



**Federal Aviation
Administration**

Next**GEN**

NextGen Update: 2014

From the Administrator

August 2014

Dear Members of the Aviation Community:



NextGen is happening now. And it's making a difference.

NextGen gives pilots and controllers more flexibility at Atlanta, allowing for tighter headings. That's as many as a half dozen more planes per hour, depending on weather. That saves up to 4,000 hours of tarmac time waiting to take off. At an airport that handles 45 million travelers a year — 85 people every minute, every hour, every day — that's huge savings, especially if you're a passenger waiting for takeoff.

NextGen has reduced wake-based separation standards for arrivals at seven major airports: Boston, St. Louis, Philadelphia, Newark, San Francisco, Memphis and Seattle. That pays off in fewer delays and decreased fuel burn. At Louisville, UPS saves 7,761 gallons of fuel on arrivals every night. At Memphis, the new standards translate to an additional nine flight operations per hour for FedEx, a savings of \$1.8 million per month.

NextGen has streamlined flight paths that crisscross between adjacent airports, big and small. Las Vegas is America's eighth busiest airport, and just 13 miles from it is Henderson Executive Airport. NextGen's satellite-based navigation now lets them operate seamlessly. Flights there run simultaneously with safe separation, saving each flight 10 minutes in the air. Again, less time means less fuel.

NextGen reduces congestion in busy metro areas with a plan called Metroplex. These are special procedures that allow aircraft to maximize routes and avoid fuel-burning turns that add up to millions of dollars. Metroplex is under way in Houston and north Texas, northern and southern California, Atlanta, Charlotte, N.C., and Washington, D.C. Here in the nation's capital, airlines flying into the metro area have already started using some of these NextGen procedures. We estimate they will save \$2.3 million in fuel per year and cut aircraft exhaust emissions by 7,300 metric tons.

NextGen is indeed happening now and will benefit from the leadership of Deputy Administrator Michael Whitaker, our Chief NextGen Officer (CNO), who joined us in June 2013. He is a seasoned aviation executive with extensive business, regulatory, legal and international experience who will move NextGen from completion of foundational technologies to the next phase of benefits. His [2014 CNO report to Congress](#) is available for download from the NextGen website.

The baseline ground infrastructure is complete for Automatic Dependent Surveillance–Broadcast. More than half of the country is directing air traffic with the platform for a modernized system, the En Route Automation Modernization system. It's faster, safer and more flexible. Things well beyond the vision of the Wright brothers — unmanned aircraft systems and commercial space travel — will benefit from an airspace system that is capable of handling even the most dynamic of changes. Think NextGen. Thank NextGen.

The numbers speak to what makes this report so compelling. NextGen is the future. This *NextGen Update: 2014* shows how that future is unfolding every day.



Michael P. Huerta
Administrator

WHY NEXTGEN MATTERS



The movement to the next generation of aviation is being enabled by a shift to smarter, satellite-based and digital technologies and new procedures that combine to make air travel more convenient, predictable and environmentally friendly.

As the nation's largest airports continue to experience congestion, NextGen improvements are enabling the FAA to guide and track aircraft more precisely on more direct routes. NextGen efficiency enhances safety, reduces delays, saves fuel and reduces aircraft exhaust emissions. NextGen is also vital to preserving aviation's significant contributions to our national economy.

NEXTGEN PROVIDES A BETTER TRAVEL EXPERIENCE

- NextGen means less time sitting on the ground and holding in the air. NextGen technology and procedures are shaving crucial minutes off flight times, which translate into money saved and a better overall experience for the traveling public and aviation community.
- NextGen enables the sharing of real-time data about weather, the location of aircraft and vehicles, and conditions throughout the National Airspace System. We get the right information to the right people at the right time, helping controllers and operators make better decisions and improve on-time performance.
- NextGen is better for the environment. Flying is becoming quieter, cleaner and more fuel-efficient. Operators are beginning to use alternative fuels and new equipment and procedures, reducing aviation's adverse impact on the environment. More precise flight paths are also helping limit the number of people impacted by aircraft noise.

NEXTGEN PRESERVES AVIATION'S ECONOMIC VITALITY

- Our nation's economy depends on aviation. NextGen capabilities in place today are the foundation for continually improving and accommodating future air transportation needs while strengthening the economy locally and nationally with one seamless, global sky.
- Airports are economic engines for the communities they serve, bringing visitors and commerce. NextGen is providing increased access, predictability and reliability, enhancing airport operations across the country.

NEXTGEN ENHANCES SAFETY

- The FAA's top priority is ensuring safe skies and airfields, and NextGen innovation and improvements are delivering just that. NextGen is providing air traffic controllers and pilots with the tools to proactively identify and mitigate issues associated with weather and other hazards.
- NextGen enables us to better meet our national security needs and ensure that travelers benefit from the highest levels of safety.

TABLE OF CONTENTS



5	INTRODUCTION
6	PERFORMANCE BASED NAVIGATION
10	METROPLEX ADVANCES
11	AUTOMATIC DEPENDENT SURVEILLANCE- BROADCAST
13	CONTINUING BENEFITS: NEW NEXTGEN TOOLS EMERGING
16	OPERATIONAL TOOLS FOR CONTROLLERS
18	ENHANCING SAFETY
19	PAINTING THE NAS GREEN
20	COLLABORATION: CRUCIAL TO NEXTGEN SUCCESS
24	ACRONYMS

PHOTO CREDITS

Page 2: Courtesy of FAA
Page 3: Pincasso ©2014, used under license from Shutterstock, Inc.
Page 4: Photo ©2013, used under license from Shutterstock, Inc.
Page 5: twobee ©2014, used under license from Shutterstock, Inc.
Page 6: Luis Viegas ©2012, used under license from Shutterstock, Inc.
Page 11: am70©2014, used under license from Shutterstock, Inc.
Page 12: Courtesy of FAA
Page 13: Courtesy of FAA
Page 14: Courtesy of FAA
Page 16: Courtesy of FAA
Page 17: Courtesy of FAA
Page 18: Courtesy of FAA
Page 19: ©2012, used under license from Shutterstock, Inc.
Page 21: Courtesy of International Civil Aviation Organization



INTRODUCTION

The Next Generation Air Transportation System (NextGen) continues to make great strides in transforming the National Airspace System (NAS) and delivering the benefits of satellite-based technology and procedures and new air traffic management tools. Current users of NextGen capabilities are realizing a return on their investment in time and fuel savings, and a reduction in aircraft exhaust emissions. They know NextGen delivers.

Budget and staff cuts resulting from the fiscal year 2013 sequestration have led to delays in several important programs, but the FAA continues to move NextGen forward and deliver benefits to airports and operators at home and abroad.

By the end of fiscal year 2015, the FAA will mark a pivotal milestone. We expect to complete our first set of operational improvements, establishing NextGen's foundational infrastructure. This build-out adds potential that does not exist today, making it possible for NextGen to be available gate-to-gate nationwide.

Like an iPad, this platform will enable us to run new apps — new air traffic capabilities. We have already deployed some capabilities while others are in the testing phase. Still others are in the research pipeline at the William J. Hughes Technical Center in Atlantic City, N.J.

In 2015, we will begin to see dramatic results as different NextGen components come together to provide new functionality.



NEXTGEN UPDATE: 2014



PERFORMANCE BASED NAVIGATION

Performance Based Navigation ([PBN](#)) capability has led to efficient airspace redesign, new routes and procedures throughout the NAS. PBN is yielding benefits in all phases of flight, including more direct flight paths, fuel and aircraft exhaust emissions savings and increased safety.

There are several types of PBN, including Area Navigation (RNAV) and Required Navigation Performance (RNP).

