Federal Aviation Administration

NextGen Implementation Plan

JUNE 2013

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FROM THE ADMINISTRATOR

June 2013

Dear Members of the Aviation Community:

Many years from now when we reflect back on our move to NextGen, we will take pride in being a part of the largest aviation infrastructure project in history. We will look at 2012 as a pivotal year during which we delivered actual benefits to the flying public.

We are excited by preliminary numbers from our new procedures into metropolitan Washington, D.C. Aircraft are flying new routes named to honor our troops and commemorate September 11. We have created more direct routes, cut flight miles and reduced costly level-offs with these procedures. We anticipate fuel savings of $2.3 million per year — and even more savings across the country as more users take advantage of NextGen. In Seattle, as part of our Greener Skies initiative, airlines are using precision routes to shave four to eight minutes off flight times, providing projected annual savings of more than $13 million.

With NextGen, we are creating a foundation that enhances safety, saves passengers' time and better protects the environment by reducing aircraft exhaust emissions. Measures of NextGen performance and progress can be tracked at the NextGen Performance Snapshots website.

This year, we are operating in a very challenging fiscal environment, the impact of which could continue into the future. The Budget Control Act of 2011, also known as sequestration, cut $637 million from the FAA budget this fiscal year and contains a provision for 10 years of across-the-board cuts in federal spending.

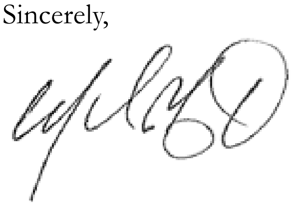
Despite the potential uncertainty associated with these cuts, our number one priority at the FAA will always be safety. We are striving to be even smarter about how we enhance safety in all of our programs. We continue to gather and share operational data to identify and address potential hazards and mitigate issues before they occur.

Our goal as an agency is to manage our national airspace in the most efficient and cost effective way possible, and NextGen plays a central role in this effort. We also want to empower our employees to work smarter and to enhance productivity.

As the entire world moves to satellite-based navigation, it is vital that we work to advance global collaboration. We need to improve the harmonization and interoperability of new technology with international aviation standards and procedures to improve safety and efficiency on a global basis.

So many of the benefits we are seeing from NextGen are due to the hard work and collaboration of the entire aviation community. I want to thank all our stakeholders for their support and partnership. As we move forward with NextGen, the FAA is committed to continue working with our stakeholders to reach the common goal of ensuring that America's aviation system, the largest in the world, remains the safest.

Sincerely,



Michael P. Huerta

FAA 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 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

- 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 our adverse impact on the environment. More precise flight paths are also helping limit the numbers 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 managers and pilots with the tools to proactively identify and resolve 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.

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EXECUTIVE SUMMARY

NextGen provides a better travel experience with less time sitting and holding on the ground or in the air.

The NextGen Implementation Plan provides a roadmap of the FAA's ongoing transition to NextGen, which is improving the way we fly.

NextGen integrates new and existing technologies, policies and procedures to reduce delays, save fuel and lower aircraft exhaust emissions to deliver a better travel experience. The NextGen Implementation Plan provides an overview of the benefits aircraft operators and passengers are receiving from recent NextGen improvements; it also highlights future benefits that will result from NextGen.

While the thrust of our work focuses on U.S. airports, airspace and aircraft, the FAA actively engages with global aviation partners to ensure operators receive benefits anywhere in the world.

NEXTGEN TODAY

NextGen is demonstrating continuing momentum in 2013 in its drive to make U.S. aviation operations safer and more efficient. Metroplex, for example, is our fast-track effort to implement satellite-based procedures and airspace improvements to reduce fuel consumption and emissions in the airspace around metropolitan areas with several airports. As of January, we had eight active metroplex areas in various phases of development. By this summer, we anticipate that north Texas and Houston will enter the implementation phase, joining Washington, D.C., where new procedures are already in place.

We are also advancing Automatic Dependent Surveillance–Broadcast (ADS-B), the NextGen successor to radar for tracking aircraft. By February 2013 we had deployed more than 500 of about 700 ADS-B ground stations. This year, the FAA is continuing to work with industry to develop the best approach for aircraft operators to equip for NextGen. Our ADS-B work is driven by the fact that aircraft flying in designated airspace must be equipped to broadcast their position to the ADS-B network by January 1, 2020.

As promised, we continued to publish a significant volume of satellite-based precision arrival and departure procedures in addition to high- and low-altitude routes. These procedures are designed to save fuel, reduce emissions, increase flexibility in the National Airspace System and facilitate more dynamic management of air traffic.

We continue to collaborate with the aviation industry to find ways to implement NextGen and create new benefits. The FAA Modernization and Reform Act of 2012 authorizes the FAA to establish an avionics equipage financial incentives program. We are actively engaging with industry to assess options that could attract additional investment in NextGen technologies and training. Additionally, the FAA accepted the newly established Surface Operations Office's concept of operations for collaborative decision making among air traffic controllers, flight crews, air carrier managers and airports.

NEXTGEN BENEFITS

NextGen provides numerous benefits for the American people, the aviation community, our environment and the economy.

To illustrate the impact of NextGen improvements we're making today, the NextGen Performance Snapshots website tracks NextGen performance metrics and highlights success stories.

As we measure today's performance, we also look forward to tomorrow's benefits. Our latest estimates indicate that by the end of the NextGen mid-term in 2020, NextGen improvements will reduce delays by 41 percent compared with what would happen if no further NextGen improvements were made beyond what we have done already.

These delay estimates are in addition to the benefits we expect from new and expanded runways.

We also estimate 16 million metric tons in cumulative reductions of carbon dioxide emissions through 2020. For the same period, we estimate 1.6 billion gallons in cumulative reductions of fuel use.

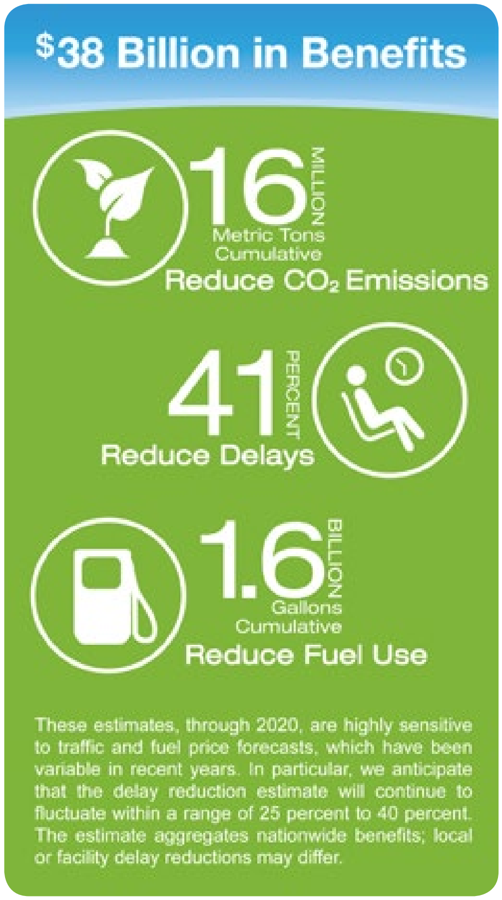
Delay reduction, fuel savings and other efficiency improvements will provide an estimated $38 billion in cumulative benefits to aircraft operators, the traveling public and the FAA. This notable increase from last year's estimated $24 billion in cumulative benefits is primarily the result of the Department of Transportation's decision to increase the dollar value of passenger time savings — the first time it has done so in a decade.[1]

MAKING A DIFFERENCE FOR GENERAL AVIATION

NextGen is providing major benefits to the general aviation community. The Wide Area Augmentation System (WAAS) has improved general aviation access to more than 1,500 airports in all kinds of weather with no costly investment in ground infrastructure.

Tens of thousands of general aviation aircraft are already equipped with WAAS receivers, which improve the availability, accuracy and integrity of GPS signals. Pilots are taking advantage of WAAS technology to fly approach procedures using Localizer Performance with Vertical Guidance (LPV) to altitudes as low as 200 feet before having to see the runway to land. The FAA has published 3,123 WAAS LPV approaches as of May 2013 and expects to publish 5,218 by 2016.

ADS-B enhances the safety of general aviation. Aircraft owners who equip with an ADS-B transceiver and a cockpit display will be able to see the location of nearby aircraft, thus improving their situational awareness.



In addition, pilots can receive weather and other aeronautical information from FAA broadcasts through their ADS-B transceivers, enhancing their situational awareness of in-flight hazards and helping to prevent accidents.

OPERATIONAL VISION

The FAA's vision for operational capabilities in the next decade includes fundamental improvements at every phase of flight. Common weather and system status information will dramatically improve flight planning. Technologies such as ADS-B and Data Communications, combined with Performance Based Navigation (PBN), will increase safety and capacity and save time and fuel, decrease aircraft emissions and improve our ability to address noise.

With NextGen, we continue to advance safety as we look to increase air traffic and introduce new types of aircraft, such as unmanned aircraft systems and commercial space vehicles. The aviation community continues to rely on Safety Management Systems (SMS) to continue to minimize risk as we bring together a wave of new NextGen capabilities. SMS are integrated safety cases and other proactive forms of management that allow us to assess the safety risk of all proposed changes. Policies, procedures and systems on the ground and on the flight deck enable NextGen improvements. We make the most of technologies and procedures in use today as we introduce innovations that will fundamentally change air traffic automation, surveillance, communications, navigation and the way we manage information.

In addition to the advances we develop through NextGen transformational programs and implementation portfolios, operations in the next decade will depend on coordination with and support from FAA specialists on safety, airports, the environment, policy development and the other building blocks of modern air traffic management. FAA information and management systems must keep these activities synchronized as we move forward through the next decade and beyond. We use a strategic Environmental Management System approach to

[1] In order to assess the full cost of delay, the Department of Transportation (DOT) considers the value of air travelers' time. From 2003 to 2011, this was estimated by DOT at $28.60 per hour. In the Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis, DOT increased that value for 2012 to $43.50 per hour.

integrate environmental and energy objectives into the planning, decision making and operation of NextGen. In addition to this effort, we are working with industry through the Continuous Lower Emissions, Energy and Noise program to advance noise and emissions reductions while improving energy efficiency.

NEXTGEN AHEAD

We have reached major NextGen milestones. PBN is providing greater operational flexibility. Surface data sharing is improving situational awareness and efficiency at airports. ADS-B is being used to control live traffic in areas such as the Gulf of Mexico, where radar coverage is not possible. In the years ahead, we will build on these and other NextGen technologies and procedures to offer additional capabilities. In the pipeline are airport safety and efficiency gains, airspace efficiency improvements and better use of Special Activity Airspace typically reserved for the military.

Future improvements are not limited to domestic airspace. Air traffic control automation enhancements and new ADS-B-enabled procedures will permit more aircraft to take advantage of optimal fuel-saving altitudes when flying over the ocean. Being able to spend more flight time at desired altitudes will potentially enable aircraft to carry less fuel, increase payload capacity, improve in-flight planning and improve the passenger experience through reduced exposure to turbulence.

Soon NextGen will provide better weather information, which will help reroute aircraft and reduce delays. Future NextGen weather detection and forecast capabilities will improve air traffic planning and collaboration by making vital weather information available earlier and with more accuracy. By making the same information available to everyone at the same time, NextGen will also create a common weather picture throughout our national airspace. Toward this end, we are collaborating with the National Oceanic and Atmospheric Administration on leading-edge scientific research to improve airspace safety and efficiency.

WHY NEXTGEN MATTERS

NextGen provides benefits to everyone — passengers, operators, recreational pilots and airports. NextGen offers a better travel experience, with fewer delays, more predictable trips and enhanced safety. People who live near airports may experience less aircraft noise and fewer emissions. NextGen will increase the predictability and reliability of airport operations, enhancing the role of airports as economic engines for the communities they serve. NextGen is vital to preserving aviation’s significant contributions to our national economy.

INTRODUCTION

THE NEXTGEN TRANSFORMATION

Smart satellite-based and digital technologies enable NextGen.

NEXTGEN DEFINED

The era of the Next Generation Air Transportation System, or NextGen, is upon us. The FAA, in collaboration with industry, is deploying NextGen procedures and technology on the ground, in the air, at air traffic control facilities and in the cockpit. So, too, is the agency writing and enacting the policies that govern these advances.

These improvements represent a widespread, transformative change in the management and operation of the way we fly. NextGen capitalizes on new and existing technologies, including satellite navigation and digital communications, to enhance safety, reduce delays, save fuel and reduce aviation's adverse environmental impact. Airports and aircraft throughout the United States are growing more connected, enabling the continuous sharing of real-time information to provide a better travel experience.

Those reaping the benefits of NextGen today include air carriers that take advantage of precision routing to get into the airport more quickly and efficiently, which reduces fuel burn, saves money and decreases aircraft exhaust emissions. They include general aviation pilots and other small-aircraft operators who have greater access to more airports nationwide — particularly in poor weather conditions — thanks to enhanced satellite navigation capabilities. They include air traffic controllers, who now have a wider array of tools at their disposal to help them make the critical decisions necessary to wring more efficiency out of the world's busiest airspace system. And they include the flying public, who are enjoying shorter flight times and fewer delays.

These advances are coming at a crucial time for our nation's economic health. As recently as 2009, civil aviation contributed $1.3 trillion annually to the national economy and accounted for 5.2 percent of the gross domestic product. It generated more than 10 million jobs, with earnings of $394 billion.[1] Given the economic challenges faced by the country today, it is imperative that we continue to protect and expand this vital economic engine. Without NextGen, the National Airspace System (NAS) will not be able to sustain anticipated growth. The NextGen investments we are making now help ensure that aviation will continue to be a significant contributor to U.S. economic recovery today and into the future.

As more NextGen capabilities become available over the next several years, the overall value of the benefits they provide will increase. Our latest estimates show that between now and 2020, the end of the NextGen mid-term:

- NextGen improvements will reduce delays by 41 percent compared with what would happen if no further NextGen improvements were made beyond what we have done already. These delay estimates are in addition to the benefits we expect from new and expanded runways.
- We will cumulatively save 1.6 billion gallons of fuel between now and 2020, reducing carbon dioxide emission by 16 million metric tons.
- Delay reduction, fuel savings and other efficiency improvements will provide $38 billion in cumulative benefits to aircraft operators, the traveling public and the FAA. This 56 percent increase over last year's estimate is primarily the result of the Department of Transportation's

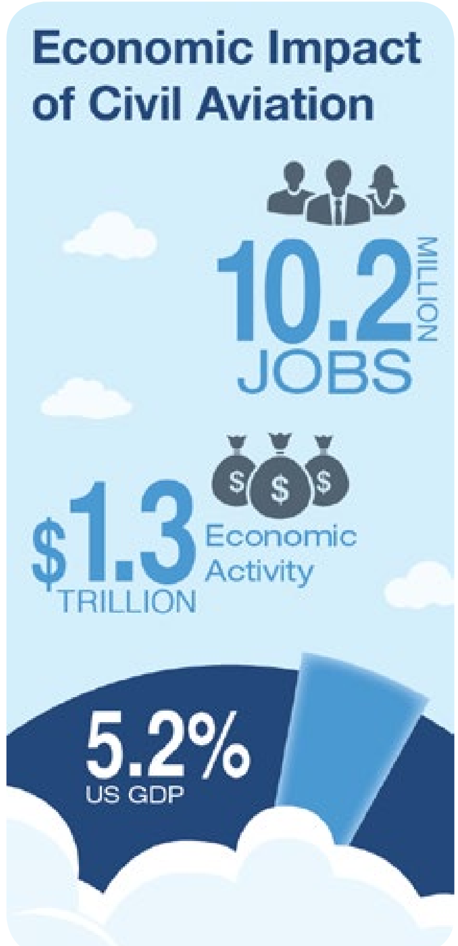
[1] "The Economic Impact of Civil Aviation on the U.S. Economy," FAA, August 2011.

(DOT) decision to increase the dollar value of passengers' time lost to delay. From 2003 to 2011, the value of passenger's time was estimated at $28.60 per hour. In the Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis, DOT increased that value for 2012 to $43.50 per hour.

THE NEXTGEN IMPLEMENTATION PLAN

The NextGen Implementation Plan is one of the FAA's two primary outreach vehicles for updating the aviation community, Congress, the flying public and other stakeholders on the progress we have made, and providing a summary overview of our plans for the future. The other is the NextGen Performance Snapshots, a website launched in 2012 to track NextGen performance metrics. The Plan, particularly the appendices, describes how the FAA intends to implement NextGen and provides the aviation community with the information it needs to take advantage of NextGen capabilities. It further offers our international partners a summary of our planning timelines in support of the agency's global harmonization efforts.

Updated annually, this Plan both draws upon and informs a number of FAA planning documents, including the NAS Enterprise Architecture;[2] the FAA's Capital Investment Plan; Destination 2025, the agency's strategic vision; and other internal documents.



This year, the FAA is pleased to introduce the next generation of the Plan, an electronic document available in e-book and PDF formats. The move to an exclusively electronic format helps conserve natural resources while complying with the Obama Administration's directive to reduce printing costs, and it capitalizes on advances in mobile technology. Throughout this year's Plan, you will find links to supplemental information on the FAA public website — including articles and fact sheets — that provide greater levels of detail on specific topics, as well as links to regularly updated material, such as the publication of Performance Based Navigation procedures, so readers will have ongoing access to the most current information the agency has to offer. For our e-book readers, access to Appendix B is through an online portal that takes full advantage of the capabilities offered by today's tablet computers.

The NextGen transformation is as important and massive a technological undertaking as any upon which the U.S. aviation community has ever embarked. Read on to learn how NextGen is making a difference and giving the world new ways to fly.

[2] The NAS Enterprise Architecture is a robust, comprehensive planning tool used by the FAA to understand the interdependencies of capabilities on systems, procedures and policies and to ensure their alignment.

NEXTGEN TODAY

DELIVERING OPERATIONAL IMPROVEMENTS

Aircraft operators are partnering with the FAA to demonstrate the value of NextGen capabilities.

NextGen continues to gain momentum in 2013 in its drive to develop and implement systems and procedures that make U.S. aviation operations safer, more efficient and friendlier to the environment.

- As of January, the FAA's Optimization of Airspace and Procedures in the Metroplex (OAPM) program had eight active teams in various phases of development. OAPM is the FAA's fast-track initiative to implement Performance Based Navigation (PBN) procedures and airspace improvements to reduce fuel consumption and aircraft exhaust emissions in some of the United States' busiest airspace. During 2013, the first three sites (Houston, north Texas and Washington, D.C.) will complete their designs and enter the implementation phase.
- The Automatic Dependent Surveillance–Broadcast (ADS-B) program continues steady deployment of ground stations. As of February, the FAA had installed more than 500 ADS-B ground stations, of which 445 were operational, providing traffic and weather information to properly equipped aircraft and supporting air traffic control separation services at 28 Terminal Radar Approach Control (TRACON) facilities. Making use of GPS and Wide Area Augmentation System technology, ADS-B is the NextGen successor to ground radar for tracking aircraft in the National Airspace System (NAS). The FAA believes that its publication during 2011 and 2012 of technical standard orders (TSO), advisory circulars (AC) and supplemental type certificates will stimulate aircraft equipage in 2013.
- En Route Automation Modernization (ERAM) deployment is on track under its revised baseline to complete initial operating capability this year and operational readiness in 2014 at all 20 en route air traffic control centers. ERAM is the new automation platform for the centers, which control high-altitude traffic. Further software development will make ERAM a foundation for important NextGen capabilities, such as Data Communications (Data Comm) and System Wide Information Management (SWIM).
- The FAA is considering operational and financial incentives to tilt the business case for aircraft owners and operators toward equipping their aircraft to use NextGen capabilities and gain NextGen benefits. The FAA Modernization and Reform Act of 2012, the agency's four-year reauthorization act, allows for the establishment of an avionics equipage financial incentive program.
- The FAA's newly established Surface Operations Office conducted an eventful first year of work in 2012, winning stakeholder consensus on and initial agency acceptance of a Surface Concept of Operations (ConOps) using the collaborative decision making process among air traffic controllers, cockpit crews, airline managers and airports. The office then worked to validate and refine the ConOps through a series of simulations.

The FAA awarded the Data Comm Integrated Services contract, which will provide for data communications between airport towers and appropriately equipped aircraft in 2016. With this contract, all six NextGen transformational programs (ADS-B, SWIM, NextGen Common Support Services–Weather, Collaborative Air Traffic Management Technologies, National

Airspace System Voice Switch and Data Comm) were under way.

Descriptions of advances include metrics established by the FAA after extensive consultations with the NextGen Advisory Committee (NAC). These metrics focus on post-implementation operations at locations where the agency has deployed NextGen systems and capabilities. They are reported on the FAA's new NextGen Performance Snapshots website.

PUTTING IT TOGETHER IN THE METROPLEX

The rapidly expanding OAPM program, commonly referred to as Metroplex, grew out of the FAA's response to the 2009 RTCA[1] NextGen Mid-Term Implementation Task Force. One of the broad-based study group's most prominent concepts was to pursue near-term, relatively straightforward NextGen advances that would take advantage of equipment already installed on aircraft.

This idea led to a combination of airspace redesign and the development of area navigation (RNAV) arrivals and departures within metroplexes — geographic areas with multiple airports and complex, sometimes conflicting flight operations. RNAV procedures are the most basic types of PBN, requiring only performance-based sensors or procedures, such as GPS or triangulation using Distance Measuring Equipment, for which most aircraft already are equipped. By structuring the RNAV routes and Metroplex airspace redesign to minimize noise impacts, environmental management techniques may enable more expeditious environmental reviews. Specialists representing all interested parties — including the FAA, airlines and airports — study each metroplex and propose improvements. Design and implementation follow to validate the recommended procedures, evaluate the designs, conduct environmental and safety reviews, and publish and implement the procedures.

In the two years since Metroplex teams launched studies of Washington, D.C., and north Texas, the program has gotten under way at six additional areas — Houston; Charlotte, N.C.; Atlanta; Northern California; Southern California and south central Florida. The Phoenix team completed its study in April 2013.

At first, the FAA intended to streamline 21 metroplexes and finish work at all of them by the end of Fiscal Year 2016. Following a schedule review in 2011, however, the FAA found that neither it nor the aviation community would have enough personnel in 2013 to staff the Metroplex teams and stay on the initial schedule. The agency reduced the number of metroplexes to 13 and lengthened some of the new project schedules. Five of the original 21 metroplexes were combined into two and are among the 13. Five others were already conducting Metroplex-like work and are continuing this effort independently.

Here is how the 21 original metroplexes were reprioritized into 13, limiting the scope of work over the near term:

- Atlanta; Boston; Charlotte; Chicago; Houston; Memphis, Tenn.; Northern California; north Texas, Phoenix, Southern California and Washington, D.C. — 11 metroplexes in all — remained unchanged.
- Cleveland and Detroit were combined into a single metroplex, Cleveland/Detroit. Orlando, Fla., south Florida and Tampa were combined into a single south central Florida metroplex.
- Denver, Las Vegas, Minneapolis-St. Paul, New York/Philadelphia and Seattle continue their independent activities.

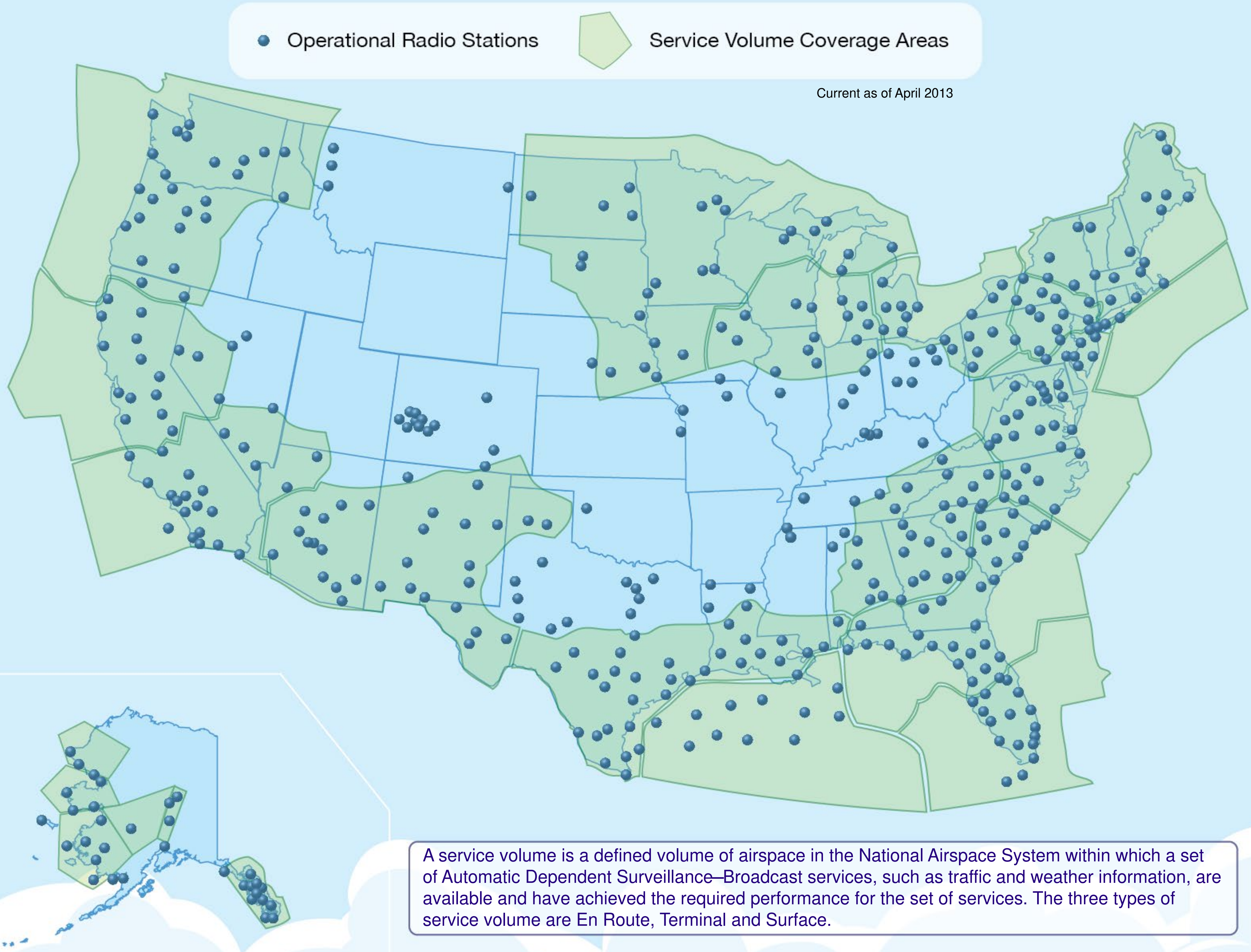
Work at each metroplex (study through implementation phases) is expected to take between 27 and 42 months depending on the complexity of the site. For Houston, an expedited process is underway, and should require 24 months from study through implementation. Houston is scheduled to complete implementation this year.

Ten projects will be finished by the original target, the end of FY 2016; Boston, Cleveland/Detroit and Memphis will be completed in 2017.

The eight Metroplex studies completed by the end of 2012 estimated substantial potential savings from RNAV approaches and departures and airspace redesign — as much as 30 million gallons of fuel and 298 thousand metric tons of carbon dioxide emissions per year.

[1] RTCA, Inc. is a private, not-for-profit corporation that develops consensus-based recommendations regarding communication, navigation, surveillance and air traffic management system issues. RTCA functions as a Federal Advisory Committee and includes roughly 400 industry and academic organizations from the United States and around the world. Members represent all facets of the aviation community, including government organizations, airlines, airspace users, and airport associations, labor unions, aviation services and equipment suppliers.

Surveillance and Broadcast Services



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, are available and have achieved the required performance for the set of services. The three types of service volume are En Route, Terminal and Surface.

Improved Airport Surface and Airspace Operations in 2012

Although RNAV is the PBN category that is central to Metroplex, the full range of PBN procedures remains the mainstay of NextGen attempts to reduce fuel consumption and engine emissions. The FAA tracks the current status of Metroplex and PBN projects at the Performance Based Navigation Initiatives website.

As study activity at the Metroplex sites has progressed, it has benefited from a new application of the FAA's mammoth Aviation Safety Information Analysis and Sharing (ASIAS) database. When safety data are available before Metroplex studies begin, airspace and procedures designers can take safety "hot spots" and issues into account before they begin their design work, rather than having to make safety fixes afterwards.

As an example of this safety-from-the-start strategy, Northern California metroplex designers relied on an analysis of Terrain Awareness and Warning System (TAWS) alerts near Mount Diablo to propose a new route so pilots would not receive as many TAWS alerts. Also, in the Burbank and Van Nuys areas, where there are numerous Traffic Alert and Collision Avoidance System (TCAS) alerts, the Southern California metroplex team changed a route so that large, scheduled-service aircraft could avoid general aviation traffic.

In May 2012, the south central Florida study team began its work with a package of ASIAS information about TAWS and TCAS alerts, missed approaches, risk of runway overruns, high-energy approaches and other irregularities. In the future, ASIAS safety analyses will be expanded to include additional topics.

In addition to generating metrics, the ASIAS program conducts its own studies of selected issues each year in depth. The Metroplex program will leverage insights gained from studies of RNAV departures and arrivals. The FAA is prioritizing ASIAS study areas to match the Metroplex schedule so airspace and procedure designers can incorporate lessons learned from investigating safety issues.

ADS-B, ERAM ON THE MOVE

The ADS-B program stayed on pace to complete deployment of about 700 ground stations early in 2014. It also reached a milestone in 2012 in its work with "national builds" of ADS-B equipment configurations. Engineers install and test initial configurations at key sites and resolve whatever problems they find. The resulting national-build configuration with the key-site improvements is common to all sites.

For ADS-B, the FAA did national-build testing at air traffic control facilities that use all three of the agency's latest facility automation systems — Houston Center, which uses ERAM; Southern California TRACON, which uses the Common Automated Radar Terminal System; and New Orleans Tower, which uses the Standard Terminal Automation Replacement System.

When the FAA published the ADS-B Out rule in 2010, the agency released TSOs to set a minimum performance standard for design and production approval of specific aircraft equipment for ADS-B Out, and ACs to provide guidance on how to install and use this equipment. Based on the stability of these key documents enabling the manufacture, installation, and operation of ADS-B Out avionics for the past two years, the FAA was able to issue supplemental type certificates to approve changes in aircraft type design. The agency believes these documents will increase industry competition to design and produce ADS-B Out avionics and establish price stability, beginning this year.

The FAA continues to develop policy regarding ADS-B In avionics, from which operators will be able to draw significant benefits. ADS-B Out avionics receive positioning data from GPS satellites, process them and transmit the aircraft's position to the ground. Ground stations send data on the aircraft's position to controller displays on the ground and to cockpit displays on aircraft that are equipped with ADS-B In. ADS-B In also will enable cockpit display of nearby ADS-B Out aircraft positions.

The policy issue is whether and when the FAA should mandate equipage with ADS-B In, as it did with ADS-B Out. In September 2011, an Aviation Rulemaking Committee (ARC) supported development of a variety of ADS-B In capabilities, flight trials to validate benefits, and early development of equipment standards and regulatory guidance for ADS-B In avionics. The committee did not support an ADS-B In equipage mandate, arguing that the immaturity of ADS-B In applications at the time — and uncertainties about achievable benefits and costs — left users unable to come up with a business case for equipage in the near term. In addition, the ARC commented that FAA policy, equipment standards, certification and operational approval guidance, procedures and ground automation were not defined well enough for users to invest.

Five months later in the FAA reauthorization act, Congress required the agency to launch by February 2013 an ADS-B In rulemaking that would mandate ADS-B In equipage by 2020 for aircraft operating in capacity-constrained airspace, at capacity-constrained airports or in "any other airspace deemed appropriate by the Administrator."

In response, the FAA established a cross-agency FAA rulemaking team to develop a Rulemaking Action Plan, the document that begins a rulemaking. In this case, the plan would cover or include ADS-B In. The plan would provide analyses of what the rulemaking team is proposing, why the proposal is necessary and what issues might arise.

The FAA also re-engaged the ARC to consider the congressional requirement and continued its own analysis — with aviation community feedback — of the economic benefits to be achieved through an ADS-B In rule. The ARC submitted recommendations in November 2012. The FAA continues to consider the potential rulemaking.

Programs with United Airlines and JetBlue Airways to demonstrate ADS-B benefits continue. United is operating In-Trail Procedures (ITP) on routes over the Pacific Ocean using aircraft equipped with ADS-B Out and ADS-B In. Flight crews of these aircraft are aware of the location, speed and identity of other aircraft in the demonstration program and thus know when to request from controllers a climb to a more fuel-efficient altitude. JetBlue's demonstration involves operating ADS-B-equipped aircraft on north-south routes off the United States' East Coast to increase capacity or regain efficiency during radar outages. The FAA will gain important performance data from each carrier.

Other ADS-B activities during 2012 include expanded coverage over the Gulf of Mexico; an agreement to install as many as three ground stations in Mexico; and agency approval for baselined program activities from 2014 through 2020, improving the program's stability. In April, an FAA-sponsored experimental ADS-B payload flew for the first time on a SpaceLoft-6 reusable suborbital launch vehicle to an altitude of more than 70 miles from Spaceport America near Las Cruces, N.M. The payload, ADS-B Out equipment designed for unmanned aircraft system and general aviation applications, transmitted as expected during the entire flight. GPS-populated ADS-B messages transmitted from the payload were received by FAA ADS-B ground stations in New Mexico and Texas.

NextGen makes flying safer, more efficient and friendlier to the environment.

Moving forward under a new schedule, ERAM was in continuous operation at seven centers — Albuquerque, N.M.; Denver; Los Angeles; Minneapolis; Oakland, Calif.; Salt Lake City and Seattle — by January 2013. Thirteen of the 20 en route centers had achieved initial operating capability, and three more were planned in the first quarter of 2013.

All automation systems met the International Civil Aviation Organization's (ICAO) November 15 target for implementing ICAO 2012, the updated, harmonized flight planning format that enables filers and air navigation service providers to benefit from NextGen and other countries' compatible advances worldwide.

In 2012, the FAA began developing advanced ERAM software that will enable the system to support NextGen capabilities, starting with data communications for aircraft preparing for departure. The agency already has developed a pre-departure reroute capability and is embedding it in deployed ERAM systems. The agency will implement the capability once all 20 centers are operating ERAM seamlessly.

FOCUS ON EQUIPAGE INCENTIVES

The FAA and its stakeholders have known since NextGen's inception that developing and deploying NextGen systems and procedures will not by itself transform the NAS. Airlines and other operators will have to equip their aircraft, develop procedures and train flight deck and maintenance personnel to take advantage and reap the benefits of NextGen capabilities. FAA analyses show ample long-term economic returns from making this investment, but conditions in the near term are uncertain. NextGen economic value depends on the rate advanced capabilities of both government and industry are deployed across the NAS; more rapid capability penetration produces a higher net present value.

The 2009 RTCA Task Force recommended that the FAA consider operational and financial incentives to improve the case for equipage. In 2011, the NAC recommended further work on such incentives, and the FAA has begun acting upon these recommendations.

In implementing NextGen, the FAA has sought to provide opportunities for NextGen-capable aircraft to receive better services and derive benefits directly from operations that use these capabilities. In a variety of operational environments, however, a "critical mass" capability level is needed before benefits can be attained. Critical mass is the percentage of aircraft in a particular airspace or at a particular location that must be NextGen-equipped to make a NextGen improvement usable as the primary mode of operation. Short of critical mass, operators lack a reasonable expectation of benefits and are less likely to invest in equipage.

How can the FAA adapt its operations to make equipage more beneficial to the operator? In 2012, continuing cross-agency efforts to pursue operational incentives — referred to in years past as the "best-equipped, best-served" concept — highlighted a potential answer to this question: Aircraft Priority Access Selection Sequence (AirPASS). Operating with AirPASS, aircraft with targeted NextGen capabilities would receive priority for such operations as takeoffs, approaches, reroutes and releases from temporary flight restrictions. AirPASS advances the service concept that if you have the proper equipment, training, certifications and procedures (both in the air and on the ground) an aircraft is eligible for priority handling relative to flights without these capabilities. Depending on how AirPASS is applied, aircraft without the targeted NextGen capability might temporarily receive a reduced level of service. AirPASS might also reduce airspace efficiency temporarily. But as more aircraft become NextGen-capable, aggregate benefits to operators and the NAS will increase.

