Federal Aviation Administration

NextGEN

Implementation Plan

March 2012

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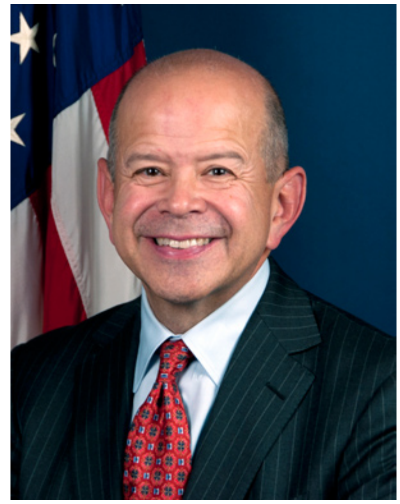
From the Administrator

March 2012

Dear Members of the Aviation Community:



We are pleased to report that in February of this year, Congress passed and President Obama signed into law the first long-term FAA authorization act since 2003. Budget authorizations through Fiscal Year 2015 provide us with greater financial guidance and stability in our efforts to advance NextGen.

As you know, maintaining and improving our critical national infrastructure, including our system of air transportation, is a top priority. It is vital that we continue to invest in the engines that drive our national economy.

Aviation sustains millions of jobs each year and accounts for more than 5 percent of the gross domestic product. Aviation enables the economic benefits of tourism, shipping and travel for business or pleasure. Through our airports, it delivers economic impact to large and small communities across this country. Continued economic growth in the aviation industry is supported through the ongoing implementation of NextGen technologies, policies and procedures, and we are pleased to report on the advancements that we have made.

During the past year, the FAA has demonstrated steady and tangible NextGen progress. Study teams completed their work analyzing arrival and departure traffic in the congested metroplex airspace around Washington, D.C., and north Texas. Design teams are working now to implement procedures that will streamline traffic flows and improve on-time performance.

Thanks to a White House infrastructure initiative aimed at expediting regulatory reviews and permit-issuance processes, we expect to implement airspace improvements in north Texas a full year ahead of schedule. We are also rolling out NextGen enhancements for controllers, such as the Automated Terminal Proximity Alert tool at Minneapolis-St. Paul International Airport, which helps controllers keep track of the spacing between aircraft lined up for final approach under instrument meteorological conditions.

We expect to make every bit as much progress in 2012. We are capitalizing on satellite technology to implement landing procedures that enable operators to maintain a steady descent to the runway during periods of low visibility. These procedures reduce aircraft exhaust emissions and burn less fuel, which improves the economic health of the industry. We will also continue deploying the ground infrastructure necessary for Automatic Dependent Surveillance–Broadcast, our satellite-based successor to radar.

As an agency, we are also going through a positive transformation. You may recall that in 2010, we embarked upon Destination 2025, a long-term strategic vision for transforming not only the national aviation system, but also the agency responsible for making it happen. In support of that vision, we launched our Foundation for Success initiative, which is putting an improved organizational structure in place to ensure the agency has the flexibility necessary to keep pace with the expected growth and advancement of aviation worldwide. As part of that initiative, we reorganized the structure of the NextGen office, moving it from the Air Traffic Organization and elevating its top official to the position of Assistant Administrator for NextGen. We also created a program management office to improve our administration and coordination of key air traffic development programs.

Of course, the FAA has long realized that we cannot accomplish NextGen alone. We can deploy capabilities, but they mean nothing if operators are not equipped and trained to take advantage of them. The NextGen Advisory Committee (NAC), composed of senior leaders representing a broad spectrum of aviation stakeholders, serves as a key interface for collaboration. The NAC released a set of recommendations this past September aimed at moving NextGen forward, and our response is summarized in this update of the NextGen Implementation Plan.

We are enthusiastic and confident about where NextGen is heading and the success achieved to date. Through continued hard work and dedication, I know we can realize the full potential of the NextGen transformation.

Michael P. Huerta
Acting FAA Administrator

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How will NextGen make flying better? We are undertaking the largest transformation of the air transportation system ever attempted, while thousands of planes and millions of passengers continue to fly safely.

The last time this happened, we had just fought and won World War II and were entering the jet age.

The time has come. Welcome to the NextGen era.

What does the NextGen transformation mean for aircraft operators flying into the next decade?

As we continue to implement NextGen capabilities over the next several years, operators and the flying public will reap the benefits of improved safety, increased capacity and better environmental performance.

Learn how the FAA expects NextGen to improve the flying experience from gate to gate.

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WHY NEXTGEN MATTERS

NextGen is a comprehensive overhaul of our National Airspace System to make air travel more convenient and dependable, while ensuring your flight is as safe, secure and hassle-free as possible.

In a continuous rollout of improvements and upgrades, the FAA is building the capability to guide and track air traffic more precisely and efficiently to save fuel and reduce noise and pollution. NextGen is better for our environment, and better for our economy.

- NextGen will be a better way of doing business. Travel will be more predictable because there will be fewer delays, less time sitting on the ground and holding in the air, with more flexibility to get around weather problems.
- NextGen will reduce aviation's impact on the environment. Flying will be quieter, cleaner and more fuel-efficient. We will use alternative fuels, new equipment and operational procedures, lessening our impact on the climate. More precise flight paths help us limit the amount of noise that communities experience.
- NextGen will help us be even more proactive about preventing accidents with advanced safety management to enable us, with other government agencies and aviation partners, to better predict risks and then identify and resolve hazards.
- NextGen boils down to getting the right information to the right person at the right time. It will help controllers and operators make better decisions. These data will assist operators in keeping employees and passengers better informed.
- Our nation's economy depends on aviation. NextGen lays a foundation that will continually improve and accommodate future needs of air travel while strengthening the economy with one seamless global sky.
- NextGen will help communities make better use of their airports. More robust airports can help communities attract new jobs and help current employers expand their businesses. By doing this, the United States will strengthen its economy and help communities realize all the benefits that aviation can bring.
- NextGen will allow us to meet our increasing national security needs and ensure that travelers benefit from the highest levels of safety.

EXECUTIVE SUMMARY

The NextGen Implementation Plan provides an overview of the FAA's ongoing transition to the Next Generation Air Transportation System (NextGen), which is improving the way things work in our nation's skies and at our nation's airports.

NextGen integrates new and existing technologies, policies and procedures to reduce delays, save fuel and lower aircraft exhaust emissions to deliver a more reliable travel experience. The NextGen Implementation Plan provides a summary overview of the benefits operators and passengers are experiencing from recent NextGen improvements; it also highlights future benefits that will result from additional NextGen implementations, and provides insight into how we are working together with the aviation community to achieve NextGen success.

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

The year 2011 was a busy one for NextGen, particularly for our continued deployment of the Automatic Dependent Surveillance–Broadcast (ADS-B) ground-based infrastructure. More than 300 ground stations were operational by the end of 2011, providing satellite-based surveillance coverage of the East, West and Gulf coasts and most of the area near the U.S. border with Canada. We expect the total complement of about 700 radio stations to be in place and operating by early 2014.

As promised, we also published a significant volume of arrival and departure procedures in addition to high- and low-altitude routes. These new Performance Based Navigation (PBN) procedures are designed to provide greater flexibility in the National Airspace System (NAS) and to facilitate more dynamic management of air traffic. Additionally, we developed a process that reduces the time it takes to introduce PBN procedures.

We significantly improved access to general aviation airports through PBN approach procedures known as Area Navigation Wide Area Augmentation System (WAAS) Localizer Performance with Vertical Guidance (LPV) procedures. We published 354 WAAS LPVs in Fiscal Year 2011. As of February 2012, there were nearly 2,800 LPVs at more than 1,400 airports throughout the United States.

Additionally, we advanced to the design phase of our metroplex initiative in two locations. Under this initiative, study groups identify near-term PBN improvements and minor airspace adjustments that can be completed in major metropolitan areas within three years. Following studies at Washington, D.C., and north Texas in 2010, we began design activities in these areas in 2011. We also completed studies in 2011 for northern California, southern California, Houston, Atlanta and Charlotte, N.C., and we are now preparing for design work in those locations.

Our ongoing advocacy of sustainable jet fuels through the Commercial Aviation Alternative Fuels Initiative reached a significant milestone on July 1, 2011. Standards-setting organization ASTM International approved the use of a renewable, bio-derived jet fuel.

NEXTGEN BENEFITS

NextGen will provide a number of benefits for NAS users, our environment and our economy.

We estimate that NextGen improvements will reduce delays 38 percent by 2020, compared with what would happen if we did not implement planned NextGen improvements. These delay reductions will provide an estimated $24 billion in cumulative benefits through 2020. NextGen delay reductions are in addition to any reduction from future runway construction or expansion.

We estimate 14 million metric tons in cumulative reductions of carbon dioxide emissions through 2020. For the same period, we estimate 1.4 billion gallons in cumulative reductions of fuel use.

To achieve timely NextGen benefits, the FAA needs to synchronize its investments with those of aviation stakeholders. To encourage operator equipage and validate concepts, the FAA conducts simulations, demonstrations, trials and flight evaluations as part of developing NextGen systems and procedures.

OPERATIONAL VISION

The FAA's mid-term operational vision remains unchanged and includes fundamental improvements at every phase of flight. Common weather and system status information will dramatically improve flight planning. Advances, such as ADS-B and Data Communications (Data Comm), combined with PBN, will increase safety and capacity, save time and fuel, decrease aircraft exhaust emissions and improve our ability to address noise.

With NextGen, we continue to advance safety as we look to increase air traffic and accommodate unmanned aircraft systems and commercial space flights. To minimize risk as we bring together a wave of new NextGen capabilities during the next decade, the aviation community relies on integrated safety cases and other proactive forms of management that allow us to assess the risk of proposed changes. Policies, procedures and systems on the ground and on the flight deck enable the mid-term system. We enhance technologies and procedures that are 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, the mid-term system depends on coordination across FAA lines of business, including specialists on safety, airports, the environment, policy development and air traffic management. FAA information and management systems must keep these activities synchronized as we approach the mid-term, reach it and move forward. We use a strategic Environmental Management System approach to integrate environmental and energy objectives into the planning, decision making and operation of NextGen.

RESPONSE TO NEXTGEN ADVISORY COMMITTEE RECOMMENDATIONS

At the FAA's request, the RTCA launched the NextGen Advisory Committee (NAC) in summer 2010 to solicit recommendations on issues critical to NextGen's successful implementation. Early in 2011, top-level aviation executives began analyzing equipage and related incentives, trajectory operations, airspace and procedures, metrics and integrated capabilities. On Sept. 29, 2011, the NAC approved the recommendations its work groups devised and then submitted the suggestions to the FAA. Cross-agency teams formulated responses and action plans, which FAA executive management approved. We summarize the NAC recommendations and the FAA responses in the Plan.

NEXTGEN AHEAD

Over the next several years, we will build on existing NextGen technologies and procedures to offer additional capabilities in the NAS.

Forthcoming improvements include expanded surface data-sharing capabilities (and corresponding policies) to enhance surface safety and foster collaborative air traffic management. We are also developing procedures to enable more efficient use of closely spaced parallel runways to improve airport throughput, particularly during poor visibility conditions.

During the 2013-2015 time frame, we plan to develop and implement mechanisms to provide NAS users with information about the current and future status of Special Activity Airspace (airspace set aside for military training and other specialized use), enabling more efficient flight planning.

We are also capitalizing on the precise surveillance of ADS-B to introduce a new capability that will enable controllers to better sequence arrival traffic from greater distances, improving the predictability and efficiency of traffic flow into busy airports. We will also leverage ADS-B to track the location of properly equipped ground vehicles on the airport surface.

Data Comm will enable a supplemental means for two-way exchange of information between controllers and flight crews. We are on track for a final investment decision this year for the VHF radio network that will carry Data Comm messages. An initial tower capability for revised departure clearances is expected in 2015.

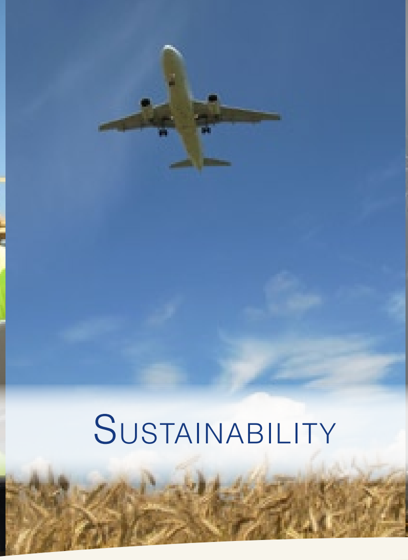
CHALLENGES

Even in the face of new challenges, the FAA remains confident about NextGen success. Given our history of overcoming difficulties, we are prepared to respond to any new obstacles.

Uncertainties and constraints increase the importance of managing NextGen with the skill and determination that such a complex system engineering project requires. We are making considerable progress on challenges that are malleable to management solutions. In 2011, the FAA reorganized the office responsible for carrying out NextGen implementation under an initiative called Foundation for Success, providing a more effective organizational and management structure for ensuring the timely, cost-effective delivery of NextGen. The head of NextGen now reports to the deputy administrator of the FAA, increasing NextGen's visibility within and outside the agency.

WHY NEXTGEN MATTERS

NextGen benefits everyone from frequent flyers to those who rarely travel by air. NextGen will provide a better travel experience, with fewer delays, more predictable trips and the highest level of safety. Many people who live in neighborhoods near airports will experience less aircraft noise and fewer emissions. Communities will make better use of their airports, strengthening their local economy. Our nation's economic health depends on a vital aviation industry.



INTRODUCTION

WHAT IS NEXTGEN?

The Next Generation Air Transportation System, or NextGen, is a transformative change in the management and operation of how we fly. NextGen enhances safety, reduces delays, saves fuel and reduces aviation's adverse environmental impact. This comprehensive initiative, which is already providing benefits, integrates new and existing technologies, including satellite navigation and advanced digital communications. Airports and aircraft in the National Airspace System (NAS) will be connected to NextGen's advanced infrastructure and will continually share real-time information to provide a better travel experience. The foundations of NextGen have been solidly built upon four major pillars: economic impact, sustainability, flexibility and safety.

ECONOMIC IMPACT

The overall health of the U.S economy is highly dependent on the aviation industry. As recently as 2009, civil aviation contributed $1.3 trillion annually to the national economy and constituted 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 protect and expand this vital economic engine. By implementing technologies and procedures that enable operators to burn less fuel and operate more efficiently and competitively, NextGen is intended to do just that.

SUSTAINABILITY

In addition to economic benefits, NextGen is helping to improve the global environment by reducing fuel burn and decreasing carbon dioxide and aircraft exhaust emissions that can adversely impact air quality. Some NextGen procedures also enable aircraft to operate more quietly, making airports better neighbors. These achievements are critical to sustaining the growth of aviation while protecting the environment.

FLEXIBILITY

While the air traffic control system in the United States is the most reliable in the world, the technology we use today has evolved about as far as it can. NextGen technologies and procedures are helping to restore flexibility to an air transportation system that is nearing the point where growth may be inhibited. Performance Based Navigation (PBN) capabilities and procedures, enabled by satellite positioning and other aircraft- and ground-based technologies, are freeing aircraft from the old highways in the sky that are dependent on ground-based beacons. PBN enables more direct, fuel-efficient routes and provides alternatives for routing around NAS disruptions, such as bad weather or unexpected congestion. Likewise, automation system improvements are providing air traffic controllers with greater decision-making tools, while digital information sharing is helping aircraft operators, controllers and traffic managers work together to maximize efficiency in the air and on the airport surface.

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

SAFETY

Safety is the FAA's first priority. The NextGen systems, policies and procedures that we are implementing are designed to ensure that the U.S. air transportation system remains the safest in the world. Satellite-based surveillance improves upon radar by providing controllers with more frequent and more accurate aircraft location information. This information can also be delivered to the cockpit, offering operators of properly equipped aircraft unprecedented traffic awareness. Up-to-date weather and airspace status information delivered directly to the cockpit will enable operators to safely make better-informed decisions while new communications technologies hold the promise of reducing misunderstandings between controllers and flight crews by supplanting many voice transmissions with digital instructions.

WHAT IS THE NEXTGEN IMPLEMENTATION PLAN?

The NextGen Implementation Plan is the FAA's primary outreach document for updating the aviation community, Congress, the flying public and other stakeholders on the progress we have made while providing a summary overview of our plans for the future. The Plan, particularly the appendices, 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, the 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 2012 update is consistent with the budget assumptions that were current at the time of publication.

While we have had to shift some of our priorities and alter some of our deployment time frames in the wake of budget constraints, the FAA remains fully committed to providing the capabilities that compose the operational vision outlined in the last several iterations of this document. As we pursue that operational vision, we remain committed to deploying near-term capabilities that take advantage of the equipment already found on many aircraft. We are well on our way, having met 92 percent of our 2011 high-priority NextGen objectives.

