March 2015, a delay that will cost in excess of $42 million.

  With the funding uncertainty of the last 12 months, the FAA has attempted to reduce delays to ERAM for as long as possible by stretching budgets in an effort to avoid cancelling testing and training. They also sought to save money by cancelling controller training trips to the FAA Technical Center (Tech Center). By October 2013, the FAA had to cancel several tests at key centers because previous delays made them impossible to go forward. For example, if Fort Worth Air Route Traffic Control Center (ARTCC or Center), Boston Center, and Memphis Center were unable to complete their tests in October, the training that had been completed by their controllers would go stale, meaning that all participants would need to be retrained. The retraining takes time and adds significant additional cost. For example, New York and Washington Centers had begun training their workforce for ERAM Operations prior to the shutdown. They were scheduled to begin ERAM operations in December 2013. The delay in their training has affected the entire program by adding up to four additional months to the current completion date of March 2015. The delays in implementation cost $6 million per month.
- *Terminal Automation Modernization and Replacement (TAMR):* This program is modernizing the air traffic control systems at the Nation's major airports as well as every Terminal Radar Approach Control (TRACON) in the country. TAMR is scheduled to replace some radar systems that are nearly 50 years old. Nearly all of the Nation's 253 terminal facilities will be affected by TAMR. TAMR's mission is to combine and upgrade multiple air traffic control technologies to a single, state-of-the-art platform called the Standard Terminal Automation Replacement System (STARS), which will maintain the safety and increase the efficiency of the NAS.

  Sequestration cuts and the 2013 government shutdown caused a ripple effect for TAMR testing and deployment. Several projects were delayed by months, and installations were postponed as a result. The TAMR project team worked with a skeleton group during the October 2013 shutdown. Due to economic uncertainty, the FAA sent its subject matter experts back to controlling traffic, which halted installations and tests, training development, and training. All of these aspects were expensive to shut down, reschedule, and finally restart. Essentially, the cost and ramifications of the shutdown are just now being fully realized. The consequences of installation and procurement delays, along with the rescheduling of nearly every program activity is far-reaching, and the cost has been estimated at as much as $10 million per month. However, since the shutdown ended the program has worked feverishly to recover lost time through collaboration.

  TAMR is now in full deployment and technical refresh mode in all three phases, having recently installed STARS at Dallas, Boise, Kalamazoo, and Allentown, and conducted technical refresh upgrades at Philadelphia and Miami. NATCA subject matter experts (SMEs) are working in all areas of this program and finding solutions to problems that have plagued modernization efforts in the past. Installation of equipment as well as modernization efforts are underway at literally dozens of TRACON facilities across the country including: Northern California, Southern California, New York, Atlanta, Denver, Chicago, Louisville, St. Louis, Minneapolis, Potomac, Austin, Billings, Tampa, Seattle, Salt Lake, Orlando, and more. NATCA SMEs have contributed to the success of this program and an incredible number of acquisition program baseline goals are being reached on or ahead of schedule as a result.

  The reasons for TAMR's recent successes are many, but can only be accomplished with a steady funding commitment. The program and FAA are poised for monumental success like never before provided that the adequate resources continue to be made available. Staying the course and finishing this project is vital to facilitate many NextGen programs.
- *Optimization of Airspace & Procedures in the Metroplex (OAPM):* Also known as Metroplex, OAPM works to increase the efficiency of airspace by improving

procedures. These changes will provide economic benefits for airlines, as well as fuel savings that are beneficial for the environment. We know from initial testing at the Washington, D.C. location, for example, that annual fuel savings are exceeding estimates and could be as much as $19 million each year, and a reduction of 75,000 metric tons of carbon. Thus the real cost is the lost opportunity for efficiency and sustainable economic benefits for end users such as airlines. The shutdown halted progress that was being made at nine test sites across the country. Listed below are two examples of the impacts of the April 2013 (which lasted one week) sequestration furloughs and the October 2013 shutdown (which lasted 16 days).

The Southern California test site was due to begin final implementation of procedure changes in December 2014. Due to the April and October 2013 stand down of the teams, the implementation date was delayed to February 2016. Those delays prevent estimated savings of $10–16 million a year in fuel, and 34,000–78,000 metric tons of carbon. A significant part of the delays due to the fact that although the teams may have been on hold for only one or two weeks at a time, they require months to reassemble.

The Houston test site was due to begin final implementation in December 2013. That was delayed until May 2014 due to the April 2013 furloughs. Houston has just begun using its new procedures (discussed later), but without the shutdown and furloughs, it could have begun cost and fuel savings six months earlier.

When Fully Funded, NextGen is Already Showing Results

While NextGen has struggled with funding uncertainty, there are also success stories of modernization projects that have already been implemented across the country. These changes assist our controllers in increasing efficiency and capacity of the NAS while maintaining the highest safety standards. Below are a few such examples of how NextGen projects are already benefiting the NAS:

1. *Houston—Optimization of Airspace & Procedures in the Metroplex (OAPM):* OAPM study teams rely on current aircraft navigation capabilities to enhance airport arrival and departure paths, provide diverging departure paths to get aircraft off the ground more quickly, and add more direct, high-altitude Area Navigation (RNAV) navigation routes between metroplexes. These changes reduce fuel consumption, providing economic benefits for airlines as well as benefits for the environment.

   Houston is an example of a success story. However, while the Houston test site was due to begin final implementation in December 2013, it was delayed until May 2014 due to the April 2013 furloughs. Through the collaboration and hard work of the facilities in the Houston area, a new type of air traffic control began on May 28, 2014. A total of 61 new procedures (50 new procedures and 11 modified or amended procedures) were implemented for Houston Center (ZHU), Houston TRACON (I90), Houston Intercontinental Airport (IAH), and the satellite airports including David Wayne Hooks Memorial (DWH), William P. Hobby (HOU), George Bush Intercontinental (IAH), and Sugar Land Regional (SGR).

   United Airlines is the main carrier at IAH, with Southwest being the focus carrier at Houston Hobby Airport (HOU). These airlines will see the most benefits from the implementation of procedures that allow aircraft to be flown more efficiently with less altitude holds and speed restrictions. The deployment of the Houston OAPM should be the playbook for future implementations. The airlines' fuel savings from the implementation of Houston's OAPM are projected to be $9.2–$26 million each year.

2. *Gulf of Mexico—Automatic Dependent Surveillance-Broadcast (ADS–B):* ADS–B, one of the cornerstone components of NextGen, is a form of surveillance that will replace traditional radar as the primary surveillance method in the NAS. ADS–B involves the broadcast of the GPS-derived position report of an aircraft or vehicle. As this technology continues to evolve and aircraft equip with ADS–B Avionics, controllers will see an increase in surveillance coverage not provided by traditional radar sources. At this time, the FAA has completed the physical infrastructure of the ADS–B network. Even more importantly, they have successfully integrated ADS–B data into existing ATC automation systems, meaning that air traffic controllers can see the new ADS–B information.

   The benefit of having increased surveillance coverage is limited to the number of aircraft that have certified Minimum Operational Performance Standards (MOPSB) avionics (this meets the certification requirements in the FAA ADS–B Mandate of 2020). As of May 31, 2014, the installation of FUSION has

reached over 30 facilities and Houston ARTCC (ZHU) is using ADS–B in the Gulf of Mexico. For many years non-radar control was the only option for controllers when working air traffic through and in the Gulf of Mexico. As ADS–B became a reality, controllers and pilots have benefitted tremendously from this technology. Aircraft flying westbound from Florida have been able to reduce delays because they can now remain in radar control when deviating south of course due to weather. In addition, helicopters flying to the oil platforms in the Gulf are delayed less frequently during poor weather because controllers are able to see them on radar now instead of working a manual non-radar grid system.

3. *Colorado—Wide Area Multilateration (WAM):* WAM is an independent, cooperative surveillance technology based on the same time difference of arrival principles that are used on an airport surface. Several ground-based receiving stations listen to signals transmitted from an aircraft and then mathematically calculate its position in three dimensions. This data is transmitted to screens viewed by air traffic controllers for separation of aircraft. WAM can interface to terminal or en-route automation systems.

   WAM is beneficial in locations with limited visibility. For example, controllers at Denver Center (ZDV) were handicapped when providing air traffic control services because they lacked radar services below 17,000 feet. With the deployment of WAM, controllers can actually see the aircraft moving on the surface of many airports and aircraft remain in radar control for their entire flight. This has two very significant consequences for controllers: controllers are able to reduce separation due to the elimination of non-radar procedures and new procedures that reduce departure delays are being created thanks to better surveillance.

4. *Phoenix—Performance Based Navigation (PBN):* The development and implementation of PBN will create more defined routing for aircraft, which ultimately increases the number of aircraft that controllers can direct. These new procedures will improve the fuel efficiency for the airlines and create safer and more efficient procedures for air traffic.

   In Phoenix, aircraft arriving from the east were being delayed or given excessive vectors due to traffic congestion. Teams consisting of the FAA, NATCA, and the users met to establish PBN/RNP procedures that have shown benefits to the airlines, business jets, and general aviation aircraft by modifying the flight routes and avoiding that congestion.

   While Phoenix is a case study in the benefits that PBN can give to the aviation industry as a whole, the government shutdown had a tremendous effect on PBN projects across the country because the schedule for designing and implementing PBN procedures is precise and any delay causes procedures to slip to future production dates. Every time this happens the new benefits are lost for that time period and it affects other procedures in a domino effect. A lot of time and effort—and therefore money—was spent in assessing what procedures could be developed and implemented along with their timelines.

   As a result, everything had to be rescheduled. Some projects slipped and some procedures were cancelled. Each time something like this happens, funding has been wasted because the work has to be redone to meet requirements. Many benefits have already been lost and will continue to be lost due to unstable funding.