In December 2011, the FAA tasked a cross-agency group to identify a selection of AirPASS candidates that could be implemented within about two years. The group considered many possibilities and narrowed them down to a Top 10. After a widely attended aviation community meeting provided feedback in March 2012, the FAA began implementation planning and execution studies for the following scenarios:

The FAA's NextGen research facilitates the safe introduction into the NAS of remotely piloted unmanned aircraft systems.

- Deconflicting airport operations and reducing weather minimums at New York LaGuardia and John F. Kennedy airports, and at Chicago O'Hare and Midway airports.
- Paired Simultaneous Offset Instrument Approaches (SOIA) at San Francisco, pending safety analysis. SOIA procedures enable aircraft to fly dual approaches to runways spaced less than 2,500 feet apart in marginal weather conditions when pilots must rely on their instruments, as well as when visibility is good.
- ADS-B East Coast offshore routes to relieve congestion on mainland north-south routes.
- ADS-B ITP in the South Pacific and beyond, facilitating fuel-saving altitude changes on trans-Pacific flights.

The FAA plans to implement these operational incentives and will issue a report on this work.

Regarding financial incentives, the FAA reauthorization act encourages the public-private partnership (PPP) concept, by which the agency would seek to leverage and maximize the use of private-sector capital for financing equipage of commercial and general aviation aircraft. The FAA's role could be to guarantee private-sector loans.

The FAA immediately established a cross-agency work group to examine PPP options, ways to reduce risks to the government, the extent of industry interest in the program and whether loan guarantees would succeed in speeding the adoption of avionics equipage.

The work group drafted and fine-tuned qualified avionics equipment — base levels of NextGen equipage geared to capabilities needed for applications in two categories of airspace, Metroplex and Other, which PPP loans could finance. The work group conducted public meetings in May and August 2012 and posted market surveys in June and September 2012 to secure feedback from stakeholders.

The goal of an equipage incentive program would be to encourage deployment of NextGen-capable aircraft in the NAS sooner than would occur otherwise. Specifically, the FAA would aim to increase the speed of adoption of base levels of NextGen equipage, which would accelerate delivery of NextGen benefits by reducing the time of mixed-equipage operations.

A key question before the work group is whether operators would take advantage of a loan guarantee program. In public meetings and in one-on-one exchanges, users have emphasized to the work group that they need to better understand the program's structure and the resultant operational benefits.

The FAA lacks complete authority to grant a loan guarantee. The FAA reauthorization act permits the agency to establish an avionics equipage incentive program, but federal credit laws require agencies to obtain specific authority to guarantee loans in an appropriations act.

Operators can review benefits from equipping for specific NextGen capabilities in Appendix A, "Foundational Avionics Enablers."

ENVIRONMENTAL STEWARDSHIP

The FAA's strategic goals include the development and operation of an aviation system that reduces environmental and related energy impacts to levels that promote sustainability without constraining growth. The primary environmental and energy issues that influence the capacity and flexibility of the NAS are aircraft noise, air quality, climate, energy and water quality. The FAA must manage and mitigate these environmental and energy challenges for NextGen to realize its full potential.

"Environmental Stewardship: A NextGen Priority" on the NextGen implementation website has more about the FAA's continuing development of aviation and environmental policy, the Environmental Management System, the Aviation Environmental Design Tool, advances in technology development and alternative fuels and FAA reauthorization act provisions on the FAA and the environment.

PERFORMANCE BASED NAVIGATION EXPANDS

The many elements of PBN, mainstays of NextGen implementation from the start, continued to grow during 2012. "Performance Based Navigation Expands" on the NextGen implementation website has more about developments in Area Navigation, Required Navigation Performance and Wide Area Augmentation System/Localizer Performance with Vertical Guidance developments.

In May 2013, the FAA launched the PBN Dashboard, a web-based tool that provides deployment and usage data on every RNAV and RNP airport procedure in the NAS. This operational information will support analysis of current PBN performance and aid in developing new procedures.

MOVEMENT ON THE SURFACE

The FAA established the Surface Operations Office in July 2011 in response to an industry recommendation that the agency create a single point of contact for stakeholders regarding surface operations. A small organization focused more on collaboration than control, the office works with the established FAA-industry Surface Collaborative Decision Making Team (SCT), which had already developed a ConOps for a collaborative surface effort. SCT members include representatives of the FAA, the National Air Traffic Controllers Association, industry associations, airlines and airport authorities.

The surface office, SCT members and other stakeholders conducted an initial validation phase for the ConOps between July 2011 and February 2012, coming up with more than 150 refinements. The FAA accepted the ConOps in April 2012. In June, the surface office launched a second validation phase, this one centered on monthly Human-in-the-Loop simulations that continued into 2013.

NextGen improvements promote environmental sustainability without constraining growth.

The ConOps focuses on improved predictions of capacity and demand at individual airports, more frequent updates from airlines on departure schedules for each of their flights, information sharing so all stakeholders are aware of an impending imbalance between capacity and demand, imposition of queue management when such an imbalance is imminent and a new position — departure reservoir manager (DRM) — to manage the queue at such times. Airlines also provide and share an “earliest off block” time for each flight, so the DRM can optimize queue lengths when there is a demand-vs.-capacity imbalance during over-capacity peaks.

As the 2012-2013 simulations validate and refine the ConOps further, the surface office will compile the simulation results and establish requirements for surface capabilities that will be carried out as part of the FAA’s next major surface initiative, Terminal Flight Data Manager (see NextGen Ahead).

An earlier surface concept, Collaborative Departure Queue Management, has proven its value in recent years through increasingly complex automated surface management demonstrations at Memphis and Orlando. During 2012, the FAA and FedEx, whose major hub is at Memphis, conducted a Surface Trajectory Based Operations demonstration during the carrier’s overnight push, a hub-and-spoke operation that constitutes the busiest time of day at the airport. Collaborative Departure Scheduling automation assigned slot times to departing aircraft based on exchanging airport capacity and aircraft readiness information between the NextGen prototype surface system and FedEx ramp operations automation over a prototype data network.

SAFETY FOR UAS, SURFACE OPERATIONS

In 2012, the FAA took on a new safety challenge — devising a plan to safely accelerate the integration of civil unmanned aircraft systems (UAS) into the NAS by September 30, 2015. Congress established this requirement in the FAA reauthorization act.

In response, the FAA created a UAS Integration Office, bringing together specialists in aviation operations and safety as a portal for everything related to civil and public use of UASs in the NAS. The office achieved the first milestone among Congress’s UAS requirements — streamlining the process for public agencies to operate UASs in the NAS.

Significant progress also included the development of a UAS ConOps defining how the integration of UASs affects and is affected by NextGen capabilities, enabling technologies and operational improvements into the 2020s.

Ground vehicles equipped with ADS-B enhance safety on the airport surface as part of a demonstration project at Boston.

Operational scenarios consider various UAS types in all classes of airspace. Combined with the FAA’s Integration of Civil UAS in the NAS Roadmap, the ConOps enables UAS stakeholders to view the transition from today’s accommodation of UAS operations to integration in all phases of flight.

Another FAA reauthorization act provision requires the agency to incorporate into the NextGen Implementation Plan its strategy for installing systems that alert air traffic controllers and/or flight crews of potential runway incursions. This strategy is documented in two Operational Improvements (OI) — Improved Runway Safety Situational Awareness for Controllers and Improved Runway Safety Situational Awareness for Pilots — in the Improved Surface Operations heading published in Appendix B of this document as well as in the 2012 update to the Implementation Plan. The FAA discussed these OIs in a separate report to Congress.

A successful demonstration at

Boston in 2012 improved safety on the airport surface and will be followed up this year at Chicago O'Hare, Denver and San Francisco. In the demonstration, the FAA and the Massachusetts Port Authority (Massport) collaborated to equip airport ground vehicles — snowplows, operations vehicles, emergency vehicles and the like — with ADS-B transceivers so these vehicles can determine their positions from GPS signals. Like aircraft, the ground vehicles show up on tower controllers' displays. Aircraft flight crews, vehicle drivers, airport operators and anyone else with ADS-B In equipment can track the ground vehicles as well.

The FAA and Massport are working under a five-year Memorandum of Agreement by which 37 vehicles had been equipped by December 2012. In October 2012, the airports at Chicago, Denver and San Francisco received approval for FAA Airport Improvement Program grants by which each will equip as many as 75 ground vehicles.

"Safety in Numbers for NextGen" on the NextGen implementation website has more about 2012 developments in the Aviation Safety Information and Sharing program and other safety initiatives.

NEXTGEN OVER THE OCEAN

Late in 2012, the FAA launched a one-year operational trial of a system aimed at removing a potential bottleneck from oceanic preferred-route procedures demonstrated in recent years as part of the Atlantic Interoperability Initiative to Reduce Emissions (AIRE).

As developed through AIRE, the original procedure enables flight crews to consult with their airline's flight operations center (FOC) to determine whether a revised route, adapting to weather and other real-time variables, would enable them to reduce fuel consumption and emissions. The potential bottleneck comes into play if the revised route might conflict with other traffic. In that event the FAA control center, equipped with Advanced Technologies and Oceanic Procedures (ATOP) conflict probe capabilities, would have to deny the pilot's request for a revision.The FOC and the pilot would go back to square one.

The new approach to oceanic preferred routes is the Oceanic Conflict Advisory Trial (OCAT), which gives the FOC access to web-based ATOP data drawn from the latest conflict probe algorithms. The FOC can judge on its own whether its preferred clearance change appears to be free of conflicts with other flights. After the FOC has done whatever trial-and-error work is necessary and found an acceptable change, the flight crew can request the change and the FAA control center can consider it under existing procedures.

NextGen benefits depend on operators equipping their aircraft, developing procedures and training their personnel.

With its launch over the Pacific Ocean, OCAT is available to participating airlines throughout the vast airspace of the Oakland Oceanic ATOP flight information region, the world's largest. At nearly 19 million square miles, it covers about 9.7 percent of the Earth's surface. OCAT developers cite studies showing that 58 percent of trans-Pacific flights could have better routes, but less than one percent of Oakland-controlled flights seek them through the Dynamic Airborne Reroute Procedure, the current method of proposing reroutes.

During 2012, the Asia and Pacific Initiative to Reduce Emissions, or ASPIRE, increased from four to 10 the number of city pairs available for environmental best practices developed in demonstrations between 2008 and 2011. These city pairs offer a variety of improvements in gate-to-gate operations, including reduced separation, more efficient flight profiles and PBN arrivals.

INTERNATIONAL HARMONIZATION

From the beginning of NextGen, the FAA has placed a high priority on collaborating with other government agencies and international organizations in the development and implementation of air traffic management (ATM) advances worldwide. International collaboration advanced significantly in 2012. The FAA, the Single European Sky ATM Research (SESAR) effort, government agencies and industry worldwide developed the ICAO's Aviation System Block Upgrades concept to maturity. The FAA and SESAR also reached new levels of collaboration under the 2011 United States-European Union memorandum of cooperation. "Collaboration You Can Depend On" on the NextGen implementation website has more.

MAKING A DIFFERENCE FOR GENERAL AVIATION

IMPROVED ACCESS, ENHANCED SAFETY

With more than 3,400 NextGen approach procedures at small airports, general aviation pilots experience improved levels of access and safety.

NextGen is providing major benefits to the general aviation community with greatly improved access to more than 1,500 airports during periods of low visibility. The next phase of NextGen implementation will enable the FAA to track aircraft more precisely and beam vital traffic and weather information to the cockpit at no additional charge to the user beyond the cost to equip.

WIDE AREA AUGMENTATION SYSTEM BENEFITS

Tens of thousands of general aviation aircraft are already equipped with Wide Area Augmentation System (WAAS) receivers, which improve the availability, accuracy and integrity of GPS signals. WAAS capability can improve GPS signal accuracy to within three feet laterally and six feet vertically. Pilots of WAAS-equipped general aviation aircraft are the primary users of Localizer Performance with Vertical Guidance (LPV) approach procedures. LPV procedures enable them to descend to altitudes as low as 200 feet before having to see the runway to land. These altitudes, by which decisions to land or go around must be made, are as low as those provided by Category I conventional Instrument Landing System (ILS) approach procedures.

By March 2013, the FAA had published 3,123 of these WAAS-enabled LPV procedures at more than 1,500 airports. The agency plans to publish 5,218 by 2016. The latest information is on the FAA's Satellite Navigation Program website.

Of the procedures published so far, more than half are at general aviation and regional airports that have no ILS. The FAA has also published more than 400 Localizer Performance (LP) procedures that employ WAAS for lateral guidance but without the added safety benefit of vertical guidance. These approaches are needed at runways where obstacles or other infrastructure limitations prevent the FAA from publishing a vertically-guided approach.

A comprehensive FAA study completed in 2012 found that of the 2,900 airports primarily used by general aviation, 800 do not have ILS systems but do have LPV and LP approaches. In order to qualify for these types of approaches, an airport must have at least 3,200 feet of paved runway. About 57 percent of airports that meet this requirement already feature LPV procedures.

About 65 percent of general aviation aircraft that fly under instrument flight rules in the National Airspace System have WAAS receivers installed. These receivers are certified under the supplemental type certificate (STC) method, which covers either a model of aircraft or an individual aircraft. An additional 3,300 business jets/turboprops have WAAS receivers under STC approval. Many other instrument-flight-capable general aviation aircraft have panel-mounted GPS receivers and moving map displays, which have enhanced safety over the past decade. Thousands of general aviation pilots also use non-FAA certified, portable GPS receivers for situational awareness.

The widespread and growing availability of WAAS approach procedures and the high equipage rate in the general aviation fleet is making it possible for the FAA to retire some ground-based navigation aids from service, including Nondirectional Beacon (NDB) and VOR types of equipment. Many general aviation aircraft owners have removed the now obsolete avionics needed to fly an NDB procedure and the FAA continues to shut down NDBs on the ground. Pilots of aircraft equipped to fly LPV procedures can take advantage of lower minimums than are available with NDB approaches.

If both ILS and WAAS approaches are available, some pilots might prefer to fly the LPV procedure because it utilizes a signal that is more stable and consistent than ILS transmissions. To read more about how general aviation operators are using WAAS today, see "WAAS Happening!" in the September/October 2012 issue of FAA Safety Briefing magazine.

ADS-B BENEFITS

As WAAS procedures continue to provide immediate benefits for general aviation, the FAA has also set the stage for major new benefits with a network of ground-based Automatic Dependent Surveillance–Broadcast (ADS-B) radio transceivers. By February 2013 the FAA had already installed more than 500 radio stations, 445 of which were in operation. We will add approximately 290 more to complete nationwide coverage by 2014. The FAA has mandated that aircraft flying in most controlled airspace be equipped with ADS-B Out — the ability to broadcast their position to the ADS-B network — by January 1, 2020. ADS-B Out avionics use onboard navigation equipment to derive an aircraft's position, which is then broadcast for air traffic control services and for use by other aircraft. The roughly once-per-second broadcast rate is not only automatic, but also depends on equipment on the aircraft for air traffic surveillance to occur — thus the cooperative and dependent nature of ADS-B.

General aviation aircraft owners who decide to equip with optional ADS-B In reception and display capability as well as the mandated ADS-B Out transmission capability will be able to see the location of nearby ADS-B Out aircraft via air-to-air reception or by relay from the ground. In addition, ADS-B In can display the location of transponder-equipped aircraft tracked by ground-based radar surveillance when this information is relayed from the ground to the cockpit, thus providing situational awareness of nearby aircraft that are not yet equipped with ADS-B Out.

NextGen has improved access to more than 1,500 airports during periods of low visibility.

Additional benefits are available to general aviation aircraft owners who decide to equip their aircraft for ADS-B In even though this capability is not required by the current FAA mandate. In addition to receiving traffic information, general aviation aircraft equipped with ADS-B In-capable Universal Access Transceivers (UAT) operating on a frequency of 978 megahertz (MHz) can receive and display weather and other aeronautical information from FAA broadcasts. This information will enhance pilots' situational awareness of inflight hazards and help prevent accidents.

Three types of FAA broadcast services provide benefits to pilots of ADS-B In-equipped aircraft:

- Traffic Information Service-Broadcast (TIS-B): This air traffic advisory service provides the altitude, heading, speed and distance of aircraft flying within a 15 nautical mile (nm) radius and within plus or minus 3,500 feet of the receiving aircraft's position. A general aviation aircraft equipped with ADS-B In can receive these data directly from other aircraft broadcasting on the same ADS-B Out frequency. In addition, the FAA relays air traffic control radar traffic information over TIS-B, so that general aviation pilots can see aircraft equipped with a transponder 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 UAT-equipped aircraft and rebroadcasts it on the 1090 MHz frequency, which is primarily used by jet aircraft. 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 and plus or minus 5,000 feet 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 and temporary flight restrictions. UAT-equipped general aviation aircraft can receive this information at altitudes up to 24,000 feet.

TIS-B, ADS-R and FIS-B services are already available in many parts of the United States, and are expected to make ADS-B In an attractive option for general aviation. Aircraft owners and operators now have the option of being early adopters of ADS-B technology and to be among the first to take advantage of its benefits years before the ADS-B Out mandate takes effect.

The FAA released ADS-B Out technical standard orders and the availability of rule-compliant avionics is increasing. The agency also completed advisory circular guidance so the general aviation community can install required avionics.

Optional ADS-B In avionics are also starting to appear on the market for situational awareness applications and flight information services.

NextGen traffic and weather information will also be available for display on some mobile devices at a time when many general aviation pilots own and use tablet computers. Due to technical requirements, however, complete TIS-B and ADS-R reports will only be broadcast to the cockpits of general aviation aircraft equipped to meet the mandate and reporting their position over ADS-B Out.

The FAA is also exploring the possibility of having standards for battery-powered ADS-B Out transmitters that can be used on gliders and general aviation aircraft certificated without an electrical system. Additionally, the FAA is working with industry to define the requirements for ADS-B systems to provide pilots with a low-cost traffic alerting capability. This ADS-B In traffic alert application would use ADS-B data to identify conflicting traffic nearby and to issue an alert to the pilot. The pilot would then look out the window to visually acquire the traffic being called out. The FAA conducted simulations of Traffic Situational Awareness with Alerts avionics in 2012 to set the stage for flight testing in 2013.

UNLEADED FUEL FOR PISTON-POWERED AIRCRAFT

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 unleaded 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. In addition to the obvious environmental concern

Improving General Aviation Airport Access with NextGen Precision

The FAA continues to deploy procedures that improve access to many general aviation airports in almost all weather conditions. Localizer Performance with Vertical Guidance (LPV) are precision GPS approaches, enhanced by Wide Area Augmentation System signals, that provide vertical guidance as low as 200 feet above the runway for equipped aircraft.

LPVs are operationally equivalent to Instrument Landing Systems (ILS) approaches but require no costly infrastructure or maintenance. As of March 2013, there were more than 3,000 LPVs at 1,500 airports in the United States, almost three times the number of ILS approaches.

Many instrument-capable general aviation aircraft have GPS receivers and moving map displays.

of operating with fuel that contains lead, the use of lead-containing fuel creates significant long-term challenges to the continued viability of the piston-powered general aviation fleet in the United States.

In 2012, the FAA received the final report from the Unleaded Avgas Transition Aviation Rulemaking Committee, a government and industry group. The rulemaking committee provided recommendations on how the agency might address the challenges of transitioning piston-powered aircraft to unleaded aviation gasoline. One of the key challenges is developing an alternative fuel that both low- and high-performance piston-powered aircraft can use safely. Lead has been used as an additive to fuel because it enables high-performance aircraft engines to operate smoothly without experiencing damaging "knocking" that could lead to engine failure.

The FAA is making investments to support the development of a practical and safe alternative fuel. However, this new fuel is unlikely to be a drop-in solution, meaning changes might be required to current engine and aircraft designs and operating instructions. One key objective is to come up with a single fuel that can meet almost all needs of both low- and high-performance piston-powered aircraft. This is because the market for fuel for piston-powered general aviation aircraft is much smaller than that for jet-powered aircraft, so it is not clear whether the economics of niche marketing could support the delivery and use of more than one type of fuel.

In response to the rulemaking committee, the FAA established the Fuels Program Office in 2012 to oversee the transition to unleaded fuel. This office enables the FAA to centralize aviation fuel expertise in one office that can more effectively support industry initiatives and the associated fuels certification projects relating to unleaded aviation gasoline.

OPERATIONAL VISION

NEXTGEN IN THE NEXT DECADE

By the dawn of the next decade, NextGen improvements will offer benefits at every phase of flight.

The best way to convey how the FAA envisions airspace system operations in the mid-term, which ends in 2020, is by showing what an aircraft operator will experience through all phases of flight, including improved safety, increased capacity and efficiency, and better environmental performance. As we transition to this state over the next several years, operators and the flying public will continue to reap the benefits of NextGen. The mid-term system, in turn, will provide a foundation for the further evolution of the airspace system in the long term.

SAFETY

With NextGen, we must continue to advance safety as traffic grows and new types of operations, such as unmanned aircraft systems and commercial space flights, continue to increase. Further reductions in the accident rate are needed as overall traffic increases, and achieving those reductions depends on targeted initiatives and an all-encompassing approach to safety that is documented in accordance with the Safety Management System.

NextGen is taking an unwavering approach to safety management. The FAA strives to identify problems as early as possible by analyzing trends, and we are putting into place preventive measures before any accident can occur. Safety information sharing and analysis tools are evaluating data from operators, FAA systems and international databases to monitor the effectiveness of safety enhancements and identify where new safety initiatives are needed.

ENVIRONMENT

NextGen will accelerate efforts to improve aviation's environmental and energy performance to sustain growth and create opportunities for added capacity. We will use a strategic Environmental Management System approach to integrate environmental and energy objectives into the planning, decision making and operation of NextGen. We will realize emissions, energy and noise benefits from advanced systems and procedures, but more improvements will be needed than we can achieve through operational enhancements alone.

A major NextGen initiative, the Continuous Lower Energy, Emissions and Noise (CLEEN) program, helps accelerate the development and certification of promising new engine and airframe technologies and sustainable alternative fuels. We expect successfully demonstrated CLEEN technologies will enter into service in the mid-term. We also expect that the effort on sustainable alternative fuels, aided by the government-industry Commercial Aviation Alternative Fuels Initiative, will meet some civil jet fuel supply needs by the end of the mid-term. This contribution will continue to grow, improving air quality and reducing net carbon dioxide emissions while aiming to achieve carbon-neutral growth by 2020, using 2005 as the baseline.

This mid-term system makes the most of today's technologies and procedures while introducing systems and procedures that fundamentally change air traffic automation, surveillance, communications, navigation and how we manage information.

In addition to the advanced systems and procedures we develop through the NextGen transformational programs and solution sets, the mid-term system depends on coordination with and support from FAA specialists on safety, security, airports, the environment, policy development and other building blocks of a modern air traffic management system. FAA information and management systems will keep all these activities synchronized as we close in on the mid-term, reach it and then build on that foundation.

Key ground infrastructure and avionics are included here in tables for each of the flight phases. Additional information, including FAA's National Airspace System (NAS) Enterprise Architecture information and other documents, are available on the FAA's NextGen website, www.faa.gov/nextgen.

While operators who adopt NextGen avionics will receive the greatest benefit in this time frame, we will still accommodate lesser-equipped aircraft. Appendix A discusses the investments operators and airports must assess to support these operations. Through international collaboration on standards, we are making sure that avionics developed to take advantage of NextGen and other advanced infrastructures worldwide will be interoperable.

FLIGHT PLANNING

Flight planners in the mid-term will have increased access to relevant information on the status of the NAS through a common network-enabled information source. Operators will have access to current and planned strategies to deal with congestion and other airspace constraints. New information will include scheduled times of military, security or space operations in special activity airspace. It will describe other airspace limitations, such as those imposed by current or forecast weather or congestion. It also will provide airport status information, such as closed runways, blocked taxiways and out-of-service navigational aids. Shared information will enable users to plan their flight operations according to their personal or business objectives. Updates will show when changes in airspace system status impact individual flight-planning objectives. Operators will plan their flights with a full picture of potential limitations on the ground and in the air along the intended flight trajectory.

An outcome of this planning process will be an electronic representation of the operator's intended flight profile, updated when conditions change in a way that may affect the flight's trajectory. Both operators and air traffic managers will have access to the same real-time information, shared via a secure communications network. This information will provide each group with improved situational awareness for planning as well as for predicting conflicts so they can be resolved. Improvements in calculated arrival times will enhance system-wide planning processes. Accomplishing this will give controllers automated information on airport arrival demand and available capacity to improve sequencing and to balance arrival and departure rates. Air traffic managers will be able to apply lessons learned to future operations by analyzing a full day's worth of data or more.

These advances will accommodate operator preferences and improve the use of resources. For operators, these advances will mean more efficient traffic management and enhanced environmental performance by improving the ability to adjust schedules before and during flight. For air traffic managers, these advances will mean more comprehensive situational awareness, including knowledge of user intent, and the capability to manage flights either in groups or individually.

FLIGHT PLANNING	Key Ground Infrastructure
	• Common Support Services–Weather (CSS-Wx) • Data Communications (Data Comm) • En Route Automation Modernization (ERAM) • Modernized Aeronautical Information Management System (AIM) • NextGen Weather Processor (NWP) • System Wide Information Management (SWIM) • Terminal Flight Data Manager (TFDM) • Traffic Flow Management System (TFMS)

PUSH BACK, TAXI AND DEPARTURE

As the time for the flight approaches, the flight crew will receive the final flight path agreement as a data message. Data communications will provide pre-departure clearances that allow amendments to flight plans. Collaborative decision makers may determine the actual push back time. When the aircraft taxis out, the flight crew's situational awareness will be improved by flight deck displays depicting aircraft progress on a moving map that indicates the aircraft's position on the airport surface. At busy airports, the displays will also show the position of other aircraft and vehicles operating on the surface. In the tower, improved ground systems, such as surface-movement displays, will enable controllers to manage the use of taxiways and runways more efficiently. They will be able to choose the best runway and taxi paths based on the departing aircraft's intended flight path and the status and positions of all other aircraft on the airport surface and in the terminal area.

These flight deck and tower displays are important safety tools that will help prevent runway incursions and other surface conflicts, especially when visibility is low. More efficient management and the ability to revise departure clearances using data

PUSH BACK, TAXI AND DEPARTURE	
Key Ground Infrastructure	• Automatic Dependent Surveillance–Broadcast (ADS-B) ground stations • Airport Surface Detection Equipment–Model X (ASDE-X) • CSS-Wx • Data Comm • Integrated Departure and Arrival Coordination System • Modernized AIM • NWP • Satellite Based Augmentation System (SBAS) • Standard Terminal Automation Replacement System (STARS) • SWIM • TFDM • TFMS
Avionics	• ADS-B In and Out, with associated displays like Cockpit Display of Traffic Information (CDTI) • Area Navigation (RNAV) and Required Navigation Performance (RNP) • Data Comm

communications will mean fewer radio transmissions, shorter wait times, fewer departure delays and reduced fuel consumption and emissions. Weather information will be integrated into decision making tools for surface management.

Departure performance will be improved with the use of multiple departure paths from each runway end with greater precision provided by Area Navigation (RNAV) and Required Navigation Performance (RNP) procedures. Multiple departure paths will enable controllers to place each aircraft on its own separate track while avoiding known constraints, thunderstorms and other severe weather near the airport.

The FAA will take advantage of increased surveillance and navigation accuracy, as well as improved understanding of wake vortices, to allow aircraft to operate simultaneously, either independently or with reduced separation, on closely spaced parallel runways. These adjustments mean airports will gain capacity for existing runways. Together, these capabilities will enhance safety, improve environmental performance and reduce operators' delays and fuel costs.

More precise departure paths will optimize system operations for entire metropolitan areas, reducing delays by allowing each airport to operate more independently. This will improve the separation of arrival and departure flows in and out of airports near one another and in some cases provide more efficient access to both commercial and general aviation airports in congested metropolitan areas. These precise departures also can be designed to support airports that are now limited by terrain and other obstacles or during periods of reduced visibility. Precise paths will reduce flight time, fuel burn and emissions. They might also decrease the impact of aircraft noise on surrounding communities.

CLIMB AND CRUISE

As the aircraft climbs into en route airspace, enhanced processing of surveillance data will improve position information and enable the flight crew and controllers to take advantage of reduced separation standards. Because the flight crew will be able to monitor the position of other aircraft from its own aircraft's flight deck, air traffic controllers will be able to assign some spacing responsibility to the flight crew as the aircraft climbs to its cruising altitude. The flight crew will determine the necessary spacing for a designated aircraft operating in the desired flight path. The aircraft will be able to easily merge behind that aircraft into the overhead stream with minimum maneuvering.

Data communications will provide both routine and strategic information to the flight crew and automate some routine tasks for

CLIMB AND CRUISE	
Key Ground Infrastructure	• ADS-B ground stations • Advanced Technologies and Oceanic Procedures • CSS-Wx • Data Comm • ERAM • NWP • Time Based Flow Management (TBFM) • TFMS
Avionics	• ADS-B In and Out, with associated displays like CDTI • Data Comm, including integration with the Flight Management System • Future Air Navigation System in oceanic airspace • RNAV and RNP

pilots and controllers. Controllers will be able to clear more aircraft to fly direct or via preferred routes and altitudes to save fuel and time. Fewer radio conversations also will reduce radio-frequency congestion and the possibility of misunderstandings. When weather prompts the rerouting of many flights, clearances will be delivered automatically to the controller and uplinked to aircraft equipped to receive data communications. This will make the rerouting process much more efficient and reduce pilot and controller workload.

If weather poses potential problems, or there are possible conflicts with other aircraft, security or military airspace restrictions or other constraints along the aircraft's planned flight path, automation will identify the hindrance and provide recommended changes in trajectory or speed. If the aircraft is equipped for data communications, the controller will send the pilot the proposed change via a data message. Pilot and controller will negotiate the change, in coordination with the flight operations center. Changes will be loaded into both ground and aircraft systems. Improved weather information, integrated into controller decision support tools, will increase controller and pilot efficiency and greatly reduce their workload.

At times, traffic delays, airspace restrictions or adverse weather will require additional changes to the flight path agreement. When rerouting is needed, controllers will be able to assign offsets to the published route. These offsets, tailored to each flight, will be a way of turning a single published route into a "multi-lane highway in the sky." Use of offsets will increase capacity in a section of airspace. Because the clearance to fly a new route will be issued and accepted using data messaging, complex reroutes can be more detailed than those now read by controllers over the radio then read back by pilots for confirmation. Not having to rely on voice transmissions eliminates one source of potential communication error and also reduces frequency congestion.

In oceanic operations, air traffic managers will provide aircraft entering oceanic airspace with an optimized trajectory. Airspace entry will be specified by track entry time and the intended trajectory. As wind and other weather conditions change, both individual reroutes and changes to the entire route structure will be managed via data communications.

DESCENT AND APPROACH

Key Ground Infrastructure

- ADS-B ground stations
- ASDE-X
- Data Comm
- CSS-Wx
- NWP
- SBAS
- STARS enhancements
- TBFM
- TFDM
- TFMS

Avionics

- ADS-B In and Out, with associated displays like CDTI
- Enhanced Flight Vision System (EFVS)
- Data Comm
- RNAV and RNP
- Vertical Navigation

DESCENT AND APPROACH

NextGen capabilities will provide a number of improvements to terminal area operations that save fuel, increase predictability and minimize maneuvers such as holding patterns and vectors used to absorb delays, and could reduce noise. Enhanced traffic management tools will analyze flights approaching an airport from hundreds of miles away to calculate scheduled arrival times and to optimize performance. These advances will improve the flow of arrival traffic to maximize use of existing capacity. Improvements in calculated arrival times will enhance system-wide planning processes. Controllers will gain automated information on airport arrival demand and available capacity, enabling them to improve sequencing and balance arrival and departure rates.

Information such as proposed arrival time, sequencing and route and runway assignments will be exchanged with the aircraft via a data communications link so that a final flight path can be determined. This path will ensure the flight, clear of potential conflicts, will experience an efficient arrival, adding to the overall efficiency of the NAS.

With the improved precision of NextGen systems, separation between aircraft can be safely reduced. Suitably equipped aircraft will be able to fly precise vertical and horizontal paths, called Optimized Profile Descents, from

LANDING, TAXI AND ARRIVAL

Key Ground Infrastructure
• ADS-B ground stations • ASDE-X • CSS-Wx • Data Comm • Ground Based Augmentation System (GBAS) • Integrated Departure and Arrival Coordination System • Modernized AIM • SBAS • STARS enhancements • SWIM • TBFM • TFDM • TFMS
Avionics
• ADS-B In and Out, with associated displays like CDTI • EFVS • Data Comm • GBAS

cruising altitude down to the runway. These paths, which could include inter-arrival spacing by the aircraft, will allow for more efficient transitions from cruise to the approach phase of flight at high-density airports. Controllers will be able to use multiple precision paths that maintain flows to each runway, through RNAV and RNP arrivals. These arrivals will reduce fuel use, emissions and potentially the number of people exposed to noise.

Today, the alignment of arrival and departure routes does not always allow for the most efficient use of airspace. By redesigning airspace, new paths can be used to provide integrated arrival and departure operations. The FAA will provide users with better options to manage departure and arrival operations safely during adverse weather. This will maintain capacity that otherwise would be lost. For example, poor visibility dramatically reduces the capacity of closely-spaced runways, prompting delays that ripple throughout the airspace system. NextGen capabilities will allow the continued, safe use of closely-spaced runways during low visibility by providing better-defined path assignments and appropriate separation between aircraft.

LANDING, TAXI AND ARRIVAL

The expanded opportunity to use runways in low-visibility conditions is due to new closely spaced parallel procedures. Before the flight lands, the assigned runway, preferred taxiway and taxi path to the assigned parking space or gate will be available to the flight crew via data communications. A ground system that recommends the best path, based on the arriving aircraft's type and parking assignment and the status and position of all aircraft on the airport surface, will enable this capability.

Flight deck and controller displays will monitor aircraft movement and provide traffic and incursion alerts, using the same safety and efficiency tools as employed during departure operations. This will reduce the potential for runway incursions. Surface and vehicle movement information will be shared among air traffic control, flight operations centers and the airport operator. Airport and airline ramp and gate operations personnel will know each inbound aircraft's projected arrival time at the gate. Having an accurate gate arrival time is expected to save airlines money because they won't have to dispatch staff to the gate early and have them wait. Operators will be able to coordinate push backs and gate arrivals more efficiently.

AIRFIELD IMPROVEMENTS

Existing runway capacity will increase through the mid-term with more precise routing and separation of departing and arriving aircraft. Throughput rates will be similar during almost all weather conditions. Updated procedures for closely spaced parallel operations will allow simultaneous arrivals. Airports may be able to site new runways with greater flexibility and make better use of existing runways. Overall, airports will balance surface, gate and terminal capacity with the improved runway capacity afforded by NextGen. Planned airfield improvements that are expected to come online in the next several years include:

NEW RUNWAYS	RUNWAY EXTENSIONS	AIRFIELD RECONFIGURATION
• Columbus (Ohio)	• Anchorage • Atlanta • Fort Lauderdale • San Antonio	• Chicago O'Hare • Philadelphia

NextGEN

Federal Aviation Administration

Integrated Flight Planning

Operators and traffic managers have immediate access to identical weather information through one data source.

Streamlined Departure Management

RNAV and **RNP** precision allows multiple departure paths from each runway. Departure capacity increased.

Efficient Cruise

RNAV, **RNP** and **RVSM** utilize reduced separation requirements increasing airspace capacity. Aircraft fly most optimal path using trajectory-based operations considering wind, destination, weather and traffic. Re-routes determined with weather fused into decision-making tools are tailored to each aircraft. **Data Communications** reduce frequency congestion and errors. **ADS-B** supported routes available for equipped aircraft.

Streamlined Arrival Management

Arrival sequence is planned hundreds of miles in advance. **RNAV** and **RNP** allows multiple precision paths to runway. Equipped aircraft fly precise horizontal and vertical paths at reduced power from descent point to final approach in almost all types of weather. Time and fuel are saved. Emissions and holding are reduced.