The NextGen transformation is as important and massive a technological undertaking as any upon which the aviation community has ever embarked. On the pages that follow, you will learn about the benefits NextGen provides today while taking a look forward at the capabilities and associated benefits on the horizon. You will also gain insight into the challenges we face as we implement NextGen and what we are doing to address them. Finally, you will be able to review a summary of the FAA's key NextGen work plans and implementation timelines as we continue 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

In 2011, the FAA continued to provide NextGen operational benefits to users of the National Airspace System (NAS) while laying the groundwork for more progress in the years ahead.

The NextGen effort is already producing significant economic, environmental and safety benefits. NextGen enables aircraft to reduce fuel burn, noise and aircraft exhaust emissions while increasing NAS access, efficiency and flexibility to accommodate growing air traffic volumes. We expect benefits to increase as the NextGen effort progresses.

We made progress in many areas in 2011, taking action to provide benefits to operators with currently installed avionics as recommended by the RTCA[1] NextGen Mid-Term Implementation Task Force. For example, pilots of aircraft outfitted with Future Air Navigation System (FANS) equipment are being cleared by controllers to fly Tailored Arrivals at three airports where the procedures are now operational.

In addition, we are partnering with several air carriers to gather Automatic Dependent Surveillance–Broadcast (ADS-B) data to support the business case for early equipage, and we have reduced the time it takes to deploy new Performance Based Navigation (PBN) procedures. As promised, we published a significant volume of arrival and departure procedures in Fiscal Year 2011, as well as new high- and low-altitude routes. These new procedures, along with new air traffic control (ATC) automation tools and adjustments to airspace sector boundaries, will provide greater flexibility in the NAS and facilitate more dynamic management of air traffic. We also continue to make progress on safety management, airport development, environmental management, international harmonization, workforce engagement, training, regulation and policy making.

The initiation of the Optimization of Airspace and Procedures in the Metroplex effort in 2010 is a good example of how the FAA is implementing industry's recommendations. The aim of this effort is to have study groups identify near-term PBN improvements coupled with airspace sector adjustments that can be completed in major metropolitan areas within three years. These metroplex areas usually encompass a number of major commercial airports, as well as general aviation airports.

[1] RTCA is a private, not-for-profit corporation that develops 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.

We completed studies and began design activities at two metroplex areas: Washington, D.C., and north Texas. Meanwhile, we started and completed studies at five more metroplexes in 2011: northern California, southern California, Houston, Atlanta and Charlotte, N.C. We are targeting a total of 21 metroplex areas in this improvement program, adding them at a rate of about five per year for studies followed by the initiation of design work. The map on page 17 highlights some of our 2011 accomplishments in support of airspace access and improved surface operations.

Because maintaining and enhancing safety is fundamental to everything we do, we will introduce these and other improvements into the NAS only after using a stringent process to ensure they are safe. We target key risk areas to reduce accidents and incidents and we aim to limit adverse environmental impact. We set robust standards for capabilities and demonstrate that they will provide intended benefits. We are also collaborating closely with international air navigation service providers and safety organizations to continue to harmonize our efforts so that aircraft will be able to operate using the same concepts, systems and procedures throughout the world.

BETTER AWARENESS WITH ADS-B

The FAA continued to make progress on installation of the ADS-B ground-based infrastructure in 2011 with more than 300 radio stations already providing coverage of the East, West and Gulf coasts and most of the area near the U.S. border with Canada. A map of ADS-B surveillance coverage appears on page 16.

We expect the total complement of about 700 radio stations to be in place and operating by early 2014. Controllers at

NEXTGEN: A COLLABORATIVE ENDEAVOR

NextGen is a complex undertaking, and the FAA is working with aviation partners to lay the groundwork for meeting our commitments to transform the National Airspace System (NAS). What follows are select examples of collaborative efforts that have produced tangible achievements in support of the NextGen transformation. As ongoing collaboration is critical to NextGen success, we will continue to work with the stakeholder community through various forums to set NextGen priorities and pursue NextGen solutions.

At the FAA's request, RTCA formed the NextGen Mid-Term Implementation Task Force in 2009. One of our most effective collaborative efforts, this consortium of 300-plus representatives of the aviation community came together to provide recommendations for moving forward together on NextGen implementation.

The FAA responded to those recommendations with plans for achieving Task Force objectives. We have completed more than a third of our Task Force response actions, making progress in areas identified by the Task Force as high priority, including metroplex operations. Work continues as scheduled on nearly half of the response actions, while the remaining actions are subject to delay because of budget constraints and program challenges. We have also been working with the aviation community to prioritize where we should implement Performance Based Navigation (PBN) routes and procedures. We also streamlined the PBN operations approval process.

One example of collaboration is the progress we have made with special activity airspace (SAA) — airspace set aside for military training and other specialized use. The Task Force advocated electronic schedules and updates of SAA to provide operators with real-time knowledge of the active status of SAA. Today's scheduling method is not automated and does not acknowledge whether SAA is inactive and available to civil operators. The FAA in 2011 published a concept of operations for SAA data automation, documented end-to-end functional requirements, set deployment timelines and conducted benefits analyses.

Another successful partnership is the Joint Planning and Development Office (JPDO), which coordinates NextGen efforts among the FAA, NASA, the departments of Defense, Commerce and Homeland Security, the White House Office of Science and Technology Policy and the Office of the Director of National Intelligence. The JPDO laid the groundwork for the future vision for NextGen by developing the long-term research plan for improvements that extend beyond the FAA's mid-term operational vision.

The FAA and NASA conduct joint NextGen technology research, simulation and field trials through Research Transition several ATC facilities can use this foundational NextGen technology to separate suitably equipped aircraft in areas with ADS-B coverage: Louisville, Ky., and Houston as of 2009; Philadelphia and Juneau, Alaska, as of 2010. ADS-B updates the aircraft tracking function in the automation system more frequently and with greater accuracy than radar, providing information such as aircraft type, call sign, heading, altitude and speed. With ADS-B, controllers can use airspace more efficiently.

In July 2011, the FAA achieved initial operating capability with ADS-B data integrated into the ATC automation system at the New York terminal radar facility, which controls air traffic in one of the busiest areas of airspace in the United States. This facility handles arrivals and departures from New York John F. Kennedy and LaGuardia, as well as Newark.

ADS-B Out involves the transmission of a GPS position (or that of comparably performing navigation equipment meeting integrity and accuracy requirements) from an aircraft in order to display the aircraft's location to controllers on the ground or to pilots in the cockpits of aircraft equipped with ADS-B In. ADS-B In is the capability of aircraft to receive ADS-B data from other aircraft or from the ground. ADS-B In complements ADS-B Out.

Concurrently, the FAA is working with several air carriers to obtain ADS-B data to validate the business case for early adoption of new equipment. These efforts are governed by memorandums of agreement in which the government and the air carriers contribute to the project. For example, JetBlue Airways will provide the FAA with data from flights off the East Coast where ADS-B Out will allow more efficient operations when radar coverage is not available. To facilitate data gathering, the FAA in 2011 began procuring ADS-B Out avionics for installation on 35 JetBlue Airbus A320 aircraft to gather the needed data.

To gain an early understanding of ADS-B operational benefits, the FAA has been working with UPS under an agreement to upgrade the company's older ADS-B avionics. The upgraded avionics will meet the requirements of the ADS-B Out rule, which mandates ADS-B Out equipage in most controlled airspace by 2020. UPS will provide operational performance data for the FAA to evaluate. In addition, the FAA will gain experience in processing rule-compliant data in its automated ATC systems.

Teams (RTT) that provide the FAA with research results to inform the implementation of NextGen technologies. The agencies successfully completed their flow-based trajectory management (FBTM) RTT work in July 2011.

This RTT work yielded multiple refinements of the FBTM concept, developed prototype multi-sector planning (MSP) tools and led to a big change in MSP thinking. Instead of establishing a new, stand-alone strategic air traffic controller position to manage aircraft trajectories across multiple sectors, this RTT showed the FAA can record the same benefits by allocating the MSP functions to the current structure of traffic management and en route controllers. The FAA will use the experience gained from the RTTs to create a repeatable transfer process that can be used with any partner.

Collaboration with NASA and the departments of Defense and Homeland Security helps us explore NextGen concepts, including efforts to facilitate the entry of unmanned aircraft systems (UAS) into the NAS. Currently, unmanned aircraft may enter the NAS only after obtaining a certificate of authorization from the FAA. In cooperation with Homeland Security's Customs and Border Protection, we are operating remotely piloted Predator B aircraft in Florida's Cape Canaveral to conduct Automatic Dependent Surveillance–Broadcast and digital data communication flight trials in support of UAS integration.

To help facilitate the FAA's collaboration with the Department of Defense, a U.S. Air Force Research Laboratory liaison works closely with FAA experimenters to identify opportunities to leverage research, laboratory capabilities and other expertise. This partnership advances work on UAS, alternative aviation fuels and human factors research.

NextGen will dramatically change the way weather information is provided to pilots, controllers and airline dispatchers, and improve the way they operate by providing a common picture of current and forecast conditions. In pursuit of these goals, the FAA is actively collaborating with the U.S. Air Force, the U.S. Navy, NASA and the National Oceanic and Atmospheric Administration's National Weather Service.

We also work with our international partners to ensure that NextGen standards, technologies and procedures are developed in concert with global air traffic modernization efforts, such as those in Europe, Japan and Australia. Much of this collaboration is accomplished through bodies such as the International Civil Aviation Organization, which makes recommendations on global standards and practices, and industry groups such as the Civil Air Navigation Services Organization, which represents both government and private air navigation service providers. Our aim is to ensure investments operators make in NextGen technology, procedures and training will deliver benefits anywhere.

The FAA is also working to gather data on the benefits provided to air carriers using ADS-B In equipment. In August 2011, the FAA initiated a 12-month operational evaluation of In-Trail Procedures (ITP), using ADS-B In over the Pacific Ocean. The evaluation of ITP will be based on data from the flights of about a dozen United Airlines Boeing 747-400s. The FAA is providing the necessary avionics for United to obtain these ADS-B In data.

Pilots of aircraft equipped with ADS-B In can now see the location, identity and speed of nearby aircraft on a cockpit display. This improved situational awareness enables pilots to know when to request a climb from controllers to reach a more fuel-efficient altitude. Preliminary FAA estimates show that, thanks to ITP, an air carrier operating between the United States and the South Pacific might earn $200,000 in additional payload revenue per aircraft each year by being able to carry less fuel. This benefit translates into approximately 270 pounds of additional payload per flight.

NextGen is already producing significant economic, environmental and safety benefits.

We published initial requirements and specifications for airborne equipment including ADS-B In installation guidance in February 2011, which followed ADS-B Out equipment standards and installation guidance issued in 2010. Additional specifications for ADS-B In will be published in 2012, including those for the ITP application.

For the general aviation community, ADS-B offers an even wider range of benefits. Pilots of properly equipped general aviation aircraft can receive up-to-the-minute graphical weather information in the cockpit, as well as other flight information, including Notices to Airmen advisories. Pilots of aircraft equipped to receive and display this information can benefit now from these data when flying over many areas of the United States. We offer these services at no cost.

In addition to gathering data on a variety of ADS-B In benefits, the FAA convened an Aviation Rulemaking Committee (ARC) in June 2010 to explore a strategy for ADS-B In implementation. This group of stakeholders made its recommendations to the agency in September 2011. The ARC called for some policy adjustments and asked the FAA to pursue early development of equipment standards and timely completion of regulatory guidance for ADS-B In applications.

The ARC wants the FAA to enable a variety of ADS-B In capabilities by 2017. The ARC has placed the highest priorities on the following capabilities:

- Cockpit Display of Traffic Information Assisted Visual Separation: This application is for use after a pilot has already visually identified the aircraft ahead to follow during an approach. It allows the pilot to maintain visual approach spacing after losing visual contact at night or in other situations where tracking is difficult. This application will sustain arrival rates closer to those attained under visual approach operations.

- Flight Deck Based Interval Management–Spacing: This application will reduce fuel burn, aircraft noise and exhaust emissions while maintaining high-density operations and efficient flight operations in the NAS.

- Traffic Situational Awareness and Alerting: This application will enhance safety in the NAS by providing alerts to general aviation pilots of conflicting traffic nearby.

Information regarding the FAA's schedule for developing guidance and standards for these applications can be found in Appendix A.

The ARC also requested that the FAA continue ADS-B In flight trials with early adopters to validate benefits, define policies and procedures, and improve understanding of equipage and operational requirements.

ENHANCING PERFORMANCE BASED NAVIGATION

The FAA produced a significant number of PBN routes and procedures, meeting our FY 2011 goal.

PBN procedures help reduce fuel use, miles flown, emissions and the number of people exposed to noise while aircraft transition during the arrival or departure phase of flight. The application of PBN also aids en route cruise at high altitude (Q-routes) and at lower altitudes around terminal areas (T-routes). These procedures could reduce delays during inclement weather.

In FY 2011, we published 49 Area Navigation (RNAV) routes including, for the first time ever, two helicopter routes connecting New York City to Washington, D.C. Also during FY 2011, we published 55 RNAV arrival and departure procedures. We also published 51 Required Navigation Performance (RNP) Authorization Required approach procedures. Production of additional RNP procedures will focus on those with the most significant benefits.

During the past five years, we have completed 28 Standard Terminal Arrival Routes (STAR) with Optimized Profile Descent (OPD) capability. Traditional arrival procedures have multiple segments of level flight during descent and each step-down requires a change in power settings. OPD procedures enable arrival aircraft to descend from cruise altitude to final approach at or near idle power with few, if any, level-offs. Because aircraft can use lower and steady power settings, OPD procedures result in reduced fuel burn, lower aircraft exhaust emissions and often less noise.

Another type of efficient arrival procedure is the Tailored Arrival (TA), which provides fuel, emissions and noise benefits similar to those of OPDs. The pilot initiates a TA with a request to an air traffic controller while the aircraft is still at cruise altitude, typically over the ocean. The controller then transmits a descent profile to the aircraft so it can be loaded in the onboard navigation computer. The commercial aircraft participating have to be equipped with FANS avionics to receive the data needed to make the approach. By contrast, other types of OPDs, such as RNAV arrival procedures, are published for all users and serve a wide variety of aircraft types.

Through technology transfer from research and development to NAS implementation, we made TAs operational at the following international gateways in 2011: Miami, San Francisco and Los Angeles. We are exploring the use of TA procedures at more airports in 2012: Anchorage, Alaska; Travis Air Force Base, Calif.; and Andrews Air Force Base, Md.

Another type of PBN is especially beneficial for smaller airports, where general aviation aircraft often operate. This form of PBN is the RNAV Wide Area Augmentation System (WAAS) Localizer Performance with Vertical Guidance (LPV) approach procedure.

We published 354 WAAS LPVs in FY 2011. As of February 2012, there were nearly 2,800 LPVs at more than 1,400 airports throughout the NAS. With LPVs, aircraft often can land in low-visibility conditions, providing more access to those airports throughout the year. WAAS LPVs provide satellite-based approaches primarily to airports and runways where no ground-based instrument landing systems exist. General aviation aircraft are the primary users of LPV procedures and about 30 percent of the fleet is equipped for LPV approaches.

ENVIRONMENTAL STEWARDSHIP

As we develop NextGen capabilities, the FAA is placing a high priority on reducing aviation's adverse environmental impact. This effort is proceeding on several fronts, including a reduction in aircraft exhaust emissions through advanced engine and airframe technologies, a shift to biofuels, efforts to allow jets to cruise more often at or near optimal altitudes to reduce fuel burn, reconfigured arrival routes to allow for optimal profile descents to reduce aircraft noise and emissions, and improved departure routing to reduce miles flown and flying time.

The FAA is proactively managing aviation environmental issues within an Environmental Management System framework. The FAA is working with other agencies and aviation stakeholders, including airports, air carriers, manufacturers and local communities, to develop environmental objectives to meet aviation environmental and energy goals. At the same time, the FAA is reviewing its procedures for meeting the requirements of the National Environmental Policy Act to ensure compliance and to improve the agency's ability to complete the process in a timely fashion.

Under the auspices of the International Civil Aviation Organization's (ICAO) Committee on Aviation Environmental Protection, the FAA continues to pursue several measures to decrease aviation's environmental footprint, including supporting development of a significant international standard for aircraft carbon dioxide emissions levels. The committee is aiming for a 2013 completion date for the standard.