5. *Memphis—Re-Categorization of Separation Standards (RECAT):* Experts in wake turbulence, safety, and risk analysis have determined that decreasing separation between similar type aircraft is as safe, or safer than, current standards and increases efficiency and capacity, meaning that like other NextGen projects, RECAT has the capacity to enhance safety, reduce delays, save fuel, and reduce aviation's environmental impact.

   Memphis Tower and TRACON were the first facilities to apply the new standards on November 1, 2012. The recategorization of Wake Turbulence is one of the most beneficial improvements when comparing the cost of implementation with the savings by the users. In Memphis, FedEx has been pleased with the results. Departure delays were reduced by 74 percent in the first week of implementation. Controllers have been very supportive of this technology and the tools provided to them identifying the weight category of each aircraft.

6. *Newark –Data Communications (DataComm):* DataComm will reduce frequency congestion by allowing the controller and pilot to communicate directly via digital communication (much like a text message). It will also reduce confusion

because the message will be in print form and not copied over the frequency. A majority of these messages will be integrated into the flight deck avionics to help save time and remove issues of incorrect data entry.

One beneficial application of DataComm is evident during severe weather, when an aircraft may receive several different routes within a period of 30 minutes. With DataComm, revised routes can be sent with a few clicks to the flight deck, saving valuable time as the aircraft is rerouted. This is especially helpful when there is a language barrier that could occur with non-English speaking pilots. DataComm also benefits surface operations by saving time, which reduces the backlog that could otherwise occur when aircraft are holding for a departure clearance.

Newark Airport (EWR) has been conducting a trial of issuing clearances via DataComm. While the program has a long way to go, it is apparent the benefits of this initiative will be substantial for controllers and users.

The 2013 government shutdown affected ERAM implementation, which in turn affected the schedule of implementation of DataComm functionality at the NAP (National Application Processor) Realm in Atlanta ARTCC (ZTL). The NAP Realm contains the logic for aircraft logons. There are two NAP Realms, one at Salt Lake Center and the other at Atlanta Center. If one fails, the other is used as a backup. This means that the key site, Salt Lake City Tower (SLC), will not have logon redundancy in the event of a failure, and controllers would have to abandon DataComm functionality and revert to voice communication.

7. *Atlanta—Equivalent Lateral Spacing Operations (ELSO):* ELSO is a procedure that enables the world's busiest airport to depart aircraft on diverging course much closer than in the past. ELSO, developed by the Mitre Corporation in 2011, added two departure routes at Hartsfield-Jackson Atlanta International Airport (ATL) due to an updated separation standard. The introduction of ELSO at ATL enables simultaneous and successive diverging departure operations by creating two departure tracks for each runway end during normal runway operations. When the weather is not conducive or the pilots are unwilling or unable to fly the RNAV routes, controllers revert back to the standard divergence. The angle between departure routes decreased from 15 degrees to 10 degrees, and the time between departures was reduced from two minutes to one minute, taking advantage of RNAV technology. Controllers at ATL now clear between eight and twelve more planes for departure each hour. Controllers rely on ELSO to expedite departures at this busy airport. The airlines serving ATL have experienced reduced delays and controllers have a more predictable course that is set for the aircraft. Initial reports are positive from both pilots and controllers.

   The advantages of ELSO have somewhat of a domino effect. Because ELSO reduces the need for a triple departure configuration at ATL, there is a reduction in controller workload. This also spurs fuel and time savings for departing aircraft.

NATCA Recommendations

The aviation community and the FAA all see the value and benefits of NextGen modernization projects. We are working collaboratively to complete testing and implementation of some key programs, as described above. At this time, NextGen needs assurances from Congress that it will provide stable and predictable funding for the duration of the projects. Below are NATCA's formal recommendations for how Congress can assist the FAA, NATCA, and other stakeholders in successfully completing NextGen modernization projects.

- *Stable and Predictable Funding:* NextGen must be fully funded through the regular appropriations process. Attempting to fund these projects with continuing resolutions, or worse, not at all, as happened during the October 2013 shutdown, has significant detrimental effect on NextGen progress.
- *Continued Collaboration:* Congress and the FAA should continue to focus on collaboration and stakeholder involvement in order to set and reach realistic deadlines.
- *Streamlining the Rulemaking Process:* The FAA's long and laborious rulemaking process costs valuable time. Changes are needed in order to streamline the rulemaking process to better implement new efficiencies.

Senator CANTWELL. Thank you, Mr. Rinaldi. Thank you very much for being here.

Mr. Beck, welcome. We look forward to your testimony.

STATEMENT OF GARY BECK, VICE PRESIDENT—FLIGHT OPERATIONS, ALASKA AIRLINES

Mr. BECK. Thank you, Chairwoman Cantwell, Ranking Member Ayotte, and members of the Subcommittee. My name is Gary Beck and I am the Vice President of Flight Operations for Alaska Airlines. It is my pleasure to testify today on the safety impact and efficacy of NextGen programs, specifically the Greener Skies initiative.

I also serve as the Co-Chair of the NextGen Implementation Working Group, and I am on the Subcommittee of the NextGen Advisory Committee. I am appearing today in my Alaskan Airlines' capacity.

Greener Skies began in 2008 to improve the efficiency of flights landing at SeaTac Airport, thereby reducing fuel usage, carbon emissions, and noise pollution. Greener Skies is the evolution of a long term initiative of Alaska, started in the mid-1990s, to use Required Navigation Performance or RNP technology to improve safety, enhance sustainability, and decrease the environmental impact of our flight operations.

Alaska was the first U.S. air carrier to invest in RNP and we are further along than any other airline in using these technologies to benefit our customers and our partners.

Greener Skies seeks to increase airspace efficiency by implementing rule changes so that aircraft can approach the airport with substantially reduced separation and do so from straight and curved paths.

This is occurring in two phases. First, we have instituted new arrival procedures that take the aircraft from cruising altitude to a few thousand feet above the ground. Second, we are pursuing a rule change that will address the aircraft's final approach from that lower altitude all the way to the runway.

The new protocols allow the aircraft to make a continuous descent rather than requiring it to level off intermittently. Basically, NextGen arrivals are akin to an airplane sliding down the banister rather than taking the stairs. The impacts so far have been significant. The new procedures have cut 17 miles from previous flight paths.

That may not sound like much, but when considering that an estimated 30,000 aircraft fly this arrival path each year, that is from all airlines, not just Alaska, we can expect a reduction in CO_2 emissions from the decreased fuel usage equivalent to removing 4,100 automobiles from the road. When considering the growth in air traffic forecasts for Seattle, the benefits will only increase.

Despite these advancements, phase two of Greener Skies has encountered set-backs in its approval process. It is time to extend these benefits all the way to the runway.

As an early adopter and champion of these initiatives, Alaska Airlines hopes we can count on congressional support to advance three key issues. My written testimony expands on these requests.

First, approve the FAA rule change for "Established on RNP," allowing aircraft to approach the runway on NextGen flight paths. Two, publish and implement the amended RNP approach proce-

dures to ensure they are used to their fullest extent as quickly as possible. Three, support an FAA post-implementation benefits analysis of the Greener Skies initiative to provide verifiable data on the benefits and impact of the program.

The airline industry benefits greatly from NextGen policies and procedures, and Alaska Airlines has been a strong proponent of their implementation. Safety, environmental stewardship, and customer satisfaction all follow from these initiatives.

We could be doing much more. We depend upon your support and our continued partnership with the FAA to ensure that NextGen and the Greener Skies initiative create as much benefit as possible.

This concludes my oral testimony, and I am pleased to answer any questions from the Committee.

[The prepared statement of Mr. Beck follows:]

PREPARED STATEMENT OF GARY BECK, VICE PRESIDENT—FLIGHT OPERATIONS, ALASKA AIRLINES

Chairwoman Cantwell, Ranking Member Ayotte, and members of the Subcommittee:

My name is Gary Beck and I am the vice president of Flight Operations for Alaska Airlines. It is my pleasure to testify today on behalf of Alaska Airlines on the safety, impact and efficacy of NextGen programs, specifically the Greener Skies initiative. In addition to my role at Alaska Airlines, I also serve as the co-chair of the NextGen Implementation Working Group focused on expanding the use of Performance-Based Navigation across the country, and I am on the subcommittee of the NextGen Advisory Committee. I submit today's testimony in my Alaska Airlines capacity.

I. Background on the Greener Skies Initiative

Greener Skies began in 2008 as a partnership between Alaska Airlines, The Boeing Company, and the Port of Seattle. Our goal was to improve the efficiency of flights landing at SeaTac airport, thereby reducing fuel usage, carbon emissions and noise pollution. Greener Skies is the evolution of a long-term initiative at Alaska to use Required Navigation Performance (RNP) technology to improve safety, enhance sustainability and decrease the environmental impact of our flight operations.

Alaska has long been a pioneer in integrating RNP technologies into our operations. Our work in this area can be traced back to the mid-1990s when we used RNP-guided flight paths to direct our aircraft operating out of the Juneau airport, a location known for its bad weather and mountainous terrain. The challenges posed by the Juneau environment spurred our entrance into this space, leading Alaska to invest early in innovative technologies that could help us more reliably and safely serve communities throughout the state of Alaska. In so doing, our corporate leaders took a risk in being the first major U.S. air carrier to invest in RNP, an unproven technology at that time. That risk was certainly worth taking, and because of that early work Alaska is further along than any other airline in using these technologies to benefit our customers and partners.