Surface Traffic Management

Automation optimizes taxi routing. Provides controllers and pilots all equipped aircraft and vehicle positions on airport. Real-time surface traffic picture visible to airlines, controllers and equipped operators. Surface movement management linked to departure and arrival sequencing. **ADS-B** and **ASDE-X** contribute to this function. Taxi times reduced and safety enhanced.

Enhanced Predeparture Clearances

Pilots and controllers talk less by radio. **Data Communications** expedite clearances, reduce communication errors. Pilot and controller workloads reduced.

Surface Traffic Management

Runway exit point, assigned gate and taxi route are sent by **Data Communications** to pilots prior to approach. Pilot and controller workload reduced and safety improved.

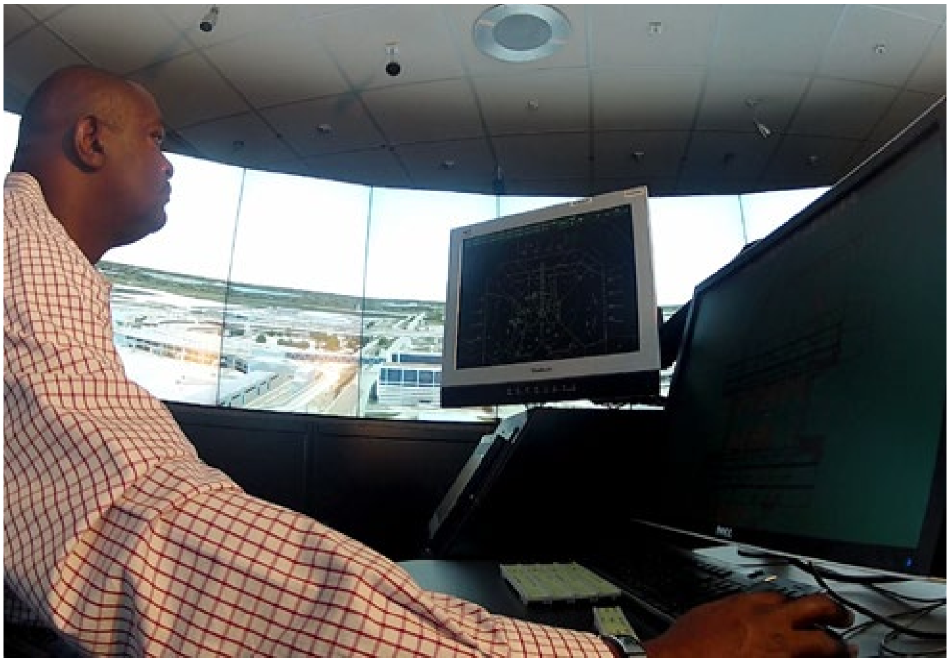
NextGen PHASES OF FLIGHT

www.faa.gov/nextgen

April 2013

NEXTGEN AHEAD

WORKING TOWARD TOMORROW



Consistent, real-time data sharing is a cornerstone of future NextGen capabilities.

For the past several years, NextGen capabilities and NextGen procedures designed for specific locations have been improving predictability, throughput and efficiency. At the same time, they have been contributing to fuel savings and improving the environmental performance of aircraft engines and design to reduce the impact of noise and emissions. The FAA is applying lessons learned from these successes to inform policy and regulations that will smooth the way for broader applications nationwide. Wider availability of NextGen capabilities will provide NextGen benefits to more commercial and general aviation operators, making it easier for them to develop the business case for equipage.

FROM THE GROUND UP

Advances in sharing real-time information about the movement of aircraft and vehicles on the airport surface are not only improving safety through enhanced situational awareness, but are also making gate, taxiway and runway traffic management more predictable and efficient. This translates to reduced delays, fuel use and aircraft exhaust emissions. The FAA's near-term benefits strategy to provide improved surface capabilities has led to a number of successful implementations, such as data sharing from Airport Surface Detection Equipment–Model X, which tracks the movement of aircraft and equipped vehicles on the airport surface. We are also seeing benefits from initiatives, such as departure queue management at New York John F. Kennedy, as well as demonstrations, such as Collaborative Departure Queue Management at Memphis, which allocate available departure capacity among aircraft operators. Building on these successes, the FAA and aviation community collaborators — including air carrier and airport operators, aviation associations and air traffic controllers — have developed the U.S. Airport Surface Collaborative Decision Making (SCDM) Concept of Operations. SCDM leverages real-time data sharing among all surface stakeholders, coupled with highly accurate operational data from flight and airport operators, to better understand and manage demand on the surface in accordance with defined procedures and policies.

The FAA's surface efficiency and safety improvement strategy also involves new traffic flow management and planning and terminal air traffic control (ATC) capabilities. One system that will assist us in that planning is the Terminal Flight Data Manager (TFDM). TFDM will optimize surface operations and the movement of aircraft off the airport surface and into the high altitude stream of air traffic. TFDM will provide an initial surface management capability at select airports and ATC facilities starting in 2015, adding more as the program continues. Additional TFDM capabilities are planned for 2017, including transitioning to electronic flight data exchange, which will make transferring flight data between towers and Terminal Radar Approach Control (TRACON) facilities more efficient. TFDM will also integrate surface surveillance and flight data and provide a scheduler/sequencer capability that integrates TFDM with the Traffic Flow Management System and Time Based Flow Management tools.

Another ATC automation improvement, the Integrated Departure/Arrival Capability, will maximize the use of runways to enhance the efficiency of arrivals and departures. In 2014 we will begin deploying this tool, which will enable tower controllers to assign slots in the overhead traffic stream to departing aircraft. Currently, those slots are assigned by controllers at the en route air traffic control center serving the departing airports, necessitating frequent phone calls between the center controller and tower controllers at multiple airports during heavy traffic periods. With the new automation tool, tower controllers will determine the best use of the available slots in the overhead stream and coordinate the departure of aircraft based on departure readiness. Better utilization of openings in the overhead stream will enable more precise scheduling for aircraft to push back from the gate, further improving overall system efficiency.

Wider availability of NextGen capabilities and associated benefits makes the business case for aircraft equipage.

In a joint effort with the European Organization for the Safety of Air Navigation (EUROCONTROL), the FAA is re-categorizing wake standards that will reduce the necessary arrival separation between various classes of aircraft. This effort identifies changes to the International Civil Aviation Organization's aircraft weight categories for improved throughput at capacity-constrained, high-density airports, while maintaining or improving wake safety. New wake turbulence categories have been proposed that more accurately group similar aircraft based on their wake turbulence characteristics, resulting in closer arrival separation for certain aircraft types without sacrificing safety. The re-categorization will result in changes to FAA Order 7110.65 to reflect the new separation standards, which began with a fall 2012 key site implementation at the Memphis TRACON, eventually resulting in improved terminal automation for closer arrival spacing.

RIGHT INFORMATION, RIGHT TIME, RIGHT PLACE

To further improve safety and efficiency in the National Airspace System (NAS), increased situational awareness and collaboration among flight planners, controllers and flight crews has to begin before the plane ever leaves the ground. Access to accurate aeronautical information is essential for effective individual flight planning and for the overall management of the NAS. The FAA's goal is to provide information related to changes in NAS status affecting safety, security and efficiency that is consistent and as complete as possible.

The ability to take advantage of special use airspace (SUA) when it is not in use by the military or otherwise unavailable to civil aviation will provide additional flexibility for air traffic planners. The FAA is working to improve consistency, timeliness and accessibility of SUA activation schedule and airspace configuration information so that NAS users will have better information for planning. With these improvements, planners will be able to make better predictions of how scheduled SUA use will affect planned flight routes and thus airspace capacity. We plan to make this capability available in 2015.

Equally vital to flight planning is having real-time information about restrictions on the use of airspace and runways. The FAA has already digitized the delivery of Notices to Airmen (NOTAM). We are working to tailor individual flight delivery by providing only those NOTAMs that affect the flight based on its planned trajectory. The initial implementation includes distribution from a single authoritative source to flight operations centers and will be available for use NAS-wide in 2015.

SMARTER ROUTES FOR A SMARTER NAS

The FAA is supporting the use of Performance Based Navigation (PBN) air traffic procedures to provide greater flexibility in the NAS and to facilitate more dynamic management of air traffic. PBN relies on the performance capabilities of the aircraft and employs sensors, such as GPS, to meet airspace requirements. The most basic form of PBN is Area Navigation (RNAV), which provides aircraft with the ability to fly more direct routes and procedures that save fuel, reduce aircraft exhaust emissions and make more efficient use of available airspace. With the addition of Required Navigation Performance (RNP), an onboard performance monitoring and alerting capability, aircraft can fly procedures that are contained within a tightly defined corridor of airspace. The proven benefits of available PBN procedures have led to a nationwide policy of RNAV throughout the NAS, and a combination of RNAV with RNP in places where the added precision that RNP procedures provide increases the capacity, throughput and safety of existing airport resources. The FAA is working with the aviation community to determine where RNP procedures will provide the most benefits.

The FAA has enlisted the assistance of a third-party vendor to supplement our development of RNP procedures for airports across the country. This vendor will be responsible for designing, implementing and maintaining 10 RNP procedures, two each at five airports: Anchorage, Alaska; Buffalo, N.Y.; Dayton, Ohio; Milwaukee, Wis.; and Syracuse, N.Y. The FAA will closely monitor the work and make sure necessary safety and environmental steps are taken. Procedures at all five airports are scheduled to be completed by the end of January 2014.

Two new capabilities will provide improvements for aircraft flying over the ocean. Automation enhancements to the FAA's Oceanic Automation System (Ocean21) will enable more aircraft to take advantage of optimal fuel-saving altitudes. Currently, traffic density and traditional separation requirements combine to limit altitude changes that would provide better fuel economy and ride quality, and take advantage of more favorable winds. With a new climb and descend capability, controllers will be able to clear aircraft to ascend or descend to their desired altitude between aircraft flying at an intermediate altitude (see Fig. 1) using Ocean21's conflict probe, which determines if there is adequate separation available for the maneuver. This capability will be available when the aircraft involved are equipped with Automatic Dependent Surveillance–Contract (ADS-C) to take advantage of the Climb/Descend Procedure (CDP). With ADS-C, the aircraft's navigation system verifies the aircraft's position using GPS signals.

While ADS-C CDP is an ATC automation enhancement, another means of accomplishing oceanic enroute climb and descend capability is with the Automatic Dependent Surveillance–Broadcast (ADS-B) In-Trail Procedures (ITP) application. ADS-B ITP depends on information derived from the flight deck of ADS-B-equipped aircraft and relayed by the flight crew to the controller. The application will enable aircraft equipped with ADS-B and appropriate onboard automation to climb and descend through altitudes where current separation standards would prevent desired altitude changes.

Preferred routing in oceanic airspace will enable aircraft to spend more flight time at desired altitudes, which, in turn, will potentially require them to carry less fuel, decrease fuel burn, increase payload capacity, improve in-flight planning and improve the passenger experience through reduced exposure to turbulence. Implementation of automation enhancements for ADS-C CDP and ADS-B ITP is planned for 2015.

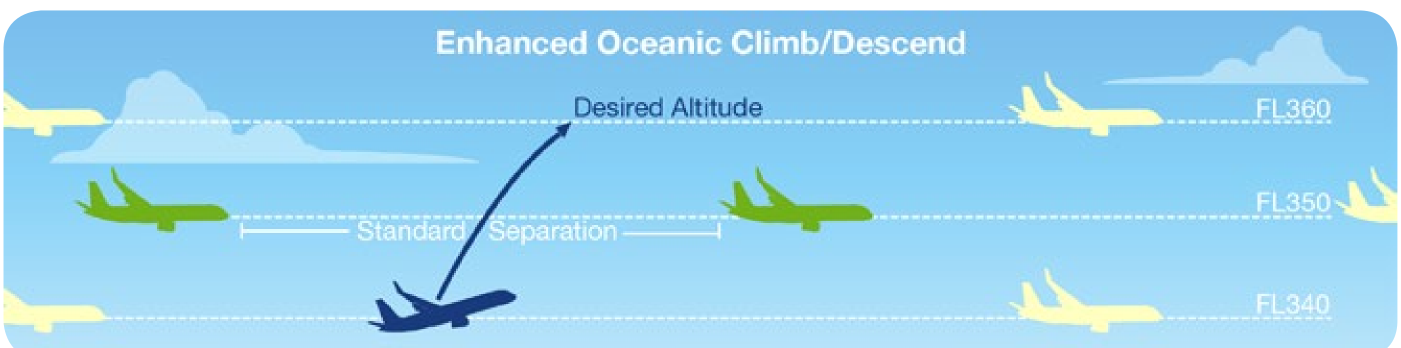


Fig. 1

SAFETY FIRST FOR EVERYONE

The FAA is developing new equipment for general aviation aircraft that will reduce the chance of mid-air collisions. Similar to a tool that commercial airlines have long used, Traffic Situational Awareness with Alerts (TSAA), builds upon ADS-B situational awareness capabilities to warn pilots of ADS-B-equipped aircraft if they come too close to another aircraft in flight. TSAA flight tests are scheduled to be completed in spring 2013. The technical standard order, which describes the requirements for building TSAA equipment, will be published in spring 2014.

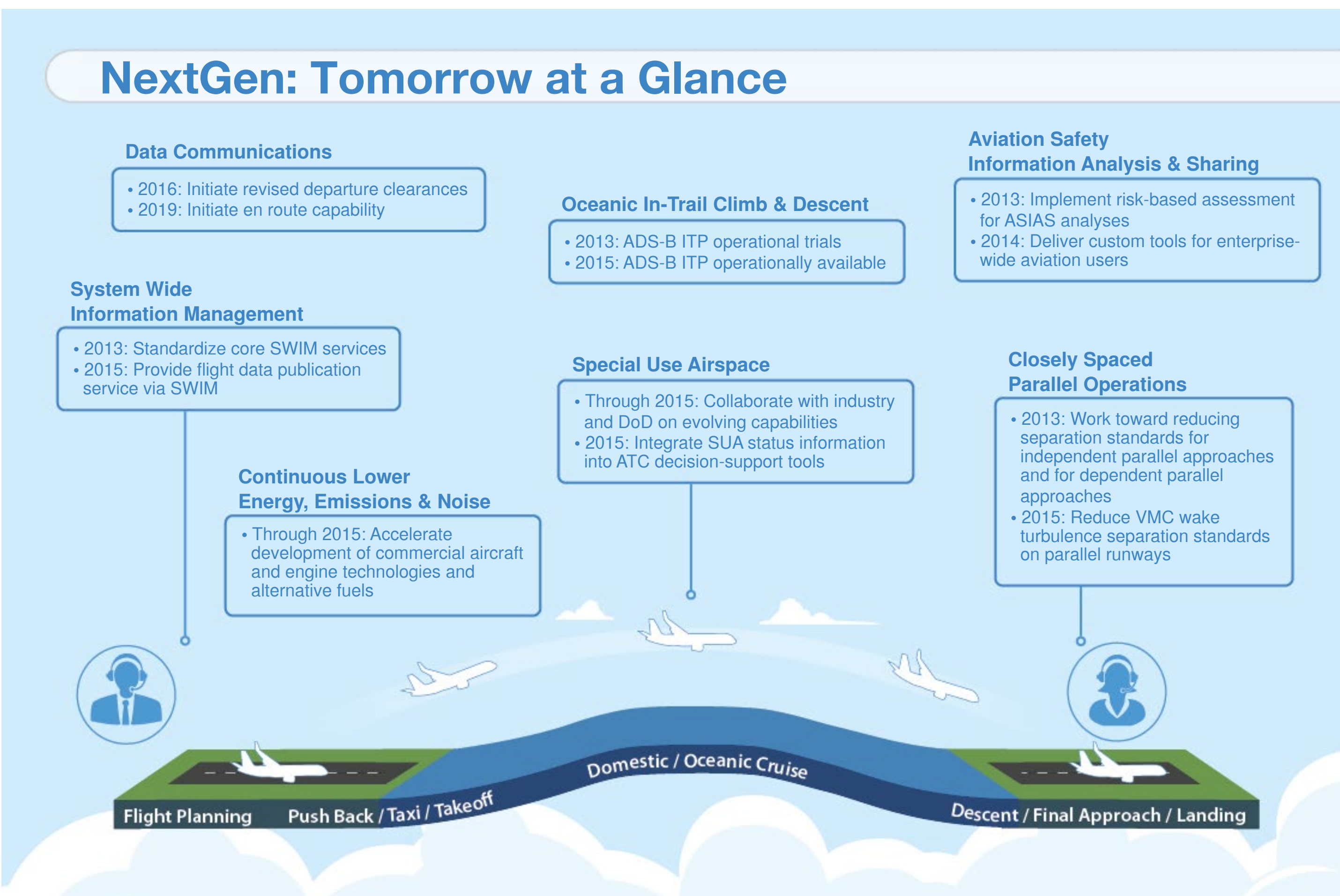
WEATHER OR NOT

Most flight delays can be attributed to poor weather. NextGen weather detection and forecast capabilities will improve air traffic planning and collaboration by making vital weather information available earlier and with more accuracy, and by making the same information available to everyone at the same time, creating a common NAS weather picture. In collaboration with the National Oceanic and Atmospheric Administration (NOAA), the FAA will align leading-edge scientific research with long-term NextGen requirements to provide incremental, near-term improvements to NAS safety and efficiency. These interim capabilities include improved detection and forecasting of in-flight icing, turbulence, and ceiling and visibility. Specifically, in 2014 we expect to introduce an improved Graphical Turbulence Guidance capability that provides flight planners with turbulence forecasts at all levels of flight, including mountain-wave turbulence, which is created when strong winds flowing toward mountains are pushed upward. A new capability that forecasts in-flight icing potential for air traffic in Alaska is scheduled for release in 2015, and a gridded, national Ceiling and Visibility Forecast is expected to be available by 2016. These weather tools will initially be available to NAS users through NOAA via the web-based Aviation Digital Data Service portal.

Beginning in 2016, NextGen Common Support Services–Weather (CSS-Wx) will disseminate via System Wide Information Management weather information used by various FAA ATC planning tools, with new categories of aviation weather information generation through the NextGen Weather Processor (NWP). CSS-Wx will be the single disseminator of weather information for the FAA, modernizing the two-way interface with NOAA for effective and efficient exchange of information, and implementing international standards for exchange of information with other government agencies, the aviation community and international partners.

The NWP will establish a common weather processing platform that will replace legacy FAA weather processors and host new capabilities, such as weather translation. Using FAA and NOAA radar and sensors and NOAA forecast models, the NWP will create standardized, aviation-specific weather information, providing a measurement of the constraint that weather will place on NAS operations. The NWP translation function takes textual, graphical and digital weather observations, analyses and forecasts from FAA and external sources and automatically produces standard weather information. This translated weather information will enable consistent, optimized decision making. Planners will use the translated information to assess weather-related impacts on traffic flows and individual aircraft trajectories. We expect these capabilities to be fully operational NAS-wide in 2016.

Additional details on the capabilities discussed in this chapter and other implementation activities can be found in Appendix A and Appendix B.



APPENDIX A

NEXTGEN INVESTMENTS FOR OPERATORS AND AIRPORTS

To take advantage of NextGen benefits, aircraft operators can determine which capabilities make sense for them and equip their aircraft accordingly.

NextGen benefits depend on FAA ground systems, space-based systems, improvements in aircraft engine, airframe and fuel technologies, advanced avionics capabilities and airport infrastructure. This appendix outlines the operator and airport investment opportunities through an overview of existing and planned capabilities, the benefits these capabilities enable and which technologies and equipment can take advantage of specific NextGen capabilities.

We use the term enablers in this appendix to describe the technologies required for an aircraft, operator or airport to implement a NextGen capability. Each enabler is defined by a set of performance and functional requirements that allow for market flexibility whenever possible. We provide guidance for operators in satisfying these requirements and deploying the enablers through advisory circulars (AC) and technical standard orders (TSO). Enablers are linked to operational improvements and capabilities that provide benefits and build on current equipage.

For each enabler, icons provide a quick look at key information.

- Target Users: Target users for each enabler can include air carriers, business jets, general aviation fixed-wing aircraft, and rotorcraft. These categories represent generalized modes of operation and may not apply to every civil or military operator. The FAA does not limit NextGen capabilities to targeted user groups. In addition to specified user groups, some users may still find it worthwhile to invest in a particular enabler to meet their operational objectives.
- Target Areas for Implementation: The general strategy for deployment can be nationwide, in oceanic areas or in metroplexes. Metroplexes are areas with large- and medium-hub airports and satellite airports.
- Maturity: An enabler may be available for operator investment, in development (including standards development) or in concept exploration.

Detail concerning operational improvements, and the FAA's implementation plan for each improvement, is provided in Appendix B.

This appendix explores several new developments, notably:

- Performance Based Navigation (PBN): In coordination with the International Civil Aviation Organization (ICAO) PBN Study Group, the FAA developed general criteria for advanced Required Navigation Performance (RNP). Additionally, the FAA began work with RTCA Special Committee (SC)-227 to develop navigation standards for Trajectory Operations.
- ADS-B: The FAA developed technical standards and

installation guidance for In-Trail Procedures (ITP) in oceanic airspace using ADS-B In. The FAA is working with industry to prepare guidance for interval management and traffic situational awareness and alerting.

- Data Communications (Data Comm): The FAA published installation guidance on dual stack data communication capabilities in 2012. Dual stack aircraft have both Future Air Navigation System (FANS) 1/A+ and Aeronautical Telecommunication Network (ATN) Baseline 1 data link systems installed with the goal of seamless operations. The FAA is working with industry to revise installation and operational guidance for ATN Baseline 2, currently planned in 2014.
- Low-Visibility Operations: An Enhanced Flight Vision System (EFVS) enabling rule is planned for 2013, along with supporting installation and operational guidance.
- Flight Deck Enhancements: Electronic Flight Bags (EFB) continue to play a larger role in NextGen flight operations. The FAA published updated operational guidance in 2012.
- Aircraft Engine, Airframe and Fuel Technologies: The agency has partnered with industry to accelerate development of new aircraft and fuel technologies and demonstrate performance gains and environmental benefits. Also, the FAA plans to study the performance of electric engines in light sport aircraft.
- Airport Enhancements: The FAA continues to evaluate existing arrival and departure procedures at airports with multiple or closely spaced runways. The goal is to safely reduce separation to improve arrival capacity, especially during low-visibility conditions.

NEXTGEN CAPABILITIES

NextGen capabilities are usually grouped by functionality, for example PBN. FAA support for NextGen equipage usually takes the form of standards development, ACs, TSOs and/or project-specific policy. A snapshot of avionics enablers, schedules, capability overviews and guidance is provided, together with the target users, target areas and maturity icons.

PBN

PBN encompasses a set of enablers with a common underlying capability of constructing a flight path that is not constrained by the location of ground-based navigation aids. Area Navigation (RNAV) is a method of navigation that permits aircraft operation on any desired flight path within the coverage of ground- or space-based navigation aids, within the limits of the capability of self-contained aids, or a combination of these. PBN defines RNAV system performance requirements in terms of the accuracy, integrity, continuity and functionality needed for operations in a particular airspace environment. FAA advisory material and rules identify performance requirements through navigation specifications. Guidance materials and rules may also identify which navigation sensors and equipment operators may use to meet performance requirements. The FAA works to define navigation specifications with a sufficient level of detail to facilitate global harmonization with the ICAO PBN Manual, Document 9613.

The RNAV designation refers to navigation accuracy, but can designate other performance and functional requirements. The FAA publishes RNAV Q-routes, T-routes, arrival procedures and departure procedures. For example:

- RNAV 2 requires sustaining an accuracy of two nautical miles (nm) for 95 percent of the flight time during the operation. The FAA uses RNAV 2 for en route operations.
- RNAV 1 requires sustaining an accuracy of one nm for 95 percent of the flight time. The FAA uses RNAV 1 for arrivals and departures.

As of January 2013, the FAA had published a combined total of 851 RNAV Standard Instrument Departures (SID), Standard Terminal Arrivals (STAR) and RNAV routes. A current inventory of RNAV procedures may be viewed on the FAA's Instrument Flight Procedures Inventory Summary website.

Overview of Aircraft Operator Enablers						
Avionics Enablers	Aircraft and Operator		Capability Overview	Target Users	Target Area	Maturity
	Guidance	Schedule				
Performance Based Navigation (PBN)						
Required Navigation Performance (RNP) 10	Order 8400.12C	Complete	Reduces oceanic separation			
RNP 4	Order 8400.33	Complete	Further reduces oceanic separation in conjunction with Future Air Navigation System (FANS) 1/A			
Area Navigation (RNAV) 1, RNAV 2	Advisory Circular (AC) 20-138C, AC 90-100A	Complete	Enables more efficient routes and procedures			
RNP 1 with Curved Path	AC 20-138C, AC 90-105	Complete	Enables precise departure, arrival and approach procedures, including repeatable curved paths			
Vertical Navigation (VNAV)	AC 20-138C, AC 90-105	Complete	Enables defined climb and descent paths			
Localizer Performance with Vertical Guidance (LPV)	AC 20-138C, AC 90-107	Complete	Improves access to many airports in reduced visibility, with an approach aligned to the runway			
RNP Authorization Required (AR) Approaches	AC 20-138C, AC 90-101A	Complete	Improves access to airports in reduced visibility with an approach that can curve to the runway; improves procedures to separate traffic flows			
Advanced RNP, RNP 0.3, RNP 2	AC	2014	Enables more accurate and predictable flight paths for enhanced safety and efficiency			
Trajectory Operations Navigation	AC, Technical Standard Order (TSO)	2015	Enhances PBN capabilities			
Alternative Positioning, Navigation and Timing	AC, TSO	2018	Provides GPS-independent alternative position, navigation and timing capability			

RNAV 1 is the mainstay in the terminal area, except where obstacles or airspace conflicts demand the improved performance provided by RNP 1. When a navigation specification includes requirements for onboard performance monitoring and alerting, or additional functionality, the FAA designates the application as RNP.

The FAA is expanding the use of RNP where beneficial, and one of the foreseen benefits is advanced RNP 1 with a defined curved path. Flying precise curved path Radius-to-Fix (RF) legs increases the consistency of aircraft tracks. RF leg application is an option where beneficial for SIDs, STARs, RNP and RNP Authorization Required (AR) approach operations. However, only RNP AR approach operations can apply an RF leg segment in the final approach segment (FAS). Expanding the use of the RF leg may help deconflict arrivals and departures in metroplexes and provide more efficient routing. The FAA plans to implement RF legs where they provide the highest operational benefit to the National Airspace System (NAS).

Many aircraft are able to use barometric altitude through the Flight Management System (FMS) to obtain vertical guidance and fly a defined vertical path. This aircraft capability is called barometric vertical navigation (baro-VNAV). Advisory vertical guidance helps the pilot maintain an optimum descent profile while complying with an air traffic control (ATC) clearance. However, the pilot is still responsible for complying with all procedure-defined altitude restrictions by referencing the primary barometric altitude source. By accounting for vertical guidance capabilities in the design of arrival and departure procedures, traffic flows can be planned more efficiently.

To access runways requiring instrument approach procedures, three approach minima capabilities offer different advantages and costs: RNP, Localizer Performance with Vertical Guidance (LPV) and RNP AR. The most basic performance capability, RNP 0.3, is a non-precision GPS approach. It is identical to the Lateral Navigation (LNAV) line of minima on RNAV (GPS) instrument approach charts. Adding vertical guidance with either baro-VNAV or Satellite Based Augmentation System (SBAS) can enable use of the LNAV/VNAV approach minima line. The Wide Area Augmentation System (WAAS) is the FAA's implementation of SBAS.

The FAA can publish LPV approaches to airports without incurring the need for Instrument Landing System (ILS) radio-navigation infrastructure and the associated maintenance costs. Likewise, RNAV (GPS) approaches are not subject to the ILS challenges of siting the localizer and glideslope antennas and do not require ground traffic to hold outside of an ILS critical area. LPV procedures can be implemented at many locations where an ILS installation is not feasible. An RNAV (GPS) instrument approach offering LPV minimums uses SBAS. LPV approaches typically offer the lowest approach minimums, using SBAS to enable decision altitudes as low as a conventional Category I ILS approach procedure.

With more advanced systems and procedures, operators are eligible for RNP AR approaches. RNP AR instrument approach procedures are designated as RNAV (RNP) approaches. These are the most demanding type of PBN operations, using very precise lateral paths — down to 0.1 nm accuracy — and can include the application of RF leg segments in the FAS. With proper aircraft equipment, operators may obtain approval to fly these procedures. This approval includes RNP AR training, database validation and operating procedures. RNP AR instrument approaches enable access at airfields with more demanding obstacles or traffic constraints. A complete listing of all RNAV (GPS), and RNAV (RNP) and LPV approaches may be viewed at the FAA's Satellite Navigation Program website.

Most air carrier aircraft can support RNAV operations and RNP, and half can support RNP AR approaches. The heart of the PBN capability in the air carrier community is the FMS function, which generally uses multi-sensor inputs to define aircraft positions. Depending on the installation, these inputs come from Distance Measuring Equipment (DME), from the Global Navigation Satellite System (GNSS) using either GPS or GPS incorporating WAAS, from VOR or from inertial guidance. For RNAV 1 and RNAV 2 capabilities, the FAA only provides DME facilities (for use with inertial input) and GNSS. DME-only navigation has coverage limitations and will not be supported on every published procedure. Most air carrier aircraft can support RNAV operations and RNP, and half can support RNP AR approaches.

In the general aviation community, PBN enablers are typically implemented in a GNSS navigator installed in an aircraft's instrument panel. These systems have become increasingly complex and capable, integrating other types of navigation, voice communication and uplinked weather information. Most of these installations can support RNP, and those equipped with WAAS can support LPV approaches. Some configurations on general aviation aircraft may be upgradeable to RNP with curved path capability.

Operational advantages provide the primary motivation for equipping with PBN enablers. Operators who equip obtain direct efficiency and access because of the new routes, procedures and approaches. The FAA is not planning to retain the full legacy ground structure, so a further incentive for PBN capability will come through less optimal services to non-equipped aircraft.

Advanced RNP operations include a set of new capabilities that will enable increased use of RF legs without the stringent requirements for RNP AR. We envision procedures with scalable accuracy values as low as 0.3 nm and criteria for RNP 2 en route operations. For helicopters, we are developing material for RNP 0.3 departure and en route operations in congested environments, taking advantage of the slow speed and high maneuverability of the rotorcraft.

As the NAS moves to a trajectory operations-based construct, new requirements will be allocated to aircraft navigation systems. The widespread use of trajectory operations will require aircraft navigation systems to perform to a new degree of standardization. The FAA is working with industry stakeholders to determine new performance standards for trajectory operations.

The FAA is exploring means to reduce the existing VOR network and a limited number of secondary surveillance radar facilities. Alternative Positioning, Navigation

Overview of Aircraft Operator Enablers						
Avionics Enablers	Aircraft and Operator		Capability Overview	Target Users	Target Area	Maturity
	Guidance	Schedule				
Automatic Dependent Surveillance–Broadcast (ADS-B) Capabilities						
ADS-B Out	AC 20-165A, AC 90-114, TSO-C166b, TSO-C154c	Complete	Enables improved air traffic surveillance and automation processing			
Airborne/ Ground Cockpit Display of Traffic Information (CDTI), ADS-B In	AC 20-172, TSO-C195	Complete	Improves awareness of other traffic			
In-Trail Procedure (ITP), ADS-B In	AC 20-172A, AC 90-114 CHG 1, TSO-C195a	Complete	Improves oceanic in-trail climb/ descent			
Interval Management, ADS-B In	AC, TSO	2015	Displays along-track guidance, control and indications, and alerts			
ADS-B Traffic Situational Awareness and Alerting, ADS-B In	AC, TSO	2014	Displays and alerts crew to airborne conflicts independent of Traffic Alert and Collision Avoidance System alerting			
Closely Spaced Parallel Operations, ADS-B In	AC, TSO	2017	Provides guidance information for aircraft participating in paired approaches to closely spaced runways			
Advanced Flight Interval Management	AC, TSO	2017	Provides higher performance along-track guidance, control and indications, and alerts for terminal operations			

and Timing would provide a means to reduce GPS dependency.

ADS-B

There are many ADS-B enablers, with different cost and benefit implications. The most basic participation with ADS-B is ADS-B Out. ADS-B Out avionics broadcast an aircraft's position and other data. Ground receivers and other aircraft within range can receive these broadcasts and use them for their own applications. ADS-B Out enables the next generation of air traffic surveillance. Using ground receivers across the country, controllers will receive and process precise ADS-B broadcasts to provide air traffic separation and advisory services. Aircraft operating in Class A airspace — from 18,000 feet mean sea level (MSL) to and including Flight Level 600 — must broadcast position data with a Mode S, 1090 Extended Squitter (1090 ES) solution to comply with the ADS-B Out rule. For aircraft operating below 18,000 feet MSL, broadcasting position with either 1090 ES or the Universal Access Transceiver (UAT) can satisfy the mandate.

Automatic Dependent Surveillance–Rebroadcast (ADS-R) takes position information received on the ground from UAT-equipped aircraft and rebroadcasts it on the 1090 megahertz (MHz) frequency, which jet aircraft primarily use. ADS-R rebroadcasts 1090 MHz data to UAT users. In concert with Traffic Information Services–Broadcast (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 and plus or minus 5,000 feet relative to the receiving aircraft's position.

Building on the ADS-B Out capability, operators can integrate ADS-B avionics with different controls and displays to implement ADS-B In enablers. The most basic enablers provide enhanced situational awareness, improving the ability of the flight crew to identify where aircraft are around them and the direction in which those nearby aircraft are headed. This technology works in the air or on the ground, but coverage issues and the availability of quality airport surveys may limit the ground capability. This basic type of display is referred to as a Cockpit Display of Traffic Information (CDTI). The CDTI may be a new display or it may be integrated with a conventional Traffic Alert and Collision Avoidance System (TCAS) traffic display. CDTI provides a graphic display of the relative position of other aircraft and surface vehicles equipped with ADS-B.

Another set of ADS-B In enablers uses ADS-B data for speed or timing guidance, typically maintaining spacing from another aircraft. This includes algorithms for oceanic ITP. Beyond these lie advanced alerting to improve airport safety and reduce the risk of collision for aircraft without TCAS. Eventually the FAA expects ADS-B to be integrated with other capabilities to support access to closely spaced runways in almost all weather conditions, and to enable airspace with separation similar to visual operations today.

In air carrier aircraft, we expect operators to implement ADS-B as upgrades to the Mode S transponder and aircraft displays. Operators will be able to upgrade or replace this equipment to support ADS-B as well as its original function. The various ADS-B In capabilities reflect different levels of integration with the controls and displays in the cockpit. Situational awareness is available using side console-mounted displays that are not integrated. Instrument panel-mounted displays that are not integrated can provide along-track guidance. Long-term capabilities will require integration with other navigation data and eventually migrate to flight displays as benefits are substantiated.

UAT also provides access to weather and other FAA aeronautical data services. ADS-B In capabilities for general aviation will use displays similar to those for air carriers.

By providing early benefits, the agency is encouraging operators to equip portions of their fleets with ADS-B before the ADS-B Out rule goes into effect on January 1, 2020. As the operators experience these benefits, they will have an incentive to accelerate and expand ADS-B equipage to the rest of their fleet.

For air carriers, this strategy uses memorandums of agreement in which each party provides in-kind contributions critical to the success of the project. Each agreement is unique, reflecting the specific operator's business model, route structure and existing avionics infrastructure, among other factors. For general aviation operators, deployment of traffic and weather information, uplinked over the UAT, will enhance benefits and motivation to equip. This information will be provided by two no-cost broadcast services, TIS-B and Flight Information Services–Broadcast (FIS-B). The FAA is also evaluating additional locations where surveillance may be expanded by employing ADS-B.

In September 2011, the ADS-B In Aviation Rulemaking committee recommended implementation of ADS-B In capabilities for suitably equipped aircraft by 2017. The FAA will incorporate these recommendations into its planning for NextGen, and the plan for developing guidance and standards is reflected in the ADS-B enabler table.

In last year's NextGen Implementation Plan, we explored concepts for ADS-B Surface Indications/Alerts and we scheduled a TSO and AC for 2016. Surface Indications/Alerts are now targeted for after the high-value Advanced Flight Interval Management concepts are complete. Where the current Interval Management would provide spacing on a single arrival stream, Advanced Flight Interval Management would allow more consistent spacing for merging from various directions and flight paths.