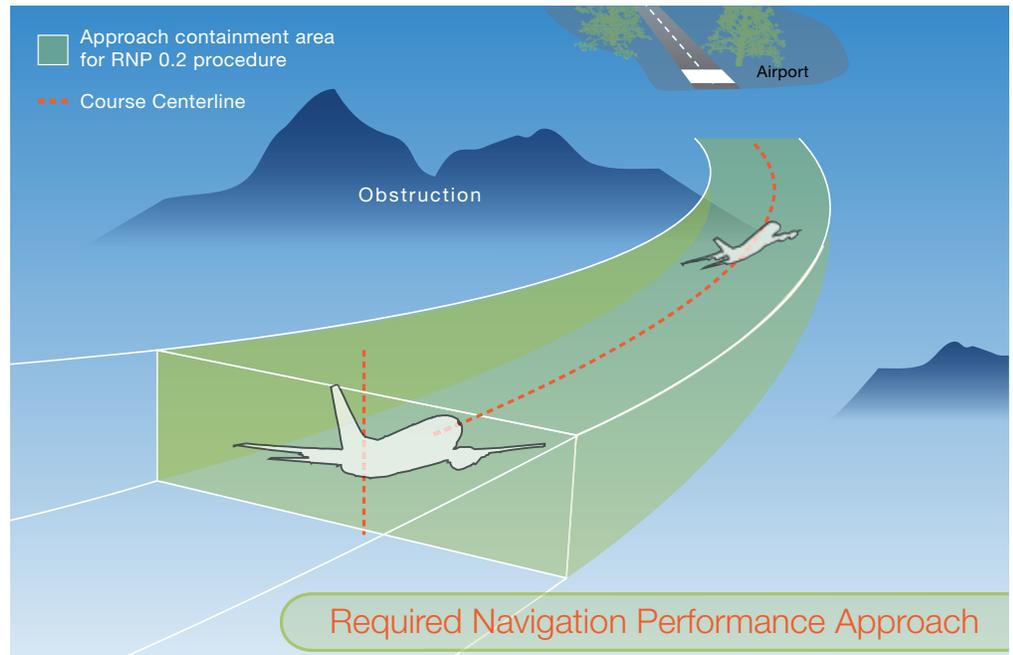
- RNAV enables an aircraft to operate on any flight path within coverage of ground- or space-based navigation aids, or a combination of both. RNAV is the broadest category and requires lower levels of navigation performance.
- An RNP procedure requires specific aircraft navigation accuracy. An “RNP 0.3” procedure requires avionics that enable the aircraft to fly within 0.3 nautical miles (nm) of the approach path’s centerline — comparable to an automobile staying within its highway lane.
- RNP Authorization Required requires the highest level of navigation performance, down to 0.1 nm accuracy.

The FAA is steadily deploying more PBN procedures for departures, high- and low-altitude routings, arrivals and approaches. New procedures often incorporate Optimized Profile Descent (OPD).

As of May 2014, the FAA had implemented more than 7,000 PBN procedures and routes that take advantage of satellite navigation. This includes:

- 686 of the most advanced type of approaches, RNP approaches, for commercial operators.
- 723 RNAV Standard Terminal Arrival (STAR) and RNAV Standard Instrument Departure (SID) routes, which improve efficiency in busy terminal airspace for commercial operators.
- More than 3,400 vertically guided approaches in the United States that improve safety and access at more than 1,600 airports. More than 65,000 aircraft of all types use the Wide Area Augmentation System and 55 percent of commercial aircraft are approved to use barometric vertical navigation.

- 114 new routes in the high-altitude airspace (Q-Routes) used by jets and another 100 low altitude routes (T-Routes) for general aviation



Required Navigation Performance refers to the degree of navigation precision required to fly the course. An RNP value of 0.2 means onboard avionics equipment must be capable of keeping the aircraft within 0.2 nm of the centerline of the approach path.

Download [NextGen Works for General Aviation](#) to learn more about how NextGen is benefitting the general aviation community.

The remaining PBN procedures are various types of approaches that ensure basic access to the nation’s airports.

PBN BENEFITS

US Airways Captain Brian Townsend was a member of the metroplex team involved in planning and implementing new procedures in Washington, D.C.

On a flight from Phoenix in summer 2013, Townsend flew the FRDMM (for Freedom) [OPD STAR](#) into Washington Reagan. The flight marked the first anniversary of the implementation of OPDs in the Washington metroplex and provided the airline’s chief executive officer and president their first experience with a continuous descent.

As Townsend began his descent at 37,000 feet about 155 nm out, he pulled back the throttles with

1,493 gallons of fuel onboard. About 27 minutes later, the Airbus A320 cleared the runway with 1,343 gallons remaining — a total fuel burn of 194 gallons. This compares with an average burn of 269 gallons or more.

“That was significant to me,” Townsend said.

Airlines using NextGen procedures at Washington, D.C., airports are expected to save 2.3 million gallons of fuel per year and cut aircraft exhaust emissions by 7,300 metric tons.

Communications are reduced as well, as there is no need to request, receive and confirm clearances to level-off altitudes in the traditional step-down approach. The procedures also work as effective air traffic management tools for controllers.

Townsend noted how opinions have changed about the procedures. At first he was told, “You can’t do that. It’s too complex an operation.”

“Today, it’s the norm,” Townsend said.

That norm is also in Atlanta where new departure routings have reduced aircraft separations, resulting in an increase of as many as a half dozen more departures per hour, depending on weather. The FAA estimates this will save airlines \$9.1 million annually. Over the ocean, NextGen technologies are helping the FAA control 24 million square miles of airspace. The FAA’s upgrades to the Advanced Technologies and Ocean Procedures (ATOP) system with NextGen

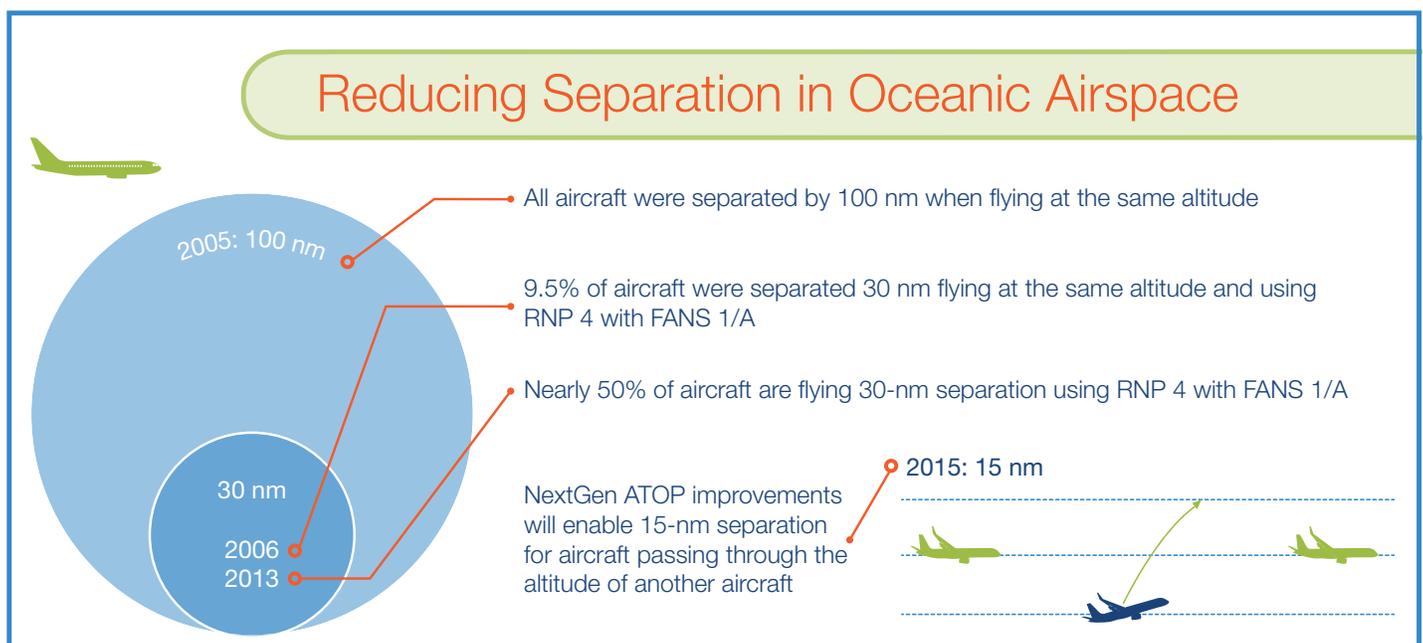
technologies are key to implementing PBN procedures in oceanic airspace that is controlled at New York; Anchorage, Alaska; and Oakland, Calif. ATOP provides controllers with information on each aircraft’s operational capability, its exact location, its intended flight path and any potential conflicts up to 2 hours into the future.

ATOP also gives pilots flexibility to sidestep prescribed oceanic flight “lanes” and fly customized, user-preferred routes and altitudes.