From its inception at the Juneau airport, we have taken RNP technologies to the next level with the Greener Skies initiative. In 2010 the FAA, with whom we have a long history of successful collaboration, declared our project in Seattle a NextGen initiative. The primary objective of the project was to study the feasibility of two instrument approach streams to parallel dependent runways (runways separated by 2,500 to 4,300 feet) with:

- one aircraft arriving on a straight-in flight approach,
- an adjacent aircraft arriving on a curved path to a parallel runway,
- and both considered "established" on the approach, with at least one of the aircraft using NextGen guidance technology.

Today, aircraft must be separated by 1,000 feet vertically or three nautical miles laterally until they are "established" on straight-in final segments to dependent parallel runways. One of the key goals of NextGen is to implement rule changes that allow aircraft to be established on both curved and straight-in paths, allowing for

reduced separation between the aircraft of just 1.5 nautical miles diagonally. The key benefit of reduced separation is increased airspace efficiency. Thirteen airports in the National Airspace System (NAS) would benefit from this rule change.

The initial phase of the Greener Skies initiative was to develop and implement two Area Navigation (RNAV) arrivals and six RNP approaches. In navigational parlance, arrivals are published flight procedures that take the aircraft from its cruising altitude to a much lower altitude, typically a few thousand feet, in the airport vicinity. Approaches are procedures that take the aircraft from that position all the way to the runway. The primary benefit of the NextGen procedures is that they allow the aircraft to make a continuous decent rather than requiring it to level off intermittently. A helpful analogy is that NextGen arrivals are akin to the plane sliding down the banister rather than taking the stairs.

In the summer of 2013, after several years of exhaustive trials, training, safety assessments and FAA airspace negotiations, we were able to publish and implement the two arrival procedures outlined in phase one of Greener Skies (HAWKZ and MARNR). We overcame some initial challenges and at the end of August, with support of the FAA, all qualified and equipped aircraft and airlines arriving in Seattle from the north, south, and west began using the NextGen arrival procedures. This success continues today.

We are currently in phase two of Greener Skies, and our objective is to obtain a waiver to the Air Traffic Control Handbook that would allow the implementation of the "Established on RNP" procedure. This mechanism will allow for the reduced separation of 1.5 miles between approaching aircraft, and for those aircraft to approach on both straight-in and curved paths. This reduction in separation is a key factor in reaping the full benefits of the Greener Skies initiative.

II. Benefits of Greener Skies

We have seen significant positive impacts from the implementation of our two RNAV arrival procedures. For aircraft landing to the south, the HAWKZ procedure provides a 17-mile savings over previous landing procedures. That may not sound like much, but when considering that an estimated 30,000 aircraft fly this arrival path each year (from all airlines, not just Alaska), the fuel burn reduction quickly adds up. With an average of 44 gallons of fuel saved per flight, we can expect 1.3 million gallons of annual savings for aircraft arriving Seattle. Early modeling shows an expected reduction in CO_2 emissions equivalent to 4,100 automobiles. And when considering the growth in air traffic forecast for Seattle, the benefits will only increase.

Additionally, we have worked closely with the Port of Seattle to ensure the procedure designs do not affect the Port's long-standing noise-abatement corridors. The flight procedures are optimized to concentrate flights over Puget Sound and compatible land uses, reducing the number of people who experience aircraft overflights. Greener Skies has allowed Alaska to continually find innovative ways to serve our customers, the communities in which we work and reduce our environmental impact.

III. Challenges

Our integration of NextGen programs has been a marked success. But despite these benefits, we face challenges in fully implementing NextGen and ensuring our initiatives have the greatest positive impact they can. We have experienced significant success implementing the two new arrival procedures as part of phase one of the Greener Skies initiative. But the second phase, which will deepen the impact of this program by optimizing our approach protocols in tandem with the arrival procedures, has encountered setbacks in its approval process. In short, the benefits we gain during the decent from cruising altitude to the beginning of our final approach are considerable; extending those benefits all the way to the runway is our next goal.

As an early adopter and champion of these initiatives, Alaska Airlines hopes we can count on Congressional support to advance three key issues:

a. *Approve the FAA rule change for "Established on RNP"*
   The rule changes that follow from the "Established on RNP" waiver are crucial to NextGen implementation. Roadblocks exist in this space, in many cases understandably. But approval of the rule change is a necessary first step to ensure the beneficial impacts of NextGen.

b. *Publish and implement the amended RNP approach procedure*
   Though the approach procedures were published in 2013, they are not fully used—with the notable exceptions of the Denver and Portland airports. These procedures must be amended and fully implemented. We currently foresee a minimum two-year delay from initial publication, which further stalls the bene-

fits of NextGen. Additionally, continuity in the teams developing these procedures will reduce the time to implementation.

c. Support an FAA post-implementation benefits analysis of the Greener Skies initiative

It is important that we have verifiable data on the benefits and impact of the Greener Skies initiative. We have begun culling that data ourselves, but we ask the FAA to take a leadership role in developing a benefit analysis in order to validate the metrics we use to measure the impact of Greener Skies.

IV. Conclusion

The airline industry benefits greatly from NextGen policies and procedures, and Alaska Airlines has been a strong proponent of their implementation. Safety, environmental stewardship and customer satisfaction all follow from these initiatives. But we could be doing much more. Arrival procedures have seen dramatic improvement. But we have an opportunity to make further progress by integrating our approach procedures with those arrival protocols. We depend upon your support and our continued partnership with the FAA to ensure that NextGen and the Greener Skies initiative are as impactful at the national and local level as we know they can be.

Senator CANTWELL. Thank you. We will start a round of questioning of 5 minutes each from my colleagues.

I think in just summarizing where I see this discussion because all of you have added some very good input, I think the public first of all does not understand all the acronyms and what it all means, they just know the promise that we keep saying this is going to deliver to them in more fuel efficient planes.

And it looks like half of the money we have spent so far is on this ERAM system, which is supposedly, on its way, I guess might be a way of saying it.

But I guess my question is, you know, we have this almost chicken and egg situation with the industry. On one end, Mr. Beck has moved—his airline has moved—very quickly in establishing even prior to this, a Greener Skies navigation system, again, focused on the terminal end, but you know, made the investment, moved ahead.

I guess what I am saying is we want to see more of a partnership with the FAA and industry, because industry also needs to make these same implementations, but if that progress—I am not sure "stalemated" is the right word, but delayed—then where we are right now is we have spent $5 billion, the industry may not be moving fast enough, it wants to move faster, so we are kind of doing an across the board let's implement each aspect of the software as opposed to maybe the most leveraged things.

Now I know the ERAM system is one of the most leveraged things that we have to get done, but when I look at this end of the table, Mr. Beck, I think well, why not implement as the NextGen Advisory Committee suggested, making Performance Based Navigation a very, very high priority, and why not implement across the country a more rapid deployment of the system.

So, my understanding is we have the Metroplex in—is it Dallas?

VOICE. Houston.

Senator CANTWELL. Houston, that is going to go next, but then the next set, it is going to take us like six years to implement. Can't we move faster at getting these Performance Based Navigation systems in place sooner while we are working obviously on the back end system, because they obviously did not need the ERAM system before they started making changes.

So, I guess what I am asking, and I would love everybody's input, are there some more low hanging fruit that brings in the actual partnerships faster and the actual realized savings faster than just saying to the taxpayer we are going to spend another $5 billion before we see the major benefits?

So, anybody who wants to answer that.

Mr. WHITAKER. Yes, thank you, Chairwoman Cantwell. If I can start, I think communicating about NextGen has been one of our great challenges, and one of the things we are focused on is to try to improve that communication, and part of that communication is to point out that we are very close to completing that foundational phase.

Regardless of whether this was going to be called NextGen" or something else, we were operating the air traffic control system with equipment from the 1970s and the 1980s, and it had to be upgraded, and a big portion of NextGen was to upgrade all that equipment.

So, we are closing in on the completion of that, and that will enable additional technologies, but the other focus has very much been, at least in the last year, on working with industry through the NAC, understanding the priorities, and then trying to match those priorities with our budget and our capabilities, and what is ready to be rolled out.

PBN is clearly front and center in that. The Houston——

Senator CANTWELL. Performance Based Navigation.

Mr. WHITAKER. Yes, Performance Based. "Metroplex" is even a better term. The Houston Metroplex has been a great success, and the new routes are achieving an 80 percent usage rate, so we have ironed out some of the issues about usage. We are seeing a very successful program. We are receiving e-mails from pilots who are raving about it versus other problems they have experienced in the past.

Senator CANTWELL. Great, so why not move up that deployment more rapidly, because my understanding of what is going to happen is we are going to see them come online and then over the next 4 years, we will see like a little dribble of——

Mr. WHITAKER. So, we have a dozen more in the next three years, and we have, I think, a pretty aggressive schedule. The issue is that every airport is different, every airspace redesign is different.

So, we have certainly learned lessons from Greener Skies and from other efforts, but we feel that Houston really shows all of those efforts coming together, and I know Paul can comment on that. We had a very close collaboration, and I think that collaboration has been what has made it so successful.

So, there have been learnings from the past, but it is clearly a focus of the NextGen Advisory Committee and the FAA.

Senator CANTWELL. Anybody else want to comment on that?

Mr. RINALDI. I would like to, Chairman. Mike Whitaker is absolutely correct. Houston is completely different but what we have now is a good play book to move forward. Houston took somewhere between 18 months and 24 months to develop, and instead of doing one or two approaches like we did with Greener Skies in Seattle,

we did the whole Metroplex, 61 procedures. Monumental task. We did not know how that was going to work.

Controllers trained right up to the last day, and the way they were working airplanes and the way the pilots were flying the airplanes the day before, on May 28, changed with a snap of the fingers at six in the morning on May 29.