Overview of Aircraft Operator Enablers

Avionics Enablers	Aircraft and Operator		Capability Overview	Target Users	Target Area	Maturity
	Guidance	Schedule				
Data Communications						
FANS 1/A (Satellite Communications)	AC 20-140A, AC 120-70B	Complete	Provides oceanic data communications and surveillance, transfer of communications			
FANS 1/A+ [VHF Digital Link (VDL) Mode 2]	AC 20-140B, AC 120-70B, TSO-C160a	Complete	Provides domestic data link clearances			
Aeronautical Telecommuni-cation Network Baseline 2	AC	2015	Provides clearances, terminal information, and Initial Trajectory Operations			

We are also continuing research on use of ADS-B for paired approaches to parallel runways, where aircraft stay close enough together to avoid wake while maintaining safe separation.

DATA COMMUNICATIONS

Data Comm allows some communications to move off the voice channel and provides a verifiable record, reducing communication errors. It also allows increased air traffic efficiency by reducing the time spent on routine tasks, such as communications transfers. The FAA deployed data communications as part of the FANS program in oceanic airspace. Boeing and Airbus developed integrated communication and navigation capabilities (FANS 1 and FANS A, respectively), providing a pilot-controller data link and the ability to send surveillance data from the aircraft to the ATC system through Automatic Dependent Surveillance–Contract. Operators targeted these navigation and communication capabilities primarily for oceanic airspace, where they provided the greatest initial benefits, enabling a safe reduction in separation between aircraft from 100 nm to 50 nm and later to 30 nm.
The FAA updated its data communications plans in response to an RTCA NAC recommendation to not require domestic use of a latency timer. This is reflected as FANS 1/A instead of FANS 1/A+.

As the FAA moves forward with deploying a domestic ATC data link system, it is important to make use of the FANS capabilities installed within some fleets, particularly widebody air carriers conducting international operations. The domestic program will use an adaptation of FANS appropriate for high-density, surveilled environments through FANS 1/A over VHF Digital Link Mode 2. These aircraft will be able to receive departure clearances and airborne reroutes. This enabler builds on pre-existing FANS 1/A capabilities, adapting them for domestic operations.

ATN was developed through ICAO to provide a more universally capable and reliable ATC data communication system. Earlier versions of ATN provided interim capabilities. Europe has a mandate for ATN Baseline 1 (Link 2000+), which operators can retrofit into aircraft without modification of the navigation system. The desired capability for full participation in continental U.S. airspace will be the second version, called ATN Baseline 2. RTCA SC-214 and the European Organization for Civil Aviation Equipment Working Group-78 are jointly developing standards to define the safety, performance and interoperability requirements for air traffic services supported by data communications. Data communications will also need to accommodate still evolving navigation, surveillance, and aeronautical information service requirements to support the air-ground functional integration. Finalizing these requirements may impact the schedule for ATN Baseline 2 criteria. Both Europe and the United States plan to implement ATN Baseline 2 with a larger set of operational services for all phases of flight.

Operators of fleets that fly internationally have adopted FANS 1/A for oceanic and remote area applications. The FAA is evaluating potential operational incentive scenarios in which aircraft may receive more rapid or efficient departure reroutes during inclement weather.

Overview of Aircraft Operator Enablers

Avionics Enablers	Aircraft and Operator		Capability Overview	Target Users	Target Area	Maturity
	Guidance	Schedule				
Low-Visibility Operations						
Head-Up Display (HUD)/ILS	Order 8400.13D	Complete	Reduces minimums at qualifying runways			
Enhanced Flight Vision System (EFVS)	AC 20-167, AC 90-106	Complete	Uses enhanced flight visibility to continue approach below minimums			
	AC	2014	Expands operational use of EFVS			
Ground Based Augmentation System Landing System III	Project-specific policy	2016	Provides autoland in very low visibility			

Overview of Aircraft Operator Enablers						
Avionics Enablers	Aircraft and Operator		Capability Overview	Target Users	Target Area	Maturity
	Guidance	Schedule				
Flight Deck Enhancements						
Flight Information Service–Broadcast	TSO-C157a, TSO-C154c	Complete	Provides weather and aeronautical information in the cockpit			
	TSO	2015	Provides Universal Access Transceiver link-specific requirements for weather and aeronautical information to the cockpit			
Electronic Flight Bag (EFB)	AC 20-173, AC 120-76B, AC 91-78	Complete	Allows electronic access to paper products			
Synthetic Vision Systems	AC 20-167	Complete	Provides an electric means to display a synthetic vision image of the external scene topography to the flight crew			
Airborne Access to System Wide Information Management, or SWIM	AC 20-177	Complete	Provides flight crews with access to SWIM over non-aeronautical frequency bands			
Airborne Collision Avoidance System (ACAS-X)	AC, TSO	2020	Improves airborne collision avoidance performance with fewer nuisance alerts			

FLIGHT OPERATIONS CENTERS

The FAA will define technical requirements for the communications infrastructure that will enable data exchange. This will include the requirements enabling external users to connect to the FAA's System Wide Information Management (SWIM) security gateway allowing the exchange of FAA and Flight Operations Center (FOC) data. In the near term, new flight planning capabilities will allow the operator to provide a prioritized list of trajectory options for each flight. Taking into account operator flight priorities, the FAA's traffic flow management automation will use these lists to determine flow assignments. Collaboration between the FAA and the operator during the flight planning process will become increasingly sophisticated and leverage new automation and data exchange capabilities. The flight operations centers will manage the exchange of their trajectory option sets and regularly re-evaluate them based on their specific business model. FOCs will also provide flight priority information when traffic management initiatives are required because of volume or weather conditions.

The continuing evolution of flight planning support tools and communications infrastructure to support FOC air traffic management and cockpit decision making will continue to ensure safe and efficient operations.

Airborne Access to SWIM (AAtS) enables in-flight aircraft access to information available through SWIM. AAtS extends these capabilities to the cockpit through third party communication vendors, providing Internet access on the flight deck, for example on an EFB. Although AAtS aircraft guidance is complete, AAtS implementation is still in development.

LOW-VISIBILITY OPERATIONS

The FAA is supporting several different capabilities for operators who need to access an airport during low visibility — when the cloud ceiling is below 200 feet above the runway or visibility is less than one-half mile. At many airports, the FAA has approved the use of a head-up display (HUD) on a precision approach to lower minimums. A HUD provides critical flight and navigation data on a transparent screen directly in front of the pilot, allowing simultaneous viewing of primary flight display information, navigation information and the extended scene. When a HUD is integrated with a suitably qualified precision approach system, the FAA has approved operations to 100 feet above the runway before the flight crew acquires the runway environment with natural vision. The use of a qualified HUD when flying to a suitable ILS facility will reduce the required runway visual range (RVR) visibility for the approach and will increase access compared with non-equipped aircraft. The accuracy of these ILS facilities has been verified for this type of operation. In addition, the airport must have the equipment to measure and report the current RVR visibility. The FAA is increasing the number of airports with RVR to expand this capability.

When a HUD is integrated with suitably qualified EFVS, the FAA has approved operations to 100 feet above the runway before the flight crew acquires the runway environment with natural vision. EFVS affords a high level of access, providing a visual advantage to the flight crew for seeing required visual references using EFVS technology. With enhanced flight vision, access is allowed that otherwise would be denied because of low-visibility conditions. Existing rules allow approaches to straight-in landing operations below decision height, or minimum descent altitude, using EFVS. The FAA will release a notice of proposed rulemaking for EFVS in 2013.

Another enabler is the Ground Based Augmentation System (GBAS) landing system. This system uses differential corrections to GPS to support all categories of precision approach. Although the FAA is not deploying Category I GBAS, a non-federal system was approved for use within the NAS in September 2012 and has been installed at several airports based on user requests. The current FAA GBAS program is researching use of this technology to support Category III operations in accordance with baseline ICAO standards. This capability can service multiple runways at an airport with a single system and does not require critical area taxi restrictions. While there are only a few GBAS Category I approaches, new aircraft are being manufactured with the basic capability to reduce the costs of transiting from ILS to GLS Category III when it is mature. The FAA moved implementation from 2014 to 2016 due to the need for further research to mature this technology. EFVS has been adopted by the high-end business community and HUD has spread to the air carrier fleet providing improved service. While not mandated, the low-visibility enablers allow aircraft equipped with this capability to gain airport access while non-equipped aircraft cannot.

Current Equipage Levels of Available Enablers*

Enabler	Air Transport	Air Taxi	Helicopter
RNP 10 - Oceanic	90%	8%	N/A
RNP 4	90%	8%	N/A
RNAV 1	96%	57%	19%
RNAV 2	98%	72%	23%
RNP 1 with Curved Path	50%	6%	3%
VNAV	68%	34%	N/A
LPV Approach	<1%	N/A	N/A
RNP AR Approach	50%	10%	3%
ADS-B Out (rule compliant)	2%	N/A	N/A
Airborne/Ground CDTI, ADS-B In	2%	0%	0%
ITP, ADS-B In	<1%	0%	0%
FANS 1A (SATCOM)	10%	12%	N/A
FANS 1A+ (VDL Mode 2)	2%	12%	N/A
HUD/ILS	17%	<1%	<1%
EFVS	2%	12%	0%
EFB	9%	36%	12%

* The reported number represents the upper bound of all aircraft under the holder's authorized operations specifications. These equipage levels are sensitive to fleet composition changes.

FLIGHT DECK ENHANCEMENTS

FIS-B provides terrestrial-based weather data and real-time NAS status information to aircraft equipped with the ADS-B-enabled UAT link or by use of other FIS-B links, e.g., XM Weather, Sirius and appropriate displays. These data are primarily intended to improve safety of operations for general aviation aircraft. FIS-B is the more generic use of data link communications providing graphical and/or textual weather and aeronautical information to and from aircraft, along with a cross-link service. Various operational domains are supported, including pre-flight, surface operations, terminal and domestic en route. Terrestrial and satellite links support global operations. AAtS functionality is also envisioned. AAtS enables aircraft systems to access data to support collaborative decision-making and ensure a common understanding of status of airspace, systems and weather. The airborne access may be through an installed

Foundational Avionics Enablers											
Metroplex						General					
Enablers	Target Users				Target Area	Enablers	Target Users				Target Area
ADS-B Capabilities*											
ADS-B Out						ADS-B Out					
Recommended PBN											
RNAV 1, RNAV 2						RNAV 1, RNAV 2					
RNP 1 with Curved Path						LPV					
VNAV						* See requirements in 14 CFR 91.225 and 14 CFR 91.227					
RNP AR Approach											

system or an EFB. AAtS must be used to support collaborative decision making to qualify under the NextGen avionics incentive program. For more information on installation of non-required telecommunication equipment, see AC 20-177, Design and Installation Guidance for an Airborne System for Non-Required Telecommunication Service in Non-Aeronautical Frequency Bands.

EFB devices can display a variety of aviation data or perform basic calculations, e.g., performance data and fuel calculations. In the past, much of this information was provided via printed documentation, and calculations were performed manually based on data provided to the flight crew by flight dispatch. EFBs also have the ability to send and receive graphical and textual information for use on the flight deck.

ACAS-X is a family of collision avoidance systems. ACAS-X_A is intended to fill the role of current TCAS, serving as a collision avoidance system for large transport and cargo aircraft. ACAS-X_O is intended for specific flight operations of those same users when normal separation may result in excessive nuisance alerts, such as closely-spaced parallel operations.

Synthetic vision displays, which electronically show external topography, are gaining popularity among flight crews.

EQUIPAGE LEVELS

The Equipage Level table summarizes current equipage levels of mature avionics enablers among air transport operators [14 Code of Federal Regulations (CFR) part 121 operators], air taxis (14 CFR part 91K and 135 operators) and helicopters (14 CFR part 135 operators). The high penetration of PBN enablers reflects the maturity of those capabilities, which have been delivered in various forms for more than 10 years. While the general aviation fleet continues to experience significant adoption of advanced technologies, especially with WAAS avionics, precise equipage numbers are difficult to obtain and are not included. The equipage numbers on the preceeding page are based on documented operational approvals for air carriers, air taxi and helicopters, and are normalized to the subset of the fleet applicable to the operation.

FOUNDATIONAL AVIONICS ENABLERS

The FAA has evaluated available enablers and identified those that provide the most NAS benefits when a high level of participation is achieved.

The metroplex foundational enablers were selected for providing the greatest impact on metroplex operations and presume high levels of equipage. The general foundational enablers target the minimum NextGen capabilities outside of metroplex areas. Both capability levels are displayed above. These recommended avionics will be updated when additional enablers become available. Operators may elect to use any of the other enablers, which provide benefit but do not require high levels of participation.

Overview of Aircraft Operator Enablers						
Enablers	Operator or Airport Guidance	Operator or Airport Schedule	Capability Overview	Target Users	Target Area	Maturity
Aircraft Engine, Airframe and Fuel Technologies						
Drop-In Alternative Jet Fuel Blends with Jet A	ASTM standard D7566	Complete	Expands jet fuel specification to allow use of Jet A blended with up to 50% of Synthetic Paraffinic Kerosene from Fischer-Tropsch or Hydroprocessed Esters and Fatty Acids processes			
Electric Propulsion	ASTM standard	2014	Enables certifiable electric propulsion technology with zero fuel burn and lower noise for light sport aircraft			
Additional Drop-In Alternative Jet Fuels	ASTM standards alcohol-to-fuel pathways	2014	Expands jet fuel specification to allow use of Jet A blended with up to 50% of alternative jet fuels from novel processes and feedstocks e.g. alcohol-to-jet and pyrolysis			
	ASTM standards pyrolysis	2015				
New Airframe Technologies	Technology available for product development	2015	Provides demonstrated and certifiable airframe technologies with lower fuel burn, emissions and noise			
More Efficient Engines	Technology available for product development	2015	Provides demonstrated and certifiable turbine engine technologies with lower fuel burn, emissions and noise			

AIRCRAFT ENGINE, AIRFRAME AND FUEL TECHNOLOGIES

In partnership with industry, the Continuous Lower Energy, Emissions and Noise program accelerates the development of new certifiable aircraft technologies and alternative jet fuels. Drop-in alternative jet fuels research continues with the intent of developing a range of ASTM International-approved fuels that provide improved environmental performance without compromising safety or requiring changes in aircraft, engines or fuel-supply infrastructure.

ASTM International has approved for commercial use alternative jet fuels consisting of Jet A blended with up to 50 percent synthetic paraffinic kerosene from the Fischer-Tropsch process (approved in 2009) or Hydroprocessed Esters and Fatty Acids process, formerly known as Hydroprocessed Renewable Jet biofuel (approved in 2011). Developers are beginning to test additional advanced alternative jet fuels in support of eventual ASTM approval. ASTM approval for alcohol-to-jet fuel pathways is targeted for 2014 and pyrolysis is targeted for 2015.

Operator investment is limited to purchasing alternative jet fuel blends as they become available in commercial quantities. We expect air carriers to sign long-term fuel purchasing agreements to help facilitate deployment of these alternative fuels.

Operators are also mulling other technical advances that will provide both performance gains and environmental benefits. Operators may retrofit some new certified airframe and engine technologies on existing aircraft to speed technology insertion into the fleet, while other new technologies such as the high bypass ratio geared turbofan and open-rotor engines will await future generations of aircraft.

AIRPORT ENHANCEMENTS

Airports are active participants in NextGen implementation across the NAS. While many investments in NextGen technologies are the responsibility of the FAA or aircraft operators, airports will also have opportunities to advance NextGen.

Overview of Airport Enablers						
Avionics Enablers	Operator or Airport		Capability Overview	Target Users	Target Area	Maturity
	Guidance	Schedule				
Airport Enhancements						
Geographic Information System	AC 150-5300-16,-17, -18	Ongoing	Provides detailed geospatial data on airports and obstructions			
ADS-B for Surface Vehicles	AC 150/5220-26	Complete	Provides ADS-B squitter equipage for surface vehicles operating in the movement area	Airport rescue firefighting equipment, snowplows and inspection trucks		

PBN instrument flight procedures are a key component of NextGen because they can improve the efficiency of airport arrivals and departures. For general aviation operators and some regional air carriers, LPV approach procedures can provide Category I minimums. Business jet operators and air carriers are more commonly equipped for RNAV and RNP, which can support RNP AR approach minimums. The FAA may opt for an incremental phase out of many of the ILS Category I installations by 2025, as both LPV and RNP provide more cost-effective and flexible instrument approach procedures. The FAA continues to evaluate ground-based augmentation system technology, which could boost existing ILS Category II and Category III installations at airports throughout the NAS.

Airports have the key role of discussing with their users the need for new or additional PBN procedures. A hub airport may serve air carriers that are actively seeking to expand the use of RNAV or RNP procedures, while a general aviation airport may benefit from new LPV approach procedures. An airport can request that the FAA initiate the consideration and design of these procedures. Airports can facilitate the aeronautical survey and obstruction-mitigation and runway-lighting actions that may be needed to achieve lower minimums. The surveys and obstruction mitigation could be eligible for Airport Improvement Program (AIP) funds.

The FAA is reviewing the use of Light-Emitting Diode (LED) obstruction lights and approach lights with aircraft using EFVS or Night Vision Imagery technology relying on an infrared signature. Current LED fixtures have not provided this infrared signature. The same issues may be present in LED high intensity runway edge lights. For these reasons, per Program Guidance Letter 12-02, LED obstruction lights, LED approach lights and LED high intensity runway edge lights are not AIP-eligible at this time.

Surface surveillance and management is another key area for airport involvement in NextGen. In 2011, the FAA completed installation of Airport Surface Detection Equipment–Model X (ASDE-X) at 35 airports. The agency aims to install enhancements to airport surface detection equipment, known as the Airport Surface Surveillance Capability (ASSC), at eight other civil airports between 2014 and 2017. At these facilities, airports can install ADS-B Out squitters on airport-owned vehicles that regularly operate in the movement area. Squitters would broadcast vehicle positions to ATC, aircraft equipped with ADS-B In and the airport operations center. This would improve situational awareness and safety, particularly during construction projects and winter weather events. ADS-B Out vehicle squitters could be AIP-eligible.

The FAA continues to research the need and technology options for non-movement area surface surveillance, particularly in support of NextGen surface traffic management concepts that are also still in development. For airports not receiving ASDE-X or ASSC, the FAA is also researching low-cost technologies and systems that could provide a surface surveillance capability.

Some airports have elected to install surveillance systems to complement those the FAA has installed and provide coverage of non-movement areas. There is an overall increase in situational awareness when airports monitor surface operations more precisely. These systems can also support departure queue management concepts. Departure queue management cannot eliminate delays, but it does shift delays from the runway to the ramp or gate area where aircraft can wait with engines off. The FAA is continuing to develop departure queue management options, with operational use expected in a few years.

The FAA recognizes and appreciates the efforts of airports and vendors to develop systems and tools to improve surface situational awareness. The results to date show substantial promise, but challenges with data sharing and distribution have emerged. As a result, the FAA requests that airports considering investments in surface surveillance technologies work in coordination with the FAA during the system design phase. The FAA is refining policy and processes to enable improved access to NAS data to support emerging surface operational concepts under NextGen. The agency has streamlined approval processes to give aviation users access to appropriate NAS data through the NAS Enterprise Security infrastructure. With advance coordination, vendor systems can be designed with an architecture that is compatible with emerging FAA surface operational plans.

Because new runway and taxiway infrastructure is critical to capacity and efficiency, the continued transition of airport layout plans into the Airport Geographic Information System (GIS) application will improve the airport planning process. Airport GIS can also provide the accurate geospatial data needed for surface moving maps and new instrument flight procedures. The FAA is also proceeding with research to revise the separation standards for Closely Spaced Parallel Operations (CSPO) on parallel runways. The revisions to CSPO standards will be incremental throughout the remainder of the decade and beyond to incorporate both existing and new technologies. There may also be dependencies on PBN implementation and aircraft equipage rates. Changes like this may give airports greater design flexibility by allowing better use of existing runway layouts

The FAA is continuing to evaluate existing arrival and departure procedures at airports with multiple or closely spaced runways. Our goal is to safely reduce the separation between aircraft as they approach closely spaced parallel runways. This reduction will improve the arrival capacity on those runways especially during poor-visibility conditions. Analyses of independent and dependent runway standards, including blunder and wake analyses, are ongoing. A blunder is when an aircraft veers off its path during approach. Blunder analyses consider the necessary separation distance required for independent approaches to parallel runways in case of blunders.

The current lateral separation standard for independent (concurrent) arrivals applies to runways spaced 4,300 feet or more apart. In 2011, the FAA completed blunder analyses and determined that lateral runway separation can be reduced for independent arrivals on parallel runways spaced closer than 4,300 feet apart. Using specific procedural and systems criteria, this standard could be reduced to 3,600 feet if approved through the FAA's Safety Management System (SMS) process. An expected update to FAA Order 7110.65 will reflect these changes once the SMS processes are complete. Additionally, an ongoing analysis of dependent approaches aims to reduce the current 1.5 nm-staggered separation for approaches to parallel runways spaced 2,500 feet or more apart, up to the independent runway separation standard.

Today, there are 16 parallel runway pairs at eight airports — Boston, Cleveland, Newark, Memphis, Philadelphia, Seattle, San Francisco and Salt Lake City — spaced less than 2,500 feet apart that are authorized for 1.5 nm-dependent staggered approaches, per FAA Order 7110.308. Work will continue through 2015 to authorize additional runway pairs at additional airports for this procedure. Also in 2015, the FAA plans to reduce dependent staggered separation behind Heavy aircraft (capable of takeoff weights greater than 255,000 pounds) and Boeing 757 aircraft operating on closely spaced parallel runways.

In 2011, the FAA completed its evaluation of RNAV approaches, including RNP and WAAS LPV in place of ILS approaches for parallel runways. Changes to ATC procedures to allow combinations of RNAV and ILS approaches for dependent approaches on runways spaced at least 2,500 feet apart and for independent approaches were published in 2011. In 2012, FAA performed the safety analysis to allow RNAV approaches for dependent staggered approaches.

In 2015, the FAA expects to reduce wake turbulence separation standards during favorable wind conditions for departures on parallel runways during visual conditions. The FAA is continuing to work with ICAO to update the wake separation standards based on analysis of wake generation, wake decay and the effects experienced when an aircraft comes into contact with wake turbulence. The new separations will increase capacity while maintaining or enhancing safety by considering aircraft type-specific leader-follower aircraft pairings.

INTERNATIONAL HARMONIZATION

As the FAA and its international counterparts advance respective airspace modernization efforts, collaboration is essential to ensure functional integration. The agency is actively engaged in the harmonization of equipment standards and technology deployment. The ICAO Global Air Navigation Plan, which provides an approved framework to implement capabilities that maximize return on investment, informs our work. "Collaboration You Can Depend On" on the NextGen implementation website has more.

APPENDIX B

DELIVERING NEXTGEN

IMPLEMENTATION PORTFOLIOS

SUPPORTING PORTFOLIOS

NextGen is transforming the National Airspace System (NAS) through a number of operational improvements. We implement each improvement through a series of capabilities, or increments, that provide individual benefits and combine to provide a transformative change in the way we operate the NAS. In this appendix, we have summarized our work plans to deliver operational improvements along with timelines and locations when available.

Work is progressing to deliver related capabilities in eight implementation portfolios and two portfolios with supporting activities that address safety and environmental and energy considerations. See the graphic above for a list of the portfolios.

For each of the implementation portfolios, you will see a timeline for operational improvements (OI) and their related increments, a description of OIs and increments, and selected implementation work activities that support the OIs. We have also listed which budget line item(s) fully or partially fund those work activities. The NextGen Infrastructure portfolio provides information about systems that serve as enablers for various capabilities and also includes information about airport improvements that will increase capacity and efficiency.

Successful implementation of these capabilities may depend on changing systems such as the FAA's Telecommunications Infrastructure, or implementing systems such as Automatic Dependent Surveillance — Broadcast. Development and implementation can also be affected by other internal and external factors, such as program interdependencies, realignment of priorities or concept validation work. This means we may have to adjust the timeline or the scope of a capability.

In the course of development and as capabilities become more refined, we have changed the name of some capabilities to more accurately reflect the improvement they will provide. As operational improvements mature, we have moved some capabilities from one portfolio to another to better manage interdependencies. The implementation dates for some increments have also shifted. These changes are indicated in footnotes and marked with open bars on the timelines in affected portfolios.

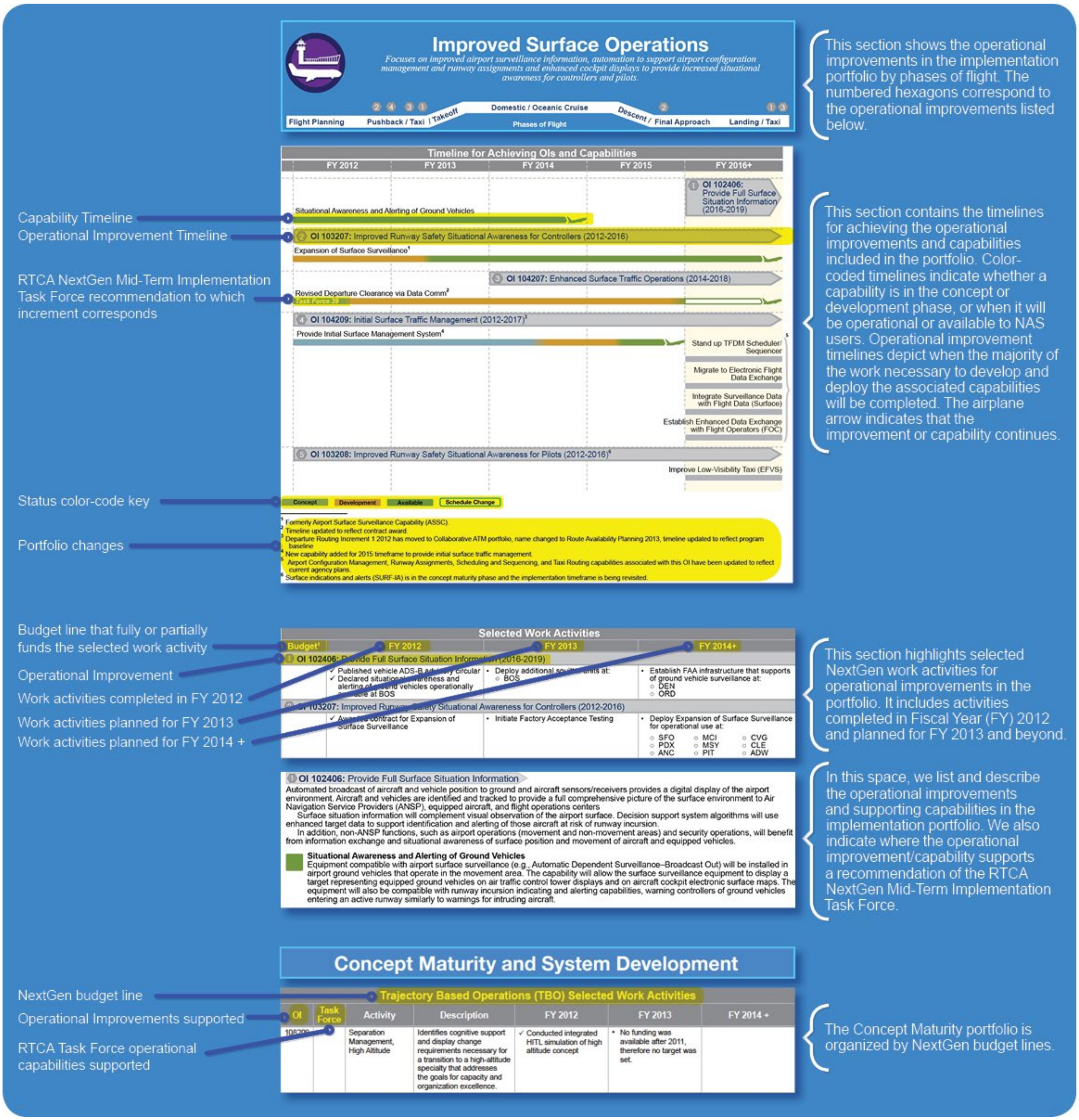
The capabilities displayed in the implementation portfolio timelines depict our current plans through 2015. Detailed planning for post-2015 capabilities scheduled for deployment through the end of the NextGen mid-term in 2020 and beyond, is ongoing. Additionally, some increments are in concept development and we have not yet determined when these capabilities will be available. While these increments are shown in the implementation portfolio timelines as becoming available in 2016 or later, preliminary work to further develop those increments is ongoing.

The FAA is using a segment planning approach, which offers additional insight into the development and implementation of capabilities in the 2016 time frame and beyond while facilitating lower-level program planning. While the degree of uncertainty is higher, the segment planning approach guides the agency's concept maturity work.

Before we implement a NextGen capability in the NAS, we complete a lengthy and complex process of development. Once we have conceived a concept for developing a needed capability, the FAA matures and validates that concept through research, modeling, simulated and operational demonstrations, Human-in-the-Loop testing and other activities. This concept validation work often leads to a decision to implement a certain capability. In that case, we add the capability, or increment, to one of the implementation portfolios. In some cases, our pre-implementation work does not validate the proposed concept or benefit, that is, the proposed capability does not provide benefit to the NAS, and development stops.

The Concept Maturity and System Development portfolio includes pre-implementation activities, funded by the NextGen capital budget, for several operational improvements and some work that is not yet directly associated with an implementation portfolio. Some activities support more than one operational improvement.

HOW TO READ PORTFOLIOS



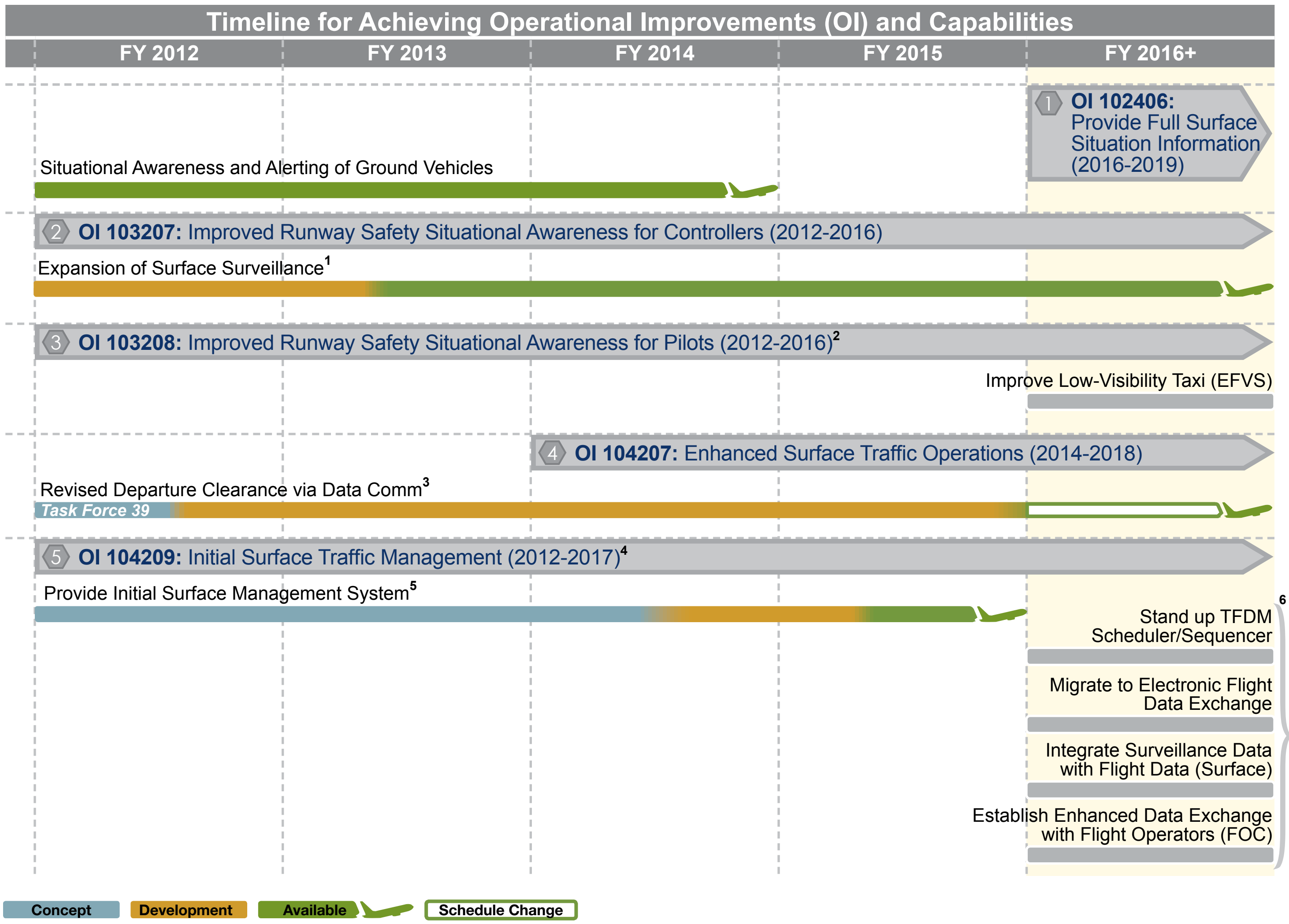
Selected NextGen Capabilities by Portfolio for Implementation in 2012-2013

This map shows the location of selected NextGen capabilities implemented in 2012 and capabilities we plan to deliver in 2013.

NAS-Wide
Collaborative Airspace Constraint Resolution
RNAV (GPS) Approaches
ASIAS Collaboration Capabilities
MSP
RNAV SIDs and STARs at Single Sites
External Surface Data Release
BOS
Situational Awareness and Alerting of Ground Vehicles
ZBW
Transition to PBN Routing for Cruise Operations
New York Metropolitan Area
Large-Scale Redesign of Airspace Leveraging PBN
MKE
External Surface Data Release
Philadelphia Metropolitan Area
Large-Scale Redesign of Airspace Leveraging PBN
ZNY
Transition to PBN Routing for Cruise Operations
ORD
External Surface Data Release
Chicago Metroplex
OAPM
New Jersey Metropolitan Area
Large-Scale Redesign of Airspace Leveraging PBN
MDW
External Surface Data Release
EWR
GBAS Category I Non-Federal System Approval
PCT
ATPA
Additional 7110.308 Airports
SDF
ATPA
MEM
RNAV SIDs and STARs at Single Sites
Wake Re-Categorization Phase 1 – Aircraft Re-Categorization
Charlotte Metroplex
OAPM
A80
ATPA
Atlanta Metroplex
OAPM
Houston Metroplex
OAPM
MIA
RNAV SIDs and STARs at Single Sites

Improved Surface Operations

Focuses on improved airport surveillance information, automation to support airport configuration management and runway assignments and enhanced cockpit displays to provide increased situational awareness for controllers and pilots.



[1] Formerly Airport Surface Surveillance Capability (ASSC).

[2] Surface Indications/Alerts is in the concept maturity phase and the implementation time frame is being revisited.

[3] Timeline updated to reflect contract award.

[4] Departure Routing Increment 1 2012 has moved to Collaborative ATM portfolio, name changed to Route Availability Planning 2013, timeline updated to reflect program baseline.

[5] New capability added for 2015 time frame to provide initial surface traffic management.

[6] Airport Configuration Management, Runway Assignments, Scheduling and Sequencing, and Taxi Routing capabilities associated with this OI have been updated to reflect current agency plans.