Environmental initiatives include:

- In partnership with industry, the FAA initiated the Continuous Lower Energy, Emissions and Noise (CLEEN) program. The objective is to reduce aircraft fuel burn by 33 percent and to reduce oxides of nitrogen by 60 percent compared with ICAO emissions standards. CLEEN aims to achieve these goals through a combination of new engine and airframe technologies. In addition, the goal is to reduce aircraft noise — from the engine or the airframe — by a cumulative 32 decibels from the current ICAO standard. CLEEN technologies include sustainable alternative aviation fuels, lighter and more efficient gas turbine engine components, noise-reducing engine nozzles, adaptable wing trailing edges, optimized flight trajectories using onboard flight management systems, and open rotor and geared turbofan engines. CLEEN will accelerate the development of these technologies for potential introduction into aircraft and engines beginning in 2015. Progress in 2011 included a test of a new jet engine combustor design. Preliminary results from 2011 tests show that the CLEEN oxides-of-nitrogen goal will be met.

- The FAA is a member of the Commercial Aviation Alternative Fuels Initiative, a government/industry consortium working to develop and deploy alternative jet fuel (see sidebar on page 14).

- The FAA completed testing of its Aviation Environmental Design Tool (AEDT) in 2011. AEDT uses dynamic aircraft performance algorithms to calculate aircraft noise levels, fuel consumption and exhaust emissions affecting air quality and greenhouse gas emissions. The FAA plans to make AEDT available for use by aviation environmental specialists in 2012.

- The FAA, in association with the National Air Traffic Controllers Association (NATCA), tested a surface traffic management strategy called N-Control at Boston in 2011. The goal was to reduce taxi times by taking multiple factors, such as wind and other weather conditions, into account when calculating a target rate for pushing aircraft back from the gate. Researchers in the ATC tower suggested an optimal number of pushbacks in 15-minute intervals for controllers to use. A two-month trial in the summer of 2011 resulted in substantial fuel savings and overall taxi-time reductions. The FAA plans to test the N-Control strategy at an additional airport in 2012.

THE SAFETY FACTOR

The FAA's Office of Aviation Safety and commercial air carriers have established a data exchange known as the Aviation Safety Information Analysis and Sharing (ASIAS) system. ASIAS houses large amounts of proprietary airline and internal FAA data. Government and industry sharing of ASIAS data makes this approach well suited to support the systemic changes being planned for the NAS under NextGen.

FUELING SUSTAINABLE NEXTGEN FLIGHTS

Over the last year, the FAA and its partners made great strides toward the commercial use of drop-in alternative jet fuels. Drop-in fuels are functionally identical to conventional jet fuel and do not differ in performance or operational capability. Operators can use these fuels without any modification to existing engines or fuel infrastructure.

On July 1, 2011, the aviation community reached a major milestone when ASTM International, a standards-setting organization, approved the use of a drop-in biofuel known as Hydroprocessed Esters and Fatty Acids (HEFA) jet fuel.[1] This amended fuel specification is the culmination of a collaborative effort among the FAA, the Department of Defense (DoD) and the aviation industry through the Commercial Aviation Alternative Fuels Initiative. The approval assures the safety and performance of this type of bio-derived fuel for commercial use by airlines globally.

HEFA biofuel can be mixed up to 50 percent with standard kerosene. It is the second drop-in alternative fuel that ASTM has approved for operational use. Fifty-percent synthetic fuel blends created from a process known as Fischer-Tropsch synthesis were approved in 2009. Over the last year, the FAA has partnered with the U.S. Department of Agriculture to develop a Feedstock Readiness Level Tool. Released in November 2011, this tool assesses the development and availability of various agricultural or forest-based feedstocks for the production of commercial and military aviation biofuels.

There is no single renewable jet fuel solution that will meet all of aviation's needs. Crop availability, diverse climates and the energy production potential of a given region are variables that necessitate multiple solutions for meeting fuel demand. To that end, the FAA is working to get ASTM approval of as many commercially viable and environmentally sustainable drop-in alternative jet fuel options as possible. The FAA, DoD and the aviation industry plan cooperative tests of jet fuels from biomass, sugars and alcohols. The FAA is funding these activities through grants from the U.S. Department of Transportation's Volpe Center and through the Continuous Lower Energy, Emissions and Noise program, which also supports maturation of green engine and airframe technologies.

In December 2011, the FAA announced contract awards to analyze fuel quality control procedures, conduct engine durability tests with alternative fuels and perform key testing to support qualification and certification of jet biofuels from alcohols, organic matter and other renewable materials. We expect these activities to support the next round of fuel approvals, scheduled to begin in 2014.

Reducing aviation's contribution to aircraft exhaust emissions and climate change impacts are key potential benefits of alternative jet fuels. Measuring those benefits requires quantifying the full life-cycle emissions from alternative fuel production, distribution and use. The FAA and the U.S. Air Force are jointly funding the development of greenhouse gas life-cycle analyses through the FAA's Partnership for Air Transportation Noise and Emission Reduction Center of Excellence. Results show that certain alternative jet fuels could reduce carbon dioxide emissions by as much as 80 percent over regular jet fuels when considered on a life-cycle basis.

[1] Formerly known as Hydroprocessed Renewable Jet (HRJ) biofuel.

ASIAS uses 65 databases (up from 46 in 2010), and analytical tools enable the FAA, NASA and air carriers to conduct safety analyses, develop benchmarks, find emerging system risks, feed system safety modeling projects and enhance the effectiveness of risk mitigation actions. To facilitate participation, information that could be linked back to a specific company is removed from voluntarily reported air carrier data. Since its inception in October 2007, ASIAS has established individual data- and report-sharing agreements with 43 commercial air carriers that account for more than 95 percent of commercial operations in the NAS.

The FAA continues to evaluate other sources of data and will add them to ASIAS when merited. Several important data sources will be added in the next two years, including ADS-B and pilot/controller voice recordings. As of December 2011, these data sets include 110,000 voluntary reports submitted by pilots under the Aviation Safety Action program and 40,000 voluntary reports submitted by controllers and other FAA employees under a similar safety initiative called the Air Traffic Safety Action Program. In addition, ASIAS includes Flight Operational Quality Assurance program recorded flight data from more than eight million airline flights as well as FAA radar and runway positional data.

Due to these rich sources of data, ASIAS is emerging as the most comprehensive collection of air safety data in the U.S. aviation industry. This government-and-industry partnership has already produced safety benefits for air carriers, the FAA and the traveling public. Recent studies using the ASIAS data set and analytical tools have helped improve insights on a variety of possible safety risks. For example, ASIAS is helping the FAA and stakeholders with better characterization and understanding of missed approaches, runway overruns, rejected takeoffs, auto braking and energy states on final approach. This nuanced understanding is expected to aid in accident prevention.

> NextGen is a collaborative endeavor, and the FAA is actively working with aviation partners to transform the NAS.

The FAA's Air Traffic Organization (ATO) assesses and manages the risks involved in changing the way we manage air traffic in the NAS. And in current practice, the FAA's Safety Management System employs safety risk management, safety assurance, safety policy and safety promotion to rigorously manage risk. To date, our efforts have been focused on individual programs and projects, including systems procedures and airspace changes that can be analyzed in one safety risk management document. Now the FAA is enhancing this effort by adding a holistic hazard analysis of interacting systems under a process called Integrated Safety Risk Management. This enhanced approach will contribute to the safe implementation and integration of both new and legacy NAS capabilities.

NextGen will also enhance safety management via the Safety Analysis System (SAS), which will provide an automated environment for analyzing and addressing NAS-wide safety risks and enable users to extract information from multiple databases and systems. With a functioning SAS, the ATO will be able to collect, assimilate, share, analyze and view information to ensure all NAS users have a consistent view of system safety. SAS will facilitate risk-based decisions and enhance the agency's predictive capabilities. SAS, an internal ATO system, will complement ASIAS by drawing data directly from some NAS sources not tied to ASIAS. SAS will also be capable of sharing safety data with the ASIAS platform.

IMPROVING APPROVAL PROCESSES

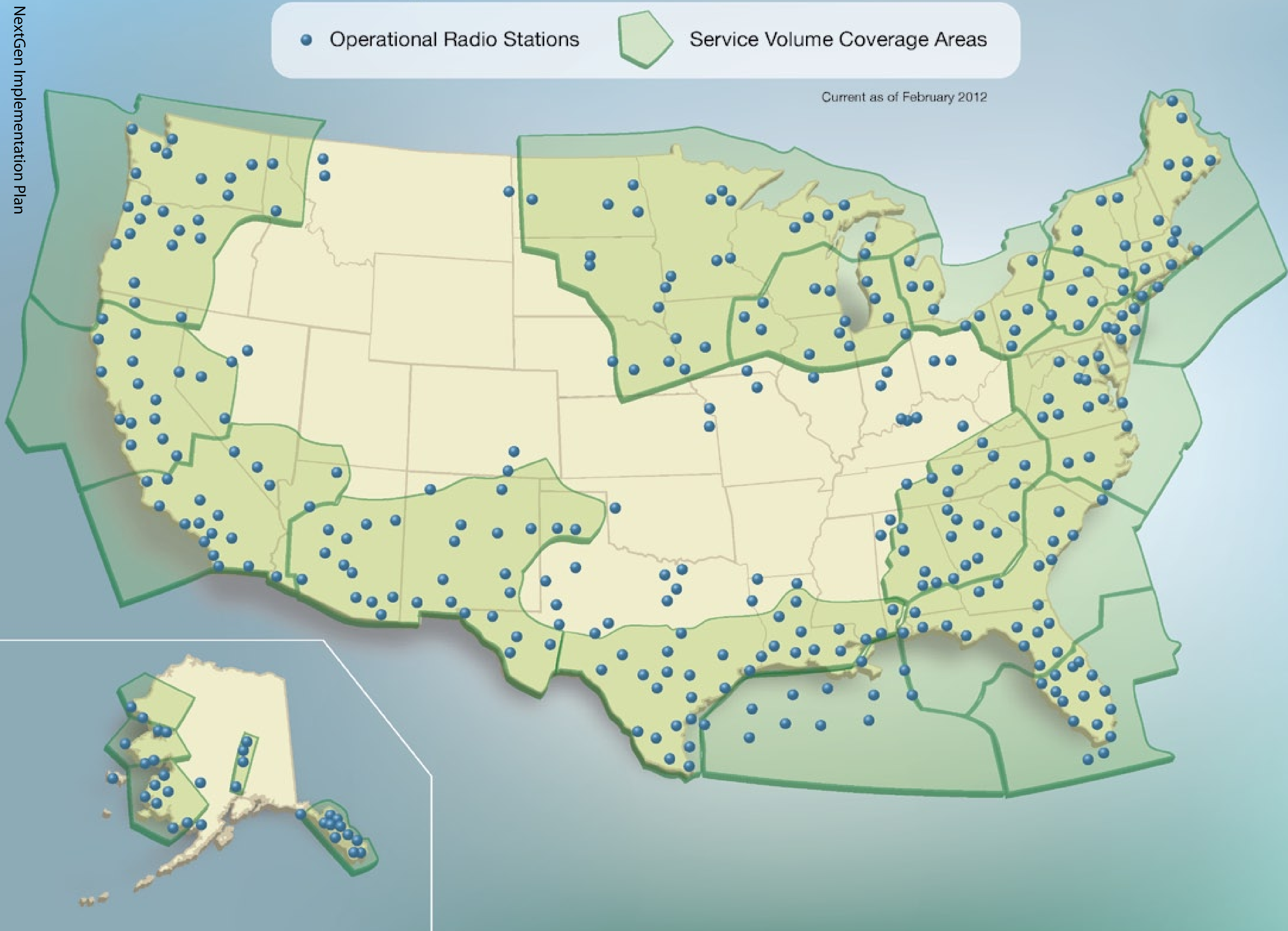
In 2011, the FAA focused on a number of initiatives to ensure consistent and efficient evaluations and approvals of NextGen technologies and operations.

For example, Aviation Safety and the ATO collaborated on how we develop and improve Instrument Flight Procedures (IFP). The FAA began this initiative in response to a Task Force recommendation and issued an implementation plan in 2011 following a review of all processes, tools, standards and policies used by the agency to develop PBN and other instrument procedures. This process improvement implementation plan guides future FAA actions on procedure initiatives.

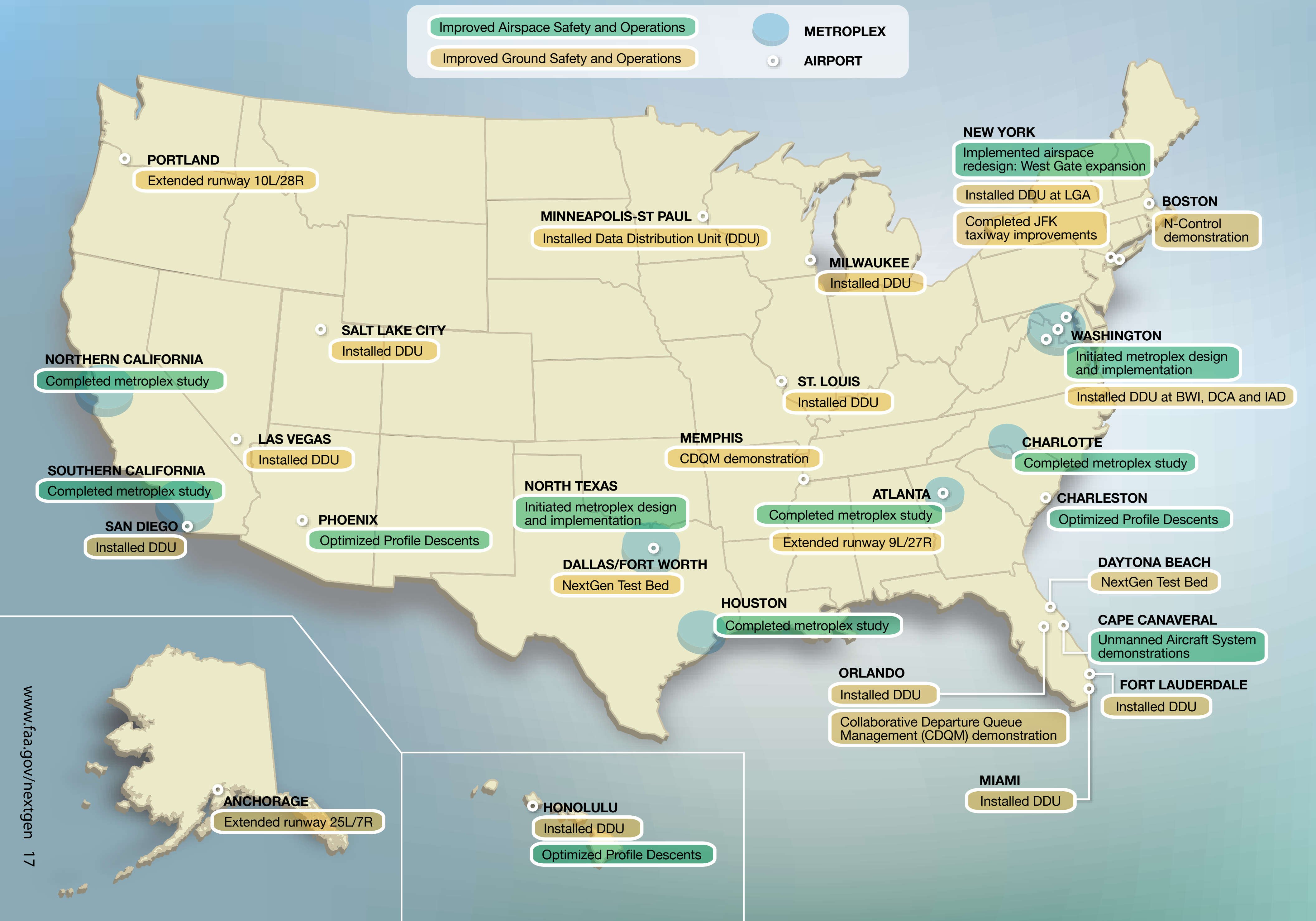
FAA objectives for improved procedure development include standardizing the data used by government and industry and automating the transfer of information across several ATC automation platforms currently in use. We have already taken steps to enhance the exchange of data, improve database management and advance the environmental compliance process involved with procedure development.

In addition to revising the approval process, the FAA continues to show how aircraft operators and airports can achieve various capabilities and reap benefits from enablers such as ADS-B or LPV avionics (see Appendix A). This schedule provides transparency for manufacturers who are developing the equipment and operators who are interested in scheduling multiple aircraft modifications at the same time to reduce the overall cost of implementation. Many enablers build on capabilities already installed or available for aircraft today.