It was a huge success. We now have a good platform where we don't just change one or two procedures within Seattle, but maybe we can go back in there and actually re-do all of the procedures within Seattle and see the benefits.

So, I think getting Houston under our belt and actually having that platform gives us the ability to be successful. North Texas will be next, and then we will start looking at Southern California and Northern California also.

Senator CANTWELL. Thank you. Senator Ayotte?

Senator AYOTTE. I want to thank all of you for being here. Mr. Whitaker, I love that we share New Hampshire as home, so thank you for being here, I appreciate it.

I wanted to follow up on Senator Cantwell's question about the PBN, Performance Based Navigation procedures, so we are not all using acronyms.

As I understand the IG's recommendation, in terms of what the Chair has asked about more quickly implementing these measures across the country, I read his report to say that he has recommended that you complete an action plan and develop milestones to increase the use of the PBN procedures.

So, could you comment on that, and I hope you will commit to doing that, because as you had the experience you were talking about in Dallas and taking those lessons from it, and looking to what was the absolutely great point the Chair made, how do we accelerate this procedure across the country?

I would love to hear your response to what they recommend so that we can take those lessons and more quickly move forward with this so people can really see the tangible benefits of NextGen.

Mr. WHITAKER. Thank you, Senator. We have looked at the work that the IG has done on PBN, Performance Based Navigation, as well as the NAC. The NAC has a working group that focuses just on implementation, because it is such a high priority, and we are fusing the results of that work into action plans around how to execute more efficiently.

I will say that we have reached a tipping point. We have—over half the routes are now PBN routes. When we first started this process, I think we had a bit of a first come/first serve basis, rather than having a holistic plan for implementation.

So, we are going through the previous routes and culling out ones that do not have utilization or may somehow clog the system, and then we are focused on much more of a holistic national plan for the route network.

Metroplex is a big part of that because that allows us to get at some of the congestion most efficiently. The PBN implementation is a key focus of the NAC and clearly a priority for us as well.

Senator AYOTTE. Mr. Hampton, do you have a comment on this discussion, having obviously looked at this in your report?

Mr. HAMPTON. Yes. The FAA did concur with our recommendation, and they fully understand the importance of PBN. However, I want to point out that maximizing the benefits of Performance Based Navigation relies on a couple of things. One is adjusting the Controller Handbook, and that was done in Houston, and a lot of work is underway, I would say roughly half of the 15 ones on target have been completed.

So, you need an integrated approach. Not only that, you need training for the controllers at that specific facility. That will help maximize the benefits. At some point, there will be an additional controller tool set that will be needed to help them better manage aircraft.

I think what you will see coming out from the NAC report and FAA's response is a very integrated approach to developing PBN. You need all the pieces to line up to deliver the benefits, and I think the FAA is working very well with industry and the controllers in that regard.

Senator AYOTTE. Mr. Hampton, I wanted to follow up with you on some of the other findings that you had in the report.

You talked about the measures that have been implemented and talked about the things FAA has done, but I also saw a number of issues that you raised in your report, including slow progress in meeting deadlines and implementing core components of the program, cost increases and schedule delays, and long-standing programmatic and organizational challenges.

So, is this a funding issue or is this an issue that is focused on what needs to be done from the FAA, and can you help me understand how we deal with some of the issues that I see in your report that are obviously independent of funding?

Mr. HAMPTON. Thank you for the question. The problems that we have seen with NextGen and execution are not traceable to an issue of funding.

Congress had provided FAA in the neighborhood of between $5 billion to $6 billion for NextGen. In the 2008–2009 time frame, the appropriators gave more money than FAA requested to accelerate key NextGen technologies.

Money may be an issue going forward, but in the past, it was not. We do recognize that the sequester did cause some disruptions to FAA programs, but by and large, money has not been a problem with the execution of NextGen. It is more traceable to defining requirements and developing an executable plan.

Senator AYOTTE. Is that the number one issue, you think, defining requirements and——

Mr. HAMPTON. Yes, that is the root cause of most of the problems with NextGen. Another point is integrating and developing capabilities at specific locations. I think the FAA is getting to the point now in response to the NAC focusing on a set of priorities.

The priorities the NAC recommended—Performance Based Navigation, surface operations, closely spaced parallel runways, and DataComm, DataComm is a little further off—represent—are pretty good places to go. There are opportunities for tremendous benefits.

So, it is a question of focus. FAA cannot afford to advance NextGen on a broad front, but rather on a more focused and con-

centrated way, and I think their budgets and plans need to reflect that.

Senator AYOTTE. Thank you.

Senator CANTWELL. Thank you. Senator Booker?

STATEMENT OF HON. CORY BOOKER,
U.S. SENATOR FROM NEW JERSEY

Senator BOOKER. Can you repeat what you just said? You said the FAA cannot afford to do it on a broad front?

Mr. HAMPTON. Let me rephrase that. The past plans were relatively unconstrained, and that hurt FAA's ability to actually execute. I think it is the best practice throughout business and industry to focus on several key areas and execute them, go to the areas that have the most positive return on benefit.

Senator BOOKER. So, help me understand, just for my concern. The airport systems in the region of the country in which I am in, in New Jersey, Newark Liberty is the fifteenth busiest airport in North America, and once you combine that with JFK and LaGuardia, you have now got the busiest airport system in the entire United States, which makes us one of the busiest airport systems globally.

So, my concern is with the numbers of near misses, the challenges we have—Mr. Rinaldi and I have talked about staffing issues and the like—safety is the number one concern that I have.

While I am thrilled about the long-term impact that the implementation of NextGen will have, I mean extraordinary benefits environmentally, and I can go on, I am very, very concerned about the speed with which we are addressing the issues in the Newark Liberty Airport area.

You hit right to the root of what my concerns were, which is why are we moving as slow, why can we not move faster? So, you are telling me it is not a funding issue at all?

Mr. HAMPTON. In the past, it has not been a funding issue. We did a report last year and it focused on some of the causes. Chief among them was an inability to define requirements, developing an executable plan, and an agency culture that was resistant to embracing the NextGen culture and change, and making significant changes in how air traffic is managed.

Senator BOOKER. So, lack of a plan, some technical issues?

Mr. HAMPTON. Correct.

Senator BOOKER. These are the issues that have been sort of causing the slow pace going backward, but as you look at the advancing forward—let's go with the next year to 2 years, is the funding that we are looking at—because right now, the Fiscal Year 2015 budget submitted to Congress contains around a $174 million shortfall compared to the Fiscal Year 2014 related to the NextGen budget.

I look at that discrepancy, and I am wondering if the research and development portion, which was cut approximately $43 million—is this causing a strain basically in terms of the FAA's ability to address the challenges?

I do not mind if Mr. Whitaker or Mr. Hampton answers that.

Again, I am proud of New Jersey's role. I mean, you know, the facility in Atlantic City, we are focused really on the DataComm

technology that you discussed, and I am really proud of the role my state is playing in all this.

But again, that budget differential, how is that going to impact the future implementation?

Mr. HAMPTON. On that question, sir, thank you very much. That is the point we have made, is going forward, it is very important for the FAA to clearly lay out what its requirements are in terms of funding for NextGen, sustaining the NAS, and also what the key R&D elements that still have to be done to advance some of the more advanced concepts. I think that is an important question particularly as FAA reauthorization comes forward.

The FAA has to balance sustaining the existing system, running the system, which they do very well, and introducing new capabilities. I think it is paramount that the FAA gives this committee a clear understanding of what its resource requirements are. I think that is essential.

Senator BOOKER. Mr. Whitaker?

Mr. WHITAKER. Thank you, Senator. If I may just comment, I think one area—one challenge we have with NextGen—is that people do not realize it was designed as a twenty-year endeavor. So, if you look at our funding stream, 20 years, $20 billion program, the first time we hit that funding level was 2009. So, we are not that far down the path as it was laid out.

One of the areas where we do not agree with the IG is that we view this as an endeavor that you approach in segments. You do not have to define all of the details of what is going to happen in 2025. We take it in segments, and as those segments complete, we start focusing more on the second segment.

We have had discussions back and forth for quite a while with the IG over this approach. We follow the OMB approach with respect to that.

But it is important that we keep it funded at the appropriate level.

Senator BOOKER. So, the differential in funding is a concern of yours?

Mr. WHITAKER. All of these programs—the individual components are six to eight year programs, and you have to make investment decisions going forward. If you do not have funding predictability, it is very hard to do that. We do not want less money and we do not want more money. We want the amount of money that was built into the program so we can execute.

Senator BOOKER. So, in the final seconds I have two things. One is the clarity of funding requests seems to be what Mr. Hampton is saying in terms of a plan to understand, because again, I feel like a little bit, pun intended, that I am flying blind in terms of understanding what the future needs are.

Is this differential in funding really something I should concern myself with or not, and the conflicting testimony I am hearing, at least reading into it, has me a little concerned, and I know my team, we want to dig a little deeper into that so we can properly advocate whether it is resources or whether it is some of the technical issues. I want to make sure that we are applying the proper energy in the proper place.

And then I just want to say one more time, the most congested airport in the United States of America, the most flights going in and out of the Kennedy/LaGuardia/Newark Airports, the most pollution being spewed into our air, what these small parts are making.

This is a serious crisis in my opinion in terms of the number of challenges we are having with safety in our area, and the urgency to get this new technology implemented as quickly as possible.

So, for you to say to me a twenty-year plan, that is all nice, but I am really focused on how quickly can we create an environment of safety in the Nation's most busiest air traffic area, where we are facing, I think, straining the capacity of a limited number of air traffic controllers relying on technology frankly that has been around for many decades, perhaps even before I was born.