Improved Surface Operations

Selected Work Activities			
Budget	**FY 2012**	**FY 2013**	**FY 2014+**
1 OI 102406: Provide Full Surface Situation Information (2016-2019)			
Supported by ADS-B	✓ Published vehicle ADS-B advisory circular ✓ Declared situational awareness and alerting of ground vehicles operationally available at ○ BOS	• Deploy additional squitter units at ○ BOS	• Establish FAA infrastructure that supports ground vehicle surveillance at ○ DEN ○ ORD
2 OI 103207: Improved Runway Safety Situational Awareness for Controllers (2012-2016)			
Supported by ADS-B	✓ Awarded contract for Expansion of Surface Surveillance	• Initiate factory acceptance testing	• Deploy Expansion of Surface Surveillance for operational use at ○ SFO ○ MCI ○ CVG ○ PDX ○ MSY ○ CLE ○ ANC ○ PIT ○ ADW
4 OI 104207: Enhanced Surface Traffic Operations (2014-2018)			
Supported by NextGen Data Comm	✓ Achieved final investment decision for Data Comm tower service	• Complete Revised Departure Clearance trials procedures and training development	• Deploy revised DCL via Data Comm for operational use to suitably equipped operators
5 OI 104209: Initial Surface Traffic Management (2012-2017)			
Supported by NextGen TFDM	✓ Completed installation of DDUs at ASDE-X and ASDE-3/ multilateration locations. Provided data dissemination capability at ○ DEN ○ MSP ○ MDW ○ SLC ○ MKE ○ ORD ✓ Published FAA Order 1200.22E	• Complete documentation in support of an initial investment decision for TFDM	• Complete documentation in support of a final investment decision for TFDM • External Surface Data Release - Publish to NEMS from all sites that have ASDE-X and ASSC • Provide Initial Surface Management System to selected sites

Descriptions of OIs and Capabilities

1 OI 102406: Provide Full Surface Situation Information

Automated broadcast of aircraft and vehicle position to ground and aircraft sensors/receivers provides a digital display of the airport environment. Aircraft and vehicles are identified and tracked to provide a full comprehensive picture of the surface environment to air navigation service providers (ANSP), equipped aircraft, and flight operations centers.

Surface situation information will complement visual observation of the airport surface. Decision support system algorithms will use enhanced target data to support identification and alerting of those aircraft at risk of runway incursion.

In addition, non-ANSP functions, such as airport operations (movement and non-movement areas) and security operations, will benefit from information exchange and situational awareness of surface position and movement of aircraft and equipped vehicles.

Situational Awareness and Alerting of Ground Vehicles
Equipment compatible with airport surface surveillance, e.g., Automatic Dependent Surveillance–Broadcast (ADS-B) Out, will be installed in airport ground vehicles that operate in the movement area. The capability will allow the surface surveillance equipment to display a target representing equipped ground vehicles on air traffic control tower displays and on aircraft cockpit electronic surface maps. The equipment will also be compatible with runway incursion indicating and alerting capabilities, warning controllers of ground vehicles entering an active runway similarly to warnings for intruding aircraft.

2 OI 103207: Improved Runway Safety Situational Awareness for Controllers

At large airports, current controller tools provide surface displays and can alert controllers when aircraft taxi into areas where a runway incursion could result. Additional ground-based capabilities, including expansion of runway surveillance technology, e.g., Airport Surface Detection Equipment–Model X (ASDE-X), to additional airports, will be developed to improve runway safety.
Task Force: Surface

Expansion of Surface Surveillance
Nine airports using the Airport Surface Detection Equipment–Model 3 (ASDE-3)/Airport Movement Area Safety System for situational awareness and surveillance of the airport surface, and not scheduled to receive ASDE-X, will receive the Airport Surface Surveillance Capability (ASSC). ASSC receives inputs from multilateration system sensors, ADS-B, and Airport Surveillance Radar/Mode Select terminal radars. This will provide a fused target position of all transponder-equipped aircraft and ADS-B-equipped ground vehicles on the airport surface movement area, as well as aircraft flying within five miles of the airport, for display in the airport control tower. The ASDE-3 primary surface radar will be decommissioned after ASSC installation.

In Concept Exploration | **In Development** | **Available** at least one site

Descriptions of OIs and Capabilities

3 OI 103208: Improved Runway Safety Situational Awareness for Pilots

Runway safety operations are improved by providing pilots with improved awareness of their location on the airport surface as well as runway incursion alerting capabilities. Additional enhancements may include cockpit displays of surface traffic, e.g., vehicles and aircraft, and the use of a cockpit display that depicts the runway environment.

Improve Low-Visibility Taxi (EFVS)
The FAA and industry are partnering to develop a taxi benefit for aircraft equipped with certified enhanced vision systems. Currently, Enhanced Flight Vision System (EFVS)-equipped operators can use their EFVS only for approved situational awareness and safety while on the ground. Some operators have requested that they be authorized taxi benefits when their company's weather minimums are lower than an airport's weather operating minimums and if their aircraft are equipped with EFVS. The FAA is evaluating the feasibility of this request in concert with other activities related to improved low-visibility surface operations.

4 OI 104207: Enhanced Surface Traffic Operations

Terminal automation provides the ability to transmit automated terminal information, departure clearances and amendments and taxi route instructions via Data Communications (Data Comm), including hold-short instructions.

Revised DCL via Data Comm
A Departure Clearance (DCL) Data Comm capability will allow controllers to rapidly issue departure clearance revisions, due to weather or other airspace issues, to one or more aircraft equipped with Data Comm. The use of Data Comm for this type of capability has both safety and efficiency benefits over the current voice-based method of communications between controllers and pilots. This initial implementation of DCL is planned for radios and Future Air Navigation System messaging as the link scheme.
Task Force: Data Communications for Revised Departure Clearance, Weather Reroutes and Routine Communications (39)

5 OI 104209: Initial Surface Traffic Management

Departures are sequenced and staged to maintain throughput. ANSP uses automation to integrate surface movement operations with departure sequencing to ensure aircraft meet departure schedule times while optimizing the physical queue in the movement area.
Task Force: Surface

Provide Initial Surface Management System
This increment will provide an initial surface situational awareness capability to FAA facilities outside of the Air Traffic Control Tower (ATCT), specifically in the Traffic Management Unit for Terminal Radar Approach Control, Air Route Traffic Control Centers or Air Traffic Control System Command Center. This capability will provide improved knowledge of surface congestion in these facilities, and improved coordination of air traffic control and Traffic Flow Management actions across several facilities. It is envisioned to include a display of the current surface situation, e.g., using ASDE-X data.

Stand Up Terminal Flight Data Manager Scheduler/Sequencer
This capability generates and displays a projected runway schedule showing arrival and departure demand, improving departure schedule integrity. It provides Traffic Flow Management constraints to tower controllers, such as Expected Departure Clearance Times. This capability also generates and disseminates flight state data.

Migrate to Electronic Flight Data Exchange
This capability provides for the introduction of Electronic Flight Strip capability in the ATCT, including updated flight coordination with Terminal Radar Approach Control, and potentially also including the replacement of the interface with En Route Automation Modernization. It replaces paper flight strips and several prototype electronic flight strip implementations.

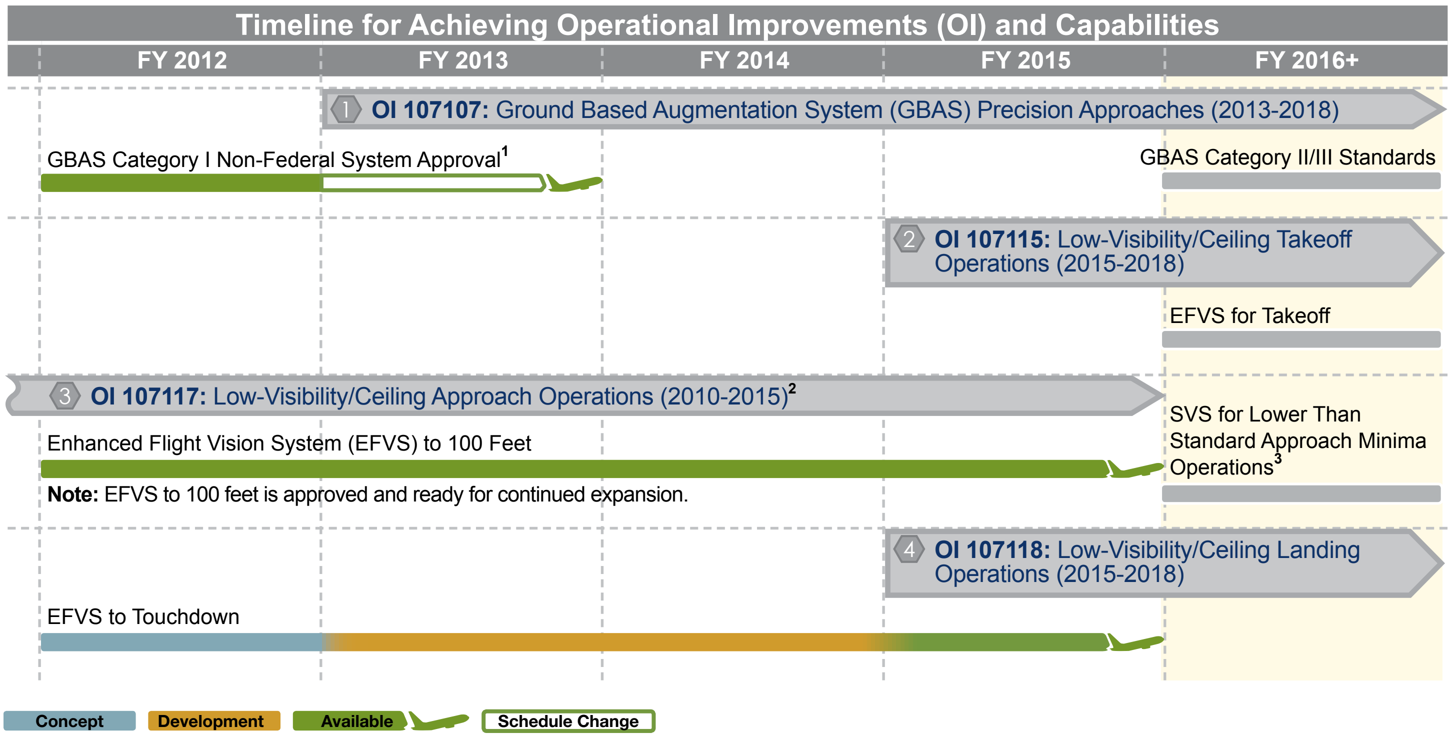
Integrate Surveillance Data with Flight Data (Surface)
This capability is intended to integrate surface surveillance functionality (e.g., ASDE-X, Airport Surface Surveillance Capability), including safety logic, onto a more capable platform. This will include the integration of full flight plan information with surveillance data, and also provide the basis for Surface Traffic Management.

Establish Enhanced Data Exchange with Flight Operators (FOC)
This increment will provide architecture, data standards, and policy for FAA to exchange data with flight operators. FAA will make surface flow management data and plans available to flight operators. In return, flight operators will make updated flight-specific information, including updates of pushback readiness times and parking locations available to FAA. Policy and procedures will govern how the information is shared, how the data can be used, and how flight operators participate. Exact data to be exchanged will be determined by the Collaborative Decision-Making process.

In Concept Exploration | **In Development** | **Available** at least one site

Improved Approaches and Low-Visibility Operations

Outlines ways to increase access and flexibility for approach operations through a combination of procedural changes, improved aircraft capabilities and improved precision approach guidance.



[1] Dependent on system acceptance by Houston Airport System.
[2] LPV Approaches has moved to Performance Based Navigation portfolio, name changed to RNAV (GPS) Approaches.
[3] Dependent on input from industry.

Selected Work Activities

Budget	FY 2012	FY 2013	FY 2014+
1 OI 107107: Ground Based Augmentation System (GBAS) Precision Approaches (2013-2018)			
Supported by NextGen Flexible Terminal Environment	✓ Declared GBAS Cat I system operationally available at ○ EWR	• Declare GBAS Cat I System operationally available at ○ IAH	
3 OI 107117: Low-Visibility/Ceiling Approach Operations (2010-2015)			
Supported by Operations Appropriations	✓ Completed NPRM for EFVS to 100 feet	• Publish NPRM for EFVS to 100 feet	• Disposition public comments from NPRM for EFVS to 100 feet • Begin drafting final rule for EFVS to 100 feet
4 OI 107118: Low-Visibility/Ceiling Landing Operations (2015-2018)			
Supported by Operations Appropriations	✓ Completed NPRM for EFVS to touch down	• Publish NPRM for EFVS to touch down	• Disposition public comments from NPRM for EFVS to touch down • Begin drafting final rule for EFVS to touch down

Descriptions of OIs and Capabilities

1 OI 107107: Ground Based Augmentation System (GBAS) Precision Approaches

GPS/GBAS support precision approaches to Cat I and eventually Cat II/III minima for properly equipped runways and aircraft. GBAS can support approach minima at airports with fewer restrictions to surface movement and offers the potential for curved precision approaches. GBAS may also support high-integrity surface movement requirements.

GBAS Category I Non-Federal System Approval
GBAS provides local corrections to GPS to improve accuracy, integrity, and availability of the navigation service. GBAS is designed and being implemented to enable GBAS Landing System precision instrument approaches to Category (Cat) I, and eventually Cat II/III, minima for multiple runways. This includes runways not served by Instrument Landing Systems (ILS). The GBAS systems design for Cat I use in the National Airspace System was approved in 2009 and will serve as an incremental step toward the development of a Cat III approach. GBAS Cat I is being implemented as a non-federal system on a per-airport request basis. The GBAS Cat I increment involves government-industry partnerships and is anticipated to result in service provision at the first airport in 2012.

GBAS Category II/III Standards
GBAS is intended to provide precision approach service to Cat II/III minima without the need for critical area protection, and offer the potential for increased flexibility in approach design and highly accurate approach guidance to the runway. Similar to GBAS Cat I, GBAS Cat II/III provides improved low-visibility access and increases operational efficiency and single- and multiple-runway capacity through the use of GBAS ground stations. The FAA plans to develop Cat II/III standards for ground and avionics equipment and publish procedures for each runway end receiving GBAS service. The standards for GBAS Cat II/III are being developed in harmony with International Civil Aviation Organization standards.

2 OI 107115: Low-Visibility/Ceiling Takeoff Operations

Leverages same combination of head-up display, Enhanced Flight Vision System (EFVS), Synthetic Vision System (SVS) or advanced vision system to allow appropriately equipped aircraft to take off in low visibility conditions.

EFVS for Takeoff
EFVS for low-visibility takeoff operations and for authorization of increased operational benefit, beyond situational awareness and safety, for equipped users. Such authorization, if approved, would allow EFVS-equipped operators to use enhanced vision systems to meet takeoff visibility requirements, as well as depart from some runways with reduced infrastructure, e.g., no centerline lighting.

3 OI 107117: Low-Visibility/Ceiling Approach Operations

The ability to complete approaches in low-visibility/low-ceiling conditions is improved for aircraft equipped with some combination of navigation derived from augmented Global Navigation Satellite System (GNSS) or ILS and other cockpit-based technologies or combinations of cockpit-based technologies and ground infrastructure.

Enhanced Flight Vision System (EFVS) to 100 Feet
The ability to conduct an approach and land in low-visibility conditions depends largely on the type of approach and the aircraft's capability. Infrared sensor technology currently is used in EFVS to provide pilots with an enhanced visual image and allow them to see, in certain low-visibility conditions, the visual references necessary to continue descending below Decision Altitude/Decision Height (DA/DH) or Minimum Descent Altitude (MDA) on an instrument approach procedure. Under 14 CFR Part 91.175, the FAA already allows EFVS to be used in lieu of natural vision to descend below DA/DH or MDA down to 100 feet above the runway touchdown zone on an instrument approach procedure. In order to descend below 100 feet, however, the visual references must be identified using natural vision.

The FAA is engaged in rulemaking to enhance the benefits of having EFVS capability by allowing commercial operators to dispatch and begin instrument approaches in more low-visibility conditions than currently authorized.

Synthetic Vision System (SVS) for Lower Than Standard Approach Minima Operations
The FAA is evaluating various concepts for allowing SVS technology to be used to conduct instrument approach procedures with lower-than-standard minima (Cat II, special authorization (SA) Cat I, SA Cat II) or in lieu of certain ground infrastructure.

4 OI 107118: Low-Visibility/Ceiling Landing Operations

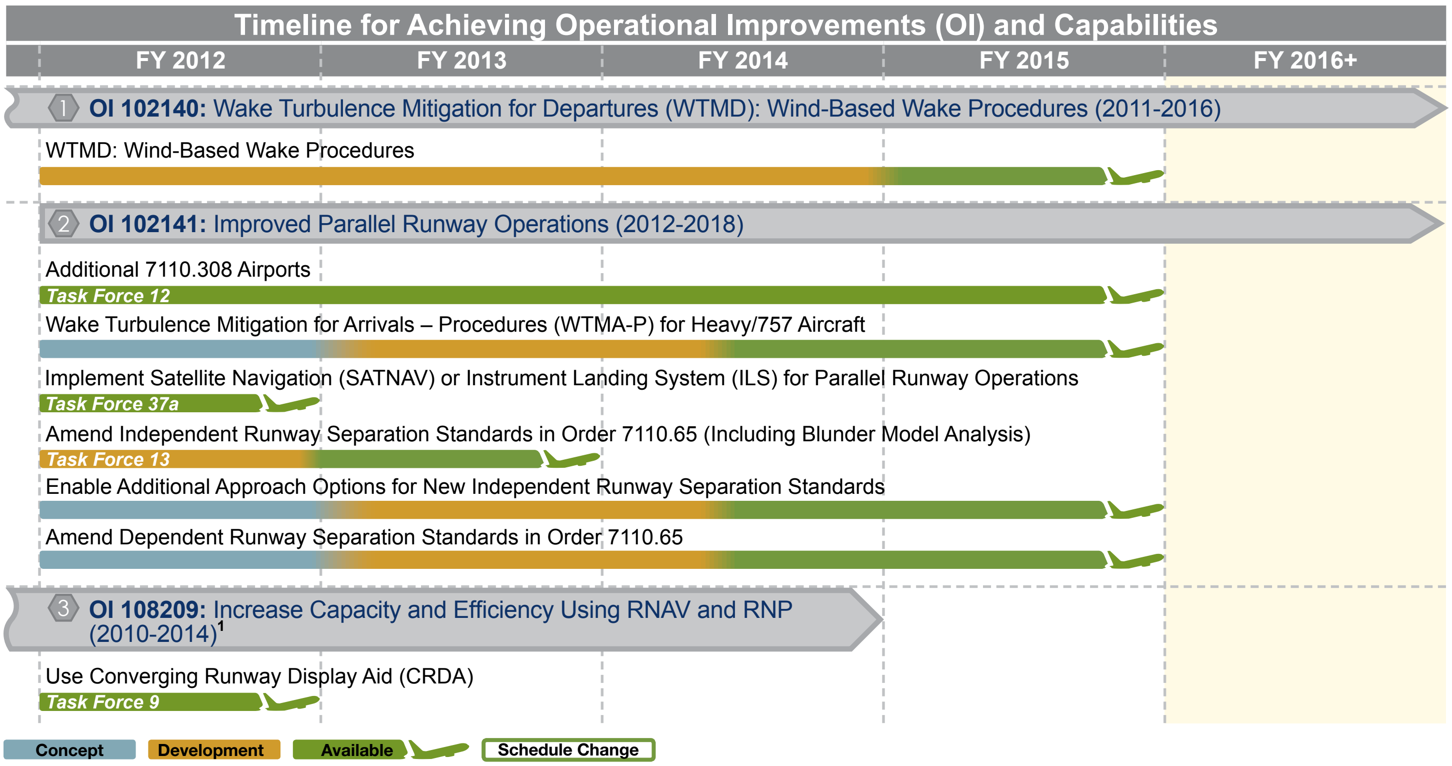
The ability to land in low-visibility/low-ceiling conditions is improved for aircraft equipped with some combination of navigation derived from augmented GNSS or ILS and head-up guidance systems, EFVS, SVS, advanced vision system and other cockpit-based technologies that combine to improve human performance.

EFVS to Touchdown
EFVS will allow improved access, with a greater assurance of landing without needing to execute a missed approach. The FAA continues to work with RTCA on concepts, standards and criteria to support the use of EFVS all the way to touchdown. The FAA also is engaged in rulemaking activity that would permit EFVS to be used to touchdown. Under specific visibility conditions, authorized users could utilize the enhanced visual image to touchdown, which will further increase access to runways in low-visibility conditions.

In Concept Exploration | **In Development** | **Available** at least one site

Improved Multiple Runway Operations

Improves runway access through the use of improved technology, updated standards, safety analysis and modifications to air traffic monitoring tools and operating procedures that will enable more arrival and departure operations.



[1] Formerly OI 104109: Current Arrival/Departure Sequencing

Selected Work Activities

Budget	FY 2012	FY 2013	FY 2014+
OI 102140: Wake Turbulence Mitigation for Departures (WTMD): Wind-Based Wake Procedures (2011-2016)			
Supported by NextGen Flexible Terminal Environment	✓ Reviewed safety risk management document	• Initiate controller training in preparation for WTMD operational prototype demonstration at ○ IAH • WTMD Installation at ○ SFO	• Complete Data Collection of WTMD at ○ IAH ○ SFO ○ MEM • WTMD operationally available at ○ IAH
OI 102141: Improved Parallel Runway Operations (2012-2018)			
Supported by NextGen Flexible Terminal Environment	✓ Reviewed safety risk management document on proposed standards for independent runway separation ✓ Expanded the application of FAA Order 7110.308 at ○ EWR ○ SFO ✓ Completed Blunder Model Revision	• Complete document change proposal for reduced standards for dual simultaneous independent parallel instrument approaches in Order 7110.65 • Complete safety study for reduced separation standards for simultaneous dependent parallel approach • Investigation of next Order 7110.308 sites: ○ LAS ○ PHX • Complete safety assessment for WTMA-P for Heavy/B757	• Review safety risk management document on proposed standards for simultaneous dependent parallel approach • Complete Safety Analysis for reduced separation standards for simultaneous independent parallel approaches – dual with offset • Complete Safety Analysis for reduced separation standards for simultaneous independent parallel approaches – triples
OI 108209: Increase Capacity and Efficiency Using RNAV and RNP (2010-2014)			
Supported by Operations Appropriations	✓ Developed CRDA training program for air traffic control specialists		

Descriptions of OIs and Capabilities

1 OI 102140: Wake Turbulence Mitigation for Departures (WTMD): Wind-Based Wake Procedures

Procedures are developed at applicable locations based on the results of analysis of wake measurements and safety analysis using wake modeling and visualization. During peak-demand periods, these procedures allow airports to maintain airport departure throughput during favorable wind conditions. A staged implementation of changes in procedures and standards, as well as the implementation of new technology, will safely reduce the impact of wake vortices on operations. This reduction applies to specific types of aircraft and is based on wind transporting an aircraft's wake away from the parallel runway's operating area.

WTMD: Wind-Based Wake Procedures
Changes to wake rules are implemented based on wind measurements, allowing more closely spaced departure operations procedures to maintain airport/runway capacity. Procedures are developed at applicable locations based on the results of wake measurements and safety analyses using wake modeling and visualization. During peak demand periods, these procedures allow airports to maintain airport departure throughput during favorable wind conditions. A staged implementation of changes in procedures and standards, as well as the implementation of new technology, will safely reduce the impact of wake vortices on operations. This reduction applies to specific types of aircraft and is based on wind transporting an aircraft's wake away from the parallel runway's operating area.

2 OI 102141: Improved Parallel Runway Operations

This improvement will explore concepts to recover lost capacity through reduced separation standards, increased applications of dependent and independent operations, enabled operations in lower-visibility conditions and changes in separation responsibility between air traffic control and the flight deck.
Task Force: Runway Access

Additional 7110.308 Airports
This increment provides airports with maximum use of closely spaced parallel runways by authorizing participating aircraft to operate at reduced lateral and longitudinal spacing on dependent, instrument approach procedures to runways with centerline spacing less than 2,500 feet. This increment will expand the application of FAA Order 7110.308 beyond the locations and runway ends already approved, and implement this capability using available ground and airborne equipment, existing displaced runway thresholds, historical wind data and procedural modifications to instrument approach procedures to maximize the reduced separation benefit.
Task Force: Increase Use of Staggered Approaches (12)

Wake Turbulence Mitigation for Arrivals-Procedures (WTMA-P) for Heavy/B757 Aircraft
This increment allows heavy and Boeing 757 aircraft to lead a dependent, staggered instrument approach procedure to closely spaced parallel runways at spacings less than the single-runway separation used today. This will increase the efficiency of runway throughput at approved airports. Operational availability is planned for 2014-2015.

Implement Satellite Navigation (SATNAV) or Instrument Landing System (ILS) for Parallel Runway Operations
This increment will enable policy, standards and procedures to allow use of SATNAV or ILS when conducting simultaneous independent and dependent instrument approaches, and implement this new capability at approved locations. The current standard for parallel approaches relies on ILS for simultaneous independent and dependent approaches. This increment expands this capability by implementing both unaugmented GPS-based approaches, such as Area Navigation (RNAV) (GPS), and RNAV Required Navigation Performance (RNP), as well as Wide Area Augmentation System-augmented GPS-based approaches, such as Localizer Performance with Vertical Guidance and Ground Based Augmentation System Landing System (GLS), for these parallel approach applications. This provides more options for air traffic control and users during Instrument Meteorological Conditions (IMC). Further research and evaluation of GLS approaches is required, but their inclusion in a future update to FAA Order 7110.65 is expected. These additional options increase the chance of maintaining higher throughput when needed to support demand.

This improvement will increase access to parallel runways during IMC, particularly where various constraints prevent ILS installation, and will allow continued operation using SATNAV as a backup approach option if the ILS is out of service.
Task Force: Implement CSPO: SATNAV or ILS (37a)

Amend Independent Runway Separation Standards in Order 7110.65 (Including Blunder Model Analysis)
This increment amends runway spacing standards to achieve increased access to parallel runways with centerline spacing less than 4,300 feet without high-update surveillance, and implements this change at approved locations. Current runway spacing standards for independent closely spaced parallel approaches are based, in part, on outdated assumptions about aircraft blunder rates that include severity and frequency. Due to the fact that the blunder assumptions were based on information available 20 years ago and some subjective views at the time, current spacing standards may be unnecessarily conservative, limiting capacity and airport growth. This increment includes the collection and analysis of data leading to a revision of these assumptions, followed by a safety analysis to determine possible new, reduced, safe minimum spacing for simultaneous independent approaches in IMC, as outlined in FAA Order 7110.65.

Changes to standards will result in increased access in a number of possible ways, including reducing spacing for new runway construction and allowing independent approach operations where currently only dependent, or single-runway, operations are authorized.
Task Force: Revise the Blunder Assumptions (13)

In Concept Exploration | **In Development** | **Available** at least one site

Descriptions of OIs and Capabilities

Enable Additional Approach Options for New Independent Runway Separation Standards
The analysis that provided the basis for the recommended simultaneous independent parallel instrument approach (SIPIA) runway separation standard addressed the use of ILS, Localizer Performance with Vertical Guidance, and Ground Based Augmentation System Landing System approach operations, for determining the limits of safe operation utilizing current National Airspace System (NAS) infrastructure with no high-update surveillance. This increment will enable use of additional GPS-based approach options with vertical guidance that may include Lateral Navigation/Vertical Navigation, RNP and RNP Authorization Required for use in performing SIPIAs to runways at reduced lateral runway separation (less than 4,300 feet). It is anticipated that these approach options will meet the same independent runway separation standard as determined in Order 7110.65. However, further analysis is required to determine the supported lateral runway spacing. These additional approach options will allow for continued use of higher throughput procedures, for example, if the ILS is out of service or where no ILS currently exists.

Amend Dependent Runway Separation Standards in Order 7110.65
This increment will support the safety analysis and additional work required to identify a revised separation standard for simultaneous dependent parallel instrument approaches (runways spaced between 2,500 feet and 4,299 feet), as well as revise FAA Order 7110.65 to permit this operation. This would lead to a significant increase in the arrival rate for dependent operations.

3 **OI 108209:** Increase Capacity and Efficiency Using RNAV and RNP

The spacing and sequencing of air traffic safely maximizes the efficiency and capacity of the NAS throughout the arrival and departure phases of flight. Air traffic controllers optimize the arrival and departure portion of flight by sequencing and spacing aircraft on final approach and coordinating arrival and departure air traffic with adjacent air traffic control facilities. The primary factor in establishing spacing and sequencing is the principle of "first come, first served." Other factors may include emergencies, presidential movement, lifeguard, etc. Controllers apply separation standards to achieve efficient use of airports and the navigable airspace between them.

Traffic Management Coordinators (TMC) establish initial traffic management planning and anticipated flow rates using arrival/departure rates and current/anticipated airport conditions. TMC functionality is distributed throughout the NAS to traffic management units at Air Route Traffic Control Centers, high-activity Terminal Radar Approach Control facilities, and at the highest-activity airport traffic control towers. Each plays a role in arrival and departure sequencing, depending upon the current conditions. The TRACON plays a major role in the spacing and sequencing in the terminal area. Arrival traffic is sequenced by using speed control and vectoring until cleared for the appropriate approach. Departures are handled in a similar manner with speed control and vectoring until transitioned to the en route environment. Additionally the Departure Spacing Program evaluates aircraft flight plans at participating airports, models projected aircraft demand at shared departure fixes, and provides windows of departure times to controllers based on projected fix crossing times.

In performing traffic synchronization functions, controllers receive input from various sources such as, voice and data communications, and weather and automation systems. Voice inputs include Pilot Reports (PIREPS) via radio from aircraft, coordination air traffic control towers, other TRACON positions, adjacent ATC facilities, Traffic Management Unit, and the TRACON area supervisor.

Data inputs include track and weather data from Airport Surveillance Radar and Air Traffic Control Beacon Interrogator–Model 5/Mode S, and intent/flight plan data from the Host Computer System. The controller may also enter information directly.

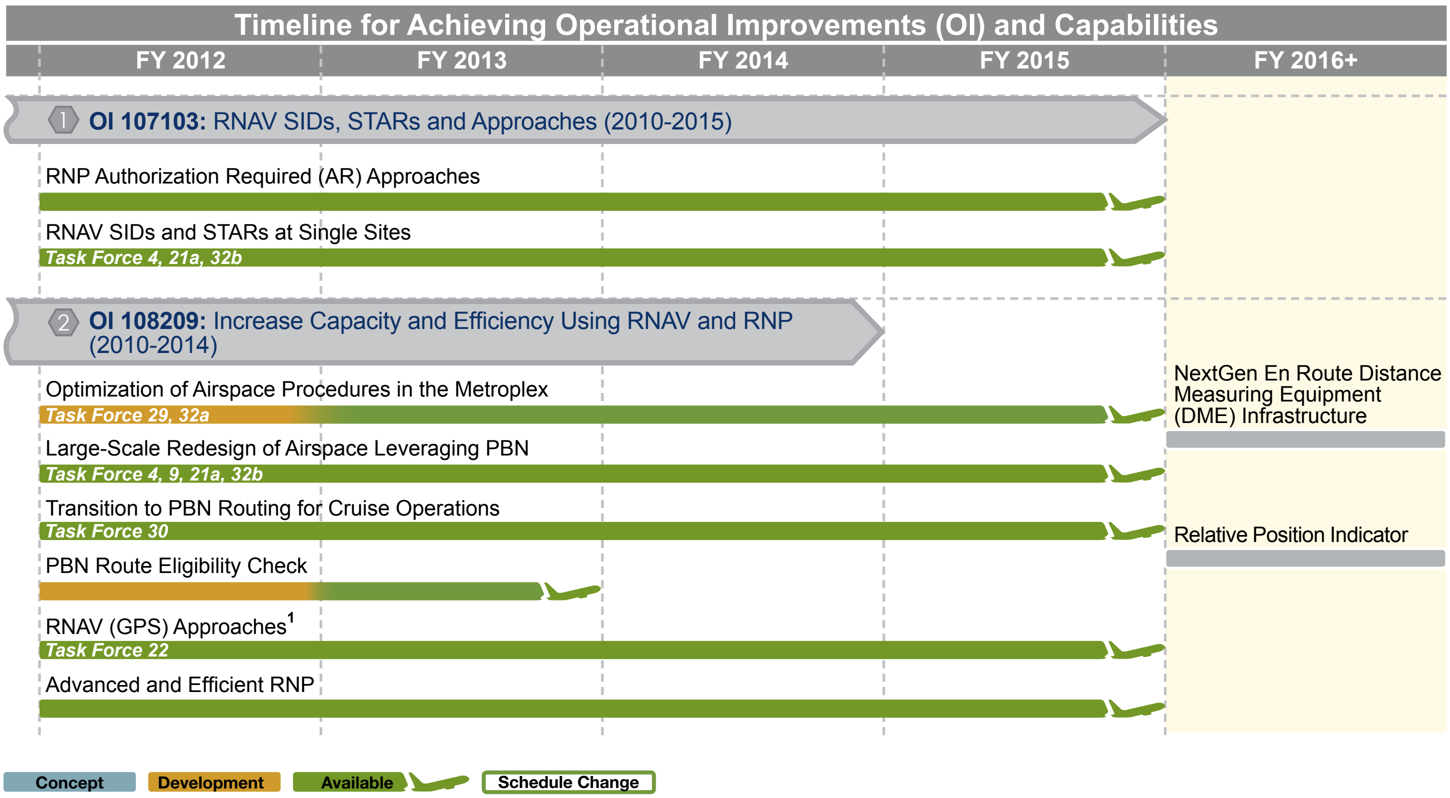
Task Force: Runway Access

Use Converging Runway Display Aid (CRDA)
CRDA is an automation aid used by air traffic controllers to judge spatial relationships between aircraft that are destined for converging or intersecting runways. CRDA projects position information for an aircraft approaching one runway onto the straight-in final approach course of another aircraft approaching a converging or intersecting runway (known as "ghost" targets), thus allowing a controller to easily visualize and direct a safe and efficient separation distance between the two arriving aircraft. This activity is assessing the current use of CRDA functionality and facilitating the development of procedures to extend its use. This activity supports the implementation of an arrival/departure window tool at selected sites.
Task Force: Increase Capacity and Throughput for Converging and Intersecting Runways (9)

In Concept Exploration | **In Development** | **Available** at least one site

Performance Based Navigation

Addresses ways to leverage emerging technologies, such as satellite-based Area Navigation and Required Navigation Performance, to improve access and flexibility for point-to-point operations.



[1] Formerly LPV Approaches, moved from Improved Approaches and Low-Visibility Operations portfolio.

Selected Work Activities

Budget	FY 2012	FY 2013	FY 2014+
1 **OI 107103:** RNAV SIDs, STARs and Approaches (2010-2015)			
Supported by Operations Appropriations	✓ Completed 4 STARs at ○ BOS ✓ Completed 2 SIDs at ○ MSP ✓ Completed 2 STARs at ○ LAX ✓ Completed 18 SIDs and 4 STARs at ○ MEM ✓ Completed 4 SIDs at ○ MIA	• Complete RNPs at ○ DEN • Publish SIDs at ○ DEN • Publish STARs and RNPs at ○ MSP • Publish procedures at ○ SEA • Publish SIDs at ○ MSP • Publish STARs at ○ PDX	• Continue implementation of RNAV SIDs, STARs and Approaches

Performance Based Navigation

Selected Work Activities			
Budget	**FY 2012**	**FY 2013**	**FY 2014+**
OI 108209: Increase Capacity and Efficiency Using RNAV and RNP (2010-2014)			
Supported by NextGen PBN-Metroplex RNAV/RNP	✓ Completed Las Vegas Optimization environmental assessment ✓ Initiated design teams for implementation of PBN-optimized airspace and procedures at ○ Charlotte Metroplex ○ Southern California Metroplex ○ Atlanta Metroplex ○ Houston Metroplex ✓ Selected sites for next set of study teams for implementation of PBN-optimized airspace and procedures ✓ Completed ZAB (1 route) Q 37 route implementation ✓ Completed implementation of ZNY 4 Q-routes ✓ Declared PBN route eligibility check operationally available at key sites ✓ Completed ZSE 9 Q-routes implementation ✓ Completed ZBW 3 T-routes implementation ✓ Published 500 WAAS LPV and LP procedures	• Continue Las Vegas Optimization: ○ Complete Phase 1 implementation ○ Complete Phase 1 training and development ○ Complete Phase 1 cutover • Complete 1st Article for NextGen En Route DME Infrastructure • Initiate implementation for PBN-optimized airspace and procedures at ○ Houston Metroplex • Initiate PBN Optimization of Airspace and procedures projects for: ○ Chicago Metroplex ○ Phoenix Metroplex • Continue production of 500 WAAS LPV and LP procedures per year	• Implement remaining stages of New York/New Jersey/Philadelphia Metropolitan Area Airspace Redesign ○ Stage 2B: PHL route expansion and 3rd dispersal heading • Complete Las Vegas Optimization procedure implementation • Initiate Stage 3: West Side of Chicago Airspace Program Controller training Chart 1 & 2 • Complete implementation of PBN-optimized airspace and procedures for: ○ Washington Metroplex ○ Houston Metroplex • Implement remaining stages of New York/New Jersey/Philadelphia Metropolitan Area Airspace Redesign ○ Stage 3: North Gate realignment ○ Stage 4: full airspace integration • Continue production of 500 WAAS LPV and LP procedures per year

Descriptions of OIs and Capabilities

OI 107103: RNAV SIDs, STARs and Approaches

Area Navigation (RNAV) is available throughout the National Airspace System (NAS) using satellite-based avionics equipment and systems.