Expanded Satellite-Based Surveillance



Improved Airport Surface Operations and Airspace Access in 2011



VALIDATING CONCEPTS

Once we have developed a concept, we use simulations and demonstrations to pursue it further. The FAA's William J. Hughes Technical Center in Atlantic City, N.J., has been using its new NextGen Integration and Evaluation Capability (NIEC) to explore, integrate and evaluate NextGen concepts. The NIEC complex features an ATC simulation area, a cockpit simulator, unmanned aircraft system (UAS) ground control stations, a simulated tower cab interior, an Airline Operations Center emulator, legacy and NextGen weather tools, a Traffic Management Unit, a Traffic Flow Management display and an ADS-B display.

In 2011, FAA researchers used the NIEC to conduct numerous simulations and real-time human factors studies. For example, under an agreement with NATCA, the NIEC was used for several simulations and Human-in-the-Loop studies with controllers. Sessions focused on ATC tower modernization using new automation and sensors; integration of UASs into the NAS using real-time data gathered from a simulated flight of a UAS near Atlantic City and other similar data; four-dimensional trajectory based operations and net-enabled operations. In addition, the FAA has created a network linking the NIEC with other laboratories, including the Florida NextGen Test Bed and corporate facilities. In 2012, the North Texas NextGen Test Bed and Department of Defense Research and Engineering Network will be added to the network.

OPERATIONAL WORKFORCE

The FAA continues its efforts to train its workforce. Since the agency published its 2010 Acquisition Workforce Plan, it has met 92 percent of its overall workforce requirements for FY 2011 Capital Investment Plan programs. The technical controller training office is working with NextGen program offices and with the human factors group to ensure that controllers and technicians get the right training at the right time. Training for aviation inspectors, engineers and flight test pilots is also being developed to ensure effective oversight of implementation. Early collaboration has ensured that the training development process will be aligned with NextGen implementation.

Liaisons from both NATCA and the Professional Aviation Safety Specialists were assigned to headquarters in FY 2011 to enhance workforce engagement. These and other labor representatives will provide operational expertise in the development and implementation of NextGen concepts as well as guidance on labor participation in NextGen initiatives.

GLOBAL HARMONIZATION

The FAA continues to partner with international air navigation service providers (ANSP) and safety organizations to ensure that NextGen concepts, systems and procedures match those under development elsewhere. The goal is to provide safe, seamless, efficient and environmentally responsible operations worldwide. The FAA is working with ICAO, industry standard making bodies and international civil aviation authorities to harmonize standards for NextGen technologies and procedures.

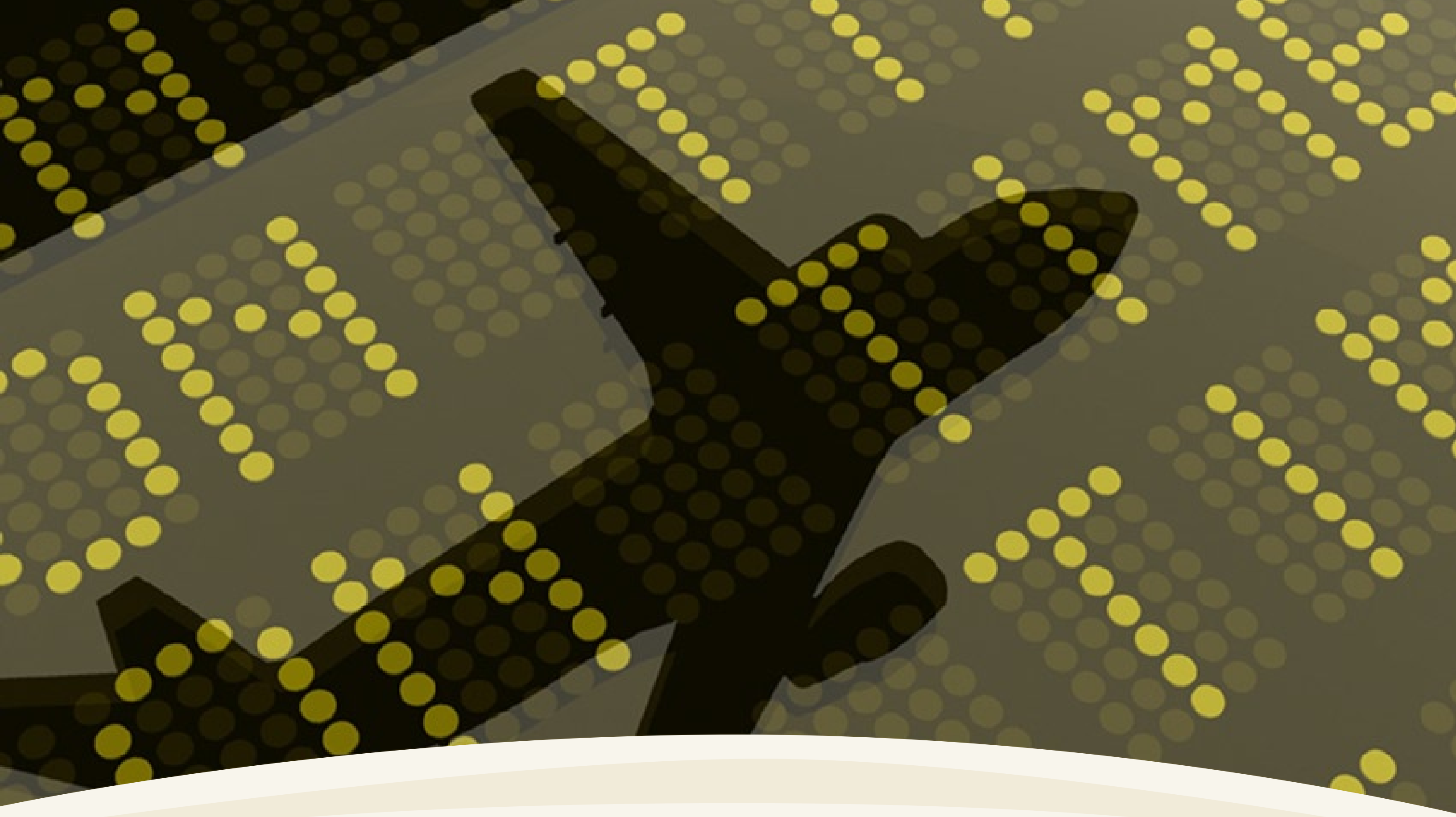
The United States and the European Union also continue to work on improving interoperability of NextGen and its European equivalent, Single European Sky Air Traffic Management Research (SESAR), by cooperating on civil aviation research and development through previously signed agreements.

In addition, the FAA is working with international partners to validate gate-to-gate NextGen improvements on transoceanic flights between Asia and the United States and between Europe and the United States. These improvements include new procedures on the surface and during climb, cruise and descent.

In the Asia and Pacific Initiative to Reduce Emissions (ASPIRE), the FAA is partnered with ANSPs in Australia, New Zealand, Singapore, Japan and Thailand (which joined in 2011). The ASPIRE joint venture conducted a series of six Green Flights in 2008-2011 to successfully demonstrate the potential for fuel and emissions savings in the region. These flights used a variety of improvements in gate-to-gate operations, including reduced separation, more efficient flight profiles and tailored arrivals.

After the demonstration flights, the partners began promoting best practices available daily to all equipped aircraft on selected city pairs between the United States and the Asia Pacific region. The ASPIRE Daily campaign aims to raise the profile and use of procedures to reduce the environmental footprint of aircraft in all phases of flight for the Auckland-San Francisco, Los Angeles-Singapore, Los Angeles-Melbourne and Sydney-San Francisco city pairs.

In 2011, the FAA, the European Commission, European ANSPs and 40 European airlines continued a joint effort to demonstrate NextGen and SESAR capabilities on trans-Atlantic flights. As part of the Atlantic Interoperability Initiative to Reduce Emissions (AIRE), the effort involved several gate-to-gate projects, including trans-Atlantic Green Flights conducted in late 2010 and early 2011 with Air France between New York JFK and Paris Charles De Gaulle as well as between Paris Orly and Guadeloupe's Pointe-á-Pitre Airport. The flights use procedures designed to reduce environmental impact and required no special equipage. AIRE will enter its third phase in 2012 to demonstrate additional procedures.



NEXTGEN BENEFITS

ESTIMATING FUTURE OPERATIONAL VALUE

NextGen will provide a number of benefits for National Airspace System (NAS) users, our environment and our economy. In fact, we are already seeing substantial improvements from reduced fuel use, environmental performance and airspace flexibility. As more NextGen capabilities become available, those benefits will continue to grow, contributing greatly to the economic vibrancy of aviation in the United States. Recognizing that NextGen provides improvements is not enough, however. We must also understand that without NextGen we will not be able to sustain the performance of the U.S. airspace system and our economy will suffer.

To estimate future benefits, we incorporate data from capabilities already implemented in the NAS into our ever-improving models. This enables us to refine overall NextGen benefit estimates each year. Our latest estimates show that by 2020:

- NextGen improvements will reduce delays, in the air and on the ground, by 38 percent compared with what would happen if no further NextGen improvements were made beyond what we have done already.
- Delay reduction will provide $24 billion in cumulative benefits to aircraft operators, the traveling public and the FAA.
- We will save 1.4 billion gallons of fuel, reducing carbon dioxide emission by 14 million metric tons, also cumulative.

These high-level benefit estimates for 2020 are very similar to the 2018 benefits on which we reported in last year's update of the NextGen Implementation Plan. The two-year difference arises from a number of factors. The soft economy and reduced passenger demand prompted airlines to reduce schedules, often resulting in fewer delays throughout the NAS. Internal factors include challenges in deploying complex systems such as En Route Automation Modernization (a key enabler of many NextGen capabilities), refinements to our modeling inputs and budget pressures. Our baseline delay estimates include benefits we expect from new and expanded runways, including those at Chicago O'Hare, Fort Lauderdale and Philadelphia airports. These contribute to the "no further progress" scenario.

To determine near-term benefits, we focus our estimates on time frames eight to 10 years in the future. Those time frames also correspond to the NextGen break-even point. The break-even point is the year when cumulative benefits, to the FAA and NAS users, equal and then exceed the cumulative costs of implementation. Last year we estimated NextGen would break even in 2018; now we believe we will attain that milestone in 2020.

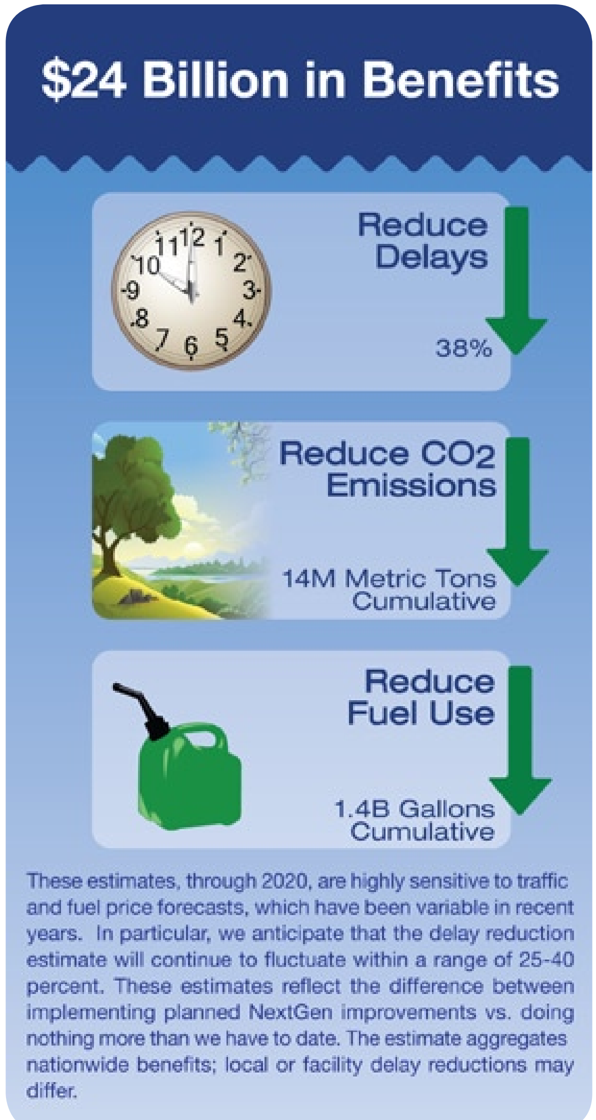
It takes a longer time horizon, however, to understand the full life cycle of most of our mid-term and later projects. Indeed, some NextGen improvements will just be coming on line to full effect in 2020, with an expected 10 to 20 years of service life ahead of them. Looking out to 2030, then, and comparing benefits with the full cost of deploying and maintaining our mid-term improvements, we estimate that the overall NextGen initiative has a benefit-to-cost ratio of more than two-to-one.

In addition to incorporating new operations, NextGen will support the introduction of new aircraft, engine and fuel technologies that will increase the environmental benefit that come from operations. We believe that over time, the fuel-saving and environmental benefits from these new technologies will exceed those from operational changes.

As in earlier updates to the Implementation Plan, these estimates reflect our current view of budgets and schedules, based on congressional appropriations for FY 2012 and the FAA's FY 2013 budget request to Congress. Our estimates are system-wide aggregates and do not reflect improvements at specific localities or airports.

Achieving NextGen benefits depends heavily on decisions by airspace users on whether and when to equip their aircraft with the avionics that will enable them to take advantage of the specific NextGen capabilities we deploy. Except for Automatic Dependent Surveillance–Broadcast Out avionics, which we mandate by 2020 for aircraft operating in most controlled airspace, operators' equipage decisions will depend on their ability to leverage NextGen improvements to improve their own bottom line.

Qualitatively, the argument for equipping is straightforward. Airspace users who equip will reduce their operating costs and travel time through greater efficiency on the airport surface, more-direct routes, precision navigation in departures and approaches, and collaborative decision making in all phases of flight. In some cases, those who equip sooner will benefit sooner. And all users will benefit if travelers experience more predictable flights with less time lost to delays.



Quantitatively, equipage questions become complicated. Operators must consider the costs of equipment, installation, training and operations; incentives to equip; the timetable for FAA deployment of capabilities; users' confidence in benefit estimates, and other factors. Many of these decision criteria remain uncertain, leading many operators to take a wait-and-see approach to equipping.

To keep abreast of cost estimates, the FAA needs the steady refinement of its benefit estimates enabled by analyzing a continuing stream of data from the demonstrations, trials, flight evaluations and simulations we conduct as a normal part of developing NextGen systems and procedures.

Following are a few examples of FAA activities during the past year that contributed to analyses of benefits or the business case for NextGen:

- Optimization of Airspace and Procedures in the Metroplex study teams estimated substantial fuel saving in the Washington, D.C., and north Texas metroplexes, mainly from systematic application of multiple Optimized Profile Descents and reduced distances in flight. For Washington, the estimate is $6.4 to $19 million per year in fuel savings, and the prospective north Texas saving is $10.3 to $21.7 million. In addition, reduced radar vectoring will decrease pilot-controller communications and the complexity of the controller workload. The Washington and north Texas projects moved to the design and implementation phase in 2011.
- Atlantic Interoperability Initiative to Reduce Emissions (AIRE) demonstrations continued in 2011, delivering more data on benefits from real-time rerouting and other fuel-saving measures. By optimizing lateral tracks relative to winds aloft between Portuguese and U.S. airspace, 65 Air Europa A330 and Iberia A340 flights from Madrid to the Americas and the Caribbean were able to save an average of 274 gallons of fuel and reduce carbon dioxide emissions by 2,608 kilograms per flight. In a limited number of Air France Transatlantic Green Flights, Air France 777s saved an average of 70 gallons of fuel per flight through real-time lateral and vertical optimization.

Also in these flights, the average fuel saving from area navigation Global Navigation Satellite System approaches was 111 gallons. In Airbus A380 Green Flights from New York to Paris, also limited in number, taxiing out on two engines instead of four saved an average of 120 gallons of fuel per flight, while optimizing lateral profiles over the Atlantic reduced fuel consumption by 200 gallons per flight. Flight crews chose two-engine taxis only if the estimated taxi time was more than 20 minutes. The Single European Sky Air Traffic Management Joint Undertaking conducted 18 demonstration programs in 2010-2011; the three reported here are the ones in which the FAA participated.