We are also developing a NextGen capability known as In-Trail Procedures (ITP) that will give properly equipped aircraft a better opportunity to change altitude in oceanic airspace. Delta Air Lines, which participated in a yearlong ITP trial over the Atlantic Ocean that concluded in December 2013, is a fan of ITP’s potential. Delta equipped three Boeing 767 Extended Range aircraft for the effort.

“It’s an excellent situational awareness tool,” Delta chief technical pilot Mark Bradley said.

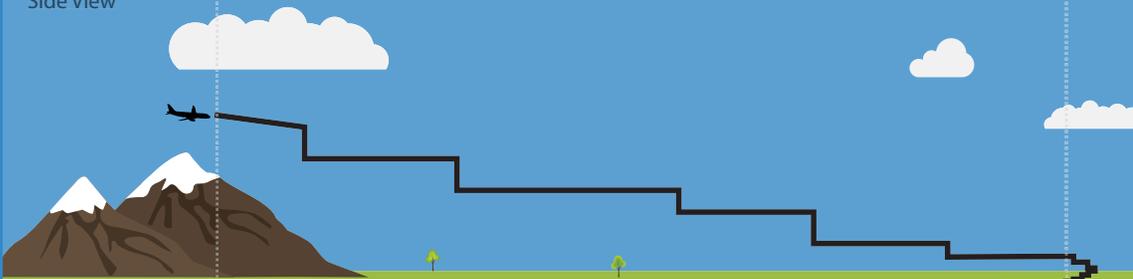
NextGen procedures allow aircraft to climb or descend past each other in as little as 15 nm. This compares to the normal 30-100 nm between aircraft. The upgrades give pilots the flexibility to reach higher altitudes where lower temperatures reduce jet engine fuel burn. The upgrades also allow the flexibility to fly at altitudes with more favorable winds and to avoid turbulence.



PBN Arrival Benefits

Before NextGen:

Side View



To keep aircraft safely separated, controllers direct pilots to descend to lower altitudes as they approach the airport.

Top View



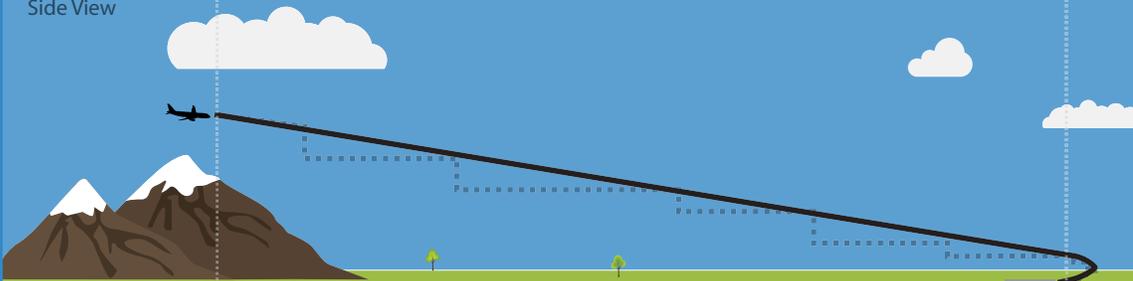
At the same time, controllers direct pilots to make course corrections to merge with traffic.

After NextGen:

130 nautical miles

Not to Scale

Side View



With no loss of safety, controllers direct pilots to follow a more precise, predictable route.

Top View



The route is also set horizontally. Every plane must navigate within the set boundaries of that path.

In this PBN illustration, an RNAV STAR procedure begins 130 nm away from the airport. As an aircraft nears the airport, an RNP procedure with a curved approach continues the smooth descent. Pilots and controllers do not need to interact frequently, so they can put more focus on safety. An aircraft descends with reduced power, so fuel burn is reduced. The pilot does not have to fire up engines to level off frequently, so aircraft exhaust emissions are reduced.

METROPLEX ADVANCES

The FAA has identified 14 metroplexes in the NAS where NextGen can offer the greatest operational improvements. **Metroplexes** are complex, congested swaths of metropolitan airspace that include several major and reliever airports. The Washington, D.C., metroplex, for example, comprises three major airports — Reagan, Dulles and Baltimore-Washington — and 15 reliever airports.

Metroplex design is a formidable undertaking. Sequestration and the 2013 government shutdown have caused some uncertainty about when the agency will deliver tangible benefits to users. But uncertainty did not end a critical component of Metroplex success: the collaboration and input of expertise of all users of the airspace.

Starting with a study phase, the FAA reaches out to airports, airlines, airspace users and stakeholders to determine airspace operational needs and community concerns. Those needs differ among the varied operations of major hubs, reliever airports and military air bases.

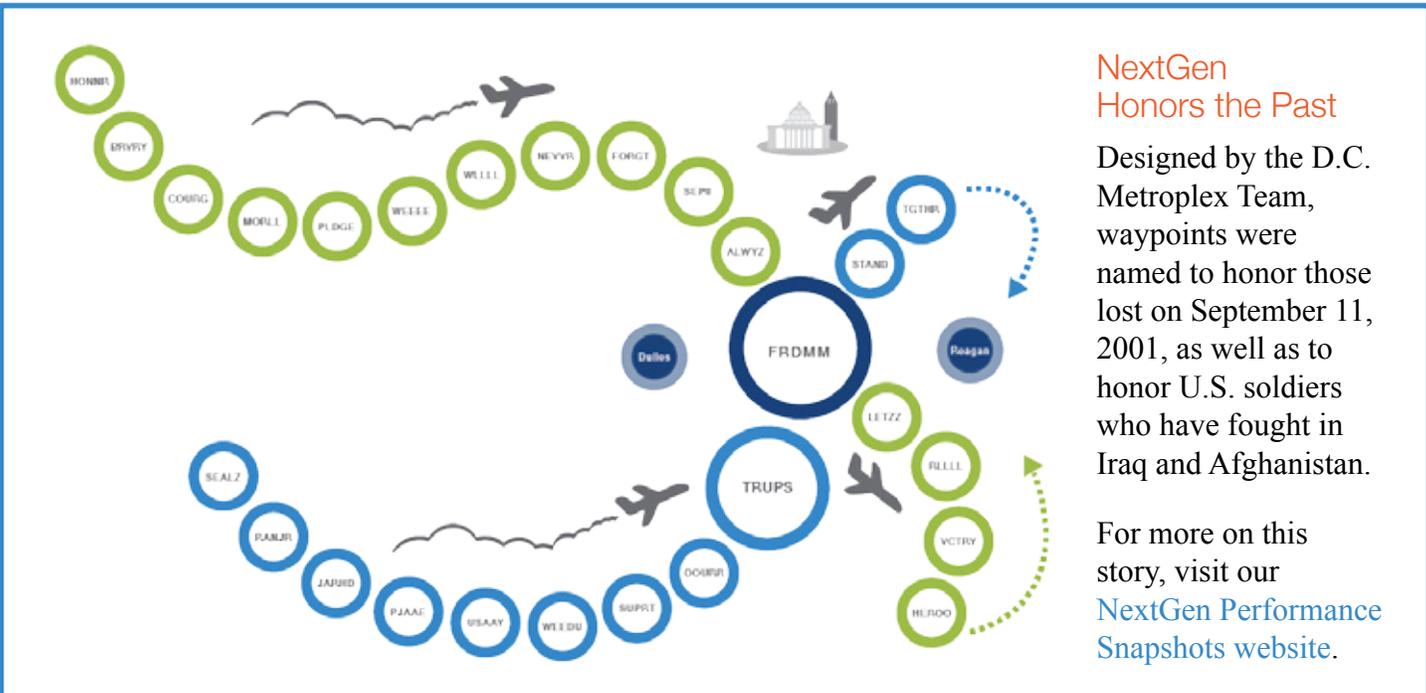
After the study phase, Metroplex moves through a design and procedures development phase followed by operational and environmental assessment reviews, then an implementation and training phase.

During this period of about 3 years, extensive simulations, analysis and industry participation are crucial to successful procedures development. Maintaining safe operations is the number one priority.

In 2013, the FAA updated three RNAV OPD STARs that were implemented at Dulles and Reagan airports in 2012. Post-implementation analysis of the OPD STARs showed an estimated annual benefit to airspace users of \$2.3 million in fuel savings.

In 2013, employee furloughs and travel budget restrictions resulted in some Metroplex program delays and departure from planned timetables. In the Southern California metroplex, the October 2013 government shutdown slipped the design completion phase about a month from January to February 2014, and delayed completion of the metroplex implementation phase from August to September 2016.