Task Force: Metroplex

RNP Authorization Required (AR) Approaches
Required Navigation Performance (RNP) AR approaches are performance-based navigation operations that are implemented to meet the needs of the airspace users and airports in terms of efficiency, safety, and access. A key feature of RNP AR approaches is the ability to use curved, guided path segments known as radius-to-fix (RF). RNP AR is an optional capability that involves avionics and flight crew training. Safety analysis will be conducted to help determine the feasible route spacing for these approaches based on equipage.

RNAV SIDs and STARs at Single Sites
This increment covers Performance Based Navigation (PBN) procedure improvements initiated and developed outside of the Optimization of Airspace and Procedures in the Metroplex (OAPM) and Large-Scale Redesign of Airspace Leveraging PBN increments. These RNAV procedures address location-specific requirements and seek to add efficiency and optimize existing initial capability PBN procedures.
Task Force: Integrate Procedure Design to Deconflict Airports, Implement RNP with Radius-to-Fix (RF) Capability, and Expand Use of Terminal Separation Rules (4, 21a and 32b)

OI 108209: Increase Capacity and Efficiency Using RNAV and RNP

RNAV and RNP can enable more efficient aircraft trajectories. Combined with airspace changes, RNAV and RNP increase airspace efficiency and capacity.

Task Force: Metroplex, Cruise Overarching, and NAS Access

<u>**Navigation System Infrastructure**</u>

NextGen En Route Distance Measuring Equipment (DME) Infrastructure
Additional DME coverage over the continental United States is needed to optimize and expand RNAV routes by closing coverage gaps at and above Flight Level 240. Work is being done to improve the determination of Expanded Service Volumes (ESV) that may help eliminate DME gaps. Where ESVs cannot be established, DME will be installed at selected locations to support RNAV and Required Navigation Performance using DME/DME/Inertial Reference Unit as the primary navigation means, and provide backup if GPS is not available.

In Concept Exploration | **In Development** | **Available** at least one site

Descriptions of OIs and Capabilities

Integrated Airspace and Procedures

Optimization of Airspace Procedures in the Metroplex
OAPM is a systematic approach to implementing Performance Based Navigation procedures and associated airspace changes in major metropolitan areas with multiple airports, including all types of operations and connectivity with other metroplexes making use of existing aircraft equipage. Expected improvements from OAPM include efficient descents, diverging departure paths and decoupling of operations among airports within the metroplex airspace.

The OAPM expedited timeline and focused scope binds the airspace and procedures solutions to those that can be achieved without requiring an Environmental Impact Statement (requiring only an environmental assessment or categorical exclusion) and within current infrastructure and operating criteria. The major metroplexes addressed under OAPM have been defined in the RTCA Task Force 5 Final Report and FAA Destination 2025 and have been prioritized using criteria and considerations developed with aviation industry consensus.
Task Force: Optimize and Increase RNAV Procedures (32a and 29)

Large-Scale Redesign of Airspace Leveraging PBN
Airspace and procedures solutions that do not fit within the environmental and criteria boundaries of an Optimization of Airspace and Procedures in the Metroplex project become candidates for other integrated airspace and procedures efforts. Also included in this increment are the legacy airspace management program projects. These include projects started prior to the formation of the National Operational Airspace Council in August 2009 and include the New York/New Jersey/Philadelphia Metropolitan Area Airspace Redesign, Chicago Airspace Project, Houston Area Air Traffic System and the Las Vegas Optimization Project. Although these are considered legacy projects, many of the efficiencies and benefit gains will come from optimized PBN procedures.
Task Force: Integrate Procedure Design to Deconflict Airports, Implement RNP with RF Capability, and Expand Use of Terminal Separation Rules (4, 21a and 32b), Increase Capacity and Throughput for Converging and Intersecting Runways (9)

Transition to PBN Routing for Cruise Operations
This approach replaces the conventional Navigation Aid (NAVAID)-based Jet and Victor airways with RNAV routes, including high-altitude Q-routes. High-altitude RNAV routes offer an efficient way to navigate en route airspace instead of NAVAID-to-NAVAID routing. Key focus areas include Q-route development connecting the terminal improvements in the OAPM and legacy large-scale airspace redesign projects, New York Wind Route Options Playbook transitions and resolution of en route choke points.
Task Force: Develop RNAV-Based En Route System (30)

RNAV (GPS) Approaches
RNAV approach procedures allow aircraft to fly precise paths, with and without vertical guidance, providing airports with significant increases in access, especially for runway ends not equipped with an Instrument Landing System (ILS), and in flexibility, by providing an alternative instrument approach at airports with ILS. All RNAV approach procedures require the aircraft to be equipped with suitable RNAV avionics with GPS or the Wide Area Augmentation System (WAAS) and are published as RNAV(GPS) procedures. RNAV(GPS) approaches include minimums for lateral navigation (LNAV), LNAV with vertical navigation (LNAV/VNAV), localizer performance (LP), and localizer performance with vertical guidance (LPV). Implementation of RNAV (GPS) procedures with LPV or LP will continue until all qualified runway ends are served. This improvement will provide increased benefits to more than 55,000 general aviation aircraft (Part 23), 3,800 corporate business jets/turbo props (Part 25 and some Part 23) and 200 regional jets already equipped with WAAS.

In addition to LPV approach implementation, the FAA will deliver LP approaches to runways that do not qualify for LPVs due to obstacles. LP procedures will provide the lower possible minima for runways that cannot support LPV approaches.
Task Force: Implement LPV Approaches to Airports without Precision Approach Capabilities (22)

Advanced and Efficient RNP
This increment includes RNP-established for simultaneous and dependent parallel approaches and concurrent RNP operations at airports in close proximity (for example, SEA/BFI). RNP-established will allow suitably equipped RNP-capable aircraft to turn onto final to a parallel runway using an RNP curved path without the necessity of 1,000 feet of vertical separation. This would allow shorter downwind legs for the suitably equipped aircraft, and also would allow Optimized Profile Descents. This increment will lead to development of safety case and air traffic control rule changes that enable the implementation of RNP-established for advanced RNP procedures, including parallel approaches to maximize the benefits to RNP-equipped aircraft. Operational benefits are anticipated in the areas of safety, efficiency, predictability and the environment. This increment will be implemented only at SEA/BFI.

Air Traffic Tools/Automation

Relative Position Indicator
RPI is a tool that can assist both the controller and traffic management in managing the flow of traffic through a terminal area merge point. RPI provides a symbol on the radar situation display that conveys relative position information for converging traffic. It does this by calculating the flight path distance to the merge of the source aircraft and places the indicator at that distance as measured along the merging route, including curved paths. RPI's effectiveness is enhanced by the predictability and repeatability of flight tracks, like those produced by RNAV, RNP, and advanced leg types, such as radius-to-fix legs and procedures.

PBN Route Eligibility Check
En route automation will check the eligibility of aircraft to operate on performance-restricted routes. Performance-restricted routes are identified in system adaptation using associated attributes that characterize the required performance. A filed flight plan amendment with ineligible routes will be rejected, the ineligible portion replaced with an alternative route, or indication provided to the controller that the flight is ineligible for a portion of its flight. This capability is part of En Route Automation Modernization Release 3.

In Concept Exploration | **In Development** | **Available** at least one site

Time Based Flow Management[1]

Enhances system efficiency and improves traffic flow by leveraging the capabilities of the Traffic Management Advisor decision-support tool, a system that is already deployed to all contiguous U.S. Air Route Traffic Control Centers.

Phases of Flight

Flight Planning	Pushback / Taxi / Takeoff	Domestic / Oceanic Cruise	Descent / Final Approach	Landing / Taxi
	2 4 / 1 2	1 3	1 2 4	2

Timeline for Achieving Operational Improvements (OI) and Capabilities

FY 2012 | FY 2013 | FY 2014 | FY 2015 | FY 2016+

1 OI 104115: Current Tactical Management of Flow in the En Route for Arrivals/Departures (2010-2014)

- Implement TMA's Adjacent Center Metering Capability at Additional Locations — *Task Force 24*
- Implement TMA at Additional Airports — *Task Force 24*

2 OI 104117: Improved Management of Arrival/Surface/Departure Flow Operations (2015-2018)

- Integrated Departure/Arrival Capability (IDAC)

3 OI 104120: Point-in-Space Metering (2014-2018)

- Extended Metering
- Arrival Interval Management Using Ground Automation

4 OI 104123: Time-Based Metering Using RNAV and RNP Route Assignments (2012-2016)

- Use Area Navigation (RNAV) Data to Calculate Trajectories Used to Conduct TBM Operations

Concept | Development | Available | Schedule Change

[1] The Arrival Interval Management using Ground Automation increment, which was included in the FY 2012 Appendix B, is not included in this timeline because it is in the concept maturity phase and the implementation timeline is being revisited.

Selected Work Activities

Budget	FY 2012	FY 2013	FY 2014 +
1 OI 104115: Current Tactical Management of Flow in the En Route for Arrivals/Departures (2010-2014)			
Supported by NextGen TBFM	✓ Developed site integration and deployment plan ✓ Implemented TMA's ACM Capability at Additional Locations: ○ SFO	• Develop site evaluation plan for Implementation of TMA at Additional Airports: ○ CLE ○ DCA ○ BWI • Develop site evaluation plan for Implementation of TMA's ACM Capability at Additional Locations: ○ IAD	• Implement TMA at Additional Airports: ○ BWI ○ DCA ○ TEB ○ CLE ○ HPN • Implement TMA's ACM Capability at Additional Locations: ○ ATL ○ SAN ○ LAX ○ IAD
2 OI 104117: Improved Management of Arrival/Surface/Departure Flow Operations (2015-2018)			
Supported by NextGen TBFM	✓ Initiated software development	• Develop integrated test strategies	• Declare IDAC operationally available at an ARTCC and an airport

Time Based Flow Management

Selected Work Activities			
Budget	**FY 2012**	**FY 2013**	**FY 2014 +**
③ **OI 104120:** Point-in-Space Metering (2014-2018)			
Supported by NextGen TBFM and ADS-B	✓ Developed course design material for an improved training program for traffic management ✓ Updated concept and requirements document ✓ Began development of flight deck interval management minimum operational performance standards	• Identify key site for Extended Metering • Complete integrated test strategy for Arrival Interval Management Using Ground Automation • Conduct system design technical interchange meeting (TIM) for Arrival Interval Management Using Ground Automation	• Deliver improved Traffic Management Coordinator training to traffic management • Declare arrival interval management using ground automation available in the NAS
④ **OI 104123:** Time-Based Metering Using RNAV and RNP Route Assignments (2012-2016)			
Supported by NextGen TBFM	✓ Initiated software development	• Conduct integrated testing • Declare TBM using RNAV & RNP route data operationally available at an ARTCC	

Descriptions of OIs and Capabilities

① OI 104115: Current Tactical Management of Flow in the En Route for Arrivals/Departures

Proper spacing and sequencing of air traffic maximizes National Airspace System efficiency and capacity in the arrival and departure phases of flight.

Task Force: Cruise

Implement TMA's Adjacent Center Metering Capability at Additional Locations
To expand the benefits of time-based metering and Time Based Flow Management's (TBFM) other advanced flow management capabilities, Adjacent Center Metering (ACM) will be implemented at the following additional locations:
LAX — ACM from ZAB;
SFO — ACM from ZSE, ZOA, ZLA and ZLC;
SAN — ACM from ZLA and ZOA;
ATL — ACM from ZDC and ZHU; and
IAD — ACM from ZNY.
Task Force: Expand Use of Time-Based Metering (24)

Implement TMA at Additional Airports
To expand the benefits of time-based metering and TBFM's other advanced flow management capabilities, TBFM will be implemented at the following additional locations: BWI, CLE, DCA, HPN, SAN and TEB.
Task Force: Expand Use of Time-Based Metering (24)

② OI 104117: Improved Management of Arrival/Surface/Departure Flow Operations

This integrates advanced arrival/departure flow management with advanced surface operation functions to improve overall airport capacity and efficiency.

Integrated Departure/Arrival Capability (IDAC)
IDAC, the first increment of this OI, increases National Airspace System efficiency and reduces delays by providing decision-making support capabilities for departure flows. IDAC automates the process of monitoring departure demand and identifying departure slots. It also deconflicts the departure times between airports with traffic departing to common points in space and provides situational awareness to air traffic control tower personnel so they can select from available departure times and plan their operations to meet these times. The results of these enhancements are more efficient departure flows and less delay.

③ OI 104120: Point-in-Space Metering

The air navigation service provider uses scheduling tools and trajectory-based operations to assure smooth flow of traffic and increase the efficient use of airspace. The following capabilities comprise elements of the interval management concept, which is designed to improve aircraft spacing by precisely managing the intervals between aircraft whose trajectories are common or merging. This concept increases airspace throughput while enabling aircraft to reduce fuel burn and environmental impacts.

In Concept Exploration | **In Development** | **Available** at least one site

Descriptions of OIs and Capabilities

Extended Metering
This capability will extend the metering horizon beyond the nominal distance used today. Currently, metering is conducted approximately 150-200 nautical miles from the adapted arrival airport, though this distance is extended during ACM operations, which are conducted at several locations. ACM will be implemented at additional locations — see sub-section 5.1.2.4.1. Building upon the ACM capability, Extended Metering will increase the distance from the airport where metering will be conducted without significant degradation in the accuracy of aircraft-specific slot times to the meter reference points. This capability will provide flow-deconfliction for metered aircraft at the meter reference points (in addition to meter fixes). The specific distances and locations where extended metering operations will be implemented will be based on operational need and benefits. This capability will be leveraged in the future to support end-to-end metering, meaning metering through each phase of flight.

Additionally, the technical infrastructure that will be developed for this increment will be scalable to support additional metering initiatives planned for subsequent implementation.

Arrival Interval Management Using Ground Automation
The ground-based component of Interval Management (Ground-Interval Management–Spacing) provides automation changes that will enable en route controllers to use speed control to maneuver aircraft to meet metering times while providing the opportunity for aircraft to fly optimized descents to the meter fix (the Terminal Radar Approach Control boundary).

4 OI 104123: Time-Based Metering Using RNAV and RNP Route Assignments

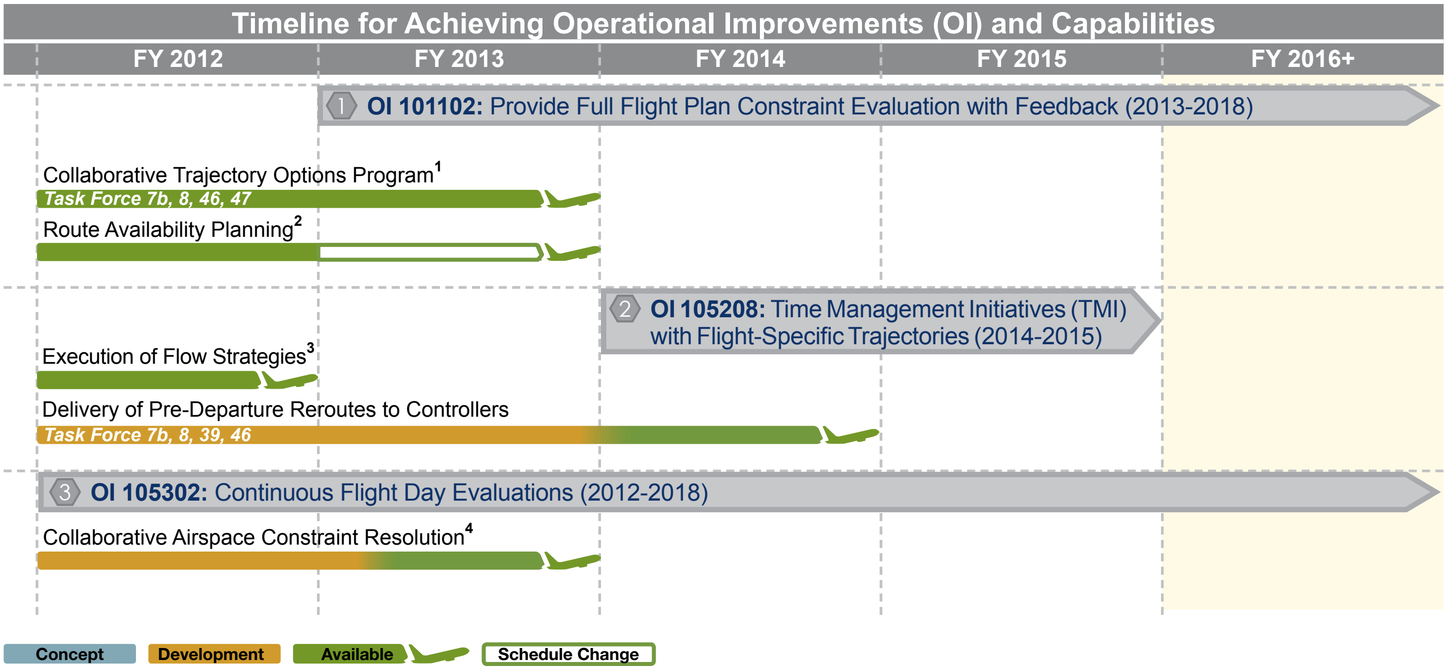
RNAV, RNP and time-based metering provide efficient use of runways and airspace in high-density airport environments. Metering automation will manage the flow of aircraft to meter fixes, thus permitting efficient use of runways and airspace.

Use Area Navigation (RNAV) Data to Calculate Trajectories Used to Conduct TBM Operations
In addition to the en route RNAV routes, which are already used to calculate trajectories, the Terminal Radar Control Center RNAV routes for both Standard Instrument Departures and Standard Terminal Arrival Routes will be used to calculate the terminal component of aircraft trajectories.

In Concept Exploration | In Development | Available at least one site

Collaborative Air Traffic Management

Involves NAS operators and FAA traffic managers, along with advanced automation, in managing daily airspace and airport capacity issues such as congestion, special activity airspace and weather. Updated automation will deliver routine information digitally.



1 Formerly Electronic Negotiations
2 Formerly Departure Routing Increment 1 2012, moved from Improved Surface Operations portfolio, timeline updated to reflect program baseline
3 Formerly Basic Rerouting Capability
4 Formerly Automated Congestion Resolution

Selected Work Activities

Budget	FY 2012	FY 2013	FY 2014+
1 **OI 101102:** Provide Full Flight Plan Constraint Evaluation with Feedback (2013-2018)			
Supported by NextGen CATMT	✓ Completed factory acceptance testing for Collaborative Trajectory Options Program ✓ Completed operational testing with user flight planning interfaces for Collaborative Trajectory Options Program	• Deploy Route Availability Planning for operational use at ○ C90	
2 **OI 105208:** Time Management Initiatives (TMI) with Flight-Specific Trajectories (2014-2015)			
Supported by NextGen CATMT	✓ Execution of Flow Strategies operationally available NAS-wide	• Conduct system and operational testing of accepting pre-departure reroutes into ERAM at ○ ZMP ○ ZDV	• Delivery of Predeparture Reroutes to Controllers operationally available NAS-wide
3 **OI 105302:** Continuous Flight Day Evaluations (2012-2018)			
Supported by NextGen CATMT	✓ Completed requirements analysis for Collaborative Airspace Constraint Resolution	• Deploy Collaborative Airspace Constraint Resolution for operational use for strategic and tactical constraints NAS-wide	

Descriptions of OIs and Capabilities

1 **OI 101102:** Provide Full Flight Plan Constraint Evaluation with Feedback

Constraint information that impacts the proposed route of flight is incorporated into air navigation service provider (ANSP) automation, and is available to users.
Task Force: Integrated Air Traffic Management

Collaborative Trajectory Options Program
This increment provides flight planners with information about congestion along their intended routes and allows the system to accept user preferences as part of constraint resolution. This is a two-way exchange that gives the flight planner the choice of delaying a flight or choosing alternate routes. The initial phase of Collaborative Trajectory Options Program is limited to the period before a flight plan is filed.
Task Force: Improve CATM Automation to Negotiate User-Preferred and Alternative Trajectories (7b, 8 and 46) and Integrated System-Wide Approach (CDM/TFM/ATC) (47)

Route Availability Planning
Assessment of weather impact on departure routes and associated flights will be provided to tower traffic management coordinators and supervisors to improve departure operations.

This increment will be implemented via the Route Availability Planning Tool capability. This capability, coupled with Automatic Dependent Surveillance–Broadcast In, will be available to supervisory personnel and/or traffic management coordinators in Traffic Flow Management System-equipped towers.

2 **OI 105208:** Traffic Management Initiatives (TMI) with Flight-Specific Trajectories

This capability will increase the agility of the National Airspace System (NAS) to adjust and respond to dynamically changing conditions such as impacting weather, congestion and system outages.
Task Force: Integrated Air Traffic Management and Data Communications

Execution of Flow Strategies
This capability is the means by which Traffic Flow Management System-generated reroutes are defined and transmitted via System Wide Information Management, making the reroute information available to air traffic control facility automation tools. This capability makes reroute information available for processing, but depends upon changes in the En Route Automation Modernization (ERAM) program to deliver the change to the appropriate sectors.

Delivery of Pre-Departure Reroutes to Controllers
This increment will give ERAM additional capabilities to receive amended routes pre-departure and provide updated flight data to the tower. ERAM will also display the protected route segment data to the en route controllers to make them aware of any constraints it affects.
Task Force: Improve CATM Automation to Negotiate User-Preferred Routes and Alternate Trajectories (7b, 8 and 46) and Digital Air Traffic Control Communications for Revised Departure Clearances, Reroutes and Routine Communications (39)

3 **OI 105302:** Continuous Flight Day Evaluations

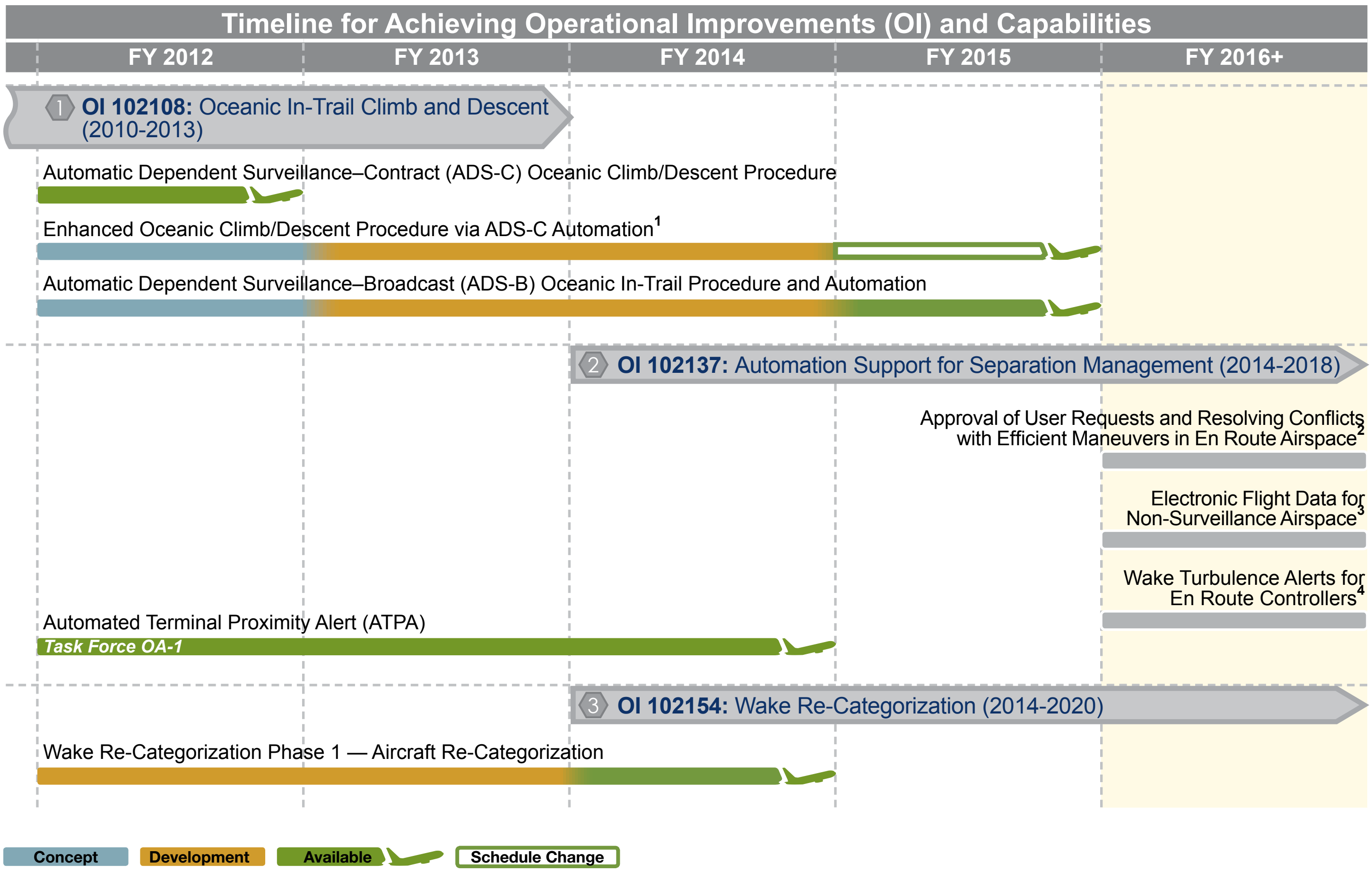
Continuous (real-time) constraints are provided to ANSP traffic management decision-support tools and the NAS users.

Collaborative Airspace Constraint Resolution
This increment recommends reroutes for flight-specific Traffic Management Initiatives. An automated decision support tool models and proposes reroute solutions for pre-departure and airborne flights. It uses enhanced congestion prediction capabilities enabled by the integration of weather forecast data with existing and enhanced Traffic Flow Management system rerouting capabilities. Collaborative Airspace Constraint Resolution will allow NAS customers whose flights are predicted to encounter en route congestion due to weather (or other constraints) to submit inputs for constraint resolution.

In Concept Exploration | **In Development** | **Available** at least one site

Separation Management

Provides controllers with tools to manage aircraft in a mixed environment of varying navigation equipment and wake performance capabilities.



[1] Formerly ADS-C Automation for Oceanic Climb/Descent Procedure, schedule extended to 2015
[2] Formerly Automation Support for Non-Surveillance Airspace – Electronic Flight Strips
[3] Formerly Problem Detection and Wake Turbulence Alert in 3 nm Separation Areas
[4] Formerly Introduce Probed Menus onto the Radar and Data Consoles

Separation Management

Selected Work Activities			
Budget	**FY 2012**	**FY 2013**	**FY 2014+**
OI 102108: Oceanic In-Trail Climb and Descent (2010-2013)			
Supported by NextGen Trajectory Based Operations and ADS-B	✓ Completed ADS-C CDP operational trial ✓ Conducted ADS-C CDP automation transition ✓ Completed ITP operational evaluation interim analysis ✓ Completed ITP operational evaluation flights in the Pacific	• Complete second phase of operational trials for ADS-B ITP	• ADS-B ITP operationally available
OI 102137: Automation Support for Separation Management (2014-2018)			
Supported by Flexible Terminal Environment	✓ ATPA service available at CARTS facilities with color displays at ○ DEN ○ NCT ○ A80 ○ SCT ○ SDF ○ PCT ✓ Conducted ATPA integration and developmental test	• Implement ATPA in a Standard Terminal Automation Replacement System facility	• Implement ATPA Service Available in all STARS Facilities
OI 102154: Wake Re-Categorization (2014-2020)			
Supported by NextGen System Development	✓ Completed draft changes to FAA Orders for implementing the 6 Category wake separation standards ✓ Completed draft supporting SRMD and implementation strategy for changes to NAS automation	• First Site Operational at ○ MEM	• Publish new wake separation standards in Order 7110.65

Descriptions of OIs and Capabilities

1 OI 102108: Oceanic In-Trail Climb and Descent

Air navigation service provider (ANSP) automation enhancements will take advantage of improved communication, navigation and surveillance coverage in the oceanic domain. When authorized by the controller, pilots of equipped aircraft use established procedures for climbs and descents.

Automatic Dependent Surveillance–Contract (ADS-C) Oceanic Climb/Descent Procedure
The ADS-C Climb/Descent Procedure (CDP) (previously known as ADS-C In-Trail Procedure (ITP)) is a new concept that allows a properly equipped aircraft (aircraft equipped with Future Air Navigation System 1/A) to climb or descend through the altitude of another properly equipped aircraft with a reduced longitudinal separation distance (compared with the required longitudinal separation minima for same-track, same-altitude aircraft). This procedure allows more aircraft to reach their preferred altitudes. ADS-C CDP will increase the benefits from the use of advanced communication, navigation and surveillance capabilities through Controller-Pilot Data Link Communications, Required Navigation Performance and ADS-C.

Enhanced Oceanic Climb/Descent Procedure via ADS-C Automation
Automation enhancements to the Oceanic Automation System (Ocean21) would maximize the benefits of ADS-C CDP as traffic and the number of equipped aircraft increase. The automation enhancements to Ocean21 include capabilities to allow a controller to select two aircraft and ensure they are eligible for ADS-C CDP, send concurrent on-demand position reports to two aircraft, determine if the minimum separation distance between the two aircraft is greater than the ADS-C CDP separation distance (greater than 15 nautical mile (nm)), display the ADS-C CDP conflict probe results to a controller and build an uplink clearance message to the ADS-C CDP requesting aircraft and an uplink traffic advisory message to the blocking aircraft.

Automatic Dependent Surveillance–Broadcast (ADS-B) Oceanic In-Trail Procedure and Automation
Similar to the ADS-C CDP concept, ADS-B ITP will enable aircraft equipped with ADS-B and appropriate on-board automation to climb and descend through altitudes where current non-ADS-B separation standards would prevent desired altitude changes. With this procedure, the aircraft desiring to climb or descend (the maneuvering aircraft) obtains flight identification, altitude, position and ground speed transmitted by proximate ADS-B-equipped non-maneuvering (reference) aircraft. The maneuvering aircraft must therefore be equipped with ADS-B In capability and an appropriate onboard decision-support system, both of which would have to be certified for this application. The reference aircraft is required to have ADS-B Out capability (the maneuvering aircraft should also have ADS-B Out to serve as a reference aircraft for other aircraft). The ADS-B signal can be received by aircraft equipped with ADS-B In and by ground stations providing information to ground stations and other aircraft. The pilot of the aircraft desiring a maneuver uses the ADS-B information received to determine if the ITP criteria have been met before requesting the maneuver.

The FAA is conducting an operational trial of ADS-B ITP along South Pacific routes with migration to other oceanic regions. During this operational trial, the ADS-B ITP criteria will be manually checked by the controllers using current Oceanic Automation System tools. The FAA has formed a contractual partnership that is focused on the next steps necessary to conduct this operational trial. These steps include but are not limited to development and certification of onboard systems that provide the ADS-B ITP criteria and display that information to the pilot.

If the operational trial of manual ADS-B ITP is successful, the ground system may be updated to better support ADS-B ITP. The operational trials will help determine what should be automated, e.g., aircraft eligibility checks, and what information should be displayed to controllers.

In Concept Exploration **In Development** **Available** at least one site

Descriptions of OIs and Capabilities

2 OI 102137: Automation Support for Separation Management

ANSP automation provides the controller with tools to manage aircraft separation in a mixed navigation and wake performance environment.

Task Force: Overarching

Approval of User Requests and Resolving Conflicts with Efficient Maneuvers in En Route Airspace
Probed menus will be integrated on the en route radar and the data consoles. Integrating this capability into the consoles assists radar controllers in determining possible problem-free flight plan changes without having to use the data consoles to create trial plans. A controller will also be able to use this capability to simultaneously examine the problem status of a set of possible clearances. The problem status for each of these trial plans is presented in the following menus:

- Route (for each downstream route fix)
- Altitude (for a range of altitudes around the filed altitude)
- Speed (a range of speeds around the trajectory speed)

This capability allows the controller to gauge quickly whether user requests can be granted and to provide the least disruptive maneuvers to resolve detected problems.

Electronic Flight Data for Non-Surveillance Airspace
This capability will provide automation support to controllers for flights in airspace without radar or ADS-B coverage, and for aircraft in this non-radar airspace that are not ADS-B equipped. This capability will utilize electronic flight data, eliminating the need for paper flight strips. The automation will distinguish non-surveillance flights on the display.

Paper flight strips will be eliminated because all the capabilities available from the paper-based system will be provided by electronic flight data or other display views. The automation will be enhanced to take advantage of new information sharing capabilities such as display of critical information to the controller, who can display additional information when needed, and collapse data when not needed.

The automation will also be enhanced to accept Aircraft List flight data notations, including non-radar symbology, entered by the controller for use in all sector displays.

Wake Turbulence Alerts for En Route Controllers
The use of 3-nm separation in en route airspace is being expanded based on the current procedures for using 3-nm separation because En Route Automation Modernization (ERAM) can accommodate additional radar inputs and the redesign of airspace being accomplished in the optimization of airspace and procedures in the metroplex. En route conflict alert will be enhanced to support wake turbulence separation requirements in 3-nm separation areas and transition airspace. The introduction of variable separation standards may result in circumstances where wake separation becomes the driver for safe separation. Providing a wake turbulence separation indicator will benefit the controller by enhancing situational awareness, helping the controller to maintain awareness of wake turbulence separation requirements for any given aircraft pair in an effort to reduce operational errors, and avoiding the occurrence of wake encounter incidents.

Wake separation standards are integrated with problem detection to better ensure that wake separation is accounted for in specific operational conditions. The introduction of various separation standards applicable to the special classes of aircraft expected in the National Airspace System, e.g., the Airbus 380, will increase the complexity of the traffic. Planning for reduced separation in the 3-nm airspaces will enhance throughput into terminal areas.

En route conflict alert will be enhanced to support wake vortex separation requirements in 3-nm separation areas and transition airspace. Problem detection and trial planning capabilities also will be enhanced to support aircraft-to-aircraft alerts in 3-nm separation areas and transition airspace, to include alerts based on wake vortex separation requirements. Sectors that contain tactical airspace (sectors where 3-nm separation is likely to be used and transition airspace) have traditionally been the areas where problem detection was inhibited. Problem detection will be enhanced to support areas where procedures and surveillance accuracy allow reduced separation in en route airspace. These enhancements will support separation management in more tactical areas of air traffic control, areas where wake vortex separation will need to be applied.

Automated Terminal Proximity Alert (ATPA)
ATPA is an air traffic control automation tool that provides situational awareness and alerts to controllers on Common Automated Radar Terminal System (CARTS) color displays and on Standard Terminal Automation Replacement System (STARS) displays. ATPA provides decision support information to controllers to make spacing adjustments needed to safely achieve optimal final approach spacing and efficiency, and alerts controllers when compression between subsequent aircraft is likely to result in unsafe separation.
Task Force: Achieving Existing 3- and 5-mile Separation Standards (OA-1)

3 OI 102154: Wake Re-Categorization

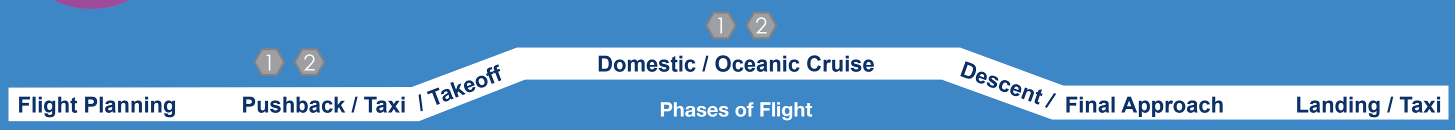
Legacy wake separation categories are updated based on analysis of wake generation, wake decay and encounter effects for representative aircraft.