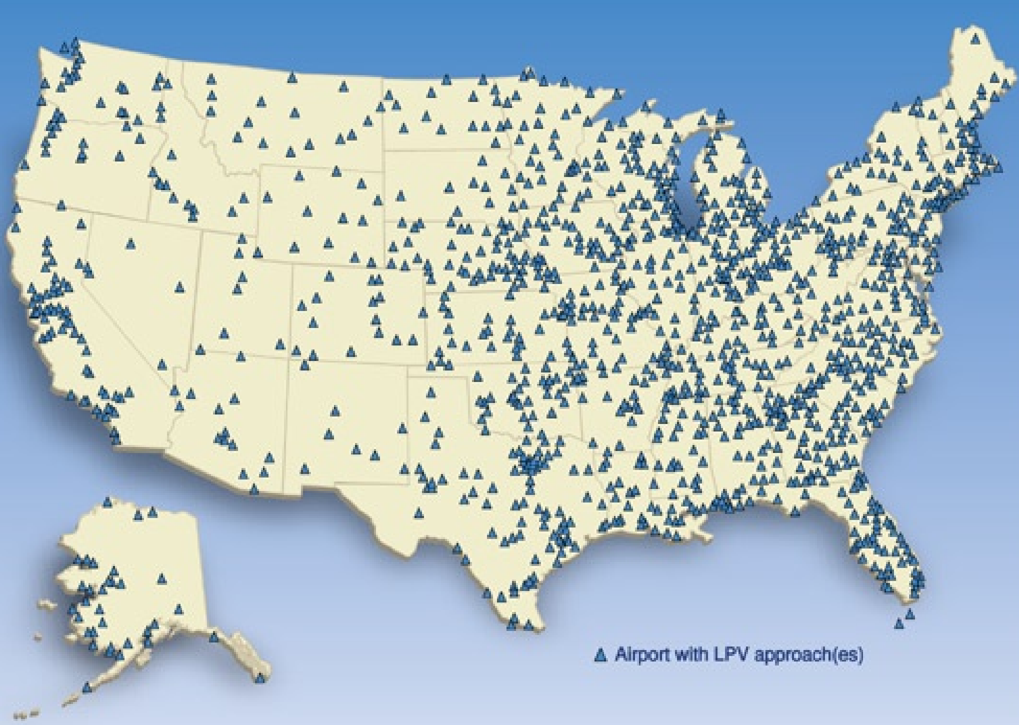
- An FAA-funded analysis fleshed out benefits available from a surface congestion management technique that the Port Authority of New York and New Jersey used in 2010 at New York John F. Kennedy (JFK) to avoid disruption while the airport's longest runway was being rebuilt. The analysts estimated that the procedure could save 14,800 hours of taxi-out time per year at JFK, reducing fuel consumption by 5 million gallons and carbon dioxide emissions by 48,000 metric tons. These reductions came from adapting software used during de-icing operations to track and limit access to taxiways for departing aircraft until the aircraft could take off without delays. In effect, airlines took departure delays at gates or parking spots with engines off rather than burning fuel in taxi queues. JFK retained the procedure after the runway work was completed, and analysts were able to compare operations using the system under normal circumstances with operations before the runway work began.

Travelers will benefit from more predictable flights and better on-time performance.

- A demonstration in 2011 of the N-Control concept to reduce the number of aircraft in departure queues at Boston Logan Airport, following up a demonstration conducted during the previous year, also involved holding aircraft at the gate. Fuel savings increased to 22-26 gallons per aircraft held, and engines emitted 217 fewer kilograms of carbon dioxide per aircraft. The average gate hold was 5.5 minutes, during which aircraft avoided the stop-and-go taxiing that wastes fuel during a takeoff delay.

These successes, coupled with other benefits being recorded throughout the NAS, help shape the case for government and stakeholder investments. Going forward, steady NextGen progress will be necessary to address aging technology, NAS access, fuel burn, the environment, safety and economic benefits.

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 200-250 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 February 2012, there were 2,772 LPVs at 1,410 airports in the United States, almost three times the number of ILS approaches.

OPERATIONAL VISION

NEXTGEN IN THE NEXT DECADE

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

With NextGen, we must continue to advance safety in the face of increasing traffic and the introduction of unmanned aircraft systems and commercial space flights. Further reductions in the accident rate are essential as overall traffic increases, and achieving those reductions depends on focused initiatives and a pervasive approach to safety that is formalized through the Safety Management System.

NextGen will take full advantage of proactive safety management, which allows us to analyze trends and uncover problems early on, so that preventive measures are put in place before any accident can occur. Our safety information sharing and analysis tools will evaluate data from a variety of FAA systems, a multitude of operators, and international databases to monitor the effectiveness of safety enhancements and identify where new safety initiatives are warranted.

NextGen will accelerate efforts to improve aviation's environmental and energy performance to be able to sustain growth and add capacity. A strategic Environmental Management System approach will be used 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 can be operationally achieved.

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. Entry into service of successfully demonstrated CLEEN technologies is expected in the mid-term. We also expect that, aided by the government-industry Commercial Aviation Alternative Fuels Initiative, sustainable alternative fuels will fulfill some civil jet fuel supply needs by the end of the mid-term. This contribution will continue to increase in future years, improving air quality and reducing net carbon dioxide emissions while striving to achieve carbon-neutral growth by 2020, using 2005 as the baseline.

This mid-term system is enabled by policy, procedures and systems both on the ground and on the flight deck. It makes the most of technologies and procedures that are in use today, while introducing new systems and procedures that fundamentally change air traffic automation, surveillance, communications, navigation and the way we manage information.

FLIGHT PLANNING	Key Ground Infrastructure
	• Data Communications (Data Comm) • En Route Automation Modernization (ERAM) • Modernized Aeronautical Information Management System (AIM) • NextGen Network Enabled Weather (NNEW) • NextGen Weather Processor (NWP) • System Wide Information Management (SWIM) • Terminal Flight Data Manager (TFDM) • Traffic Flow Management System (TFMS)

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 the other building blocks of a modern air traffic management system. FAA information and management systems must keep all these activities synchronized as we approach the mid-term, reach it and move on.

Key ground infrastructure and avionics are included here in tables for each of the flight phases. A more detailed description of the mid-term system, including the FAA's National Airspace System Enterprise Architecture and other documentation, is available on the FAA's NextGen website, www.faa.gov/nextgen.

While operators who adopt related new avionics will receive the greatest benefit in this time frame, lesser-equipped operators still will be accommodated. The investments for operators and airports to support these operations are discussed in Appendix A. Through international collaboration on standards, we make certain that avionics developed to take advantage of NextGen or 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 National Airspace System through a shared 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 use for special activity airspace for military, security or space operations. It will describe other airspace limitations, such as those due to current or forecast weather or congestion. It also will show the status of properties and facilities, such as closed runways, blocked taxiways and out-of-service navigational aids. This shared information will enhance the ability of users to plan their flight operations according to their personal or business objectives. Updates will be available as individual flight-planning objectives are affected by changes in airspace system conditions. Operators will plan their flights with a full picture of potential limitations, from ground operations to the intended flight trajectory.

An outcome of this planning process will be an electronic representation of the operator's intended flight profile, updated for changing conditions that might affect the flight's trajectory. Operators and air traffic management personnel will have common access to this real-time information, shared via a secure network. This information will provide each group with improved situational awareness for planning and for the ability to predict and resolve conflicts. Improvements in calculated scheduled 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 the balance between arrival and departure rates. Later analysis of a substantial body of data — a full day's, or more — will enable managers to apply lessons learned to future operations.

These advances will better accommodate operator preferences and improve the use of resources, even to the point of scheduling at the destination. For operators, they will mean more efficient traffic management and enhanced environmental performance by improving the ability to fine-tune and adjust schedules during planning and throughout the flight. For air traffic management, they will mean more comprehensive situational awareness, including user intent, and a capability to manage flights in groups as well as individually.

PUSH BACK, TAXI AND DEPARTURE

As the time for the flight approaches, the final flight path agreement will be delivered to the flight crew as a data message. Data communications will provide pre-departure clearances that allow amendments to flight plans. Actual push back time may be calculated collaboratively. When the aircraft taxis out, the flight crew's situational awareness will be improved by flight deck displays that portray aircraft movement on a moving map that indicates the aircraft's position on the airport surface and, at busy airports, the position of other aircraft and surface vehicles. In the tower, improved ground systems, such as surface-movement displays, will enable controllers to manage the use of taxiways and runways more efficiently, choosing 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 improve our prevention of runway incursions

PUSH BACK, TAXI AND DEPARTURE

Key Ground Infrastructure

- Automatic Dependent Surveillance–Broadcast (ADS-B) ground stations
- Airport Surface Detection Equipment–Model X (ASDE-X)
- Data Comm
- Integrated Departure and Arrival Coordination System
- Modernized AIM
- NNEW
- NWP
- Satellite Based Augmentation System (SBAS)
- Standard Terminal Automation Replacement System (STARS)
- SWIM
- TFDM
- TFMS

Avionics

- ADS-B, Traffic Information Services–Broadcast (TIS-B), Flight Information Services–Broadcast (FIS-B)
- Area Navigation (RNAV) and Required Navigation Performance (RNP)
- Data Comm

and other surface conflicts, especially when visibility is low. More efficient management and the ability to revise departure clearances using data 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 for surface management.

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

The ability to operate simultaneously on closely spaced parallel runways — through increased accuracy in surveillance and navigation, and through improved understanding of wake vortices — means airports, in effect, will gain capacity for their existing runways. Together, these capabilities will enhance safety, improve environmental performance and reduce operators' delay and fuel costs.

Precise departure paths will optimize system operations for entire metropolitan areas, reducing delays by allowing each airport to operate more independently. This will better separate arrival and departure flows for airports in proximity to one another, which will provide more efficient access to both commercial service and general aviation airports in congested metropolitan regions. 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 may also decrease the impact of aircraft noise on surrounding communities.

CLIMB AND CRUISE

As the aircraft climbs into the 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 their own aircraft's flight deck, air traffic personnel will be able to assign spacing responsibility to the flight crew as it climbs to its cruising altitude. The aircraft will be able to merge into the overhead stream with a minimum of additional maneuvers.

Data communications will provide routine and strategic information to the flight crew and automate some routine tasks for both pilots and controllers. Controllers will be able to focus on providing more preferred and direct routes and altitudes, saving fuel and time. Fewer voice communications also will reduce radio-frequency congestion and spoken miscommunication. When weather affects many flights, clearances for aircraft equipped for data communications will be delivered automatically to the controller and uplinked, increasing controller and operator efficiency.

If weather could become problematic, or there are potential conflicts with other aircraft, homeland security interventions or

CLIMB AND CRUISE

Key Ground Infrastructure

- ADS-B ground stations
- Advanced Technologies and Oceanic Procedures
- Data Comm
- ERAM
- NNEW
- NWP
- Time Based Flow Management (TBFM)
- TFMS

Avionics

- ADS-B In and Out, with associated displays like Cockpit Display of Traffic Information
- Data Comm, including integration with the Flight Management System
- Future Air Navigation System in oceanic airspace
- RNAV and RNP

other constraints along the aircraft's planned path, automation will identify the complication 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. Agreed-on changes will be loaded into both ground and aircraft systems. Improved weather information, integrated into controller decision support tools, will increase controllers' efficiency and greatly reduce their workload during bad weather.

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. Tailored to each flight, these offsets 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. Since the final agreement will be reached via data messaging, complex reroutes can be more detailed than those constrained by the limitations of voice communications and reduce one source of error in communications.

In oceanic operations, air traffic management personnel 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

NextGen capabilities will provide a number of improvements to terminal area operations that save fuel, reduce noise, increase predictability and minimize maneuvers such as holding patterns and delaying vectors. Enhanced traffic management tools will analyze flights approaching an airport from hundreds of miles away, across facility boundaries, and will calculate scheduled arrival times to maximize arrival performance. These advances will improve the flow of arrival traffic to maximize use of existing capacity. Improvements in calculated scheduled 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 the balance between 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 to agree on a final flight path. The final flight path will ensure that the flight has no potential conflicts, and that there is an efficient arrival at the airport, while maintaining overall efficiency of the airspace operation.

With the improved precision of NextGen systems, separation between aircraft can be reduced safely. Suitably equipped aircraft will be able to fly precise vertical and horizontal paths, called Optimized Profile Descents, from cruising altitude down to the runway. These precision paths, which may include precise inter-arrival spacing by the aircraft, will allow for more efficient transitions from cruise to the approach phase of flight into high-density airports. Controllers will be able to use multiple precision paths that maintain flows to each runway, through RNAV and RNP arrivals. Precise arrivals will reduce fuel use, emissions and the number of people exposed to noise.

Today, the structure of arrival and departure routes does not 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, maintaining capacity that otherwise would be lost. Poor-visibility conditions dramatically reduce the capacity of closely spaced runways, and the capacity losses ripple as delays throughout the airspace system. NextGen capabilities will make it possible to continue using those runways safely, by providing better-defined path assignments and appropriate separation between aircraft.

LANDING, TAXI AND ARRIVAL

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

DESCENT AND APPROACH

Key Ground Infrastructure

- ADS-B ground stations
- ASDE-X
- Data Comm
- Ground Based Augmentation System (GBAS)
- NNEW
- NWP
- SBAS
- STARS enhancements
- TBFM
- TFDM
- TFMS

Avionics

- ADS-B In and Out
- Data Comm
- GBAS avionics
- RNAV and RNP
- Vertical Navigation

system that recommends the best runway and taxi path will enable this capability. The ground system determines 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.

Flight deck and controller displays will monitor aircraft movement and provide traffic and incursion alerts, using the same safety and efficiency tools as during departure operations. This will reduce the potential for runway incursions. Surface and gate area 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. Operators will be able to coordinate push backs and gate arrivals more efficiently.

LANDING, TAXI AND ARRIVAL

Key Ground Infrastructure

- ADS-B ground stations
- ASDE-X
- Data Comm
- Integrated Departure and Arrival Coordination System
- Modernized AIM
- NNEW
- STARS enhancements
- SWIM
- TBFM
- TFDM
- TFMS

Avionics

- ADS-B, TIS-B
- Data Comm

AIRFIELD IMPROVEMENTS

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 the following:

NEW RUNWAYS

- Columbus (Ohio)

RUNWAY EXTENSIONS

- Anchorage
- Atlanta
- Fort Lauderdale
- San Antonio

AIRFIELD RECONFIGURATION

- 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 allow 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 planned hundreds of miles in advance. **RNAV** and **RNP** allow 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, equipped aircraft, ramp operators and airports. 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 Surface Traffic Operations

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

Enhanced Surface Traffic Management

Runway exit point, assigned gate and taxi route 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

March 2012

RESPONSE TO NEXTGEN ADVISORY COMMITTEE RECOMMENDATIONS

The NextGen Advisory Committee (NAC) was launched at the FAA's request in summer 2010. It is chartered with developing a common understanding of NextGen priorities in the context of overall NextGen capabilities and implementation constraints, recognizing that the FAA and its stakeholders must share responsibility and accountability for achieving NextGen benefits.

The NAC provides a venue to solicit recommendations on issues that are critical to the successful implementation of NextGen, with an emphasis on the near term and mid-term. It is also an ongoing forum to obtain a mutual commitment of resources and synchronized planning between government and industry that will support and, when necessary, identify opportunities for industry participation in NextGen implementation.

NAC members are senior executives representing operators, manufacturers, air traffic management, aviation safety, airports and environmental entities from civil and military sectors.

Early in 2011, under tasking from the FAA, the NAC began analyses of issues that include metrics, equipage and related incentives, and deploying NextGen operational improvements within metroplexes. For example, we asked:

- What are the best metrics for measuring how much the implementation of NextGen initiatives improves operations in the National Airspace System (NAS)?
- How might the FAA create operational and financial incentives for aircraft operators to equip for NextGen when their internal business-case analyses find an insufficient ratio between benefits and costs?
- Who should be incentivized to equip for NextGen, and what are the most important aspects of those incentives?
- What priorities should the FAA consider for improving operations in the nation's busiest metropolitan regions? Which of these metroplexes should the FAA focus on first? What are the highest-priority capabilities within each metroplex?

On Sept. 29, 2011, the NAC approved the recommendations developed by its work groups and submitted them to the FAA. The FAA is adjusting its planning as necessary to address these recommendations. Our responses and actions take into consideration funding allocations, scheduling constraints, investment decisions, standards, training and other critical work that will be required by the FAA and industry as well as the interdependencies that exist between systems. What follows is a summary of the NAC recommendations and FAA action plans to address the recommendations.

BUSINESS CASE AND EQUIPAGE

This set of recommendations falls into broad categories, including delivery of benefits early to equipped operators in order to make use of existing capabilities and implement operational incentives, and reduction of uncertainty about NextGen timelines and the level of benefits and costs.

RECOMMENDATIONS:

- The FAA should remove the uncertainty associated with implementing capabilities that close the business case for equipping.
- The FAA should collaborate with operators to develop estimates of the direct benefits for users equipping with NextGen avionics.
- The FAA should establish a stable, long-term implementation plan for each capability requiring a critical mass of installed avionics to achieve user or societal benefits.
- The FAA should determine key benefit thresholds (fleet equipage percentages below which users cannot realize benefits), by location and time of day, and look for opportunities to reduce the thresholds to facilitate faster realization of benefits.