Metroplex met with additional challenges due to delays in implementing En Route Automation Modernization (ERAM). The new computer platform is required for NextGen operations in high-altitude airspace.



The diagram illustrates the Washington, D.C. Metroplex. It features a central hub labeled 'FRDMM' (Ronald Reagan Washington National Airport) and 'TRUPS' (Dulles International Airport). Surrounding these hubs are numerous waypoints, each represented by a circle containing an alphanumeric code. The waypoints are arranged in a roughly circular pattern around the central hubs. Some waypoints are highlighted in green, while others are in blue. The diagram also includes icons of an airplane and the U.S. Capitol building. To the right of the diagram, there is a text box with a title and a paragraph, and a link to a website.

NextGen Honors the Past

Designed by the D.C. Metroplex Team, waypoints were named to honor those lost on September 11, 2001, as well as to honor U.S. soldiers who have fought in Iraq and Afghanistan.

For more on this story, visit our [NextGen Performance Snapshots website](#).

The sequester significantly impacted our ERAM deployment schedule, resulting in about a 7-month delay for the final site operational transition. The Metroplex program follows this deployment schedule to avoid redoing much of the work for automation adaptation and training and further delaying both programs.

As ERAM is the linchpin of many NextGen benefits, the FAA considers its deployment the highest priority. Delays in our Metroplex activities range from 5-17 months based on the particular site and its interdependence with ERAM restarts after sequestration.

AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST

Automatic Dependent Surveillance–Broadcast (ADS-B) is crucial to the transformation of the NAS from a radar- to satellite-based system. ADS-B uses GPS signals to determine an aircraft's location.

ADS-B has two main functions: ADS-B Out and ADS-B In.

- As the name implies, an aircraft equipped with ADS-B Out avionics is able to transmit its position, airspeed information and other data directly to other properly equipped aircraft and to ground receivers. These ground stations relay the information to controllers and other aircraft equipped with ADS-B In.
- ADS-B In refers to an aircraft's capability to receive data from ground stations and other ADS-B-equipped aircraft, as well as flight advisories and real-time weather information. Commercial aircraft can benefit from advanced

ADS-B In air navigation applications, such as interval management. With interval management, airspace and runway capacity and aircraft fuel efficiency are increased. Controller and flight deck tools help achieve and maintain desired aircraft spacing, increasing capacity along a route or approach path to a runway. The increased accuracy of ADS-B velocity information also improves the FAA ground automation's trajectory predictions, which are used to schedule aircraft arrival times at airspace fixes.

The FAA completed baseline deployment of 634 ground stations in March 2014. As of June 2014,

ADS-B had been integrated into the automation platforms at 17 en route air traffic control facilities, which control high-altitude traffic.

Aircraft operating in most controlled U.S. airspace must install ADS-B Out by January 1, 2020. This mandate ensures compatibility



ADS-B in the Gulf of Mexico enables controllers to track helicopter traffic in an area where radar surveillance is unavailable.

of aircraft operating in the NAS, which will enable users to reap the benefits of ADS-B. In response to the FAA Modernization and Reform Act of 2012, the FAA continues to consider rulemaking to mandate equipage with ADS-B In avionics.

BENEFITS OF ADS-B

ADS-B deployments are already providing operational benefits in places like Alaska and Louisville, Ky. As part of its nationwide rollout of ADS-B, the FAA deployed 12 ground stations on offshore oil platforms in the Gulf of Mexico. Coupled with nine ground stations along the U.S. Gulf Coast, the platform stations extend ADS-B coverage well into the Gulf.

JetBlue Airways has become a pioneer for airline use of ADS-B over the Gulf. Joe Bertapelle, the carrier's director of Strategic Airspace Programs, wanted to know: "What can NextGen do for JetBlue? What NextGen capability can I use to run my airline's schedule better?" Bertapelle saw possibilities in ADS-B and persuaded JetBlue to equip 35 of its Airbus A320s with it.

A September 2013 flight from Los Angeles to Fort Lauderdale, Fla., provided a test. A line of thunderstorms had formed on the west coast of Florida. The best route was over the Gulf. However, with no radar coverage over water, controllers could not normally track that route.

Without ADS-B the JetBlue flight would have been rerouted over the Florida Panhandle to get away from the storms and keep the A320 in radar range — adding 15 minutes to the trip, burning an extra 60 gallons of jet fuel and pumping aircraft exhaust emissions into the air.

With its new ADS-B capability, the flight was given the best route over the Gulf to avoid the storms, and controllers tracked the A320 the entire time. JetBlue created a template for future flights tracked primarily by ADS-B.

The FAA, in collaboration with Mexican Airspace Navigation Services, will soon fill a gap in ADS-B

coverage over the Gulf. Current ADS-B coverage stops about 200 nm short of the Yucatán Peninsula. That will change in September 2016 when the FAA will install three ground stations in Mexico.

The new ground stations in Mexico will benefit aircraft flying over the Gulf between the United States and the Yucatán Peninsula, making 5 nm separation of aircraft possible where 100 nm is now required.

The FAA estimates the expansion will result in nearly \$70 million in savings for operators because of increased flights over the Gulf along the U.S.-Mexican airspace boundary. Increased capacity will reduce delays during peak periods, saving aircraft direct operating costs and passenger time.



Joe Bertapelle, JetBlue's director of Strategic Airspace Programs, explains how NextGen helps his airline.

ADS-B can also provide unprecedented levels of situational awareness for general aviation pilots. In addition to receiving traffic information, general aviation aircraft equipped with Universal Access Transceivers (UAT) can receive and display weather and other aeronautical information from FAA broadcasts. This information will enhance pilots' situational awareness of in-flight hazards and help prevent accidents.

Detailed information on how NextGen is benefitting general aviation operators is available by downloading [NextGen Works for General Aviation](#).

CONTINUING BENEFITS NEW NEXTGEN TOOLS EMERGING

SWIM

System Wide Information Management (SWIM) is the data-sharing backbone of NextGen. Since 2010, SWIM has been distributing weather and flight planning information to NAS users, mainly to airline operations centers.

In September 2013, the FAA formally demonstrated Aircraft Access to SWIM (AAtS) at the agency's NextGen Florida Test Bed. AAtS will enable the transmission of real-time weather and traffic advisory information, such as pilot reports, Notices to Airmen and Aviation Meteorological Reports directly to the cockpit. It will provide flight crews operating properly equipped aircraft with the same information their dispatch centers receive. The data can be displayed on an electronic flight bag or some tablets. The agency plans to conduct a two-way AAtS demonstration in early 2015 and expects it to be available NAS-wide by 2020. The capability is expected to play a part in a "mini-global" demonstration also scheduled for 2014-2015, during which the FAA and international partners will showcase the ability to share real-time flight information worldwide.

The SWIM Terminal Data Distribution System (STDDS) takes raw surface data and converts it into easily accessible information. STDDS sends surface information from airport towers to the corresponding Terminal Radar Approach Control (TRACON) facility, which makes the information available via SWIM messaging services. Airlines and airports can use this information to streamline surface operations and increase efficiency.

In August 2013, Miami TRACON became the first facility to begin distributing data from the towers included in its coverage area to an airline via STDDS. Ultimately, 136 airports will provide surface information via STDDS at 39 TRACONs to users via SWIM services.

STDDS will also provide surface data to the Traffic Flow Management System (TFMS) so it can better calculate end-to-end trajectories. TFMS is used by

controllers to balance traffic demands with capacity across the entire NAS.

Establishing protocols and standards is vital to SWIM's effectiveness — and the FAA continues to collaborate with other agencies and countries to do just that. Messaging standards for SWIM's Publish/Subscribe and Web services have been established. Initial implementation of several core information models is under way, including the Aeronautical Information Exchange Model, Weather Information Exchange and the Flight Information Exchange Model (FIXM).



By March 2015, ERAM is expected to be operational at all 20 U.S. en route centers.

FIXM was developed in collaboration with international partners to serve as a global standard for sharing data about flights throughout their life cycle. Partners include Airservices Australia, Eurocontrol, NavCanada and the International Air Transport Association. The International Civil Aviation Organization identified the requirements for FIXM and endorsed it as part of the [Global Air Navigation Plan's](#) Aviation System Block Upgrades of air traffic management capabilities.

The FAA is planning to unveil several new SWIM capabilities by FY 2015, including:

- **Flow Information Publication:** This capability provides subscribers with access to traffic flow information.