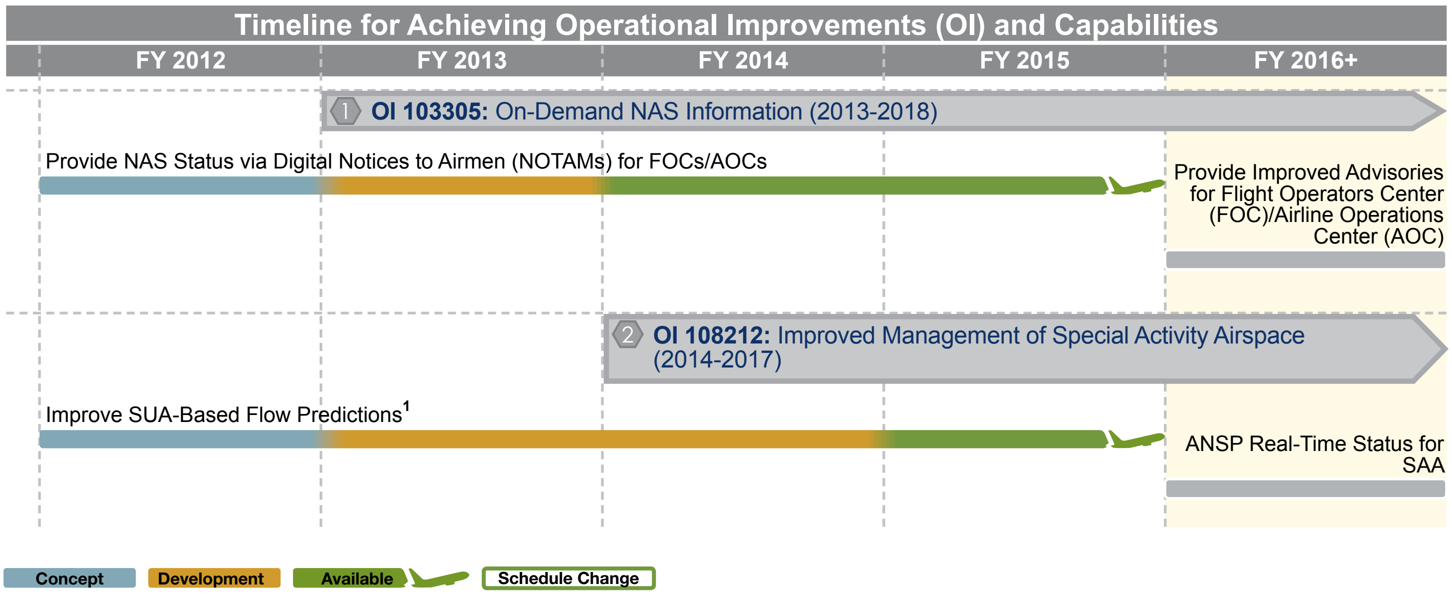
Wake Re-Categorization Phase 1 — Aircraft Re-Categorization
Wake re-categorization is a joint effort between the FAA and the European Organization for the Safety of Air Navigation that identifies changes to the International Civil Aviation Organization aircraft weight categories for improved throughput at capacity-constrained, high-density airports while maintaining or improving wake safety. New wake turbulence categories have been proposed that more accurately group like aircraft based on their wake turbulence characteristics, resulting in closer longitudinal separation for certain aircraft types without sacrificing safety. The re-categorization will require document changes to reflect the new separation standards.

In Concept Exploration | **In Development** | **Available** at least one site

On-Demand NAS Information

Ensures that airspace and aeronautical information is consistent across applications and locations, and available to authorized subscribers and equipped aircraft.





[1] Formerly SUA Forecast of Capacity Constraints

Selected Work Activities

Budget	FY 2012	FY 2013	FY 2014+
1 **OI 103305:** On-Demand NAS Information (2013-2018)			
Supported by NextGen ADS-B, CATMT and SWIM	✓ Prototyped Aeronautical Common Service infrastructure through integration of commercial off-the-shelf tools	• Achieve In-Service Decision	• Operational Use of Digital NOTAMS in the NAS
2 **OI 108212:** Improved Management of Special Activity Airspace (2014-2017)			
Supported by NextGen Collaborative Air Traffic Management (CATM), CATMT and SWIM	✓ Deployed SWIM enterprise messaging nodes based on internal user demand at ○ ATL ○ ZLC ✓ Completed prototype development and demonstrations of Airport Survey Collection, SUA editing capability, and Aeronautical Common Service information ✓ Conducted airborne access to SWIM Operational and Technical Requirements Industry Day ✓ Developed the requirements for Aeronautical Information Management, SWIM interface for SUA	• Develop the interface requirements for Traffic Flow Management System (TFMS) for SUA	• Operational Use of SUA Data for Internal & External Consumers

Descriptions of OIs and Capabilities

1 OI 103305: On-Demand National Airspace System (NAS) Information

NAS and aeronautical information will be available to users on demand. NAS and aeronautical information is consistent across applications and locations are available to authorized subscribers and equipped aircraft. Proprietary and security-sensitive information is not shared with unauthorized agencies or individuals.

Provide NAS Status via Digital Notice to Airmen (NOTAMs) for FOCs/AOCs
This increment enables the issuance of digital NOTAMs for those airspace constraints affecting a flight based on its trajectory. The initial implementation includes distribution outside of the air navigation service provider (ANSP), including FOCs and AOCs.

Provide Improved Advisories for Flight Operations Center (FOC)/Airline Operations Center (AOC)
This increment ensures that National Airspace System and aeronautical information is consistent, allowing users to subscribe to and receive the most current information from a single source. The information that will be made available and be distributed via System Wide Information Management is airport reference and configuration (current and planned) and will follow the Aeronautical Information Exchange Model standard.

2 OI 108212: Improved Management of Special Activity Airspace

Changes to status of airspace for special use are readily available for operators and the ANSP. The status changes are transmitted to the flight deck via voice or Data Communications. Flight trajectory planning is managed dynamically based on real-time use of airspace.

Improve SUA-Based Flow Predictions
This increment translates the Special Use Airspace (SUA) activation schedule and knowledge of the airspace configurations into predicted traffic flow constraints. Route impact assessments would therefore account for forecast airspace capacity loss and route blockage, including SUAs.

ANSP Real-Time Status for SAA
Airspace use is optimized and managed in real time, based on actual flight profiles and real-time operational use parameters. Airspace reservations for military operations, unmanned aircraft system flights, space flight and re-entry, restricted or warning areas, and flight training areas are managed on an as-needed basis. Enhanced automation-to-automation communications and collaboration enables decision makers to dynamically manage airspace for special use, increasing real-time access and use of available airspace. The enhanced interface provides a consistent source of Special Activity Airspace status digitally to external users such as the Department of Defense.

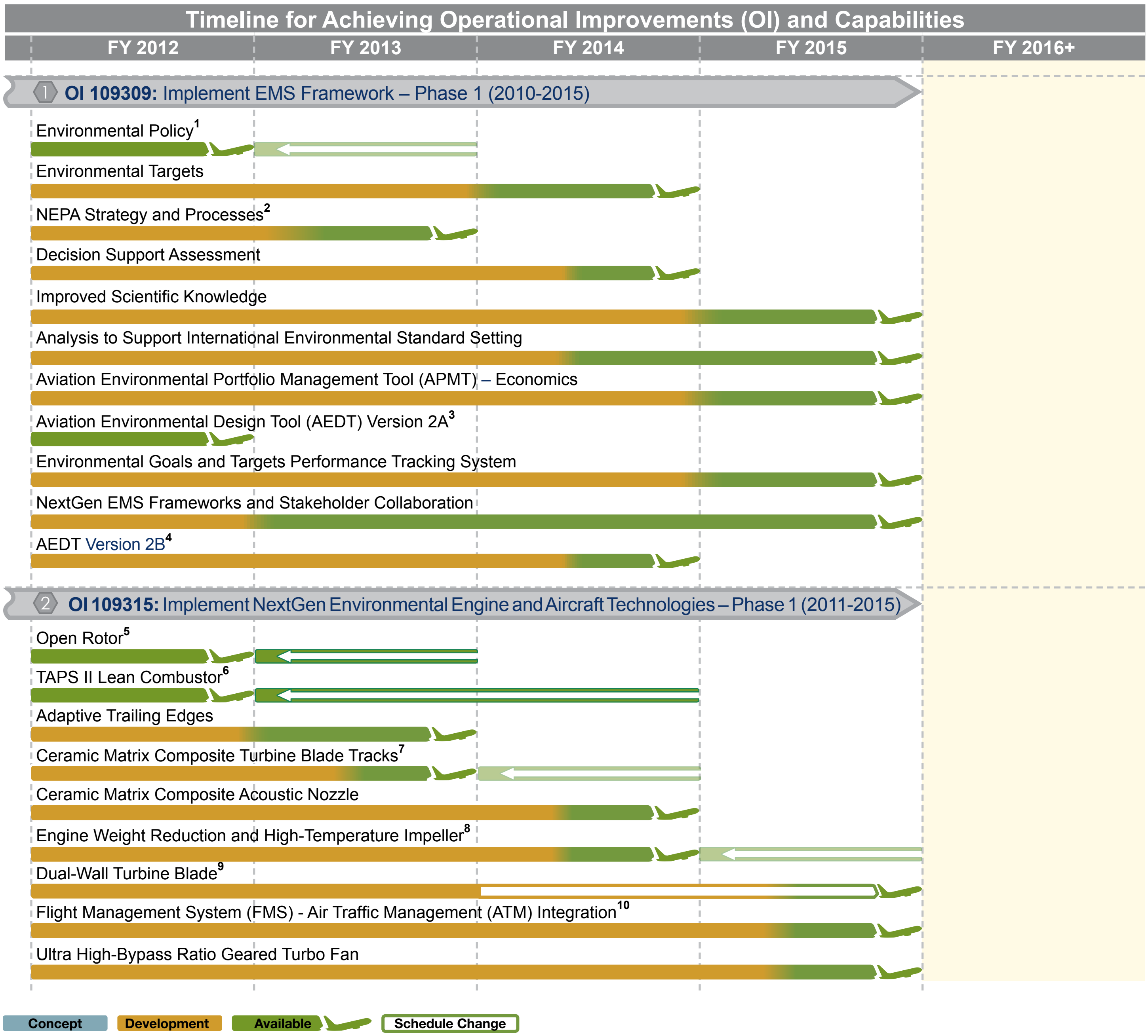
In Concept Exploration | **In Development** | **Available** at least one site

Environment and Energy

Describes enabling activities leading to the establishment and implementation of the NextGen Environmental Management System, the strategy for ensuring compliance with the National Environmental Policy Act and technologies that support NextGen environmental goals.

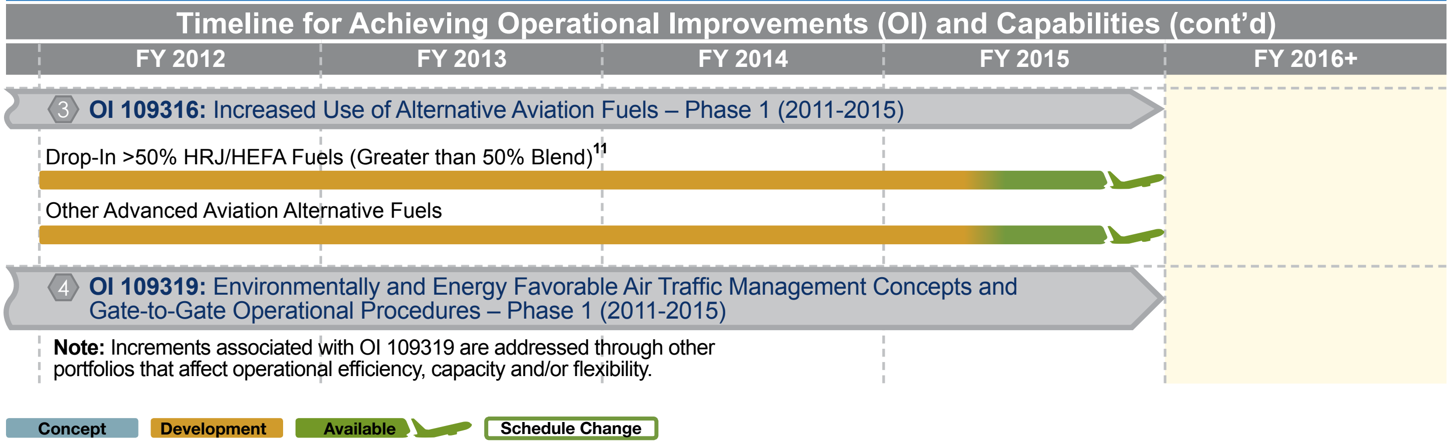
Flight Planning | Pushback / Taxi | Takeoff | Domestic / Oceanic Cruise | Descent / Final Approach | Landing / Taxi

Phases of Flight



[1] Implementation of this capability occurred in 2012.
[2] Implementation of this capability occurred in 2012.
[3] Formerly AEDT-Regional (AEDT2a)
[4] Formerly AEDT-Airport (AEDT2b)
[5] Demonstration of this capability occurred in 2012.
[6] Implementation of this capability occurred in 2012.
[7] Demonstration of this capability is planned for 2013.
[8] TRL 7 demonstration no longer required. Capability will be available upon successful completion of TRL 6 demonstration.
[9] Demonstration of this capability is planned to occur in 2015; further analysis and development required to mature technology.
[10] TRL 7 demonstration no longer required. Capability will be available upon successful completion of TRL 6 demonstration.

Environment and Energy



[11] Formerly Drop-In >50% HRJ Fuels (Greater than 50% Blend). HRJ has been relabled as HEFA by ASTM.

Selected Work Activities

Budget	FY 2012	FY 2013	FY 2014+
1 OI 109309: Implement Environmental Management System (EMS) Framework – Phase 1 (2010-2015)			
Supported by NextGen System Development	✓ Publicly issued FAA aviation environment and energy policy ✓ Developed preliminary quantitative NextGen targets for noise, climate and energy ✓ Secured international approval of metrics for aircraft carbon dioxide emissions standards ✓ Publicly released AEDT–Regional tool ✓ Completed FAA NextGen NEPA Plan	• Develop EMS performance tracking system • Report on NAS-wide impacts of potential aircraft CO_2 emissions standard options • Enhance AEDT capability and complete Beta version of AEDT2b analysis tool with supporting documentation • Deliver report on aviation emissions impact on climate change through Aviation Climate Change Research Initiative program • Develop targets for NextGen air quality goal	• Refine quantitative targets supporting NextGen goals for noise, air quality, climate and energy • Report on the analysis to support ICAO's Commission on Aviation Environmental Protection noise certification and aircraft emission standard • Document standardized approach for aviation stakeholders to apply and address NextGen environmental goals and targets • Publicly release AEDT-airport tool (AEDT2b)
2 OI 109315: Implement NextGen Environmental Engine and Aircraft Technologies – Phase 1 (2011-2015)			
Supported by NextGen R , E & D	✓ Matured and demonstrated at the following TRLs: ○ Twin Annular Premixing Swirler II Lean Combustor (TRL 6) ○ Adaptive Trailing Edges (TRL 7) ○ Ceramic Matrix Composite Turbine Blade Tracks (TRL 5) ○ Ceramic Matrix Composite Acoustic Nozzle – Completed instrumentation of CMC Nozzle in preparation for ground test demo (TRL 5) ○ Dual-Wall Turbine Blade (TRL 5) ○ Open Rotor (TRL 5)	• Mature and demonstrate at the following TRLs: ○ Ceramic Matrix Composite Acoustic Nozzle (TRL 7) ○ Ceramic Matrix Composite Turbine Blade Tracks (TRL 6) ○ FMS-engine integration (TRL 5) ○ Engine Weight Reduction and High-Temperature Impeller (TRL 5)	• Mature and demonstrate at the following TRLs: ○ Dual-Wall Turbine Blade (TRL 6) ○ Ceramic Matrix Composite Acoustic Nozzle (TRL 7) ○ Engine Weight Reduction and High-Temperature Impeller (TRL 6) ○ Flight Management System (FMS) – Air Traffic Management (ATM) Integration (TRL 6) ○ FMS-engine integration (TRL 6) ○ Ultra High-Bypass Ratio Geared Turbofan (TRL 6)
3 OI 109316: Increased Use of Alternative Aviation Fuels – Phase 1 (2011-2015)			
Supported by NextGen System Development	✓ Developed >50% renewable alternative aviation fuel (bio-fuel) characterization Fuel Readiness Level (FRL) 3-4	• Conduct engine component tests of >50% renewable alternative fuel (FRL 5)	• Conduct ground test demonstration of >50% renewable HRJ alternative fuel (FRL 6)

Descriptions of OIs and Capabilities

1 OI 109309: Implement EMS Framework – Phase 1

Enable the use of the Environmental Management System (EMS) framework, including environmental goals and decision-support tools, to address, plan and mitigate environmental issues through development of an initial EMS framework, pilot analysis and outreach programs.

Environmental Policy
This enabling activity will refine and formalize NextGen environmental and energy policy, including NextGen environmental goals. It also will establish EMS roles and responsibilities for FAA organizations to efficiently address critical NextGen environmental requirements, goals and other policies to improve environmental performance.

Environmental Targets
This enabling activity will explore, test and refine quantitative NextGen environmental targets for noise, air quality, climate, energy and water quality.

NEPA Strategy and Processes
This enabling activity establishes effective strategic approaches for addressing the National Environmental Policy Act (NEPA) requirements of NextGen improvements. This includes applying best practices to minimize redundancy of analyses and maximizing time and cost efficiencies. When necessary, it will outline an approach for integrating NEPA considerations into existing FAA guidance at key decision points, such as the Acquisition Management System and Systems Engineering Manual to ensure appropriate consideration is given early in the planning phase.

Decision Support Assessment
This enabling activity addresses mission-level NextGen decision-support capabilities (capabilities that support FAA planning decisions such as those related to capacity management) and operational-level capabilities, e.g., those related to flow contingency management and trajectory flow. NextGen decision-support capabilities will be screened to identify environmental and energy aspects and possible changes to the decision-support capabilities to support environmental and energy goals.

Improved Scientific Knowledge
This enabling activity will improve knowledge of aircraft source-level noise and emissions of air pollutants and greenhouse gases, their atmospheric evolution, and impacts on human health and welfare and climate change. Improved scientific knowledge is used to inform each of the environment- and energy-enabling activities and support other NextGen OIs.

Analysis to Support International Environmental Standard-setting
This enabling activity addresses analysis and benefit assessment to support the development and implementation of the U.S. Aviation Greenhouse Gas Emissions Reduction Plan and International Civil Aviation Organization environmental standards, such as for aircraft carbon dioxide emissions and more stringent noise levels.

Aviation Environmental Portfolio Management Tool (APMT) — Economics
APMT capabilities will be continuously enhanced through 2015 to enable analysis of airline-and aviation-market responses to environmental mitigation and policy options, and for analyzing U.S. environmental issues critical to NextGen under various fleet growth and evolution scenarios.

Aviation Environmental Design Tool (AEDT) Version 2A
The AEDT will provide capabilities for integrated environmental analysis at regional levels for fuel burn, emissions and noise.

Environmental Goals and Targets Performance Tracking System
A system will be established that will support the systematic identification of environmental benefits across the National Airspace System (NAS), enabling the FAA to measure progress toward achieving NextGen environmental goals. This system may include business practices, automation capabilities and interfaces with other automation systems.

NextGen EMS Frameworks and Stakeholder Collaboration
Standardized approaches will be identified for aviation stakeholders, e.g., manufacturers, airports, airlines and the FAA, to identify and address key environmental issues critical to stakeholder environmental programs or EMSs. These approaches are intended to allow aviation stakeholders to collaborate and address cross-cutting environmental challenges.

AEDT Version 2B
The AEDT will provide capabilities for integrated environmental analysis at airport, regional and global levels for fuel burn, emissions and noise.

2 OI 109315: Implement NextGen Environmental Engine and Aircraft Technologies – Phase 1

Mature technologies to reduce noise, emissions and fuel burn of commercial subsonic jet aircraft. Technologies are demonstrated at sufficient readiness levels to achieve goals of the FAA's Continuous Lower Energy, Emissions, and Noise program.

Open Rotor
General Electric will mature open rotor technology to Technology Readiness Level (TRL) 5. This technology will reduce fuel burn, emissions and noise.

TAPS II Lean Combustor
General Electric will mature Twin Annular Premixing Swirler (TAPS) II lean combustor technology to TRL 6. This technology will reduce engine combustion emissions.

Adaptive Trailing Edges
Boeing will mature adaptive trailing edges technology to TRL 7. This technology will reduce fuel burn, emissions and noise.

Descriptions of OIs and Capabilities

Ceramic Matrix Composite Turbine Blade Tracks
Rolls-Royce will mature ceramic matrix composite turbine blade tracks technology to TRL 6. This technology will reduce fuel burn and emissions.

Ceramic Matrix Composite Acoustic Nozzle
Boeing will mature ceramic matrix composite acoustic nozzle technology to TRL 7. This technology will reduce fuel burn, emissions and noise.

Engine Weight Reduction and High-Temperature Impeller
Honeywell will mature engine weight reduction and high-temperature impeller technology to TRL 6. This technology will reduce fuel burn, emissions and noise.

Dual-Wall Turbine Blade
Rolls-Royce will mature dual-wall turbine blade technology to TRL 6. This technology will reduce fuel burn and emissions.

Flight Management System (FMS) – Air Traffic Management (ATM) Integration
General Electric will mature FMS-ATM technology to TRL 6. This technology will reduce fuel burn, emissions and, potentially noise.

Ultra High-Bypass Ratio Geared Turbofan
Pratt & Whitney will mature ultra high-bypass ratio geared turbo fan technology to TRL 7. This technology will reduce fuel burn, emissions and noise.

3 **OI 109316:** Increased Use of Alternative Aviation Fuels – Phase 1

Determine the feasibility and market viability of alternative aviation fuels for commercial aviation use. Obtain ASTM International approval of Hydrotreated Renewable Jet (HRJ) blends and other advanced sustainable fuel blends from renewable resources that are compatible with existing infrastructure and fleet, thus meeting requirement to be a drop-in fuel.

Drop-In Greater Than 50 Percent HRJ/HEFA Blend Fuels
This enabling activity will advance the use, acceptance, and deployment of other HRJ/HEFA blend fuels (>50 percent) through air quality impact assessments, lifecycle emissions analyses, engine ground tests and flight demonstrations by 2015.

Other Advanced Aviation Alternative Fuels
This enabling activity will explore and qualify additional classes of sustainable aviation alternative fuels blends that use novel feedstocks and conversion processes, e.g., advanced fermentation, alcohol oligomerization and pyrolysis. Efforts include environmental and performance feasibility through air quality and lifecycle emissions analyses, fuel properties analysis, engine performance evaluation, ground tests and flight demonstrations by 2015. These efforts will advance deployment of these sustainable alternative fuels, including environmental acceptability and ASTM International approval.

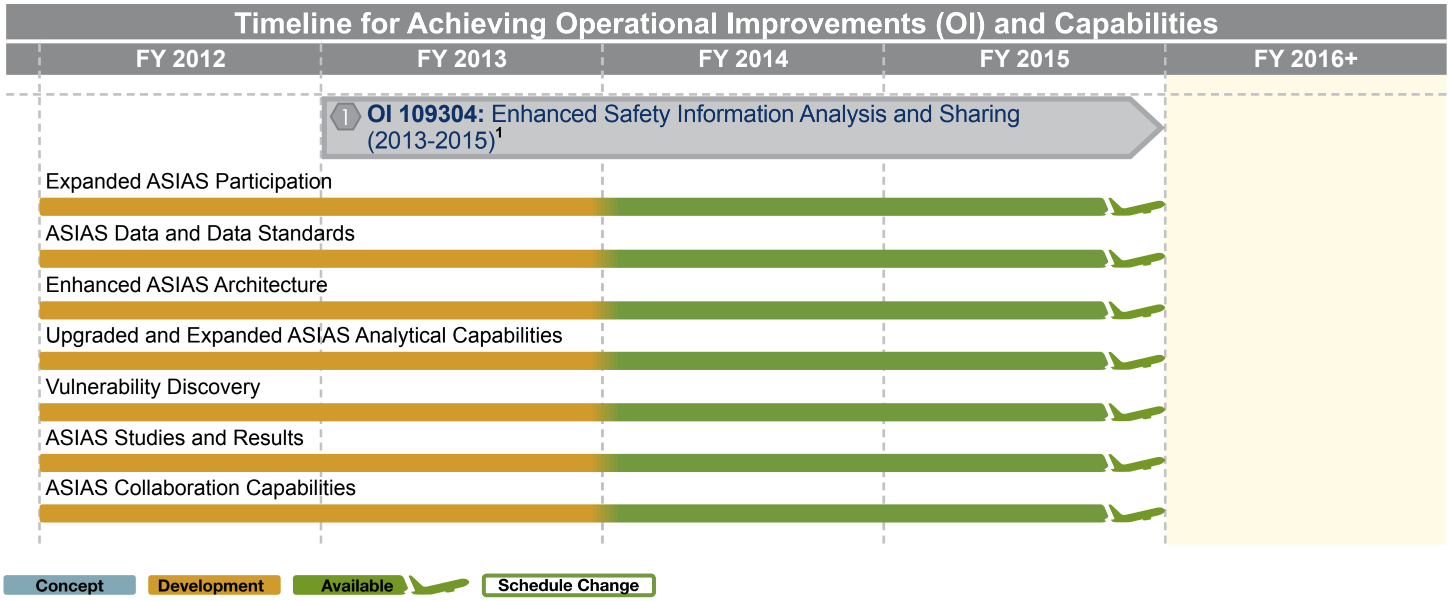
4 **OI 109319:** Environmentally and Energy Favorable Air Traffic Management Concepts and Gate-to-Gate Operational Procedures – Phase 1

Explore, develop, demonstrate, evaluate and support the implementation and deployment of air traffic management and gate-to-gate operational changes to the NAS that have the potential to reduce the environmental impacts of aviation support mobility growth by increasing the capacity and throughput of the NAS.

In Concept Exploration | **In Development** | **Available** at least one site

System Safety Management

Contains activities that enable development and implementation of policies, processes and analytical tools that the FAA and industry will use to ensure that changes introduced with NextGen enhance or do not degrade safety while delivering benefits.



[1] ASIAS is realigning enabling activities based on a new 5-year plan, which refines the original five capabilities listed in the 2012 Appendix B into seven new capabilities that better defines the development work. The new enabling activities are Expanded ASIAS Participation, ASIAS Data and Data Standards, Enhanced ASIAS Architecture, Upgraded and Expanded ASIAS Analytical Capabilities, Vulnerability Discovery, ASIAS Studies and Results, and ASIAS Collaboration Capabilities. They replace Enhanced Query Capabilities, Airspance Facility Data, General Aviation Flight Data, Enhanced Stakeholder Access, and Enhanced Data Standards.

Selected Work Activities

Budget	FY 2012	FY 2013	FY 2014+
OI 109304: Enhanced Safety Information Analysis and Sharing (2013-2015)			
Supported by NextGen System Develop-ment and ASIAS	✓ Deployed capabilities that fuse text and digital data from proprietary and government sources ✓ Developed a prototype of an information retrieval and indexing system that demonstrates the ability to detect NAS risks that have a one in 3 million chance of occurrence with a probability of 95% using multiple ASIAS data sources and a single search directive ✓ Incorporated NAS facility performance and additional data into ASIAS database, i.e., outage data, traffic management data, sector complexity data ✓ Established agreements with two of the FAA Center of Excellence for General Aviation Research members Embry-Riddle Aeronautical University and University of North Dakota to include digital data from general aviation aircraft	• Demonstrate use of aggregate high-end general aviation data to identify, measure and track general aviation-related safety risks • Deploy track visualization tools on ASIAS portal to provide search interface and additional data for ASIAS participants, such as weather, runway configurations and threaded track • Develop a FOQA sampling plan to ensure statistically significant representation of aircraft types and equipage in the ASIAS FOQA archive • Incorporate general aviation data into the ASIAS data set • Report on data currently being captured by aircraft sensors useful to safety analysis that should be incorporated into the revised FOQA standard, including data from new technologies • Demonstrate the ability to link available voice recorder data to other data sources for retrieval, e.g., given a threaded track, find the associated voice tapes	• Deploy capability to detect anomalies from aggregated views of track data and other FAA data sources for identification of safety risks • Deploy the capability to query multiple databases with a graphical interface, both FAA and proprietary, with one search directive to retrieve information of interest to safety analysts in an efficient manner • Prioritize known risk monitoring metrics specifically for NextGen system changes based upon risk prioritization assessment framework and timeline for changes • Establish required data standards for all voluntary safety reports used by ASIAS, including ASAP for all domains and ATSAP reports • Develop a plan to ensure statistically significant representation of maintenance, dispatch, and cabin safety voluntary reporting programs in the ASIAS archive • Deploy portal based capabilities organized by airport of "airport scorecard" for selected airports based upon the risk assessment framework

Descriptions of OIs and Capabilities

OI 109304: Enhanced Safety Information Analysis and Sharing

Aviation Safety Information Analysis and Sharing (ASIAS) will improve system-wide risk identification, integrated risk analysis and modeling and implementation of emergent risk management.

Expanded ASIAS Participation
To date, ASIAS has been focused on key domestic Federal Aviation Regulation Part 121 operators. In upcoming years, ASIAS will work toward expanding participation to enhance safety throughout the National Airspace System.

ASIAS Data and Data Standards
Each ASIAS data source must support established data quality standards. Data quality standards are unique for each source and are based on the identified purposes and use of the data source as outlined in the ASIAS Data Source Assessment. This enabling activity continues to enhance the data available for ASIAS in addition to implementing data standards within the ASIAS community.

Enhanced ASIAS Architecture
This enabling activity will continue to evolve the ASIAS architecture toward a more centralized model to achieve operational cost efficiencies and data fusion capabilities when data is stored in a central archive.

Upgraded and Expanded ASIAS Analytical Capabilities
The enabling activity will upgrade and expand ASIAS capabilities in the areas of dashboards and visualization, metrics and monitoring tools, information management and retrieval, text/digital data fusion, voice recorder to data linkage (including fusion of voice data with threaded track data), development of customized data mining and extraction techniques and enhanced query tools and techniques (including the capability to query and extract voice data).

Vulnerability Discovery
This enabling activity will develop enhanced risk assessment techniques and will enhance the timeliness of NextGen safety analysis results through improved data access, reduction and management techniques.

ASIAS Studies and Results
Under the direction of the ASIAS Executive Board, ASIAS conducts various studies including directed studies, safety enhancement assessments, known-risk monitoring and benchmarking. This enabling activity will support sharing of the results of these studies throughout the FAA and the ASIAS community.

ASIAS Collaboration Capabilities
This enabling activity supports the sharing of ASIAS results and capabilities with and among ASIAS participants, the FAA, and the global aviation safety community.

In Concept Exploration **In Development** **Available** at least one site

NextGen Infrastructure

Selected Work Activities						
Budget Line	**Task Force**	**Activity**	**Description**	**FY 2012**	**FY 2013**	**FY 2014+**
Automatic Dependent Surveillance–Broadcast (ADS-B)	28	ADS-B NAS-wide implementation	Provides highly accurate and more comprehensive surveillance information, than currently available from radar, via a broadcast communication link. ADS-B receives flight data from aircraft, via a data link, derived from on-board position-fixing and navigational systems. Aircraft position (longitude, latitude, altitude and time) is determined using GPS, an internal inertial navigational reference system or other navigation aids.	✓Completed final assessment of 3-nautical mile (nm) separation in en route operations (beyond those achievable in the near-term prior to ADS-B equipage)	• Achieve Initial Operational Capability (IOC) for ATC Surface Advisory Services at 12 sites • Achieve IOC for En Route ATC Separation Services at 15 sites • Achieve IOC for Terminal ATC Separation Services at 45 sites	• Achieve IOC of Automation Upgrades for ATOP automation platform • Achieve IOC for at 1 ASSC Site • Achieve IOC for Ground-Based Interval Management–Spacing • Achieve IOC for Terminal ATC Separation Services at 15 sites
Data Communications (Data Comm)	16 17 39 44 42	Data Comm	Implements Data Comm capabilities that provide new methods for delivery of departure clearances, revisions and taxi instructions in the terminal environment, specifically in the tower. In the en route environment, Data Comm Segment 1 will provide the basic capabilities for controllers and flight crews to transfer air traffic control (ATC) clearances, requests, instructions, notifications, voice frequency communications transfers and flight crew reports as a supplement to voice communications.	✓Achieved final investment decision for procurement of en route Data Comm automation infrastructure and controller-pilot data link communications applications	• Complete Revised Departure Clearance trials procedures and training development	• ERAM 4.2 Initial Test Release (ITR) • TDLS V12 ITR • Complete Data Comm Integration Testing
NAS Voice System (NVS)		NVS	Provides the connectivity for efficient communications among air traffic controllers, pilots and ground personnel. It connects incoming and outgoing communication lines via a switching matrix to the controller's workstation.	✓Released Screening Information Request ✓Achieved final investment decision for NVS Segment 1 ✓Awarded contract for NVS Segment 1	• Acceptance of first demonstration system from NVS vendor	• Achieve final investment decision for NVS Segment 2, the production system • Achieve First site IOC
System Wide Information Management (SWIM)	40 35	SWIM	Provides policies and standards to support NAS data management, secure its integrity and control its access and use.	✓Achieved final investment decision for SWIM Segment 2	• Provide terminal data distribution capability • Complete Flight Data Publication - Initial Flight Data Services operational • Complete documentation in support of Initial Investment Decision (IID) for Common Support Services–Weather (CSS-WX) Segment	• Publish data for: ○ pilot weather report ○ Traffic Flow Management ○ flight data ○ Runway Visual Range • Provide flight data publication host air traffic management data distribution system/flight data input/output and AIM Special Use Airspace client

Selected Work Activities						
Budget Line	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014+
Collaborative Air Traffic Management Technologies (CATMT)	47	CATMT	Identifies cognitive support and displays change requirements necessary for a transition to a high-altitude specialty that addresses the FAA's goals for capacity and organization excellence.	✓Upgraded the Traffic Flow Management System to include an initial electronic negotiation capability for more efficient flight planning	• Design and develop Route Availability Planning Tool (RAPT) • Design and develop the next increment of the Collaborative Airspace Constraint Resolution capability	CATMT WP3: • Complete test and deployment of Collaborative Information Exchange (CIX) • Deploy the 1st increment of TFM Remote Site Re-engineering (TRS-R) Phase 2 • Begin design, develop and test the 2nd increment of TRS-R Phase 2
Demonstra-tions	28	Colorado Wide Area Multilatera-tion (WAM) Phase 2	Supports the Denver Air Route Traffic Control Center's ability to provide en route air traffic separation services to DRO, GUC, MTJ and TEX.	✓Completed key site installation	• Deploy phase 2 system that includes WAM and ADS-B at ○ DRO ○ GUC	• Provide WAM surveillance services supporting air traffic for: ○ DRO ○ GUC ○ MTJ ○ TEX
Future Facilities		Future Facilities Investment Planning	Supports optimization of FAA's air traffic service provider resources. Considers infrastructure alternatives and associated benefits, which include improved work environment, reduced time and cost to train controllers, seamless information exchange and reduced overall air traffic service provider costs while increasing the level of service.	✓Achieved initial investment decision for segment 1, project 1 (also known as Liberty Integrated Control Facility)	• Begin final location selection for segment 1, project 1	• Complete Final Site Selection • Approve and execute land acquisition
Airport Improvement Program		Airfield development	Continues the development of new runways and extensions to increase capacity and efficiency.	✓Completed ANC Runway 7R/25L extension ✓Completed rehabilitation of PDX Runway 10R/28L ✓Completed ATL Runway 9L/27R extension ✓Continued Future Airport Capacity Task (FACT) 3 to identify capacity-constrained airports in 2020 and 2030 ✓Completed Airport System Strategic Evaluation Task study, to propose updates to the federal airport classifications for general aviation airports that reflect the airports' roles in their community, the region and the NAS ✓Considered obstruction removal and lighting needs so that airports with LPV approach procedures can achieve lower minimums ✓Continued ADS-B vehicle squitter demonstration program at BOS ✓Continued research into low-cost surface surveillance framework	• Complete ATL Runway 9L/27R extension and Runway 9R/27L widening • Complete SAT Runway 3/21 extension • Complete FACT3 to identify capacity-constrained airports in 2020 and 2030 • Consider obstruction removal and lighting needs so that general aviation airports with LPV approach procedures can achieve lower minimums • Continue ADS-B vehicle squitter demonstration program at ○ BOS and expand to ○ DEN ○ ORD ○ SFO • Continue research into low-cost surface surveillance framework	• Complete ORD Runway 10C/28C • Complete FLL Runway 9R/27L • Complete CMH Runway 10R/28L relocation • Continue additional JFK taxiway improvements • Complete JFK Runway 4L/22R reconstruction, extension, and widening • Continue ORD O'Hare Modernization Program • Continue PHL Capacity Enhancement Program • Continue planning and environmental projects

Concept Maturity and System Development

Arrivals/Departures at High Density Airports (HD)
The focus of this solution set is to increase the arrivals and departures in areas where demand for runway capacity is high, where there are multiple runways with airspace and taxiing interaction, and where airports are in close proximity with potential for airspace/approach interference.