ACTION:

The FAA will continue to communicate our plans for delivering NextGen capabilities and work with industry to limit uncertainty for operators and improve our understanding of operators' business cases.

We intend to compile a comprehensive database of NextGen equipage information that will combine fleet forecasts with the current state of equipage across operators, estimate lifecycle costs and establish realistic assumptions for forward-fit and retrofit rates. The FAA will also continue working with our industry partners to identify an achievable level of business-case analysis and data sharing that will enable users to justify investments. To do this, we will need information from operators on the status of their fleets and their equipage plans.

The FAA will develop NextGen benefit estimates applying metrics that are useful to operators. We will need sensitive business information to perform this work, and historically, operators have been reluctant to provide such information.

Our future budgets are uncertain, and plans sometimes change as a result of new information or re-prioritization of initiatives. We will investigate challenges to NextGen capabilities that arise from mixed equipage and the factors that contribute to equipage thresholds. Where possible, we will develop estimates of the equipage thresholds that deliver benefits at specific locations.

RECOMMENDATION:

- Given the high cost of retrofitting the entire Part 121 fleet for Required Navigation Performance (RNP) 0.3 with navigation and curved path (Radius-to-Fix or RF) capability, the FAA should collaborate with the aviation community to develop capabilities (including needed policies, procedures and complementary automation) to enable the large percentage of currently equipped users to perform RNP 0.3 with RF leg procedures routinely, to realize near-term benefits in a mixed-equipage environment and to stimulate forward-fit and retrofit decisions.

ACTION:

The FAA will continue to identify locations where RNP-equipped aircraft can achieve benefits, and we will continue to work with industry on RNP procedures. We will continue efforts to enable an integrated procedure design concept at and between busy airports. We will publish RNP procedures as quickly as we can and continue to work with the NAC to prioritize locations for RNP implementation. Success in this area will require continued industry engagement.

The FAA will continue to provide guidance for and expedite the development of performance based navigation (PBN) criteria and standards, and implement airspace and procedure improvements. We will identify issues that constrain the use of PBN procedures, including operator readiness and willingness, and together with operators develop a mitigation strategy to establish PBN procedures as the primary operation unless conditions dictate otherwise.

Implementing some RNP procedures requires a detailed quantitative and qualitative environmental review because the location and number of proposed flight paths may be different from what currently exists. We will continue to assess our National Environmental Policy Act compliance work to look for ways to improve the approval process. We will continue to work with local airport authorities and operators as appropriate.

RECOMMENDATION:

- Where significant retrofit and forward-fit equipage is needed to achieve system and societal benefits, the FAA should work with the aviation community to develop tailored strategies for maximizing benefits in a mixed-equipage environment to achieve optimal value overall.

ACTION:

The FAA will interact with the community to identify more opportunities to develop tailored strategies.

RECOMMENDATIONS:

- The FAA and the aviation industry should validate and agree on which specific capabilities warrant equipage incentives. For each capability, the FAA should work with the NAC to identify the target user, the system performance improvements and the metrics with which to measure the improvements. We should use incentives only to overcome business-case gaps and achieve threshold or optimal equipage levels.
- The FAA should make incentives available for aircraft that are first to be equipped but cannot reap benefits for lack of a critical mass of equipage, and for operators who have equipped but are not attaining the intended benefits. Success of incentives should be measured by attaining targeted improvements in system performance, not a targeted equipage level. Where possible, the FAA should prioritize operational incentives over financial incentives.
- The FAA should work with the NAC to identify candidate NextGen capabilities for operational incentives and evaluate the business case for equipped users.

ACTION:

The FAA will provide feedback on our priorities for incentivizing operator equipage for PBN, Automatic Dependent Surveillance–Broadcast (ADS-B) and Data Communications (Data Comm). We will work with the NAC to identify specific NextGen capabilities for which we can provide operational incentives and evaluate the business-case implications for equipped users.

The FAA supports operational incentives and will give them priority. We are working on several near-term proposals for operational incentives. When these proposals are mature, we will work with the operators on validation and possible implementation. The long-term FAA reauthorization act, signed into law in February 2012, contains a provision that authorizes us to establish a financial incentives program. The FAA is studying this new authority.

RECOMMENDATION:

- As avionics incentives are implemented, the FAA should work with the NAC to measure user- and system-performance impacts, comparing achieved performance with targeted performance.

ACTION:

The FAA will continue to work with the NAC to develop, refine and track metrics that can indicate the success of capabilities against targets. This requires joint accountability, as operators' performance and actions will have significant impact on these outcomes.

RECOMMENDATION:

- The FAA should encourage ADS-B Out equipage through incentives to equip sooner than the 2020 mandate. The agency should develop criteria for low-cost ADS-B In equipment for general aviation operators. The agency should track ADS-B Out installation rates and work with the aviation community if these rates indicate a risk of significant non-compliance.

ACTION:

As we implement ADS-B, we are supporting programs with air carriers to demonstrate the benefits of advanced ADS-B applications and procedures during revenue service. The operational evaluations will give us improved cost and benefit data and might encourage airlines to equip early. Given the 10-year time frame under the mandate, issued in 2010, to equip with ADS-B Out, we do not agree that financial incentives are necessary to meet the equipage deadline. We might use operational incentives to motivate equipage. We will continue to track ADS-B Out equipage installations for both general aviation and commercial aircraft. The FAA concurs with enabling low-cost implementation of ADS-B In for general aviation.

RECOMMENDATION:

- The FAA should continue to work with the general aviation community to implement Wide Area Augmentation System (WAAS) approaches at eligible runway ends.

ACTION:

The FAA will continue to work with the general aviation community regarding WAAS approaches.

RECOMMENDATION:

- The FAA should work with the Department of Defense (DoD) to understand the operational and financial impacts of partial equipage of military aircraft with NextGen avionics, realizing that the DoD has many aircraft and missions, that data and analysis results are sensitive, and that the DoD will not be able to equip all its aircraft.

ACTION:

The FAA will continue to work with DoD liaisons to coordinate plans and implementation of key NextGen capabilities related to avionics.

METRICS

This set of recommendations will demonstrate how the FAA is ready to partner with the NAC to develop methods for measuring the effect of NextGen initiatives.

RECOMMENDATION:

- The FAA should expand NextGen goals to explicitly include reducing fuel burn and flight operating costs, maintaining or improving access to airspace and airports for all stakeholders, and supporting mixed-equipage operations.

ACTION:

The FAA is reviewing ways to incentivize equipage in certain areas. We included the first two of these goals in our Destination 2025 strategic plan, and we will support mixed operations for a long time as operators equip. In order to measure to a fuel-burn goal, the FAA will require fuel-burn data. We will count on the NAC to work with industry and help devise ways for us to obtain such data.

RECOMMENDATIONS:

- The FAA's NextGen Dashboard should convey measurements of NAC-recommended key performance indicators (KPI) for capacity, efficiency and predictability, and FAA-selected KPIs for safety and environment. Stakeholders should be able to select different views at any level of the dashboard, including different filters. The FAA should collect data from all core airports, all airports and airspace within metroplex areas, and highly used high-altitude airspace. The dashboard should provide insight into the extent of NextGen implementation by flight operators and the FAA.
- The FAA should ensure that NextGen programs include resources for collecting and analyzing data, and for reporting post-implementation impacts.

ACTION:

The FAA has developed and will continue to update a website that reports what NextGen initiatives have been implemented and how. The NextGen Performance Snapshot will provide post-implementation performance data for metroplexes, airports and geographical locations such as the Gulf of Mexico. The Performance Snapshot, available on the NextGen website, will continue to evolve.

RECOMMENDATION:

- The FAA should continue to collaborate with RTCA and the aviation community to develop detailed KPIs for flexibility; further develop KPIs for access and equity to measure the ability to use NAS services, capture FAA implementation progress and risk to facilitate joint investment decisions; and determine the venues for developing diagnostic-level metrics and data sources for specific NextGen initiatives.

ACTION:

We remain committed to our work with industry to help understand the data gleaned from these metrics. We expect to complete this work in Fiscal Year 2012 and reach a common understanding between ourselves and industry of the metrics for measuring NextGen performance, as well as the early impacts of NextGen in these key performance areas.

The FAA and its stakeholders must share responsibility and accountability for achieving NextGen benefits.

AIRSPACE AND PROCEDURES

This set of recommendations identifies specific changes in airspace and procedures, most of which are already included in our plans or can be incorporated easily.

RECOMMENDATION:

- The FAA should validate the safety and capacity benefits of Area Navigation (RNAV) off the ground (ROTG) as part of the implementation process.

ACTION:

We must balance capacity and efficiency with track length and good-neighbor stewardship related to noise concerns. Site-specific requirements are unique and might block benefits from an ROTG design, but we consider such a design and use it where it is beneficial. We already address this process in PBN projects where implementing ROTG could be a factor.

RECOMMENDATION:

- Ultra-high sector modification may enhance flexibility in the Houston metroplex, particularly for east-west and west-east flows, mirroring the conclusion of the study team for the Houston Optimization of Airspace and Procedures in the Metroplex (OAPM) program. The study team recommends that ultra-high sector proposals for Houston be aligned and coordinated with potential modifications in Memphis and proposed modifications for the north Texas metroplex.

ACTION:

If the Houston design and implementation team deems ultra-high sector modifications necessary, the FAA will conduct quick-look analyses to explore potential benefits and costs. If we find potential benefits, we will forward recommendations.

RECOMMENDATION:

- The FAA should monitor closely the implementation timeline of the Denver RNAV project because of potential delays.

ACTION:

We note that the Denver project shifted from RNAV to a full PBN, which resulted in a longer schedule than originally conceived. We will continue monitoring the Denver project.

RECOMMENDATION:

- The FAA should complete the design and implementation of the current phase of the Chicago Airspace Program (CAP) within the time constraints of the O'Hare Modernization Project (OMP). The FAA should work with the NAC to develop potential airspace and procedure improvements for the Chicago metroplex after the CAP is finished. The FAA should consider using technology and procedures that have evolved since the CAP design process began, and that could be deployed under the current Environmental Impact Statement. Stakeholder participation in CAP development should continue in order to create as many optimized procedures as possible.

ACTION:

The FAA has ongoing work related to these recommendations, and OMP activities will require additional coordination. The Chicago OAPM process will begin in 2012 and will only undertake changes that fall within the existing record of decision.

RECOMMENDATION:

- The U.S. Air Force (USAF) and RTCA should continue discussions to implement a Federal Advisory Committee Act process to work toward airspace that is acceptable to the mission and business cases of all airspace users when the USAF develops large-scale airspace proposals.

RESPONSE:

The USAF reports that it is working on this process.

RECOMMENDATION:

- The FAA should continue to develop Traffic Management Advisor, Relative Position Indicator and other NextGen air traffic management tools to help increase system capacity and improve efficiency in the NAS. Also, the agency should develop metrics to measure the tools' effectiveness and to quantify throughput/capacity increases.

ACTION:

We are creating a consistent set of high-level metrics for NextGen. We are leveraging key automation systems to provide data to evaluate more detailed measures of operational performance. See Metrics on page 31 for more information.

RECOMMENDATION:

- The FAA should work with industry and the DoD to optimize south Florida airspace in coordination with the commissioning of the runway extension at Fort Lauderdale-Hollywood International Airport in 2014. Caribbean airspace and routes also should be optimized with PBN. The FAA should begin work in south Florida during the 2012 OAPM process, and the effort should be coordinated with central Florida airspace.

ACTION:

The FAA has ongoing work to address south Florida airspace redesign and Caribbean routes. The OAPM study team is scheduled to start in 2012. Last year, the Southeast Airspace and Procedures Work Group discussed Caribbean route redesign; air carriers submitted Q-route proposals during a November 2011 meeting with the work group.

TRAJECTORY OPERATIONS

These recommendations reflect the NAC's concern about establishing priorities for operational scenarios, and the FAA's communication with industry about its plans.

RECOMMENDATIONS:

- The FAA should incorporate the NAC's comments on 22 of the 26 mid-term operational scenarios related to trajectory operations.

- The FAA should incorporate the NAC's prioritization of the 22 scenarios.

ACTION:

In Fiscal Year 2012, we will review comments and determine which scenarios are actionable in support of the next iteration of the Mid-Term Concept of Operations for the NAS. Additionally, the FAA will use this prioritization to help inform NextGen segment implementation planning in FY 2012 and beyond. We will have to analyze the scenario prioritization against the trajectory operations operational improvement (OI) prioritization. We must also weigh the input for consistency against other industry recommendations, such as the RTCA NextGen Mid-Term Implementation Task Force. We will need to analyze the recommendation as part of the NextGen portfolio development process.

RECOMMENDATION:

- The FAA should baseline the operational scenarios, distribute the baseline to the aviation industry and update the baseline with input from aviation stakeholders.

ACTION:

We will make the scenarios available through the FAA's external Enterprise Architecture portal[1] in FY 2012.

RECOMMENDATION:

- The FAA should publish in the NextGen Implementation Plan the prioritization of OIs needed to implement trajectory operations capabilities.

ACTION:

The FAA will use the NAC trajectory operations prioritization of scenarios to help inform NextGen segment implementation plans.

RECOMMENDATION:

- The Data Comm program is crucial to achieving maximum benefits from Trajectory Based Operations, serving as a basic building block for NextGen capability.

RESPONSE:

The FAA suggested, in response to the NAC's recommendation in September 2011, that the NAC consider its prioritization of OIs and NextGen operational scenarios, and incorporate this prioritization in its Data Comm recommendation scheduled for February 2012. The NAC provided its recommendations at the February meeting, and the FAA is evaluating them.

RECOMMENDATION:

- The FAA should leverage existing airline equipage in demonstration projects.

ACTION:

The FAA will continue to encourage the use of existing equipage during demonstrations. Tailored Arrivals and three-dimensional Path Arrival Manager are two examples of demonstrations that leveraged existing aircraft equipage.

RECOMMENDATION:

- Enhancements to the navigation capabilities of aircraft, RNAV/RNP with Time of Arrival Control (TOAC) in the descent phase, will begin to increase benefits of trajectory operations through the adaptability of the aircraft trajectory to enable operational predictability and arrival accuracy of aircraft. Navigation standards activity to define requirements in this area is needed by mid-2013 or early 2014.

ACTION:

Seven action plans related to TOAC, also known as Required Time of Arrival, resulted from the Task Force recommendations. The FAA is working to implement limited TOAC capability between 2015 and 2018. In addition, RTCA and the European Organization for Civil Aviation Equipment are considering the research and development progress for the navigation standards noted.

INTEGRATED CAPABILITIES

In September 2011, the NAC explained the criteria and methodology it planned to use for mapping OIs to a priority set of metroplexes. The NAC presented its recommendations at the February 2012 NAC meeting. The FAA is reviewing these recommendations and will use them as input for its internal planning.

The FAA will continue to work with the NAC as we and the aviation community progress along this shared path to achieving NextGen benefits.

[1] http://nasea.faa.gov

NEXTGEN AHEAD

WORKING TOWARD TOMORROW

With NextGen implementation well under way, we are focusing our development efforts to deliver targeted benefits. Over the next several years, we will build on the NextGen technologies and procedures already available in the National Airspace System (NAS) to provide additional capabilities. This section highlights some major upcoming milestones, outlined in more detail in appendices A and B, which will enable us to realize our mid-term objectives.

AIRPORT SURFACE SAFETY AND EFFICIENCY IMPROVEMENTS

The safe and efficient use of runways is key to a smooth air transportation system. The FAA is gradually improving operations on the nation's runways through a number of NextGen initiatives.

We monitor ground movements at 35 major airports using Airport Surface Detection Equipment–Model X (ASDE-X) and share that data among air traffic controllers, traffic managers, flight operations centers, ramp operators and airports. Data sharing enhances safety and traffic flow on runways, taxiways and some ramps and improves collaborative decision making. The FAA will also provide surface data sharing at another nine busy and complex airports using Airport Surface Surveillance Capability (ASSC). While ASDE-X tracks surface movement using radar, multilateration and Automatic Dependent Surveillance–Broadcast (ADS-B), ASSC collects data from multilateration and ADS-B only. Between 2014 and 2017, ASSC will begin to track transponder-equipped aircraft and ADS-B-equipped ground vehicles on the surface and aircraft flying within five nautical miles (nm) of airports at Portland, Ore.; Anchorage, Alaska; Kansas City, Mo.; New Orleans; Pittsburgh; San Francisco; Cincinnati; Cleveland and Andrews Air Force Base, Md.

NextGen capabilities depend in part on real-time, efficient, secure and broad exchange of data from multiple sources. NextGen technologies, such as these ground safety capabilities, also make an unprecedented amount of data available and accessible to NAS users who need it. We are maturing the agency's overarching data-sharing policy, which addresses how the FAA makes information generated by NAS technologies available, how the data can be used and how we will disseminate the information. We plan to build flexibility into this policy to allow for more agility as NextGen technologies are developed.