- **Flight Data Publication Service:** This capability ensures the consistency of flight data accessed by subscribers. It also provides airspace data, operational data and general information messages.

ERAM

ERAM is the next-generation computer system being deployed to the FAA's network of en route centers, which control high-altitude traffic. This scalable automation system serves as the platform upon which NextGen capabilities such as data sharing, digital communications and trajectory-based operations will reside.

In 2013, the FAA continued the rollout of ERAM with some delay caused by employee furloughs and travel budget restrictions. By the end of the summer, ERAM regained momentum with operational testing at Boston and Cleveland en route traffic control centers. These test runs evaluate the software application in a standard operating environment. The system was also commissioned at Indianapolis Center.



Digital Data Comm messages increase efficiency and reduce the opportunity for misunderstandings.

As of June 2014, 16 of 20 FAA en route centers were using ERAM on a continuous basis. The agency has completed installation and begun initial operations, called initial operating capability (IOC), at 18 facilities. The remaining two centers — Jacksonville and Atlanta — are expected to reach IOC before the end of fiscal year 2014. All centers are expected to be operating solely with ERAM by March 2015.

TAMR

The FAA also continued to make progress in 2013 with Terminal Automation Modernization and Replacement (**TAMR**), which helps increase efficiency by combining and upgrading several air traffic control (ATC) technologies into a single automation system called Standard Terminal Automation Replacement System (STARS).

This massive project, an upgrade of computer systems that manage the transitional airspace between cruise altitude and the airport, requires changing computer processor screens and software while retraining controllers at more than 150 facilities — all without disrupting service. The FAA expects the 11 TRACON facilities that process 80 percent of U.S. air traffic to have STARS by August 2016. Full deployment is expected by February 2020.

DATA COMM

Today, controllers and pilots communicate verbally using analog radios. The use of voice communication is labor intensive, time consuming and limits the ability of the NAS to effectively meet future traffic demand.

Data Communications (**Data Comm**) will change this by allowing controllers and pilots to communicate with digitally delivered messages. With the push of a button, controllers will be able to send routine instructions, such as revised departure clearances (DCL) and weather-avoiding reroutes, via electronic messages directly to the flight deck.

Messages appear only on the cockpit display of the aircraft to which they apply, reducing the potential for miscommunication that can occur from voice radio exchanges.

Services to be provided by Data Comm are conservatively estimated to save operators more than \$10 billion over the 30-year life cycle of the program and result in future FAA savings of approximately \$1 billion in operating costs.

The software and hardware enhancements to ERAM and Tower Data Link System (TDLS), the platforms to support airport surface operations and aircraft activities near the airport, are well on their way to completion. The FAA is also moving forward with

planning and development of the en route phase of the program.

Both ERAM and TDLS are critical components of the Data Comm infrastructure, and necessary to the implementation of DCL services. ERAM modifications are also required to support data communications services in en route airspace. In 2014, we'll be integrating the various components of the Data Comm system at the FAA's William J. Hughes Technical Center in Atlantic City, N.J., and ensuring that they all work together as expected.

The FAA intends to finalize its development and deployment plans for en route capabilities by the end of calendar year 2014, while DCL services are expected to begin in 2016.

Data Comm Tower Trials

The FAA is conducting [trials](#) at Memphis and Newark towers to demonstrate Data Comm DCL services. The trials have provided invaluable feedback on the implementation of operational procedures, human-to-machine interface design and technical details that will reduce risk for the final system that will be deployed to ATC towers.

The first Data Comm tower trials began in January 2013 at Memphis with FedEx. Data Comm there is now in full operation and, as of June 2014, was supporting about 60-80 FedEx flights each day.

In April 2013, Data Comm began limited tower trials at Newark with United Airlines as our initial partner. With enthusiastic response from operators, Newark tower trials have expanded to include FedEx, UPS, British Airways and Lufthansa, and have been in full operation since April 2014.

The current program schedule provides for initial tower services to be implemented at 57 of the busiest airports starting in 2016. The second phase of the program will provide expanded Data Comm services into en route airspace beginning in 2019. Future capabilities will enable controllers to issue optimized arrival routes, holding instructions, advisory messages, speed and heading changes and transponder beacon codes.

Avionics Equipage Plans

The FAA awarded a multi-year Data Comm Integrated Services (DCIS) contract in September 2012. The 7-year contract, which can be renewed for as many as 10 additional years, provides the engineering support, communications infrastructure and avionics incentives necessary to enable Data Comm messaging and services.

To stimulate early use and adoption of Data Comm technology, the FAA is leveraging the DCIS contract to establish an avionics equipage incentive program for U.S. flag carriers. Incentives, available for a limited time starting in 2013, will equip aircraft with Future Air Navigation System 1/A (direct data link between pilot and controller) and VHF Data Link Mode 2 or Mode 0 avionics (data link between aircraft and ground stations) providing the foundation of aircraft equipage necessary for delivery of Data Comm services.

The incentive offer has been made available to all domestic carriers, and as of January 2014, seven air carriers had committed through memorandums of agreement to equip their aircraft with Data Comm avionics under the incentive program.

United Airlines was the first carrier to agree to equip its aircraft with Data Comm avionics under an incentive program. The commitment from all seven carriers covers equipage of 1,600 aircraft — 85 percent of the FAA's avionics equipage goal of 1,900 aircraft. United alone plans to equip nearly 400 aircraft over the next 6 years with avionics that will provide controller-pilot digital communications.

“We are excited to be at the forefront of this transition to a new era in air travel, which uses digital technology to improve airspace efficiencies, reduce emissions and save money,” said Howard Attarian, United's senior vice president of Flight Operations.

NVS

While Data Comm is changing the way we communicate with aircraft, NAS Voice System (NVS) will change how we communicate between facilities.

Today, voice switches operate independently at individual facilities. NVS, which takes advantage of modern router-based communications, will enable the FAA to route, monitor and share information among facilities across the country. It also gives the FAA increased flexibility to shift controller workload between facilities as needed. Pending available

resources, the FAA intends to begin deploying NVS at ATC facilities in the 2018-2019 timeframe.

NVS will also enable pilots of Unmanned Aircraft Systems (UAS) to communicate directly with controllers — a key requirement for integrating unmanned aircraft into the NAS.



NextGen and UAS

UASs aren't a part of NextGen, but NextGen technologies such as NVS will play a role in their safe integration into the NAS. Check out the FAA's [UAS Comprehensive Plan](#), mandated by the FAA Modernization and Reform Act of 2012, to learn how the agency will safely achieve NAS integration of UAS. More detailed information about our UAS integration plans can be found in the FAA [UAS Roadmap](#).

OPERATIONAL TOOLS FOR CONTROLLERS

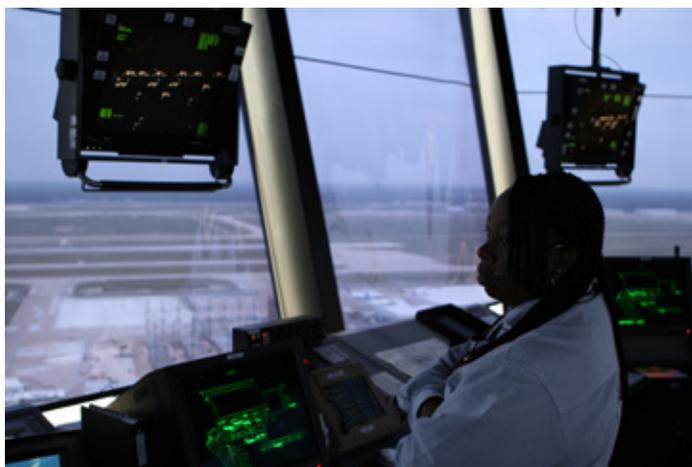
As we transform the NAS, we're also introducing a slew of new efficiency tools for controllers. These tools will reduce both controller and pilot workload. Operational improvements include Terminal Flight Data Manager (TFDM) and Time Based Flow Management (TBFM).

TFDM

TFDM is a scheduling tool that will provide controllers the capability to electronically process and distribute flight data to FAA air traffic facilities. This will foster greater efficiency for operations on the ground and in close proximity to the airport. TFDM will replace controllers' traditional paper flight strips with touch screens similar to those on smartphones and tablets. Controllers will be able to share necessary data with operators and the airport through TFDM. Initial deployment of electronic flight data capability is planned for the first airports in FY 2018.