Collaborative Air Traffic Management (CATM)
This solution set focuses on delivering services to accommodate flight operator preferences to the maximum extent possible.

Flexibility in the Terminal Environment (FLEX)
This solution set covers the terminal and airport operations for all airports. The focus of FLEX is to advance separation procedures and improve trajectory management.

Reduce Weather Impact (RWI)
This solution set includes improvements to weather information and its use to enhance safety, capacity and efficiency.

System Networked Facilities (FAC)
This solution set focuses on delivering a facility infrastructure that supports the transformation of air navigation service delivery unencumbered by legacy constraints. NextGen facilities will provide for expanded services; service continuity; and optimal deployment and training of the workforce, all supported by cost-effective and flexible systems for information sharing and back-up.

Trajectory Based Operations (TBO)
This solution set represents a shift from clearance-based to trajectory-based control. Aircraft will fly negotiated trajectories and air traffic control moves to trajectory management. The roles of pilots/controllers will evolve due to the increase in automation support. The focus of TBO is primarily en route cruise. Additional information about TBO operational capabilities can be found in the NAS Enterprise Architecture.

Arrivals/Departures at High Density Airports (HD) Selected Work Activities						
OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
		Trajectory Management – Surface Traffic Data Sharing	Focuses on the development and implementation of the technical infrastructure, operational procedures and data governance policies to facilitate the exchange of surface related data needed to enhance system efficiency, reduce delays, and foster increased collaborative decision making between the air navigation service provider, the flying community and other airport stakeholders.	✓ ASDE-X data provided to industry via ASDE-X System Oriented Architecture (SOA) Distributor (ASDE-X SD)	• The SWIM Terminal Data Distribution System (STDDS) is scheduled to be deployed at 39 sites, including all 35 instances of ASDE-X installations in the NAS. ASDE-X SD functionality will transition to STDDS providing ASDE-X data to industry and internal NAS consumers through the NAS Enterprise Messaging System (NEMS)	
104209	40 43 38 41	Trajectory Management – Surface Tactical Flow	Focuses on the development of surface-based trajectory operations and provides a roadmap for the development of a collaborative Surface Traffic Management System.	✓ Completed the evaluation report on the field assessment conducted at MEM in 2011 on the feasibility of queue management in the surface tactical flow arena for flight operators and the air traffic control tower ✓ Completed a technical transfer of queue management concepts to the Program Management Office and support artifacts	• Develop an initial shortfall analysis to identify possible gaps of airport configuration management	• Conduct field evaluations at MEM to validate the airport configuration concept • Continue technical transfer of mature surface capabilities to the Program Management Office
		Trajectory Management – Time-Based Flow Management (TBFM) Work Package III	Leverages time-based metering capabilities to implement NextGen concepts, such as terminal metering, expanding tower scheduling of departures to additional locations, integrating surface data into TBFM calculations to improve departure scheduling, enabling the opportunity for optimized descents during metering operations, and making TBFM more flexible to accommodate dynamic reroute operations in response to changing weather conditions.	✓ Developed an initial shortfall analysis to identify possible limitations of TBFM capabilities	• Develop Acquisition Management System documentation for investment analysis readiness document (IARD)	• Develop Acquisition Management System documentation for final investment decision (FID)

Collaborative Air Traffic Management (CATM) Selected Work Activities						
OI	**Task Force**	**Activity**	**Description**	**FY 2012**	**FY 2013**	**FY 2014 +**
103305		Flight and State Data Management, Flight Object	Facilitates the sharing of common flight information between systems and enables collaboration using common reference framework. The Flight Object (FO) is an extensible and dynamic collection of data elements that describes an individual flight throughout its life cycle. It is the single common reference for all system information about that flight. It associates and merges disparate data into a cohesive picture of the flight. Authorized system stakeholders and the ANSP may electronically access consistent flight data that are tailored to their specific need and use. A FO is created for each proposed flight. The FO description does not include environment or weather information since these are system-wide elements that affect multiple flights.	✓ Developed requirements of key airborne reroute capabilities for ERAM Post Release 3 to support improved system flexibility and efficiency ✓ Completed FO industry and international collaboration	• Develop the Flight Information Exchange Model (FIXM) and Schema version 2.0 • Develop the FO requirements and FO adapter requirements • Update FIXM website	• Continue development of the FIXM, and produce subsequent versions of FIXM 3.0, 4.0, etc. • Upgrade FIXM 3.0 and others to reflect data elements required by Flight Data Publication Services (FDPS) as well as collaboration with ICAO, IATA, ATMRPP, ATIEC, etc. • Continue development of architecture artifacts for Flight Object Exchange Services (FOXS) and FOXS evaluation model
103305 105208 108212	35	Flight and State Data Management, Common Status and Structure Data (CSSD)	Addresses information and capability gaps within aeronautical information to achieve NextGen shared situational awareness.	✓ Demonstrated the initial CSSD services with the digital airport data	• Conduct a prototype demonstration of Aeronautical Common Services (ACS) capabilities to support AIM Modernization Segment 2	• Develop a concept of operations for the collection and dissemination of Standard Operating Procedure (SOP)/ Letters of Agreement (LOA) to decision support tools for performing flight planning and providing situation awareness • Demonstrate limited SOP/LOA capture and dissemination capabilities in line with the concept of operations • Perform safety assessments • Develop artifacts to support investment analysis for AIM Modernization future Segment 3
105208	7b 8 46	Flow Control Management, Strategic Flow Management Integration (Integration Execution of Flow Strategies into Controller Tools)	Refines active aircraft reroute concepts; develops active aircraft reroute requirements; analyzes, simulates and develops white papers on active aircraft reroutes functions.	✓ Developed requirements of key airborne reroute capabilities for ERAM Post Release 3 to support improved system flexibility and efficiency	• Develop an ERAM system airborne reroute use case document • Finalize the ERAM system airborne reroute A-level, B-level, and display system requirements	• Validating concepts with Human-in-the-Loop (HITL) and high-level requirements development for complex routes with Data Communications • Continue requirements analysis of integration and delivery needs of re-route information from TFMS through ERAM to Data Comm

Collaborative Air Traffic Management (CATM) Selected Work Activities						
OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
105208 101102	47	Flow Control Management, Strategic Flow Management Enhancement (Enhancing the Strategic Flow Program)	Refines concept of operations for strategic flow management, analysis and white paper of strategic flow management, and modeling and simulation.	✓ Completed the concept requirements and definition plan for the Traffic Flow Management System/ CATMT Work Package 4	• Prepare a functional analysis for improving demand prediction • Prepare a functional analysis of the Integrated TMI Modeling	• Validating concepts for Work Package 4 capabilities, including examination and refinement of concepts and requirements • Complete gap analysis document to determine operational, functional, and performance gaps associated with Traffic Flow Management (TFM) after WP4
105302 105208 101102		Flight and State Data Management, Advanced Methods	Integrates weather into air traffic management (ATM); probabilistic TFM Area Flow Program will develop advanced algorithms to support the area flow support tool. Creates a unified flight planning filing by continuing assessment of fuzzy performance and common reference to the ATM domain.	✓ Conducted initial assessment of requirement for a Unified Flight Planning and Filing (UFPF) evaluation model platform and finalize the evaluation plan ✓ Conducted a demonstration of the NAS Common Reference (NCR) providing multiple NAS constraints information to preflight	• Develop a functional analysis report for UFPF and NCR concepts • Develop an initial operational requirements document for UFPF and NCR	• Complete UFPF Specific Functional Allocation • Develop UFPF Cost Analysis for Functional Allocation • Complete NCR Initial Functional Analysis • Develop NCR Operational Integration Strategy
108209 102141		Flight and State Data Management, Concept Development for Integrated NAS Design and Procedure Planning	Develops a framework for integrated national airspace design and procedures planning, enhancements to existing infrastructure to support impact assessments, and develops initial concept for best-equipped, best-served.	✓ Developed the Greener Skies research plan to identify scenarios, performance capabilities and associated ATC rules for modeling and simulation ✓ Conducted analysis to determine integration and dependency challenges for policy implementation of best-equipped, best-served	• Determine whether procedures allow the concepts to be implemented • Enhance fast time models to incorporate procedures and complete analysis	• Develop preliminary business case analysis for Required Navigational Performance to Instrument Landing System (RNP to ILS) capture • Design initial Standard Instrument Departure/ Standard Terminal Arrival Route (SID/ STAR) RNP separation procedure
		Collaborative Information Management	Develop information exchange protocol and architecture with interagency aviation stakeholders, and conduct flight operational trials as needed.		• Determine requirements and applications for mobile access to System Wide Information Management (SWIM) prototype • Develop a wireless security white paper	• Develop Agency to Agency operational data model • Simulation and Validation of interagency data and information exchange strategy

Flexible Terminal Environment (FLEX) Selected Work Activities						
OI	**Task Force**	**Activity**	**Description**	**FY 2012**	**FY 2013**	**FY 2014 +**
107107		Separation Management, Approaches, Ground Based Augmentation System (GBAS)	Begins implementation of GBAS at the nation's busiest airports (OEP 35) to achieve capacity and efficiency benefits by integrating RNAV and RNP capabilities with the Category 1 GBAS Landing System capability.	✓ Completed modification and evaluation report on development of the GBAS system at EWR to combat radio frequency interference (RFI)	• Create and update the GBAS Category III System (GAST-D) initial requirements database • Complete testing of commercially developed RFI-robust GBAS Category III Ground Prototype System	• Complete validation of compliance with the International Civil Aviation Organization (ICAO) Standards and Recommended Practices (SARPS) for the GBAS Category III system
107119		Separation Management, Approaches, NextGen Navigation Initiatives	Develops and baselines specifications and initiates solution development including acquisition and testing of navigation aid equipment.	✓ Completed a surface navigation shortfall analysis to support the development of related requirements to support implementation of the NextGen Concept of Operations ✓ Conducted an assessment of NAS operational requirement to support the development of a detailed RVR deployment schedule	• Complete coverage testing for updates to the National Standards and Orders for Terminal RNAV DME-DME • Achieve a Final Investment Decision for Enhanced Low Visibility Operations (ELVO)	• Conduct systems engineering support for NextGen Navigation concepts
107118 107119		Separation Management, Approaches, Optimize Navigation Technology	Develops and baselines specifications and initiates solution development, including acquisition and testing of navigation aid equipment.	✓ Conducted design qualification test for LED PAPI development		
	25	Trajectory Management, Arrivals (RNAV/RNP) with 3D and Required Time of Arrival (RTA)	Evaluates the ability of aircraft to accurately meet vertical constraints and time of arrival. Evaluates the advantages and disadvantages with imposing vertical constraints and RTA in different congestion scenarios. Also evaluates Data Communications (Data Comm) capabilities for aircraft messaging for RTA, and reroutes.	✓ Conducted an expanded Required Time of Arrival Demonstration to determine the feasibility of the RTA capabilities using current technologies in the NAS		
103207 104209 102406	43 38 9 41	Flight and State Data Management, Surface/Tower/Terminal Systems Engineering	Redefines and extends the TFDM and Arrival/Departure Management Tool concept of operations, funding will be used to update current analysis proposals and assess acquisition risks.	✓ Completed AMS technical and business analysis products required for Initial Investment Decision for the Terminal Flight Data Manager (TFDM) investment decision	• Complete the TFDM initial Program Requirements document (iPR) and final Investment Analysis Plan	
		Trajectory Management, Reduced RVR Minima	Brings improved capabilities through the prudent lowering of the RVR requirement by acknowledging benefits provided by cockpit equipment and crew training.		• Initiate installation and operational implementation of Reduced RVR equipment at initial candidate sites	

Flexible Terminal Environment (FLEX) Selected Work Activities

OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
102141	37a 13	Separation Management, Closely Spaced Parallel Runway Operations (CSPO)	Examines alternate proposals for further reductions of separation standards in runway spacing, and conducts simulator trials to collect data and conduct analysis.	✓ Conducted site specific examinations to determine airport operational considerations (combination of ground infrastructure, aircraft characteristics and operational conditions) that may lead to reduction in lateral runway separation standards	• Deliver the site specific evaluation final report for ORD • Develop Simplified Aircraft-Based Paired Approaches (SAPA) alerting algorithms and accompanying software reference documentation	• Acquire High Update Rate (HUR) Surveillance Data for future analysis with closely spaced parallel operations • Conduct fast-time simulations and analysis for triple approaches or operations using three closely spaced parallel runways
		Flight and State Data Management, Future Communications Infrastructure	Evaluates selected mobile and fixed applications of the aeronautical mobile airport communications system (AeroMACS) for future provisioning of both safety critical and advisory services.	✓ Conducted analysis of segregation and transport alternatives for air traffic control and airline operations center data, which will provide opportunities to reduce the infrastructure needs for digital communications on the ground		

Reduced Weather Impact (RWI) Selected Work Activities

OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
		Reduce Weather Impact (NextGen Weather Processor)	Provides improved weather observations and forecasts and tailors weather data for integration into decision support tools for collaborative and dynamic NAS decision making	✓ Completed draft cost estimate for Business Case Analysis Report ✓ Performed risk reduction activities of government furnished information (GFI) package	• Initial investment decision (IID) for NextGen Weather Processor Work Package 1 • Develop Final Implementation Strategy and Planning Document (ISPD) • Complete GFI Package	• Final investment decision (FID) for NextGen Weather Processor Work Package 1 • NWP Contract Award
		Reduce Weather Impact (Weather Observation Improvements)	Optimize observing platforms to include legacy and future systems; provide observational data of requisite space and time resolution for NextGen	✓ Delivered Flexible Terminal Sensor Network (FTSN) Initial Design Document	• Initiate proof of concept demonstration of FTSN functionality • Develop Updated Legacy Transition Plan	• Concept Requirements Definition Readiness (CRDR) activities
		Reduce Weather Impact (Weather Forecast Improvements)	Develop concepts and conduct analyzes for weather integration into decision support tools and processes	✓ Completed documentation on avoidable delay analysis and model/tool enhancements from the WITI framework	• Maintain and deliver QMS reports and documentation • Weather Impact Evaluation of CORE Airports	• Analysis on utility of the Convective Weather Avoidance Model (CWAM) for Time Based Flow Management Work Package 3 (TBFM WP3) and Collaborative Air Traffic Management Tools Work Package 4 (CATMT WP4)

System Networked Facilities (FAC) Selected Work Activities

OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
	32a 29	Integration, Development and Operations Analysis Capability	Continues to enhance, operate and maintain the operations analysis capability to support the development of iterative designs to evaluate concepts and alternatives. This will provide for an integrated environment ranging from low- to high-fidelity capabilities to support NextGen concept validation and requirements, which are required to facilitate the transition of NextGen technologies in the NAS.	✓ Designed and implement airline operations center capability for NextGen Integration and Evaluation Capability (NIEC)	• Complete the technical refresh analysis report for the reconfigurable cockpit simulator and initiate the procurement of equipment to support the NIEC technical refresh	• Install a mini-Traffic Flow Management Production Center (TPC) and integrate Traffic Flow Management (TFM) Auxiliary Platform into the NIEC
		NextGen Test Bed/ Demonstration Sites	Continues to expand the NextGen Test Bed capabilities in Daytona Beach, Fla. This program will continue integration activities between the NextGen Test Beds, increase system capabilities and improve operational fidelity of the environment. The NextGen Test Bed is a multi-domain demonstration and testing facility that integrates individual airspace domains and allows for end-to-end demonstrations, evaluations and testing in line with the NextGen gate-to-gate concept.	✓ Provided additional Florida Test Bed infrastructure to enhance demonstration capabilities	• Provide hardware (HW), and network equipment to enable connectivity to remote FAA, NASA and Industry sites	• Integrate systems between the Florida Test Bed and remote sites to leverage shared capabilities and enable inter-facility demonstration activities

Trajectory Based Operations (TBO) Selected Work Activities						
OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
108209		Separation Management, High Altitude	Identifies cognitive support and displays change requirements necessary for a transition to a high-altitude specialty that addresses the goals for capacity and organization excellence.	✓ Conducted integrated Human-in-the-Loop simulation of high altitude concept		
102108		Oceanic Tactical Trajectory Management	Develop an initial mid-term concept for Oceanic Trajectory Management in Four Dimensions (OTM-4D). A key objective of this concept is to use trajectory-based operations to improve fuel efficiency, system predictability, and performance by enabling airlines and other operators to flight plan and fly closer to their optimal (or preferred) 4D trajectories while in oceanic airspace.	✓ Conducted Automatic Dependent Surveillance–Contract (ADS-C) Climb/Descent Procedure (CDP) automation transition	• Conduct Oceanic Conflict Advisory Tool (OCAT) operational trial	• ADS-C CDP Automation Requirements • ADS-C CDP Automation Software Release • Controller Readiness • International Civil Aviation Organization (ICAO) Procedure Change
108209		Capacity Management - NextGen Distance Measuring Equipment (DME)	Provides the necessary equipment enhancements, relocation, and replacements to ensure that DME facilities are available.	✓ First article (design approval, test plan, procedures and safety assessment of contract data requirements list)		
108209 102137		Separation Management, Modern Procedures (Separation Automation Enhancements, Data-Side and Radar-Side)	Performs pre-implementation activities necessary to transition separation management automation enhancements for implementation and continued functionality for Performance Based Navigation route eligibility checking for inclusion in En Route Automation Modernization (ERAM) Release 3.	✓ Evaluated trajectory model enhancements	• D-position CHI Mini-Operational evaluation • Conflict Probe and Trajectory Model Algorithm Improvements Evaluations	• Complete Requirements Documents for Enhancements to Trajectory Modeling Accuracy and Conflict Alert and Detection Algorithm

System Development Selected Work Activities						
OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
103305 108212		New ATM Requirements	Conducts research across all solution sets, focused on maturing concepts and technologies targeting application toward the end of the NextGen mid-term.	✓ Completed the baseline requirements for future Traffic Collision and Avoidance Systems (TCAS) that define the operational and technical requirements underlying the present TCAS II equipment and standards	• Alaska current icing product/forecast icing product (CIP/FIP AK) • Develop the TCAS/ ADS-B Compatibility/ Future Requirements Document • Deliver initial report on full-antenna aperture performance model for multifunction radar capability • Complete development of NAS trajectory performance requirements • Provide acquisition planning to support requirements levied on NAS systems by uses of Airborne Access to SWIM (AAtS)	• Continuation of data elements support for trajectory modeling • Complete update to the Multi-function Phased-Array Radar (MPAR) Concept of Operations • Develop high level requirements document for MPAR
		Operational Assessments	Conducts integrated assessments to ensure that safety, environmental and system performance considerations are properly addressed throughout the integration and implementation of NextGen.	✓ Updated NextGen cost and benefits estimates	• Develop and maintain the website for NextGen Performance Snapshots (NPS) to aid in the tracking and reporting of progress within NextGen	• Continue to develop and maintain the website for NPS to aid in the tracking and reporting of progress within NextGen

System Development Selected Work Activities						
OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
		Systems Safety Management Transformation	Develops tools and supporting processes leading to a comprehensive and proactive approach to aviation safety in conjunction with implementation of NextGen capacity and efficiency capabilities. The implementation of these capabilities will require changes in the process of safety management, the definition and implementation of risk management systems and management of the overall transformation process to ensure that safety is not only maintained but improved. Creates system-wide risk baselines — and annual impact assessment of changes — including NextGen, on safety risk. Ensures highly capable and consistent risk assessment processes through Safety Risk Management (SRM) processes and taxonomy, analytical methods and integrated evaluation applications. Develops new methods to ensure continual surveillance of design approval holder compliance with Safety Management System (SMS) requirements.	✓ Demonstrated terminal area operational risk model to assess impact of NextGen operational improvements for three airports	• Compete a predictive system safety assessment of potential risks for selected NextGen Operational Improvements as defined in the NextGen Segment Implementation Plan (NSIP) version 4.0. Potential safety impacts will be assessed on accident categories similar to those in the Commercial Aviation Safety Team (CAST) plan. A final analysis report will be provided, as well as a copy of the analysis software and end-user documentation	• Deliver a fully integrated web-based pilot and controller Integrated Safety Assessment Model (ISAM) for to assess terminal and airport surface anomaly rates related to safety for NextGen Operational Improvements • Develop airport surface and high-density terminal area risk baseline and forecast safety risk models for additional airports covering top 100 terminal and airport environments
101102		ATC/Technical Operations Human Factors	Conducts system engineering and other technical support to fully integrate human factors considerations into the NextGen portfolio, and conducts focused human factors studies in areas such as controller workload and work station interfaces.	✓ Conducted a demonstration of the human error/ safety database for off-nominal NextGen conditions ✓ Established collaborative air traffic management-human factors requirements ✓ Planned NextGen human factors air-ground integration Human-in-the-Loop testing	• NextGen Human Systems Integration Research and Engineering Strategic Plan Update • NextGen Tech Ops Integrated Work Environment (IWE) Segment 2 Requirements	• Human Performance/ Safety baseline assessment • Develop Information Requirements for TMC, Dispatchers, Controllers, and Pilots for Increased Throughput During Routes and Special Handling Situations
		Staffed NextGen Towers (SNT)		✓ Issued report from second SNT field demonstration ✓ Updated SNT program requirements document		

System Development Selected Work Activities

OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
		Wake Turbulence Recategorization		✓ Completed an initial concept of operations document for more efficient leader/follower wake turbulence separation standards	• Complete a benefit assessment based on Initial Concept of Operations document for more efficient leader/follower wake turbulence separation standards	• Complete the implementation plan for the leader/follower pair-wise static tailored aircraft wake separation standards procedures and processes

Demonstration and Infrastructure (DEMO) Selected Work Activities

OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
102137 108212		NextGen – Demonstrations and Infrastructure Development	Demonstration, development and validation planning activities including International Air Traffic Interoperability, RNAV-RNP Terminal Area Demonstration, Airborne Access to SWIM (AAtS), Airborne Execution of Flow Strategies, GBAS Demonstration, Mini Global Demonstration, UAS Integration into NAS, and Future Planning.	✓ Identified a commercial service provider for an AAtS demonstration that will aid in the evaluation of the feasibility of transmitting information from the SWIM platform to the aircraft ✓ Developed a plan for Airborne Execution of Strategic Flows that will aid in the planning, development and evaluation of its feasibility within the NAS ✓ Coordinated planning documentation for GBAS in Guam with stakeholders, in order to assure harmonization within the user community	• Conduct demonstration and complete final report of results to show the capability of the FAA system and airborne aircraft to communicate non-safety-critical information via an airborne network • Work with the Single European Sky Air Traffic Management Research (SESAR) program and ICAO to define Aviation System Block Upgrades (ASBU), a set of modular targets for each country to work toward within specific time frames, in relation to the Atlantic Interoperability Initiative to Reduce Emissions (AIRE) and SWIM activities	• Conduct demonstration activities of collaborative end-to-end domain and develop standards and alternatives of near-term emerging technologies and airspace customer initiatives related to International Air Traffic Interoperability • Provide reporting and tracking for the NextGen projects in support of the NextGen Segment Implementation Portfolios as well as the pre-engineering work that aids in the mitigation of risk to developing projects • Conduct demonstration activities to show capabilities for re-routing airborne flights and continue to develop metrics and methodology for strategic flow initiatives • Conduct a Mini Global demonstration of Flight Object concepts validation, such as the Flight Information Exchange Model (FIXM) standard while developing evaluation strategies to harmonize Flight Object concepts • Complete a demonstration and prepare report to assess feasibility and requirements for integration of UAS operations in the NAS including exchange of loss-link procedures using FIXM protocols

AIRPORT AND FACILITY CODES

CORE 30 AIRPORTS

ATL	Atlanta
BOS	Boston
BWI	Baltimore-Washington
CLT	Charlotte
DCA	Washington Reagan
DEN	Denver
DFW	Dallas/Fort Worth
DTW	Detroit
EWR	Newark
FLL	Fort Lauderdale-Hollywood
HNL	Honolulu
IAD	Washington Dulles
IAH	Houston
JFK	New York John F. Kennedy
LAS	Las Vegas McCarran
LAX	Los Angeles
LGA	New York LaGuardia
MCO	Orlando
MDW	Chicago Midway
MEM	Memphis
MIA	Miami
MSP	Minneapolis-Saint Paul
ORD	Chicago O'Hare
PHL	Philadelphia
PHX	Phoenix
SAN	San Diego
SEA	Seattle
SFO	San Francisco
SLC	Salt Lake City
TPA	Tampa

OTHER AIRPORTS

ADW	Andrews Air Force Base (Maryland)
ANC	Anchorage
BFI	King County (Boeing Field)
CLE	Cleveland
CMH	Columbus
CVG	Cincinnati
DRO	Durango (Colorado)
GUC	Gunnison (Colorado)
HPN	Westchester County
MCI	Kansas City
MKE	Milwaukee
MSY	New Orleans
MTJ	Montrose (Colorado)
PDX	Portland (Oregon)
PIT	Pittsburgh
SDF	Louisville (Kentucky)
TEB	Teterboro (New Jersey)
TEX	Telluride (Colorado)

FAA FACILITIES

A80	Atlanta TRACON
C90	Chicago TRACON
N90	New York TRACON
NCT	Northern California TRACON
PCT	Potomac TRACON
SCT	Southern California TRACON
ZAB	Albuquerque ARTCC
ZBW	Boston ARTCC
ZDC	Washington ARTCC
ZDV	Denver ARTCC
ZHU	Houston ARTCC
ZLA	Los Angeles ARTCC
ZLC	Salt Lake City ARTCC
ZMP	Minneapolis ARTCC
ZNY	New York ARTCC
ZOA	Oakland ARTCC
ZSE	Seattle ARTCC

ACRONYMS

3D	Three Dimensional
1090 ES	1090 Extended Squitter
AAtS	Airborne Access to SWIM
ABRR	Airborne Reroute Execution
AC	Advisory Circular
ACAS-X	Airborne Collision Avoidance System
ACM	Adjacent Center Metering
ACS	Aeronautical Common Services
ADS-B	Automatic Dependent Surveillance–Broadcast
ADS-C	Automatic Dependent Surveillance–Contract
ADS-R	Automatic Dependent Surveillance–Rebroadcast
AEDT	Aviation Environmental Design Tool
AeroMACS	Aeronautical Mobile Airport Communications System
AIM	Aeronautical Information Management System
AIP	Air Improvement Program
AIRE	Atlantic Interoperability Initiative to Reduce Emissions
AirPASS	Aircraft Priority Access Selection Sequence
AMS	Acquisition Management System
ANSP	Air Navigation Service Provider
AOC	Airline Operations Center
APMT	Aviation Environmental Portfolio Management Tool
AR	Authorization Required
ARC	Aviation Rulemaking Committee
ARTCC	Air Route Traffic Control Center
ASAP	Aviation Safety Action Program
ASDE-3	Airport Surface Detection Equipment–Model 3
ASDE-X	Airport Surface Detection Equipment–Model X
ASIAS	Aviation Safety Information Analysis and Sharing
ASPIRE	Asia and Pacific Initiative to Reduce Emissions
ASR	Airport Surveillance Radar
ASSC	Airport Surface Surveillance Capability
ASTM	Standard-setting organization
ATC	Air Traffic Control
ATCBI	Air Traffic Control Beacon Interrogator
ATCT	Air Traffic Control Tower
ATIEC	Air Transportation Information Exchange Conference
ATM	Air Traffic Management
ATMRPP	ATM Requirements and Performance Panel
ATN	Aeronautical Telecommunication Network
ATOP	Advanced Technologies and Oceanic Procedures
ATPA	Automated Terminal Proximity Alert
ATSAP	Air Traffic Safety Action Program
baro-VNAV	Barometric Vertical Navigation
CARTS	Common Automated Radar Terminal System
CAST	Commercial Aviation Safety Team
Cat	Category
CATM	Collaborative Air Traffic Management
CATMT	Collaborative Air Traffic Management Technologies
CDM	Collaborative Decision Making
CDP	Climb/Descend Procedure
CDTI	Cockpit Display of Traffic Information
CFR	Code of Federal Regulations
CHI	Computer-Human Interface
CIP/FIP	Current Icing Product/Forecast Icing Product
CIX	Collaborative Information Exchange
CLEEN	Continuous Lower Energy, Emissions and Noise
ConOps	Concept of Operations
CRDA	Converging Runway Display Aid
CRDR	Concept Requirements Definition Readiness

CSPO	Closely Spaced Parallel Operations
CSSD	Common Status and Structure Data
CSS-Wx	Common Support Services–Weather
CWAM	Convective Weather Avoidance Model
DA/DH	Decision Altitude/Decision Height
Data Comm	Data Communications
DCL	Departure Clearance
DDU	Data Distribution Unit
DoD	Department of Defense
DME	Distance Measuring Equipment
DOT	Department of Transportation
DRM	Departure Reservoir Manager
DSP	Departure Spacing Program
EFB	Electronic Flight Bag
EFVS	Enhanced Flight Vision System
ELVO	Enhanced Low Visibility Operations
EMS	Environmental Management System
ERAM	En Route Automation Modernization
ESV	Expanded Service Volume
EUROCONTROL	European Organization for the Safety of Air Navigation
EVS	Enhanced Vision System
FAA	Federal Aviation Administration
FAC	System Networked Facilities
FACT	Future Airport Capacity Task
FANS	Future Air Navigation System
FAS	Final Approach Segment
FDPS	Flight Data Publication Services
FID	Final Investment Decision
FIS-B	Flight Information Service–Broadcast
FIXM	Flight Information Exchange Model
FL	Flight Level
FLEX	Flexibility in the Terminal Environment
FMS	Flight Management System
FO	Flight Object
FOC	Flight Operations Center
FOQA	Flight Operational Quality Assurance
FOXS	Flight Object Exchange Services
FRL	Fuel Readiness Level
FTSN	Flexible Terminal Sensor Network
FY	Fiscal Year
GAST-D	GBAS Category III System
GBAS	Ground Based Augmentation System
GDP	Gross Domestic Product
GFI	Government Furnished Information
GIS	Geographic Information System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HAATS	Houston Area Air Traffic System
HCS	Host Computer System
HD	High Density Airports
HEFA	Hydroprocessed Esters and Fatty Acids (fuel)
HITL	Human-in-the-Loop
HRJ	Hydrotreated Renewable Jet (fuel)
HUD	Head-Up Display
HUR	High Update Rate
IARD	Investment Analysis Readiness Document
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IDAC	Integrated Departure/Arrival Capability
IID	Initial Investment Decision
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IOC	Initial Operating Capability
IPR	Initial Program Requirements document
ISAM	Integrated Safety Assessment Model
ISPD	Implementation Strategy and Planning Document
ITP	In-Trail Procedure
IWE	Integrated Work Environment

LED	Light-Emitting Diode
LNAV	Lateral Navigation
LOA	Letter of Agreement
LP	Localizer Performance
LPV	Localizer Performance with Vertical Guidance
Massport	Massachusetts Port Authority
MDA	Minimum Descent Altitude
MPAR	Multi-function Phased-Array Radar
MSL	Mean Sea Level
NAC	NextGen Advisory Committee
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NAVAID	Navigational Aid
NCR	NAS Common Reference
NDB	Nondirectional Beacon
NEMS	NAS Enterprise Messaging System
NEPA	National Environmental Policy Act
NextGen	Next Generation Air Transportation System
NIEC	NextGen Integration and Evaluation Capability
nm	nautical mile
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notice to Airmen
NPRM	Notice of Proposed Rulemaking
NPS	NextGen Performance Snapshots
NSIP	NextGen Segment Implementation Plan
NWP	NextGen Weather Processor
OAPM	Optimization of Airspace and Procedures in the Metroplex
OARS	Operational Analysis and Reporting System
OCAT	Oceanic Conflict Advisory Trial
Ocean21	Oceanic Automation System
OEP	Operational Evolution Partnership
OI	Operational Improvement
OPD	Optimized Profile Descent
PAPI	Precision Approach Path Indictor
PBN	Performance Based Navigation
PIREPS	Pilot Reports
PNT	Positioning, Navigation and Timing
PPP	Public-Private Partnership
QMS	Quality Management System
RAP	Rulemaking Action Plan
RAPT	Route Availability Planning Tool
RF	Radius-to-Fix
RFI	Radio Frequency Interference
RNAV	Area Navigation
RNP	Required Navigation Performance
RPI	Relative Position Indicator
RTA	Required Time of Arrival
RTCA	Aviation industry group
RVR	Runway Visual Range
RVSM	Reduced Vertical Separation Minimum
RWI	Reduce Weather Impact
SA	Special Authorization
SAA	Special Activity Airspace
SAPA	Simplified Aircraft-Based Paired Approaches
SARPS	Standards and Recommended Practices
SATNAV	Satellite Navigation
SBAS	Satellite Based Augmentation System
SC	Special Committee
SCDM	Surface Collaborative Decision Making
SCT	FAA-Industry Surface CDM Team
SD	System Oriented Architecture Distributor
SESAR	Single European Sky Air Traffic Management Research
SFMI	Strategic Flow Management Integration
SID	Standard Instrument Departure
SIPIA	Simultaneous Independent Parallel Instrument Approach

SITS	Security Integrated Tool Set
SMS	Safety Managements System
SNT	Staffed NextGen Towers
SOA	System Oriented Architecture
SOIA	Simultaneous Offset Instrument Approach
SOP	Standard Operating Procedure
SRM	Safety Risk Management
SRMD	Safety Risk Management Document
SSE	Safety, Security and Environment
STAR	Standard Terminal Arrival
STARS	Standard Terminal Automation Replacement System
STC	Supplemental Type Certificate
STDDS	System Wide Information Management Terminal Data Distribution System
SUA	Special Use Airspace
SVS	Synthetic Vision System
SWIM	System Wide Information Management
TAPS	Twin Annular Premixing Swirler
TAWS	Terrain Awareness and Warning System
TBFM	Time Based Flow Management
TBM	Time-Based Metering
TBO	Trajectory Based Operations
TCAS	Traffic Alert and Collision Avoidance System
TFDM	Terminal Flight Data Manager
TFM	Traffic Flow Management
TFMS	Traffic Flow Management System
TIM	Technical Interchange Meeting
TIS-B	Traffic Information Service–Broadcast
TMA	Traffic Management Advisor
TMC	Traffic Management Coordinator
TMU	Traffic Management Unit
TPC	TFM Production Center
TRACON	Terminal Radar Approach Control
TRS-R	TFM Remote Site Re-Engineering
TSAA	Traffic Situational Awareness with Alerts
T-SAP	Technical Operations Safety Action Program
TSO	Technical Standard Order
UAS	Unmanned Aircraft System
UAT	Universal Access Transceiver
UFPF	Unified Flight Planning and Filing
VDL	VHF Digital Link
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VNAV	Vertical Navigation
VOR	VHF Omnidirectional Range
WAAS	Wide Area Augmentation System
WAM	Wide Area Multilateration
WITI	Weather Impacted Traffic Index
WP	Work Package
WTMA	Wake Turbulence Mitigation for Arrivals
WTMA-P	Wake Turbulence Mitigation for Arrivals–Procedures
WTMD	Wake Turbulence Mitigation for Departures

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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.

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Federal Aviation Administration

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