We are continuing to evaluate existing arrival and departure procedures at airports with multiple or closely spaced runways. Our goal is to reduce the separation between aircraft as they approach closely spaced parallel runways, which will improve the arrival capacity on those runways, especially during poor visibility conditions. To that end, analyses of independent and dependent runway standards, including blunder and wake analyses, are ongoing. A blunder occurs when a descending aircraft veers outside the approach boundaries for the runway. Blunder analyses consider the necessary separation distance for independent approaches to parallel runways in case of blunders.

In 2011, we completed blunder analyses and determined that we can reduce the lateral separation standard for independent, or simultaneous, arrivals on parallel runways spaced closer than 4,300 feet apart (the current lateral separation standard for independent arrivals applies to runways spaced 4,300 or more feet apart). Pending safety analysis, this separation standard could be applied to runways spaced at least 3,600 feet apart and added to air traffic control procedures. We will continue our blunder analyses to determine if we can reduce separation standards for parallel runways spaced less than 3,600 feet apart.

We are also analyzing dependent, or staggered, arrivals on parallel runways spaced 2,500 feet or more apart to determine if reduced separation between aircraft can be used to improve capacity with this procedure.

We currently have five parallel runway pairs (at five airports) spaced less than 2,500 feet apart that are authorized for 1.5 nm dependent staggered approaches. Work will continue through 2015 to authorize additional runway pairs, at additional airports, for this procedure. Also in 2015, we will 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 less than visual conditions.

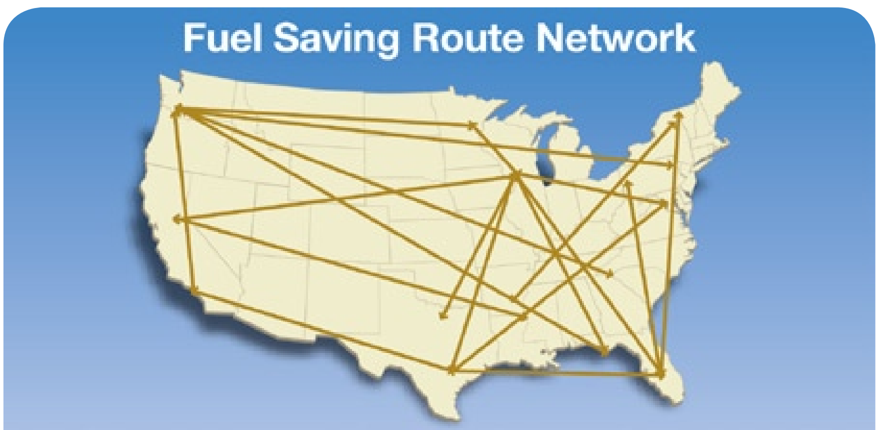
In 2011, we completed our evaluation of Area Navigation (RNAV) approaches (including Required Navigation Performance and Wide Area Augmentation System Localizer Performance with Vertical Guidance) in place of Instrument Landing System (ILS) approaches for parallel runways. Changes to air traffic control 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, we will perform the safety analysis to allow RNAV approaches for dependent staggered approaches.

In 2015, we also expect to reduce wake turbulence separation standards during favorable wind conditions for departures on parallel runways during visual conditions.

We are continuing to work with the International Civil Aviation Organization (ICAO) to update, in 2015, 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.

AIRSPACE EFFICIENCY IMPROVEMENTS

The FAA is adding fuel-saving Performance Based Navigation (PBN) routes to en route airspace and removing surface navigational aid (NAVAID) choke points, which will reduce high-altitude aircraft exhaust emissions. A key focus through 2015 is a network of high-altitude RNAV routes, or Q-routes, connecting metroplex areas and high-density city pairs.



The FAA is developing a network of high-altitude Performance Based Navigation (PBN) routes. These Q-routes will not only save time and fuel and reduce aircraft exhaust emissions, but also connect to departure and arrival PBN routes, creating a seamless flow of direct routes gate-to-gate across the United States.

The ongoing Q-route implementation plan will bring end-to-end PBN functionality to the NAS by providing seamless flight paths between departure and arrival RNAV routes. We have identified 12 Q-route network projects. Each project will have multiple Q-routes spanning multiple air route traffic control centers. We will further optimize the network as needed to generate additional user benefits.

MAKING BETTER USE OF SPECIAL ACTIVITY AIRSPACE

Consistent and up-to-the-minute data are essential for improved air traffic operations and flight planning, which means improved traffic flow and more efficient use of our airspace. With accurate, real-time, automated Special Activity Airspace (SAA) schedule data, air traffic controllers and pilots can make use of shorter routes through this airspace, which is normally reserved for military training and other specialized use.

To achieve this improvement, a number of systems will be developed. Beginning in 2012, System Wide Information Management, the NextGen information technology platform that will process data from the many different NAS systems and appropriately share the data among NAS users, will begin to disseminate schedule data for Special Use Airspace (SUA), one type of SAA. This service will be the first step in modernizing aeronautical information management to support SAA activities. In 2013, the Traffic Flow Management System, which forecasts traffic demand and resolves congestion issues, will convert the SUA data to a graphic format that both air traffic controllers and pilots can use to make strategic decisions. Additionally, the Aeronautical Common Service will collect, maintain and distribute SAA information. Upon its release in 2015, the Aeronautical Common Service will provide air traffic control automation systems the ability to consume SAA definitions and schedules. This will provide NAS users with the current and future status of SAA and enable them to plan flights through airspace they otherwise might have had to avoid. These improvements will reduce operational deviations, provide more direct aircraft routes and decrease flight time, fuel use and aircraft exhaust emissions.

ARRIVAL INTERVAL MANAGEMENT WITH ADS-B

Building on ADS-B's precise surveillance ability, the FAA is developing arrival interval management, a capability that will improve the predictability and efficiency of traffic flow into busy airports. Controllers will begin merging and spacing (metering) aircraft more than 200 nm away from the airport by assigning each flight a speed that will ensure its arrival at a precise point-in-space/point-in-time position at the airspace boundary between an air route traffic control center and a terminal radar approach control facility. We plan to achieve initial operating capability for the extended metering and ground automation components of arrival interval management in 2014. In parallel, a flight deck capability is being developed that will enable flight crews to establish and maintain precise spacing relative to a preceding aircraft, providing additional fuel-saving optimized descent opportunities. Avionics standards for the flight deck capability are scheduled to be completed in 2014.

DATA COMMUNICATIONS

Using Data Communications (Data Comm) as a foundation, NextGen will enable digital communications infrastructure and technologies to provide a supplemental means for two-way exchange of information between air traffic controllers and flight crews. The FAA is working toward a final investment decision in 2012 that will enable us to contract with a vendor to provide the VHF radio network that will carry Data Comm messages.

The FAA plans to deliver tower data communications for revised departure clearances in 2015. This first Data Comm capability will be available to aircraft equipped with Future Air Navigation System 1/A+. Together with the Data Comm Implementation Team, a government-industry collaboration initiative, the Data Comm program is planning revised

INTEGRATING NEW CAPABILITIES

NextGen capabilities are not turned on all at once. Before the FAA can deliver each new capability, myriad activities have to be accomplished, some of which include:

- safety management system and risk assessments;
- environmental assessments;
- demonstrations to ensure the capability delivers its intended benefits;
- tests to determine how the capability affects the workload of FAA technicians, air traffic controllers and pilots;
- training so that controllers and operators know how to use the capability;
- identification, development and installation of needed infrastructure and software;
- development and installation of new aircraft equipment, if needed; and
- changes to orders and policies to conform to federal and international standards.

The development of NextGen capabilities is not carried out in a vacuum. Throughout the process, the FAA collaborates with aviation community stakeholders, including operators, equipment manufacturers, academia and other federal agencies. We work with the international community, including air navigation service providers, to make sure that equipped aircraft can take advantage of similar capabilities around the world. And we carefully plan how to integrate new capabilities into the airspace, which is active around the clock.

departure clearance trials in 2012 and 2013 at three airports: Memphis, Newark and Atlanta.

A WORLD OF FLIGHT

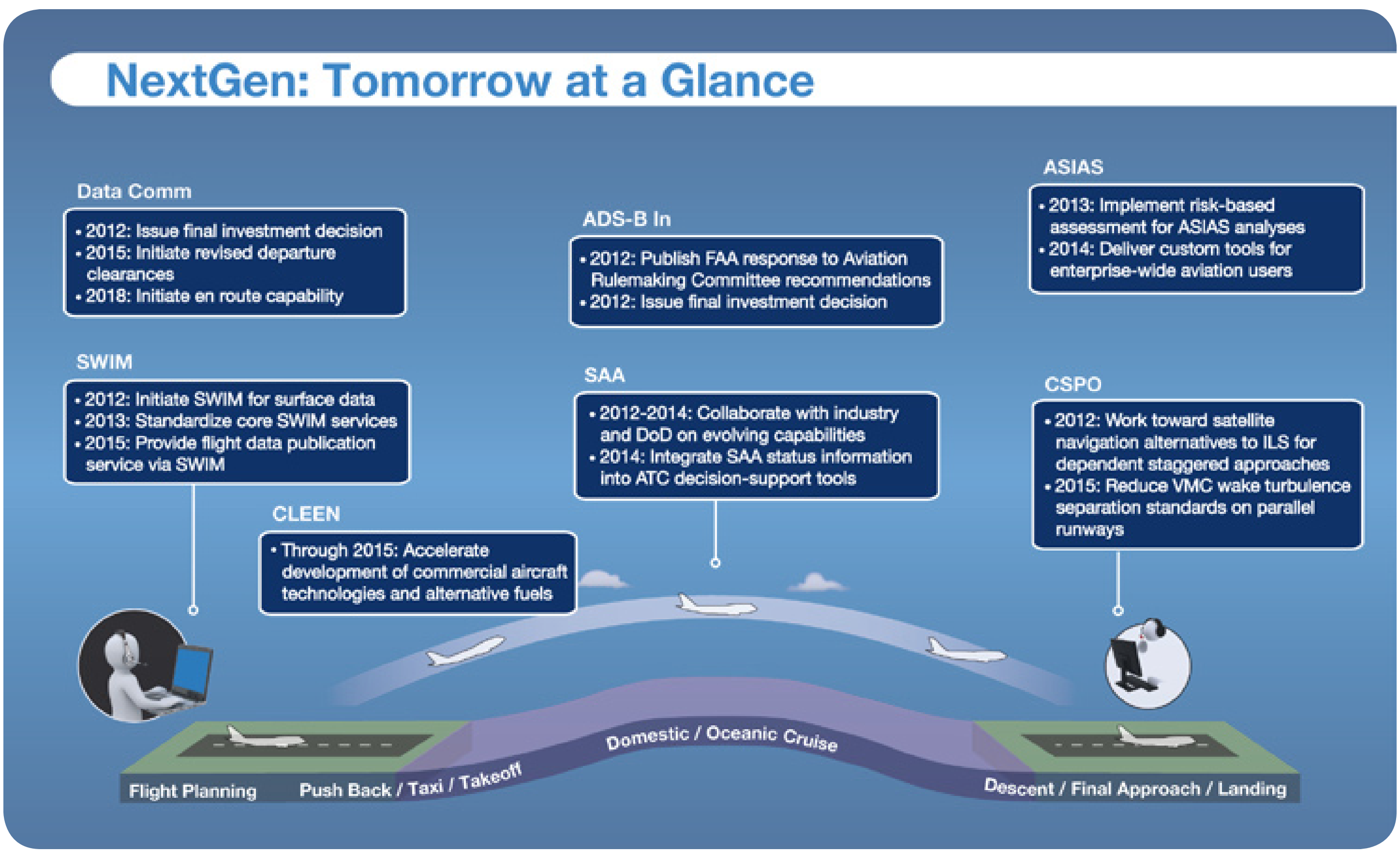
As the FAA and its aviation-community partners are developing NextGen capabilities and accompanying avionics in the United States, air navigation service providers around the world are putting similar systems in place. The increasingly global face of aviation requires that airplanes be able to use the same avionics to conduct similar operations to reap benefits around the world. The FAA is collaborating with international air navigation service providers to make sure that happens.

Over the next few years, work under a U.S.-European Union memorandum of cooperation continues to ensure interoperability between NextGen and Single European Sky Air Traffic Management Research, the European air traffic control modernization effort. The scope of cooperation includes activities grouped in five areas of work: transversal, or cross-cutting, activities, such as architecture, standards development and concept of operations work; information management; trajectory management; communications, navigation, surveillance and airborne interoperability; and other collaborative projects, such as the Atlantic Interoperability Initiative to Reduce Emissions.

> We will continue to build on available NextGen technologies and procedures to provide additional capabilities.

FAA's harmonization work also supports ICAO's Aviation System Block Upgrades initiative, which aims to harmonize global upgrades to air traffic management that can be achieved in 5-year blocks. The first block of aviation system advances comprises existing capabilities and those planned for implementation in 2013, including PBN and flexible use of airspace. These advancements do not require development of new technology, standards or infrastructure and they use avionics that are already available. The next block includes well-defined capabilities planned for implementation by the end of 2018.

As we implement NextGen, the FAA is enhancing the safety, flexibility and environmental performance of the NAS. In concert with our aviation-community partners, at home and abroad, we are implementing the capabilities, policies and safety structure necessary for a successful NextGen operating environment that will ensure aviation's continued contributions to the U.S. economy.



CHALLENGES

TACKLING A COMPLEX PORTFOLIO OF INITIATIVES

The past year has been a demanding one for NextGen policymakers and managers in many ways, chief among them the increasing requirement to overcome new uncertainties.

Difficulties in applying new technology to old applications as well as brand-new capabilities are nothing new to the FAA or NextGen. They are common in any undertaking of NextGen's scope. What is new, however, is the need to deal with common problems under uncommon circumstances.

Under the best of circumstances, management and coordination of the NextGen suite of systems and procedures is a complex undertaking. It must be managed and implemented as a portfolio, not as a series of independent programs. Under the economic and budget conditions of 2011, the demands the FAA faces have grown. In response, we adapt and adjust our plans to these demands and their impact on resources.

The combination of shifting federal budget priorities and technical problems led to changes in some of our plans and schedules for deployment of NextGen components. In the 2011 update of the NextGen Implementation Plan, for example, we reported difficulties and delays in testing En Route Automation Modernization (ERAM) as the new automation system at our en route centers, and making ERAM operational throughout the National Airspace System (NAS). We are now implementing a recovery plan aimed at minimizing further delay.

We developed important aspects of the recovery plan in close collaboration with the National Air Traffic Controllers Association (NATCA), the controllers' union. At an FAA in-service decision meeting in March 2011, reviewers concluded that high risks remained regarding two key capabilities — tracking aircraft accurately and handing off tracking data from one center to another. But a further review, this time including specialists from NATCA, found many potential problems in ERAM's core functionality.

A team at the FAA's William J. Hughes Technical Center in Atlantic City, N.J., mapped problem reports from ERAM testing to the core functionality and found many potential change requests. If not for the core-functionality analysis, these problems would have turned up later, unexpectedly.

We have known for a long time — and commented in previous Implementation Plan editions — that the systems and procedures that make up NextGen are highly interdependent. Thus we are trying not only to minimize further delays in the ERAM program, but also delays in achieving major NextGen capabilities that depend on ERAM. One such capability involves data communications, which is dependent on the Data Communications (Data Comm) program, a NextGen transformational program, and ERAM, both of which have been re-planned in order to accommodate new realities in the funding we can expect and the technical progress we can achieve. Capabilities offered by another of our transformational programs, System Wide Information Management, also depend on ERAM, as do some of the advanced service capabilities enabled by Automatic Dependent Surveillance–Broadcast.

Our current uncertainties and constraints increase the importance of managing NextGen with the skill, determination and subtlety that such a complex system engineering project requires. Fortunately, the FAA's Foundation for Success initiative is providing the kinds of management improvement we need.

We implemented NextGen-related provisions of Foundation for Success last fall, after Congress enabled them by accepting our proposals to reprogram our budget. Two Foundation provisions are central to NextGen:

- The head of NextGen used to be the senior vice president, NextGen and Operations Planning, reporting to the Air Traffic Organization's (ATO) chief operating officer (COO). Now this person is the assistant administrator for NextGen, reporting directly to the deputy administrator of the FAA. This change increases NextGen's visibility, both internally and externally, and it creates a direct line of authority and responsibility that no longer passes through the FAA's operating arm.
- Management of individual NextGen development programs previously resided in the ATO units whose operations would be improved by their deployment. Thus the acquisition program managers reported to different vice presidents, each with important operational responsibilities. Foundation for Success created a central program management office in the ATO, headed by a new senior executive reporting to the COO. This executive will increase coordination among the programs and improve the interface between the program offices and the NextGen organization.