Mr. WHITAKER. Thank you.

Senator BOOKER. Thank you.

Senator CANTWELL. Senator Begich?

STATEMENT OF HON. MARK BEGICH,
U.S. SENATOR FROM ALASKA

Senator BEGICH. Thank you very much. Madam Chair, thank you for hosting this hearing. I want to follow up, Mr. Whitaker, on what Senator Booker just talked about, and maybe Mr. Hampton, I think your point was in the plan that the FAA does, you have to make sure you are doing the best cost/benefit analysis, in other words, the highest benefit as quickly as possible and defining those areas. That is what I kind of heard.

Does your plan, Mr. Whitaker, address it that way or is it kind of the classic what I call "legislative plan," which is, you know, shop around everywhere to make everyone happy as best as you can because you will get a call from a Senator if you do not. How is your plan designed?

Mr. WHITAKER. Well, there are really two parts to this. We have a very detailed implementation plan for NextGen that goes into detail on how all the programs fit together and how they roll out over time. We are executing on that plan.

In addition to that, we do have the ability to deliver benefits, and the NextGen Advisory Committee is designed to allow us to give industry an opportunity to reach consensus and tell us what is important for implementation.

I think it is one of the most useful tools that we have, and we have had——

Senator BEGICH. That is based on, you know, risk, safety, some sort of levels of priority that you go after first?

Mr. WHITAKER. When we are dealing with the NextGen Advisory Committee, it is really commercial need and where the benefits are going to come from. The safety and risk factors are cooked into the underlying plan that we have.

We take that very valuable feedback, and that is why we have developed these four areas that we are going to be focused on over the next one to 3 years to deliver those benefits.

Senator BEGICH. As you know, with Alaska, NextGen, ADS–B, all this was pioneered in many ways in Alaska because of the unique flying conditions that we have there.

Mr. WHITAKER. Yes, sir.

Senator BEGICH. Let me ask you specifically about ADS–B technology. In regards to Alaska, I know whenever we talk to the FAA, the FAA always says, you know, we have covered Alaska, and that is true, 13,000 feet and up, but because of our general aviation capacity, which is 16 times more pilots licensed in Alaska than in any other place in the country, the 3,000 to 5,000 really does not get covered as aggressively as it could be.

We have areas like Prince William Sound, which is a huge area, as well as up in the Arctic with regards to the North Slope, which has a lot of activity, especially now with OCS development, a lot of activity with plane activity.

What is the plan to install more potential ground stations to improve ADS–B for general aviation in Alaska? I get the commercial. Generally, I fly on a lot of small planes that you might not consider commercial, but in Alaska, we consider them commercial.

Mr. WHITAKER. Yes.

Senator BEGICH. Because that is how we get around.

Mr. WHITAKER. Yes.

Senator BEGICH. So, what is the plan to increase that capacity, especially in some very high volume areas like I have just described?

Mr. WHITAKER. So, the baseline program for Alaska was 33 ADS–B ground stations, and that part has been completed, but we do recognize the terrain in Alaska presents unique challenges, so there are supplemental programs moving forward.

We already have one program underway to add eight more ADS–B ground stations on the North Slope and in other regions. There is work underway in that regard.

Senator BEGICH. Are you considering satellite coverage? Also, as you know, in Alaska, that is one other component we utilize for all our communications. We have a combination. Is that part of the equation?

Mr. WHITAKER. Well, the ADS–B takes us to that satellite coverage, so that will ultimately be the primary surveillance mechanism with the radar as a back-up.

Senator BEGICH. OK; fantastic. Let me ask you before I ask a couple of others, I have one specific question. This is very specific, very parochial, not that anything I do is parochial, it is all about Alaska.

I was just in Alaska, Nome, Alaska, which is not the easiest place to fly into, short runway, high winds. As a matter of fact, I flew in with the Coast Guard. Even they were wondering if we could make it in. One of the issues they have is—I forget the technical name of the piece of equipment—it is to measure the wind speed on the tail end of the runway, which is like near the yaw, they don't have a piece of equipment.

So, obviously, when you are landing on that airport, it is a short runway, and your end of that runway is a mountain, and there are high winds, they would like to measure that wind, and they have been struggling with the FAA for years—years—to get this one piece of equipment that could literally protect and ensure that life safety is there.

In Alaska, we do not have the luxury of long runways sometimes. We do not have the luxury of calm conditions. Alaska is a very windy place. As you know, in Alaska, it has very large industrial areas where a lot of the stuff coming from the Pacific Rim comes through that area, and that port and that airport is busy.

So, can you just put that on your shopping list? We will send you something on this. I know it is not you directly, but you are here from FAA, you get the tag.

Mr. WHITAKER. I will. I will follow up and take a look at that, Senator.

Senator BEGICH. Very good. If I could just ask one quick last question and then I will stop, if that is OK, Madam Chair, and I apologize. I just want to ask one very quick one and I will ask this to Mr. Rinaldi.

I know NAC has been working on the issue of the En Route Automatic Modernization, so forth and so on. I know both FAA and NATCA are pretty pleased about the 20 locations.

The Alaska Air Traffic Control Center was dropped off that list. At one time, they were on it, but we did not have broadband. Now we have broadband.

Can you just give me your quick thoughts on that, what that means, not being on that list and being one of those 18 to 20 sites? Then I will stop there.

Mr. RINALDI. I think you are exactly right. Originally, they were on the list and nobody wanted to actually test new programs up in Alaska because like you said, it is the main mode of transportation to many of the remote areas up there.

The En Route Center in Alaska should be on the ERAM waterfall. It was not on the funding list and it is certainly not on the list now as we roll out to our last six facilities, but we would like to see all our en route environments on one platform. It just makes sense.

Also, we could tie in the majority of equipment we are using in the Lower 48 that would also help in Alaska. So, it would just make sense that as we have the team in place and as we finish up on the East Coast and ERAM now to move to Alaska and complete that, because, you know, every one of our en route environments should have the same platform.

Senator BEGICH. I will end there and maybe I will ask FAA to respond at a later time. I had a question for Alaska Airlines, I will submit it for the record.

Thank you very much.

Senator CANTWELL. Senator Nelson?

STATEMENT OF HON. BILL NELSON,
U.S. SENATOR FROM FLORIDA

Senator NELSON. Madam Chairman, realistically, what year are we going to have NextGen ready to go, so that is how we are operating our flights? Mr. Whitaker?

Mr. WHITAKER. NextGen is a whole series of upgrades, so there is not a particular moment in time when there will be an announcement that we have flipped a switch and turned it on.

But I think the key components of NextGen really involve, in addition to the foundational programs that we have talked about,

data communication into the cockpit so that communications between controllers and pilots can happen that way, and communications can come into the cockpit——

Senator NELSON. Right.

Mr. WHITAKER. You can push a button and it can go into the flight management system.

Senator NELSON. Right.

Mr. WHITAKER. We achieve what we call four dimensional metering, so when we have an aircraft pushed back from the gate, we know what time it is going to take off and what time it is going to land, and what the altitudes will be.

Senator NELSON. Right.

Mr. WHITAKER. As I was mentioning, NextGen was designed as a twenty-year endeavor, and I think if we can stay funded and on track, that is where we will end up at the end of 20 years.

Senator NELSON. Well, are you saying 20 years from now? It was a twenty-year endeavor, but it started about ten years ago. So, are we 10 years down the road?

Mr. WHITAKER. So, if you look at the funding profile, the first full year of funding was 2009. Our target is to bring those capabilities on by 2025. We still have—we have an important step ahead of us, which is to define the equipage requirements for aircraft, and when that will be mandated, I think that will be probably the defining moment of when it all comes together.

Senator NELSON. Well, that is an awful lot of fuel that we are going to use in the meantime on routes that are not direct, the added safety of the next generation, situational awareness, and so forth.

Realistically, it is 2025?

Mr. WHITAKER. I think that is a realistic target; yes.

Senator NELSON. So, the first funding was in 2009. We have been talking about this at least for a decade.

Mr. WHITAKER. We have, and what happened is in 2003–2004, work began to develop the concept of operations for NextGen, and that work continued through 2007. You had some level of funding from 2007–2008, but in the $100 million range, if you will.

But as a twenty-year $20 billion program, you are looking at a run rate of a billion dollars a year, and that level of funding we have never actually touched upon, but we have come close beginning in 2009 and every year since then.

Senator NELSON. Mr. Whitaker, tell us about the progress that you can make with the extra funding that the administration has requested, and as you share with us, tell us so we can get on the record about the sequester, what are the sequester cuts going to do to NextGen's progress?

Mr. WHITAKER. I think that one of the keys to successfully completing NextGen is to have predictability in the funding stream. I think that is first and foremost what we need.

The many programs that make up NextGen are multi-year programs that require multi-year investment planning. So, more than picking a particular level, what we really need to know is what those levels will be.

I think a billion dollars a year is roughly what we have planned for in implementing NextGen, and that gives us the predictability that we need.

Sequestration and the Government shutdown put significant strain on those programs. We had to pull down many activities that then took months to reinstate, and that type of funding uncertainty is a significant risk to execution.

Senator NELSON. So, from the perspective of the air traffic controllers, Mr. Rinaldi, how do you think the sequester has impacted air traffic safety?

Mr. RINALDI. Thank you, Senator Nelson. I believe that the sequester cuts of last year, we have never seen that before where they actually sent controllers home to meet the mandated cuts, and everybody within the FAA, to meet the mandated cuts.

It has impacted many lines of business. The fact that they had to close the FAA Academy and stop hiring new controllers on March 1, and the plan was to open on October 1, and because the full government shutdown, they were not able to open it and get it up and running until January 1. We were a full year behind of hiring new controllers, and we are seeing controllers retiring, you know, 25 years from when they are hired.