TFDM will also integrate surface surveillance and flight data and provide a scheduler/sequencer capability that integrates TFDM with other traffic flow management tools. By sharing real-time and forecast flight operations information among controllers, airlines and airports, TFDM will improve traffic flow

and result in decreased taxi times, delays and missed connections. By combining a common situational awareness with collaborative decision-support tools, TFDM will help airlines, controllers and airports stage arrivals and departures more efficiently. Aircraft will also cut fuel burn and aircraft exhaust emissions at the airport.



TFDM will enable tower controllers, airlines and airports to more efficiently share information.

TFDM will provide an initial surface management capability at select airports and air traffic control facilities in FY 2016. In the meantime, we expect

to award an estimated 10-year TFDM development contract in April 2015 with plans for additional TFDM capabilities.

TBFM

TBFM is a scheduling tool that streamlines traffic flows by scheduling aircraft to arrive at a specific place at a specific time. This will help us line up planes so more aircraft can benefit from new NextGen procedures as they enter congested airspace. This tool will enable controllers to deliver a more consistent flow of traffic to the runway.

TBFM is an enhancement to today's Traffic Management Advisor at all 20 en route centers. Between 2016 and 2020, we will introduce new TBFM capabilities that will help pilots fly the most efficient route, reducing delays and fuel burn. One such forthcoming capability, Metering During Reroute

Operations, will more efficiently reroute aircraft in flight to avoid, for example, inclement weather.

In addition to scheduling tools TBFM and TFDM, the FAA is also focused on individualized controller tools. For example, the traffic flow tool Terminal Sequencing and Spacing (TSS) will enable controllers to routinely support PBN.

TSS provides decision support for the sequencing, spacing and merging of aircraft in terminal airspace by scheduling aircraft to cross strategic points along their arrival routes at designated times. This helps deliver a predictable and consistent flow of traffic that saves fuel and reduces aircraft exhaust emissions.

TSS is part of a TBFM work package for which we expect to award a contract in 2015 that will detail development plans.



TBFM will enable en route controllers to streamline airport arrivals.

ENHANCING SAFETY

Safety is integral to NextGen. The FAA uses a variety of methods to ensure the safety of the aviation system is enhanced as capacity and efficiency increase with NextGen implementation.

SYSTEM SAFETY MANAGEMENT TRANSFORMATION PROGRAM

The System Safety Management Transformation (SSMT) program collects data and provides modeling tools for risk assessment.

In 2013, SSMT studied whether Airport Surface Detection Equipment-Model X (ASDE-X) could be used effectively to confirm an aircraft had cleared the runway. ASDE-X is a surface surveillance tool that gathers data from multiple sources, including surface radar, to provide air traffic controllers with a detailed display of movement on runways and taxiways. The study evaluated more than 94,000 ASDE-X tracks of arriving aircraft throughout the NAS.

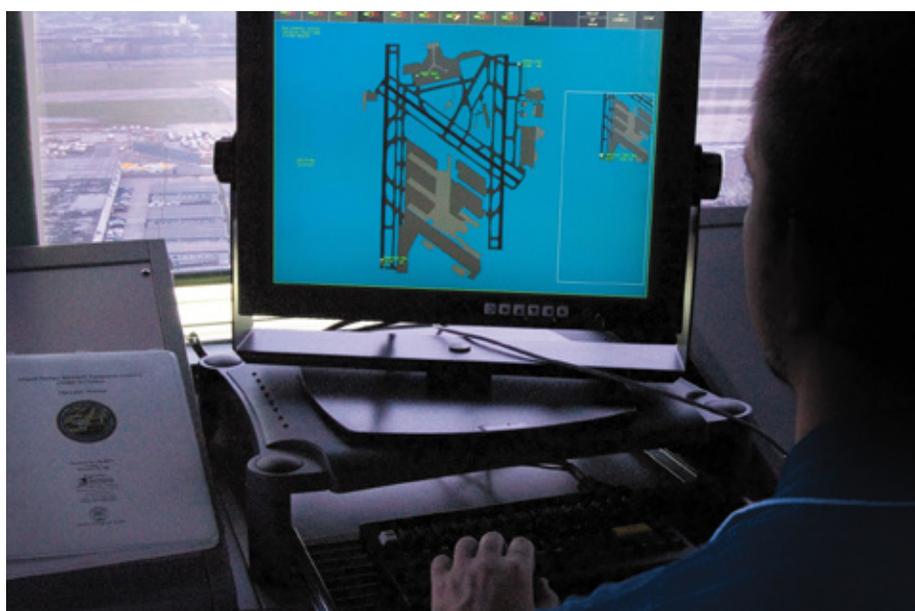
Other goals of SSMT in support of the safe implementation of NextGen are to identify and evaluate current and emerging system risks, enable analysis of NextGen system-wide safety impacts, enable what-if analysis of NextGen concepts and report safety and risk assessment projections aligned with the administrator's strategic vision for the agency.

AVIATION SAFETY INFORMATION ANALYSIS AND SHARING PROGRAM

The FAA's Aviation Safety Information Analysis and Sharing Program (ASIAS) studies data and information from 131 sources across the industry to identify precursors of accidents and mitigate safety risks before they happen. As of late February 2014, ASIAS had 46 airline members that contribute safety data. They represent 96 percent of commercial operations in the NAS.

ASIAS's rich data sources include the following safety programs:

- Flight Operations Quality Assurance programs, which collect flight recorder data from 24 operators
- Aviation Safety Action Partnership reports of safety risks from flight crews, maintenance and other employees from 40 operators
- Air Traffic Safety Action Program reports of potential safety risks from air traffic controllers



ASDE-X tracks airport surface movement and alerts controllers to potential safety hazards.

ASIAS continued its support of the FAA's airspace redesign, specifically Metroplex. ASIAS supported the Northern California, Phoenix and Florida metroplex design teams by identifying locations, or "hot spots," in the airspace where higher rates of Traffic Alert and Collision Avoidance System and Terrain Awareness and Warning System alerts occur.

In 2013, ASIAS conducted an in-depth study on Standard Terminal Arrival (STAR) operations and procedures that facilitate the transition of aircraft from high-altitude en route airspace to the airport terminal area. The study identified hot spots for STAR procedures. ASIAS also addresses the causes and

contributing factors for deviations related to ATC operations and procedure design.

Also in 2013, the ASIAs program welcomed its first general aviation members. As of June 2014, nine

business jet operators had joined the program. These additions will allow ASIAs to conduct safety analyses for the general aviation community similar to those conducted for the commercial operators.



As NextGen is implemented, the FAA evaluates plans, procedures and programs to enhance aviation safety.

PAINTING THE NAS GREEN

NextGen will accelerate efforts to improve aviation's environmental and energy performance to sustain growth and create opportunities for added capacity. A major NextGen initiative, Continuous Lower Energy Emissions and Noise (CLEEN), is a cost-sharing program with industry that helps accelerate the development and certification of new engine and airframe technologies and drop-in alternative jet fuels. The FAA expects successfully demonstrated CLEEN technologies, such as a lean combustor technology that will reduce engine combustion emissions, will enter into service as early as 2016.

Additionally, the FAA expects the effort to create drop-in alternative jet fuels, aided by the government-industry Commercial Aviation Alternative Fuels Initiative, will soon meet some civil jet fuel supply needs. Our target is to have 1 billion gallons of alternative jet fuel in use by 2018.

We expect continued growth of alternative jet fuels and improved air quality, as well as a reduction of carbon dioxide emissions. These improvements will

help us progress toward our goal of carbon-neutral growth by 2020, using 2005 as the baseline.

Moreover, the FAA has been working closely with the Environmental Protection Agency, environmental groups and industry stakeholders — including aviation associations, aircraft and engine manufacturers and fuel suppliers — to facilitate the development of an unleaded replacement fuel for piston-powered aircraft. The goal of the effort is to make available by 2018 an unleaded alternative to 100 octane low-lead fuel.

We continue to strive to decrease the number of people exposed to significant noise by fleet evolution and operational improvements such as new procedures that smooth out an aircraft's approach from the beginning of its descent to touchdown. These procedures reduce noise, aircraft exhaust emissions and fuel burn in the vicinity of airports. Operational improvements, along with emerging aircraft noise reduction technology, will help us achieve our goal of fewer than 300,000 people exposed to significant noise — defined as a day-night average sound level of 65 decibels — by 2018.