The concern with us with sequester is if it was going to come back, the staffing levels in our facilities, they are at a record low, we need to get replenishment. We need to continue to train and get new qualified controllers on board.

Senator NELSON. Thank you. Now, we are getting ready to do the FAA reauthorization next year. Mr. Hampton, beyond NextGen, what are priorities that you would like to see as we get ready for the reauthorization?

Mr. HAMPTON. Thank you for the question. I think what Mr. Rinaldi said going forward is having what is the right number of controllers at the facilities. We have work underway at the critical facilities, having them properly staffed.

In the past, they had large numbers of trainees, so adequately ensuring controller workforce. Another issue is having an adequate inspector model to make sure that we know we have the right number of inspectors. FAA has roughly 4,000 inspectors, and the key is how many we need and where do we place them. That is from the safety side.

I also think going forward you are going to have to address the issues of UAS in the next bill and how quickly they can be integrated.

Those are some of the thoughts for going forward in the next reauthorization.

Senator NELSON. Mr. Beck, do you agree?

Mr. BECK. Yes, sir; I do.

Senator NELSON. Do you want to add anything?

Mr. BECK. No, just as the Co-Chair of the PBN NextGen Implementation Working Group, I do want to echo some of the comments that Mr. Whitaker and Mr. Rinaldi and also Mr. Hampton made.

I see us making good, good progress with this NAC group, and I think we are going in the right direction, and we will be finishing up our report that will go to Congress in October.

We are going to have our milestones set, and we will mark our progress over the next one to 3 years of things we will be able to accomplish.

I just wanted to add that for the record.

Senator NELSON. Thank you, Madam Chairman.

Senator CANTWELL. Thank you, Senator Nelson. We appreciate you being here and the questions.

I wanted to ask a question about savings from a fuel perspective, whether the En Route Automation system—obviously, more direct routes, and modifications to that; right? We have routes today. They could be more direct, so that automation will save some fuel.

Then we have the Greener Skies, which is really more—I do not know what you call that, terminal based, you know, navigation.

Which of those saves the most in fuel? Where are we going to get our most savings, from the terminal focus or the en route focus?

Mr. WHITAKER. I think I may want to defer to Gary on that. We are doing a lot of work now in the NAC on trying to calculate fuel burn. It is one of the metrics that was asked for in the 2012 reauthorization, but that data was not available and has some proprietary issues associated with it.

So, we have set up a structure to put in place ways to measure that fuel burn, but I think the most notable changes are coming in the approach, the Optimized Profile Descent and some of the more efficient routings coming into the terminal.

Senator CANTWELL. Well, the reason why I asked that question is because, listen, I believe that people are doing good work here and people are trying to implement a very complex system, but I think you heard from my colleague from Florida when you said 20 years to implement, no one wants to hear that it takes 20 years to implement this. They want us to do the things we can bootstrap now and get implemented, obviously, in the most safe and secure manner, and build the system that way.

Technology drives best in flat organizations, not hierarchical, so the more hierarchical we come with this, the longer it is going to take us to implement. The flatter we can do, the better.

So, my point to Mr. Hampton about measurement, if the most savings that we are going to get is in the terminal based system, then helping to get those cities on line faster, what are the ways in which we can get every city in America thinking about, as Mr. Hampton and Mr. Rinaldi said, getting the procedural books in place.

It does not mean they are going to change over without your OK, but it gets everybody in America focused on this now and focused on what this will bring to them, and gets them ready so when you can implement.

You are learning great things from the Metroplexes in Seattle and Texas. You are learning a lot. You are going to flatten a lot of issues that are going to come up in other areas.

But again, instead of having this more elongated time period while you are doing the En Route Automation system, you know, you are spending your money and time there, and yet here is where you can empower a lot of jurisdictions across the United States of America to get going now, and getting ready for where the most fuel savings are, and again, more efficient landing and

saving passengers time and everything, not that we do not have to have the big system.

I do not know who wants to comment on that, Mr. Beck or Mr. Rinaldi.

Mr. BECK. I certainly agree that the biggest bang for our buck as an operator is from cruise altitude to the end of the runway. I mean ideally, if we can make an arrival, an approach, and not touch those power levers once we bring it back to idle until we are on short final, that is where we are going to get the most bang for our bucks from fuel savings, emission, and noise, too.

I would agree with you, Chairwoman.

Senator CANTWELL. Mr. Rinaldi, how could we empower cities across America to start—even on an empowerment level—to start looking at this and getting ready for this implementation so we do not wait another ten years before we get major cities on this program?

Mr. RINALDI. It is a great question. I think we have to actually focus on—Gary, Mr. Beck, is exactly correct. The optimal descent approach is where we are saving the fuel, saving the noise, and improving the carbon footprint on the environment.

So, we have to start connecting the highways in the sky in the en route environment so we are not—when they are at flight level 350, they are what we call "clean," and they are green. They are flying with—they are burning fuel but there is not the stop and go when they get into the terminal environment.

So, if we can start connecting Houston and North Texas and start moving up throughout the United States and connect the highways in the sky so that when they get into the terminal environment, they just have the optimal descent approach, that is where we are going to see the most benefit of NextGen, of PBN, Performance Based Navigation.

So, how do we do that quickly? We have to set more teams in place and tell them to go forth and do this great work and start connecting the highways in the sky.

The way to do that—we do have staffing issues within the FAA, but we have to start identifying some teams and start putting them in there so that we are building the system as we are going along, so when you leave Texas, you are not broken and all of a sudden we have to slow you down until you get to another major city.

Senator CANTWELL. But is there not something right now that Houston could share with Miami or Chicago or Newark, that they can be thinking about and getting ready on their own, as opposed to waiting for somebody at the FAA to knock on their door?

Mr. RINALDI. Absolutely; yes.

Senator CANTWELL. Well, I think that is what we need to look at. I do not know if you have any more questions, Senator Nelson. Yes, go ahead.

Senator NELSON. Tell me about the technology, are we such that in the NextGen, we are going to do everything from satellites and not have radar, or are we going to have radar as back-up, in which case you have duplicate of costs? What is the story?

Mr. WHITAKER. The idea is to transition to a satellite-based system, but given the nature of what we do, you need redundancies in the system, so there will be a redundancy radar system. It will

be a streamlined radar system from what we currently operate, but key to everything in aviation is redundancy, and there will be a redundant system in place.

Senator NELSON. So, that being the case, would the redundancy be robust enough that if suddenly there were a major solar explosion and this electromagnetic pulse is suddenly coming to earth and it starts to fry these satellites, that redundancy is robust enough to still control the traffic?

Mr. WHITAKER. Well, you may have exceeded my level of science knowledge, but if we have to shut down the satellite based system, it will be able to operate on the radar based system.

Senator NELSON. It will?

Mr. WHITAKER. Yes.

Senator NELSON. That is the question.

Mr. WHITAKER. Yes.

Senator NELSON. So, how much do you lessen then the existing radars so that you still have the capability to operate?

Mr. WHITAKER. So, the radar system now actually has redundancies to back it up, so we will be able to retire some of the other redundancies, if you will, but we will have a comprehensive plan that we will go through a typical safety analysis to make sure it is robust enough to handle all of the traffic, but will be more cost efficient than the one that we are running at this time.

Senator NELSON. By the way, that is not the only traffic we are looking at. In our testing, for example, of our missiles, our defense missiles, the civilian space program, on our launches, the more that we can rely on satellites to help do the tracking, the greater efficiencies we can get, but we have the same kind of question, what is the redundancy.

Thank you, Madam Chairman.

Senator CANTWELL. Thank you, Senator Nelson. Again, I want to thank the witnesses for their testimony and for their focus on this.

I think you should take away from today's hearing that while some progress has been made, we very much look forward to this July 1 report, which is mid-term, I guess, and we are going to get the final in October.

We thank Mr. Hampton again for narrowing the focus, as he mentioned. I think that is what our larger questions are. Instead of having a broad approach, we want to see more focused things that are leveraged, if you will, no pun intended, but to change the approach a little bit here, and to use the private sector to focus the attention on those things that are going to be most leveraged.

Again, if the most fuel efficiency is out of this approach issue, then what can we do to accelerate that during this time period while we are also getting the larger system replaced that is a cross navigation system.

So, I think for all of us, we are stewards of the taxpayers' dollars, so we want to see the implementation of this as cost-effectively as possible.

We also want to see the investment made by the private sector, so all of that is a hand-in-hand process, and we certainly do not want to see government shutdowns and things of that nature inhibit us in this area. We want you to have clear ideas about what

you can count on, but we also, as I said, want it to be the more leveraged things that we can do right now.

So, hopefully, you will take that feedback from us, as you report back to us on this in the future, and will take that into consideration.

The good news out of Houston, out of Seattle, does provide some very, very promising results for the long-run, so we are certainly happy about that, and certainly, I am sure consumers will be happier when they have more on-time arrivals.

Anyway, we will come back with a future hearing on this implementation. Members will have time now to submit questions to you all. We will have the record open for two weeks so members can ask individual questions.

Senator CANTWELL. I am going to submit one on the UAV system. I do not have time right now to go into that. We will submit some questions for the record as well.

But again, thank you very much for all that you are doing to help us get this new system implemented.

We are adjourned.

[Whereupon, at 11:45 a.m., the hearing was adjourned.]

A P P E N D I X

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. JOHN D. ROCKEFELLER IV TO HON. MICHAEL G. WHITAKER

According to a June, 2014 series by the *Washington Post,* both civilian drones and the GPS signals used to navigate are vulnerable to hacking or jamming. These GPS signals important part of NextGen navigation systems for manned aircraft as well, though the danger may be more acute with drones as there is no pilot on-board to immediately identify directional changes.

Dealing with this problem requires that we not only design secure systems upfront, but that we are able to immediately detect and respond to intrusions into our systems. I know you are working to build a secure system, but I also want to make sure we have the ability to detect attacks once all systems are operational.

Question 1. What are you doing to ensure that when an attack occurs we will be able to respond quickly and effectively?

Answer. The FAA follows a rigorous safety and risk management process to ensure that new systems and services introduced into the National Airspace System (NAS) are thoroughly evaluated and appropriate risk mitigations implemented to maintain and enhance the current level of safety.

While there have been claims that the implementation of ADS–B in the NAS provides greater security or safety risks to air navigation systems in the United States, considering surveillance backup strategy, independent position validation, ADS–B infrastructure implementation, Air Traffic Control (ATC) procedures, and vulnerability studies for ADS–B, the FAA finds no basis to support that claim.

Based on vulnerability assessments conducted for the FAA's Automatic Dependent Surveillance-Broadcasting (ADS–B) services, the Agency determined that the risk to the National Airspace System (NAS) due to spoofing or intentional jamming would be no greater than the risk with the use of radar systems (Mode A, C, and S) employed to separate aircraft today.

The FAA meets regularly with the Department of Defense (DOD) and Department of Homeland Security (DHS) representatives regarding the use of ADS–B information and national security issues to ensure that all NAS vulnerabilities are appropriately addressed.

Question 2. GPS is clearly a critical capability for NextGen. What are you doing to ensure aviation safety in the event that GPS is jammed or suffers a malfunction?

Answer. Multiple layers of redundancy and alternative systems ensure the safe operation of the NAS if there is a disruption to a part of the airspace system, such as the Global Positioning System (GPS).

The NAS was designed to handle widespread, naturally-occurring, GPS disruptions from events such as solar storms, but the system has not experienced such disruptions on any noticeable scale. Conversely, manmade disruptions to GPS are likely to be very localized by their very nature, and such interference has had minimal effect. The FAA has traced the very few pilot reports of GPS issues to sources on the ground such as industrial processes. These events have not affected safety and the pilots reporting them automatically have utilized the available alternatives.

GPS technology offers many advantages, but the FAA is not solely reliant on any single component of the NAS for safe operation. The future design and operation of the NAS will continue to utilize multiple layers of redundancy.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. MARIA CANTWELL TO HON. MICHAEL G. WHITAKER

Question 1. A recent *Washington Post* investigative report highlighted a disturbing number of incidents in which pilots reported dangerously close encounters with drones in the vicinity of airports, and incidents involving drones appear to be

on the rise. What steps is the FAA taking now to prevent more of these incidents from occurring around our airports?

Answer. The FAA recently adopted a change to its Flight Standards Information Management System to assist flight safety inspectors in educating operators of UAS, including Model Aircraft, to comply with applicable Federal Aviation Regulations, including operations around airports. The FAA also recently published the Interpretation for the Special Rule for Model Aircraft on June 23, 2014, which, among other things, provides guidance to Model Aircraft operators regarding coordination with Air Traffic Control when operating near airports. The FAA is working with its inspectors to ensure they give standard information to the public on how to satisfy the requirements contained in the Federal Aviation Regulations and avoid endangering the safety of the Nation's airspace.

In addition, the FAA will be developing a public outreach campaign that includes further development of the relationship with industry, including the Academy of Model Aeronautics, a nationwide community-based model aircraft organization with a successful record of safe model aircraft operations.

The FAA Modernization and Reform Act of 2012 was clear that the FAA may also take enforcement action against UAS operators, including model aircraft operators, who operate their aircraft in a manner that endangers the safety of the national airspace system. In the interpretation of the provisions of the 2012 Act applicable to model aircraft, the FAA explains that this enforcement authority is designed to protect users of the airspace as well as people and property on the ground.

Question 2. At the same time as the FAA is developing rules on the expanded use of unmanned aircraft, you are also working toward implementing the NextGen Air Traffic System. What steps are being taken in the development of NextGen to account for the presence of unmanned aircraft in the National Airspace System?

Answer. NextGen has multiple ongoing initiatives to account for the presence of unmanned aircraft in the National Airspace System.

NextGen, in coordination with other FAA lines of business, led the development of an end-state concept of operations for unmanned aircraft system integration into the NAS. This concept of operations is maturing to include the design of detailed operational scenarios which will inform safe and efficient integration of unmanned aircraft systems.

NextGen is the steward for the National Airspace System Enterprise Architecture which establishes the foundation from which evolution of the NAS can be explicitly understood and modeled. NextGen, in collaboration with the FAA's Unmanned Aircraft System Integration Office, has initiated an unmanned aircraft system National Airspace System Enterprise Architecture effort to deliver the first series of systems engineering diagrams that reflect the current, mid-term and future time frames of unmanned aircraft system National Airspace System integration. The initial diagrams capture the scenarios that are depicted in the FAA's unmanned aircraft system concept of operations, both operationally and functionally.

NextGen technologies are making it possible to safely introduce unmanned aircraft into the airspace system. Here are a few examples of the connection between NextGen and unmanned aircraft systems:

- Airborne Collision Avoidance System for UAS: In order for many unmanned aircraft to operate safely in shared airspace, we must develop technologies that enable them to "detect and avoid" other airborne vehicles. The agency is researching and developing a collision avoidance system specifically designed for unmanned aircraft. It's a technology called ACAS-Xu.
- ADS–B: This technology helps achieve collision avoidance through more precise surveillance—and separation—of both manned and unmanned aircraft in the same vicinity.
- National Airspace System Voice System: Another NextGen technology that will support unmanned aircraft is NAS Voice System. This system modernizes the voice communication capabilities that we use for air traffic services. It will enable controllers to communicate with the ground pilot of an unmanned vehicle.

Question 3. What strategies can the FAA employ to expand the Metroplex initiative, or PBN procedure development generally, to drive near-term benefits at more airports nationwide? What resources are needed to achieve this expansion?

Answer. The FAA has moved from a "quantity based" strategy to a "value-based" strategy for implementing new Performance Based Navigation (PBN) procedures. Currently, there are over 7,000 PBN procedures in the NAS. The agency goal is to not merely create more procedures but rather have procedures that add value for the customers.

This is a strategy that is endorsed by both industry, through the RTCA NextGen Advisory Committee (NAC), and labor. Drawing from the NAC recommendations on ways to improve PBN utilization, the FAA has implemented the Performance-Based Review, Revise or Remove (PRRRT) process to evaluate existing procedures. If utilization and value do not meet a cost-benefit ratio, the procedure is considered for revision to improve the value. If that not possible, the procedure is removed from the national inventory. This process is aimed at reducing the number of procedures controllers must maintain currency on, the number of procedures industry stakeholders must load/maintain in their navigation systems, and the number of procedures the FAA must maintain annually.

Additionally, the FAA is drawing on recommendations from the NAC on how and where to deploy and/or expand the Metroplex initiatives. Current and future locations are evaluated against an agreed-up set of criteria that define areas where the greatest need exists and benefits can be derived. Evaluating and tracking benefits of these initiatives are currently part of the FAA–NAC work associated with the NextGen Implementation Working Group (NIWG). Recommendations are expected out of these efforts later this year.

Question 4. In his testimony, Captain Beck of Alaska Airlines indicated that the FAA has not granted waivers for curved, GPS approaches to be considered "established" and eligible for the reduced separation between aircraft that creates efficiencies in the system. How long does it take to determine if a curved RNP approach can be "established" as on other, straight line approaches? Will you work to resolve this issue with Alaska Airlines?

Answer. The FAA has and is currently working with Alaska Airlines, as well as a consortium of additional stakeholders including Horizon Air, Southwest Airlines, Delta Airlines, the SEA Airport Authority, the Boeing Company, local ATC, NATCA, and other industry players regarding the approval of Established on RNP (EoR) concept with specially designed instrument approach procedures into Seattle-Tacoma International Airport.

The EoR concept is based on the utilization of aircraft navigation systems to achieve a specific level of positional accuracy and systems integrity to support a next generation type of reduced separation in the terminal airspace. These EoR approaches leverage the required navigational performance (RNP) found in modern aircraft avionics as a basis for relieving the standard separation standards currently mandated by FAA guidance between simultaneous approaches.

Initial RNP EoR Approach designs were created in a highly collaborative environment of stakeholders through the use of various subject matter experts and standard Performance Based Navigation (PBN) procedure development processes. An Environmental Assessment of the applicable geographic communities was conducted with flight trials and other analysis for the subject RNP EoR approaches and the findings were released to the public. The Boeing Company, in conjunction with FAA and Industry stakeholders, drafted a concept of operations document and performed a detailed safety analysis of the proposed EoR operation. The findings of both reports were utilized to validate the initial SEA EoR approach designs, and as a basis of the Safety Risk Management panel and subsequent documents that lead to the initial draft of the EoR operational Waiver request.

The FAA's Flight Standards division also conducted Human in The Loop Simulations (HITLS) of the EoR approach into SEA and recommended further considerations for maintaining the desired level of safety. These recommendations are currently being amended into an updated version of the SEA EoR waiver request to be vetted by stakeholders for concurrence and approval.

In addition, final changes to the initial RNP EoR approach designs initiated by industry stakeholders, are scheduled to be published and available for use in November of 2014. As the FAA waiver approval process proceeds, operator and ATC readiness begins to ramp up with the necessary updates to system infrastructure and training required for successful implementation and utilization of EoR. The overarching EoR plan of execution was created in a highly collaborative environment with all stakeholders, including Alaska Airlines. This continued collaboration is progressing through regular meetings on a basis of no less than every two weeks working towards a goal of an ATC waiver approval and begin operational validation in the spring of 2015.