COLLABORATION: CRUCIAL TO NEXTGEN SUCCESS

The success of NextGen depends on collaboration among the FAA and NAS users. The concepts and technologies emerging from the interplay of creative minds help realize the NextGen vision of safety and efficiency.

Collaboration includes the RTCA NextGen Advisory Committee (NAC), a group of senior officials from government, industry and labor who recommend possibilities and priorities. The NAC is chaired by a representative of industry. The FAA administrator is on the panel, as are FAA representatives from the Air Traffic Organization (ATO); Airports; Aviation Safety; and the Policy, International Affairs and Environment offices. Representatives from airlines, airports, aircraft manufacturers, general aviation and labor groups — representing pilots, air traffic controllers, aviation safety specialists, and dispatchers — also sit on the NAC.

Many NextGen technologies are a product of collaboration. Interagency collaboration between NASA and the FAA continues to yield the sophisticated automation tools important to NextGen operations.

In August 2013, a conference room at FAA headquarters was crackling with energy. Technology experts spoke excitedly during the formal hand-off of the latest automation tool from NASA to the FAA for further development: Precision Departure Release Capability (PDRC).

This traffic flow tool is designed to help controllers accurately predict when an aircraft should leave the gate and depart the runway in time to merge with the high-altitude stream of overhead traffic. With PDRC,

towers and air route traffic control centers will be able to enter and exchange flight data electronically and estimate merge times to within seconds.

The ATO's chief operating officer compared PDRC to knowing when to leave his parking spot at the FAA garage to merge into traffic flowing at high speed on the interstate and “find the space behind the tractor-trailer and in front of the Mazda.”

PDRC underwent a second round of simulation testing, involving 118 flights over a 16-week period in winter 2012-2013. When the tool is ready for implementation, the FAA expects that, on a monthly basis, more than 30,000 aircraft will receive improved departure clearances into constrained airspace.



The FAA collaborates with industry, academia, government and international partners to ensure NextGen success.

Compared with today's process, the improvement in takeoff time performance is expected to double, which would represent an estimated \$20 million in annual system-wide savings.

The FAA and NASA also set up the Air Traffic Management Technology Demonstration 1 Research Transition Team. The goal: to integrate Traffic Management Advisor

(TMA) with Traffic Metering, Controller Managed Spacing and Flight Deck Interval Management (FIM). TMA is a scheduling tool to manage airport arrival demand and FIM is designed for flight crews to work with controllers to manage aircraft spacing.

The National Oceanic and Atmospheric Administration and the FAA work together to ensure their Web services programs are synchronized to provide accurate information to the FAA's Common Support Services—Weather. This will provide the FAA

and users of the NAS with shared access to a unified aviation weather picture via the SWIM data-sharing services.

The weather information is integrated into air traffic decision-support tools and will enable collaborative decision making among NAS users to proactively plan and execute aviation operations ahead of bad weather.

AROUND THE WORLD WITH NEXTGEN

Air traffic management (ATM) modernization is worldwide and collaborative. The FAA and its representatives around the world work closely with the International Civil Aviation Organization (ICAO), air navigation service providers and global industry partners to establish a harmonized framework for ATM modernization and ensure interoperability with NextGen.

In October 2013, the FAA played a major role in securing the passage of the [Global Air Navigation Plan \(GANP\)](#) at ICAO's 38th Assembly. During this triennial summit, a majority of ICAO's 191 member states approved the GANP and its associated Aviation System Block Upgrades. NextGen heavily influenced the technologies and procedures approved in the GANP and block upgrades. The GANP and block upgrades together serve as the framework and roadmap for the standardization and harmonization of ATM systems and their interoperability with NextGen.

The FAA has existing collaboration agreements with major aviation counterparts and conducts activities with strategic partners. We collaborate with European counterparts on joint research and modernization efforts between NextGen and the Single European Sky ATM Research (SESAR) program, Europe's modernization program. The FAA also works closely with Eurocontrol and the European A6 Alliance. We promote the principles and benefits of NextGen to emerging aviation leaders around the globe, including Brazil, China and India. The FAA has built solid collaborative relationships with other important aviation partners, such as Australia and Canada.

The FAA, the European Commission and the SESAR Joint Undertaking, a European public-private partnership, collaborate on NextGen-SESAR research and to ensure standardization and interoperability between the programs.

The Japanese Civil Aviation Bureau (JCAB) continues to be one of the FAA's strongest strategic partners for modernization. The FAA and JCAB have partnered on several initiatives, such as the Asia and Pacific Initiative to Reduce Emissions, which promotes the implementation and use of advanced air traffic technology and procedures.

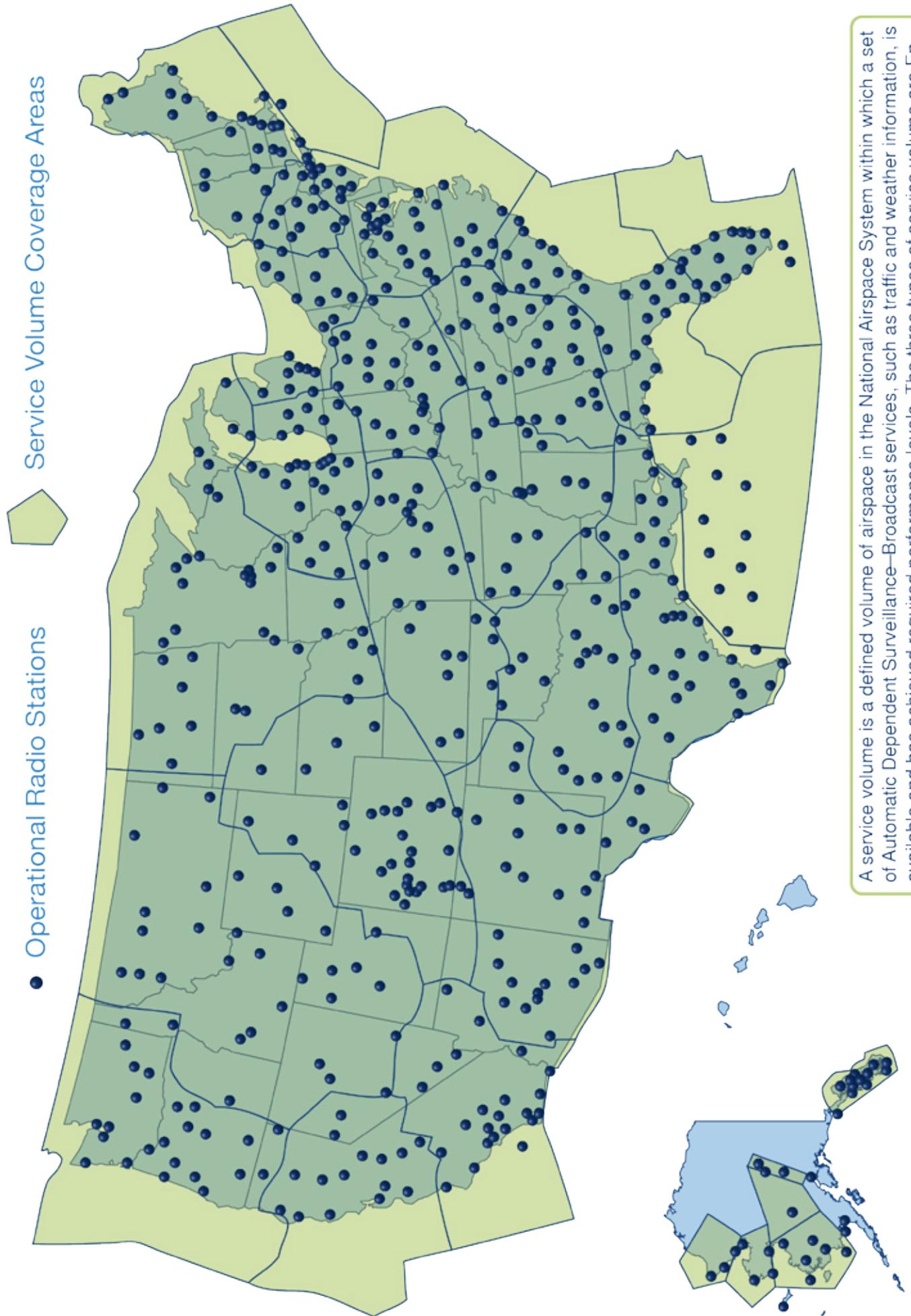


NextGen is part of a global transformation of aviation.