Question 5. Performance Based Navigation procedures enable planes to fly more closely together and on more direct routes, which lead to fewer delays, shorter flight times, and reduced fuel consumption. Despite these potential benefits, airlines and industry stakeholders in the past have raised concerns about the use of Performance Based Navigation (PBN) procedures being developed. What steps is FAA taking to increase usage of existing procedures with respect to updating policies and proce-

dures, and providing training, tools and incentives for controllers to use these procedures whenever possible for properly equipped aircraft?

Answer. While airlines and industry stakeholders may express concerns about the use of PBN procedures, they are actually used thousands of times each day. For example, in Atlanta the daily PBN procedure utilization rate during December 2013 averaged more than 1,500 operations, which accounts for more than 68 percent of all IFR operations. Another example is Chicago. The utilization rate at Chicago Midway fluctuates based on runway use, but in June 2013, the RNP approach to runway 13C was used by 73 percent of the candidate aircraft. This procedure was designed specifically to de-conflict traffic from the adjacent Chicago O'Hare airport during certain weather conditions and runway configurations. In Seattle, of the seven STARs at Seattle-Tacoma International Airport only two are PBN procedures. However, more than 42 percent of all aircraft arriving in Seattle are already using these two new procedures. Usage of non-PBN procedures has been declining while use of PBN procedures is slowly increasing as pilots and controllers become for comfortable.

The FAA has been working diligently to provide the guidance and tools controllers will need to increase utilization of PBN in the NAS. The FAA has recently implemented the PBN Implementation Process Order which provides the policy and guidance necessary for proper management, development, and maintenance of PBN procedures in the NAS. In the months leading up to the April 2014 implementation of the Climb/Descend Via phraseology, the FAA provided training to establish or reinforce more consistent use of efficient flight profiles. The FAA has been working to not only provide more training, but to also improve the standardized utilization of decision support tools that should facilitate increased utilization of PBN procedures in the NAS.

Currently, one of the largest barriers to the consistent utilization of PBN procedures is the mixed equipage of aircraft using the National Airspace System (NAS). Mixed equipage refers to the capabilities of individual aircraft in the NAS—meaning certain aircraft are not equipped to leverage the PBN infrastructure that is in place, while others are equipped for full utilization. To address the need to manage the myriad aircraft configurations operating in the NAS, the FAA is revamping adaptation and training for the existing Time-based Flow Management (TBFM) system and working to implement the Terminal Spacing and Sequencing (TSS) tool. By creating a national training course to standardize the utilization of TBFM, increase utilization of TBFM, and implement TSS; the FAA expects to enable higher utilization of RNP procedures at high volume airports.

Question 6. In the 1990s the FAA's Advanced Automation System procurement failed, at a cost of over $5 billion, with relatively little to show for that investment. As we approach that $5.9 billion investment in NextGen, how are you avoiding the problems that derailed that program in the 90s?

Answer. Lessons learned from major program failure led to sweeping changes in the FAA's acquisition management process. Most recently, in 2011, the FAA established the Program Management Organization (PMO) to manage NAS system acquisitions and ensure stronger discipline in managing the dependencies among the major programs.

The PMO structure ensures greater visibility, tighter alignment and closer integration of complex, interdependent NextGen initiatives and innovative technology. The PMO plays a critical role in the success of NextGen by acting as the bridge between strategic requirements and tactical program implementation to improve the safety and efficiency of the NAS.

The PMO has instituted bi-weekly reviews of its major acquisitions and activities, with a specific focus on risks, issues and opportunities related to system interdependencies. These reviews, with participation from executives at the director level and above across NextGen, Finance, and ATO operations, have proven extremely valuable to executive stakeholders charged with overseeing the success of NextGen.

We have utilized lessons learned from troubled programs (for example, En Route Automation Modernization or ERAM) to improve how programs are structured and how systems are implemented. These areas include program governance; communications improvements; testing processes; requirements management; risk management; and maintenance transition planning. These lessons learned and process improvements will inform a program throughout its lifecycle.

Lastly, recognizing the importance of obtaining input from users of the system early in the pre-implementation phase of programs is critical. The scope of controller and maintenance technician involvement covers a range of activities including: development of operational concepts, human in the loop simulations, and evaluation of operational prototypes. This helps to reduce risk prior to full deployment of a sys-

tem, by providing early user involvement as we mature operational capabilities and assess operational suitability of systems.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. AMY KLOBUCHAR TO HON. MICHAEL G. WHITAKER

Question. For decades the FAA Airports Division has addressed residents' concerns about airport compliance with environmental regulations using a framework that provides for collaboration and the consideration of stakeholder concerns. However, recent experiences at the Minneapolis-St. Paul International (MSP) Airport during the proposed plan for RNAV implementation suggest there is some misalignment between local expectations of the process for new projects and the FAA's processes for addressing community concerns.

Mr. Whitaker, can you talk about the FAA's role when it comes to public outreach and the way the FAA involves stakeholders including operators and communities? How does the agency intend to address public concerns moving forward in a manner considerate of precedent and local expectations surrounding the design and environmental review of NextGen aircraft procedures? Will you commit to working with the communities surrounding airports, such as the Twin Cities metro area?

Answer. The FAA conducts public outreach and coordination with stakeholders for airspace actions, in strict accordance with agency directives and procedures. Any airspace actions that are not categorically excluded from requiring an Environmental Assessment (EA) or Environmental Impact Statement (EIS) per the National Environmental Policy Act (NEPA) typically involves conducting public workshops, and soliciting public comments on draft EA and EIS documents. Associated public outreach activities includes publishing notices in newspapers, direct solicitation for comments from impacted stakeholders, and presenting briefings to stakeholder organizations.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. MARIA CANTWELL TO GARY BECK

Question. Low usage of Performance Based Navigation procedures may also be related to whether a given procedure provides real benefits to airlines. In your experience does the FAA development of new PBN procedures properly and proactively identify, develop, and implement the most useful new routes?

Answer. Over the past ten years, the FAA has had a process for developing Area Navigation (RNAV) Arrivals that included industry involvement. While progress was made at some airports, the procedures often failed when it came time for implementation. This has been due to a variety of reasons ranging from aircraft technology, pilot and controller situational bias, airspace boundary constraints, and length of time from initial design to publication.

Initially, FAA's Required Navigation Performance (RNP) approaches were developed and published with a focus on quantity, not quality. Many are simply an overlay of an existing conventional approach procedure, without providing safety, access, or operational efficiency enhancements. RNP approaches must be requested by the pilot; as such, crews are reluctant to request them and controllers are reluctant to issue them. Therefore, many RNP approaches have been published, but very few have been implemented and used.

With initiatives in the National Airspace System like Metroplex, Greener Skies, and Portland, Oregon, PBN implementation, the process has become more streamlined and inclusive. We are seeing a collaborative effort that includes a broader group of key stakeholders including FAA, Labor, Airports, Community, and Industry. Having many diverse viewpoints working toward the same goal of improving airspace safety and efficiency is proving to be a success. Low usage should be a thing of the past especially with regard to Standard Arrivals because most of the industry is equipped and trained. RNP usage should increase as equipage and training increase.

There are still challenges in this effort, but Alaska Airlines believes the FAA is on the right track. The new PBN Order that was published earlier this year, as well as the RTCA PBN Blueprint Task Group's efforts, will bring even more clarity to the process and ensure that airspace changes have a measurable benefit. Building on a process that began July 2013 at the request of the FAA, the Industry and FAA have come together to form the NextGen Integration Working Group (NTWG) under the NextGen Advisory Committee (NAC). With over one hundred representatives from all sectors of aviation, the group has been conducting deep dives of four focus areas to identify what it takes to deploy meaningful capabilities at specific sites.

The NTWG most recently met in July 2014 to receive reports on the progress being made with the four teams: Performance Based Navigation (PBN), Surface and Data Sharing, Closely Spaced Parallel Runways and DataComm-enabled Controller-Pilot DataLink Communications (CPDLC) and pre-departure clearances. The goal of the NTWG is to provide the NAC with an integrated implementation plan and recommendations for tangible benefits at the October 8, 2014, NAC meeting.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. AMY KLOBUCHAR TO GARY BECK

Question. For decades the FAA Airports Division has addressed residents' concerns about airport compliance with environmental regulations using a framework that provides for collaboration and the consideration of stakeholder concerns. However, recent experiences at the Minneapolis-St. Paul International (MSP) Airport during the proposed plan for RNAV implementation suggest there is some misalignment between local expectations of the process for new projects and the FAA's processes for addressing community concerns.

Mr. Beck, you dealt with this issue in Seattle. How important is community outreach to the success of deploying NextGen in a way that works for the community?

Answer. Community engagement through close partnerships with the airport authority is critical to successfully implementing airspace changes. The Port of Seattle, operator of Sea-Tac Airport, was a key partner in the Greener Skies project. Due to the relationships the Port already had with local communities, they were able to start engaging local leaders early in the project with the facts about what was planned and what we expected the benefits to be.

The Port shared existing noise abatement corridors and local noise concerns with the rest of the project team, ensuring new procedure designs remained within the pre-defined corridors. Even when flight paths over the ground didn't change, media coverage of Greener Skies resulted in a perception from some neighborhoods that there had been a change. The Environmental Assessment process was thorough, providing detailed information about the project impacts to the public. Being transparent with the data was helpful. Community meetings at local schools and city halls allowed citizens and local elected officials to learn about the project and share their perspective.

○

This page intentionally left blank.

This page intentionally left blank.

This page intentionally left blank.