In November 2013, the FAA and the Civil Aviation Authority of Singapore signed a memorandum of cooperation to promote the development of air traffic modernization and improvement of operational performance in the Asia-Pacific Region. Initial areas of collaboration will be Traffic Flow Management/ Collaborative Decision Making, performance measurement, block upgrades and demonstrations.

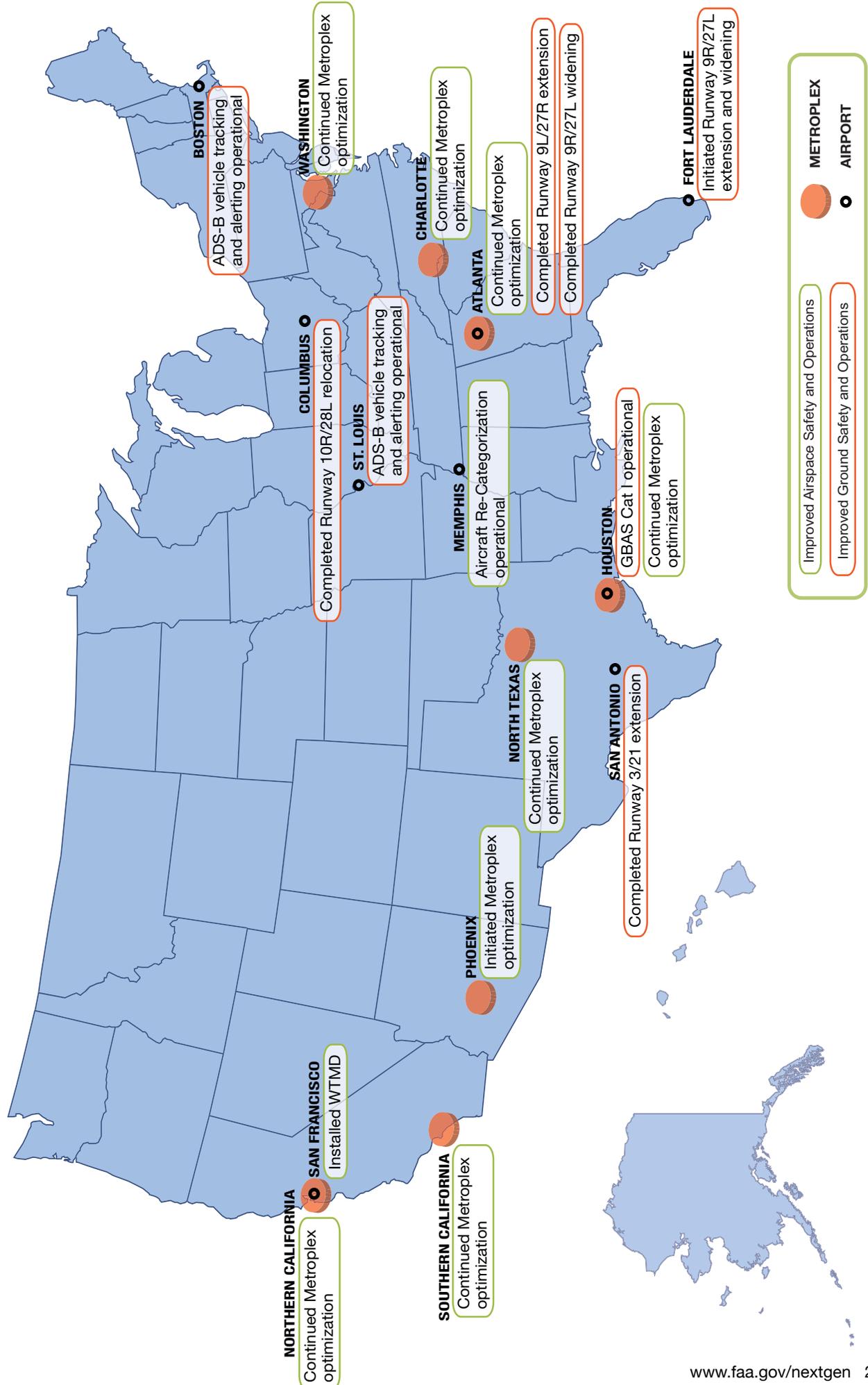
The FAA continues its strong partnership and collaboration with our neighbors in the Americas. The FAA meets regularly with Canada's air navigation provider, NavCanada, to ensure senior level support for cross-border planning and operations. The FAA will continue to support future aviation technologies through its involvement with ICAO's regional offices in Mexico City and Lima.

Surveillance and Broadcast Services as of June 2014



A service volume is a defined volume of airspace in the National Airspace System within which a set of Automatic Dependent Surveillance–Broadcast services, such as traffic and weather information, is available and has achieved required performance levels. The three types of service volume are En Route, Terminal and Surface.

Progress on Airport Surface and Airspace Improvements in 2013



ACRONYMS

AAtS	Aircraft Access to SWIM	NASA	National Aeronautics and Space Administration
ADS-B	Automatic Dependent Surveillance–Broadcast	NextGen	Next Generation Air Transportation System
ASDE-X	Airport Surface Detection Equipment–Model X	nm	Nautical Miles
ASIAS	Aviation Safety Information Analysis and Sharing	NVS	NAS Voice System
ATC	Air Traffic Control	OPD	Optimized Profile Descent
ATM	Air Traffic Management	PBN	Performance Based Navigation
ATO	Air Traffic Organization	PDRC	Precision Departure Release Capability
ATOP	Advanced Technologies and Ocean Procedures	RNAV	Area Navigation
CLEEN	Continuous Lower Energy Emissions and Noise	RNP	Required Navigation Performance
CNO	Chief NextGen Officer	RTCA	Aviation industry group
Data Comm	Data Communications	SESAR	Single European Sky ATM Research
DCIS	Data Comm Integrated Services	SID	Standard Instrument Departure
DCL	Departure Clearance	SSMT	System Safety Management Transformation
ERAM	En Route Automation Modernization	STAR	Standard Terminal Arrival
Eurocontrol	European Organization for the Safety of Air Navigation	STARS	Standard Terminal Automation Replacement System
FAA	Federal Aviation Administration	STDDS	SWIM Terminal Data Distribution System
FIM	Flight Deck Interval Management	SWIM	System Wide Information Management
FIXM	Flight Information Exchange Model	TAMR	Terminal Automation Modernization and Replacement
FRDMM	Freedom STAR into DCA	TBFM	Time Based Flow Management
FY	Fiscal Year	TDLS	Tower Data Link System
GANP	Global Air Navigation Plan	TFDM	Terminal Flight Data Manager
GPS	Global Positioning System	TFMS	Traffic Flow Management System
ICAO	International Civil Aviation Organization	TMA	Traffic Management Advisor
IOC	Initial Operating Capability	TRACON	Terminal Radar Approach Control
ITP	In-Trail Procedures	TSS	Terminal Sequencing and Spacing
JCAB	Japanese Civil Aviation Bureau	UAS	Unmanned Aircraft System
NAC	NextGen Advisory Committee	UAT	Universal Access Transceiver
NAS	National Airspace System	VHF	Very High Frequency



Learn More at the NextGen Website
www.faa.gov/nextgen



Why **NextGEN** Matters

The movement to the next generation of aviation is being enabled by a shift to smarter, satellite-based and digital technologies and new procedures that combine to make air travel more convenient, predictable and environmentally friendly.

As demand for our nation's increasingly congested airspace continues to grow, NextGen improvements are enabling the FAA to guide and track aircraft more precisely on more direct routes. NextGen efficiency enhances safety, reduces delays, saves fuel and reduces aircraft exhaust emissions. NextGen is also vital to preserving aviation's significant contributions to our national economy.

- NextGen provides a better travel experience, with less time spent sitting on the ground and holding in the air.
- NextGen gets the right information to the right person at the right time.
- NextGen reduces aviation's adverse environmental impact.
- NextGen lays a foundation for continually improving and accommodating future air transportation needs while strengthening the economy locally and nationally.
- NextGen increases airport access, predictability and reliability.
- NextGen enables us to meet our increasing national security and safety needs.
- NextGen safety management helps us to proactively identify and resolve potential hazards.
- NextGen brings about one seamless, global sky.



**Federal Aviation
Administration**

Office of NextGen
800 Independence Avenue, SW
Washington, DC 20591

www.faa.gov/nextgen