We have made considerable progress during the past year on NextGen management challenges that we cited in the 2011 update of the Implementation Plan. We can attribute much of this progress to efficiencies and improvements we have already attained through the Foundation for Success. During 2011 we:

- Streamlined and will continue to streamline the environmental review process required for some NextGen capabilities, particularly precision departures and approaches that change noise patterns on the ground. Similarly, we are streamlining the processes we use to set standards and certifications for equipment, and to develop procedures for its use.
- Took steps to improve collaboration with stakeholders and our own governance. The NextGen Advisory Committee (NAC), established at RTCA to succeed the Air Traffic Management Advisory Committee, delivered its first substantive recommendations last fall, and the FAA has responded to them (see Response to NextGen Advisory Committee Recommendations).
- Continued to emphasize human factors in all our development programs. Human-in-the-Loop simulations and demonstrations are important inputs as we develop

To realize NextGen benefits, the FAA and its stakeholders need to synchronize their NextGen technology investments. Likewise, the agency and the aviation community must harmonize their timetables for activating new capabilities, including the development of new policy and procedures.

our operating concepts. Operations personnel have a prominent role in our development programs.

- Stepped up our efforts to harmonize NextGen with international activities, launching collaborative programs with Europe under a new memorandum of cooperation, finalized in 2011.

We continue to recognize that we must integrate NextGen technologies and procedures, including training and support capabilities into the NAS while it remains active 24 hours a day, seven days a week. Similarly, we must integrate the reconfiguration of FAA facilities for NextGen into the ongoing maintenance and upgrade programs that keep NAS operations safe and reliable.

Policy issues remain key NextGen challenges within the FAA and at the NAC. Central among them are how to create incentives for operators to equip their aircraft to take advantage of newly fielded NextGen capabilities. We are continuing to explore operational and financial incentives that could improve the benefit-cost ratio in users' business-case analyses.

For operational incentives, often referred to as the best-equipped, best-served concept, the FAA would establish procedures by which operators of aircraft equipped for and capable of using a specific NextGen improvement would receive advantages over and above the benefits that result directly from the improvement itself. We are continuing to explore options for financial incentives, both within the agency and with the NAC.

The FAA needs to synchronize its investments with those of aviation stakeholders to maximize timely NextGen benefits.

With or without equipage incentives, we need to synchronize our investments with those of other government agencies and aviation stakeholders in order to maximize timely benefits from NextGen deployments. If we do not deploy NextGen capabilities by the time stakeholders equip for them, or if stakeholders do not equip without significant delay to use the capabilities once we have deployed them, the aviation community will not fully realize as timely a return on our investments.

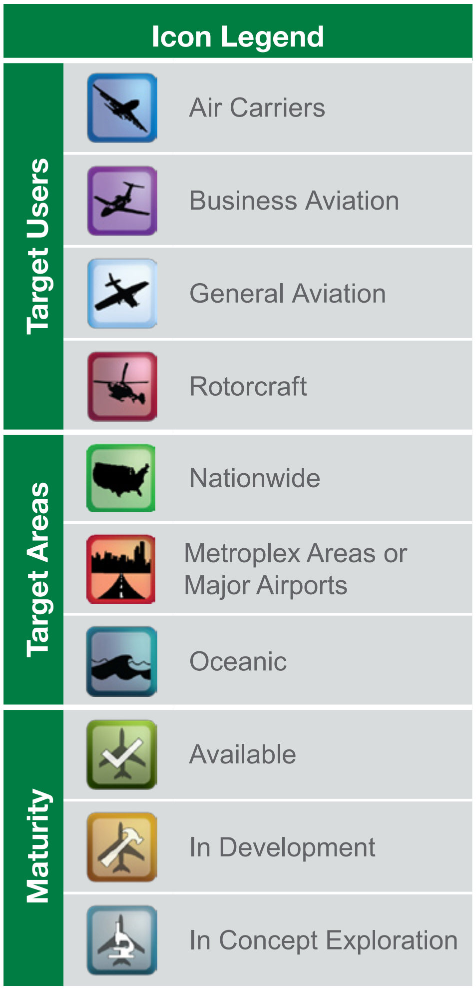
Throughout NextGen implementation, the FAA will have to manage NAS operations in ways that accommodate a mix of aircraft that are and are not equipped for specific NextGen capabilities. We have managed fleets with mixed configurations and capabilities since the beginnings of air traffic control, and we will continue to do so. We will work with the aviation community on a strategy that serves all types of operators with varying levels of equipage, maximizes overall system performance and enhances safety.

APPENDIX A
NEXTGEN INVESTMENTS FOR OPERATORS AND AIRPORTS

NextGen benefits depend on FAA ground-based systems, space-based systems, alternative fuels and engine and airframe improvements, advanced avionics capabilities and airport infrastructure. This appendix outlines the opportunities for investment by operators and airports. It provides an overview of current and planned capabilities and relates them to the benefits that they enable.

This appendix uses enablers — Automatic Dependent Surveillance–Broadcast (ADS-B) Out or Localizer Performance with Vertical Guidance (LPV) avionics, for example — to describe the technologies required for an aircraft and operator, or an 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 guide operators in satisfying these requirements and deploying the enablers through Advisory Circulars (AC) and Technical Standard Orders (TSO). The enablers are linked to operational improvements that provide benefits and build on capabilities already installed or available for today's aircraft. This appendix provides an overview of the major categories of enablers for aircraft operators as well as airports.

We target three different areas for aircraft operators: aircraft avionics, flight planning and routing support systems, and fuels and engines. Airports will also be an active participant in deployment of some improvements.



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

- Target Users: The target users for each enabler can include air carriers, business jets, general aviation fixed-wing and rotorcraft. These categories of target users represent generalized modes of operation and may not apply exactly to every civil or military operator. The FAA does not limit the NextGen capabilities to these targeted users groups. In addition to the specified user groups, some users may still find it worthwhile to invest in a particular enabler in order to meet their specific operational objectives.

- Target Areas for Implementation: The general strategy for deployment can include nationwide, in oceanic areas or in metroplex terminal areas with large and medium hub airports and satellite airports.

- Maturity: An enabler may already be available for operator investment, in development (including standards development) or in concept exploration.

Tables throughout this appendix summarize the enablers. A more complete description of each enabler can be found in *NextGen Operator and Airport Enablers*, a supplement to this appendix that is available at www.faa.gov/nextgen. Additional detail concerning the operational improvements, and the FAA implementation plan for each improvement, is provided in Appendix B. ADS-B Out capability is the only enabler selected as a mandatory capability for all aircraft operating in airspace designated by the 2010 ADS-B Out rule, which requires equipage on Jan. 1, 2020.

This appendix reflects several implementation strategy adjustments, notably:

- Performance Based Navigation (PBN): In response to RTCA's Trajectory Operations working group, the FAA will begin work on a trajectory operations navigation standard.

- ADS-B: The ADS-B In Aviation Rulemaking Committee (ARC) provided recommendations to the FAA in September 2011. The ARC recommended specific ADS-B In applications for which the FAA will begin to develop guidance. Our planning is reflected in the ADS-B enabler table.

- Data Communications (Data Comm): In April 2011, RTCA SC-214/European Organization for Civil Aviation Equipment (EUROCAE) WG-78 agreed to change its data link standards development strategy. Aeronautical Telecommunication Network (ATN) Baseline 3 was discontinued and its capabilities were merged with ATN Baseline 2.

- Avionics Safety Enhancements: Electronic Flight Bags have continued to play a larger role in NextGen flight operations. We have added them to the list of enablers we discuss in this appendix.

PERFORMANCE BASED NAVIGATION

PBN encompasses a set of enablers with a common underlying capability to construct a flight path that is not constrained by the location of ground-based navigation aids. There are varying performances and functional requirements in the PBN family, from the 10 nautical mile (nm) course width accuracy and few waypoints required by Required Navigation Performance (RNP) 10 to the 0.1 nm precision and curved paths of RNP 0.1 Authorization Required (AR) approaches. For oceanic en route navigation, RNP 10 and RNP 4 will continue to be the standards. Domestically, Area Navigation (RNAV) 2 provides the required capability en route.

RNAV 1 is the mainstay in the terminal area, except where obstacles or airspace conflicts demand the improved performance provided by RNP 1. To achieve access to runways during limited visibility (instrument conditions), three capabilities offer different advantages and costs. The

Overview of Aircraft Operator Enablers						
Avionics Enablers	Aircraft and Operator Guidance	Aircraft and Operator Schedule	Capability Overview	Target Users	Target Area	Maturity
Performance Based Navigation						
RNP 10	Order 8400.12C	Complete	Reduces oceanic separation			
RNP 4	Order 8400.33	Complete	Further reduction of oceanic separation (in conjunction with FANS-1/A)			
RNAV 1, RNAV 2	AC 90-100A	Complete	Enables more efficient routes and procedures			
RNP 1 with Curved Path	AC 90-105	Complete	Enables precise departure, arrival and approach procedures, including repeatable curved paths			
Vertical Navigation	AC 90-105, AC 20-138B	Complete	Enables defined climb and descent paths			
LPV	AC 20-138B, AC 90-107	Complete	Improves access to many airports in reduced visibility, with an approach aligned to the runway			
RNP Approaches (Authorization Required)	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			
Trajectory Operations Navigation	TBD	2014	Enhances PBN capabilities			

most basic, RNP 0.3, is a conventional non-precision approach capability achievable with GPS alone. Adding vertical guidance requires either barometric Vertical Navigation (VNAV) or a Satellite Based Augmentation System. Operators can also use a basic VNAV capability with RNP 0.3., which when coupled with tighter lateral navigation systems, or the application of more advanced systems, can allow access to RNP AR approaches. LPV typically offers the lowest approach minimums, providing a satellite-based approach that is operationally equivalent to conventional Category I Instrument Landing Systems (ILS).

The current aircraft fleet is well equipped with PBN capability. For example, in the air carrier community, the heart of the PBN capability is the Flight Management System (FMS). The FMS uses input from multiple Distance Measuring Equipment (DME), or from the Global Navigation Satellite System (GNSS) using a GPS sensor or a GPS with Wide Area Augmentation System (WAAS) sensor. DME-only navigation has coverage limitations and will not be supported on every published procedure. Most FMS installations can support RNAV operations and RNP with curved path, but less than half can support RNP AR approaches. LPV requires a WAAS receiver and integration with cockpit displays.

In the general aviation community, the 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 RNAV, and those equipped with WAAS can support LPV. Some of these configurations have fully implemented RNP with curved path and others may be upgradeable to RNP with curved path capability.

Operational advantages provide the primary motivation for equipping with PBN enablers. Operators who equip obtain a direct efficiency and access benefit because of the new routes, procedures, and approaches. However, in some instances the FAA cannot design the new route or procedure, or use it optimally, because of the need to accommodate traffic that is not equipped with these enablers. The FAA will not retain the full legacy ground structure so a further incentive for PBN capability will come through the reduction of services to the non-equipped aircraft.

As the National Airspace System (NAS) moves to a trajectory-operations-based construct, new requirements will be placed

Overview of Aircraft Operator Enablers						
Avionics Enablers	Aircraft and Operator Guidance	Aircraft and Operator Schedule	Capability Overview	Target Users	Target Area	Maturity
ADS-B Capabilities						
ADS-B Out	AC 20-165, TSO-C166b, TSO-C154c	Complete	Enables improved air traffic surveillance and automation processing			
Airborne/Ground CDTI (ADS-B In)	AC 20-172, TSO-C195	Complete	Improves awareness of other traffic			
In-Trail Procedure (ADS-B In)	Policy Memo; AC 20-172A, TSO-C195a	Complete	Improves oceanic in-trail climb/descent			
Surface Indications/Alerts (ADS-B In)	AC, TSO	2016	Displays and provides alerts based on non-normal traffic status			
Interval Management (ADS-B In)	AC 20-172B, TSO-C195b	2014	Displays along-track guidance, control and indications, and alerts			
Traffic Situational Awareness and Alerting[1] (ADS-B In)	AC 20-172B, TSO-C195b	2014	Displays and alerts crew to airborne conflicts independent of TCAS alerting			
Closely Spaced Parallel Operations[2] (ADS-B In)	AC, TSO	2017	Provides guidance information for aircraft participating in paired approaches to closely spaced runways			

[1] Formerly known as Airborne CDTI with Conflict Detection.
[2] Formerly known as Paired Parallel Approach Guidance and Alerting.

on 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 in determining these new trajectory operations performance standards.

AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST

There are many different ADS-B enablers, with different cost and benefit implications. The most basic participation with ADS-B is ADS-B Out, where the aircraft's position and certain other data are broadcast by avionics. 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.

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 types of enablers provide enhanced situational awareness, improving the ability of the flight crew to identify where aircraft are around them and the direction in which they are headed. This technology works in the air or on the ground, although coverage issues and the availability of quality airport surveys may limit the ground capability (see airport enhancements on page 48). This basic type of display is referred to as a Cockpit Display of Traffic Information (CDTI). A CDTI may be a new display, or it may be integrated with a conventional Traffic Alert and Collision Avoidance System (TCAS) traffic display.

Another set of ADS-B In enablers uses the ADS-B data for speed or timing guidance, typically maintaining spacing or separation from another aircraft. This includes both algorithms for oceanic In-Trail Procedures (ITP) and display of along-track guidance cues for interval management. 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.

The equipage for ADS-B is just beginning, with rule-compliant ADS-B equipment having gained approval in late 2010. Equipage in some aircraft began in 2011.

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. Longer-term capabilities will require integration with other navigation data integrated into flight crew displays.

For general aviation aircraft operating below 18,000 feet, ADS-B can be implemented through the transponder or through a radio called the universal access transceiver (UAT). The 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.

The FAA mandated ADS-B Out equipage in most controlled airspace starting in 2020. The agency is encouraging operators to equip portions of their fleets with ADS-B before the nationwide rule goes into effect by providing early benefits. As the operators experience the operational benefits, they will have an incentive to accelerate and expand the ADS-B equipage to the rest of their fleet.

For air carrier operators, 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 Information Services–Broadcast and Flight Information Services–Broadcast (FIS-B), uplinked over the UAT, will enhance benefits and motivation to equip. The FAA is also evaluating additional locations where surveillance may be expanded by employing ADS-B.

In September 2011, the ADS-B In ARC 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.

DATA COMMUNICATIONS

Data communications were first deployed as part of the Future Air Navigation System (FANS) program. Boeing and Airbus developed integrated communication and navigation capabilities (FANS 1 and FANS A, respectively), providing a pilot-and-controller data link and the ability to autonomously send some data from the aircraft to the air traffic control (ATC) system through Automatic Dependent Surveillance–Contract (ADS-C). Operators targeted these new 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 as low as 50 nm.

As the FAA moves forward with deploying a domestic ATC data link system, it is important to make use of the FANS capabilities already installed within some fleets, particularly the wide-body air carriers conducting international operations. As such, the domestic program will use an adaptation of FANS appropriate for high-density, surveilled environments through FANS 1/A+ over VHF Digital Link (VDL) mode 2. These aircraft will be able to receive departure clearances and airborne reroutes.

A newer capability, ATN, was developed through the International Civil Aviation Organization to provide a more universally capable and reliable ATC data communications system. The capability that will be needed for full participation in NextGen in continental U.S. airspace will be the second version, called ATN Baseline 2. In April 2011, RTCA SC-214/EUROCAE WG-78 agreed to change its data link standards development strategy. ATN Baseline 3 was discontinued and its capabilities were merged with ATN Baseline 2. The standards for this version are under development and are being harmonized internationally.

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+ (VDL mode 2)	AC 20-140A, AC 120-70B	Complete	Expands FANS to domestic clearances			
	TSO-C160a	2012				
ATN Baseline 2	AC 20-140B, AC 120-70C	2014	Provides clearances, terminal information, and Initial Trajectory Operations			

Overview of Aircraft Operator Enablers						
Avionics Enablers	Aircraft and Operator Guidance	Aircraft and Operator Schedule	Capability Overview	Target Users	Target Area	Maturity
Low-Visibility Operations						
HUD/ILS	Order 8400.13D	Complete	Reduces minimums at qualifying runways			
EFVS	AC 20-167, AC 90-106	Complete	Uses enhanced flight visibility to continue approach below minimums			
GLS III	Project-specific policy	2014	Provides autoland in very low visibility			
Avionics Safety Enhancements						
FIS-B	TSO-C157a	Complete	Provides weather and aeronautical information in the cockpit			
Electronic Flight Bag	AC 20-173, AC 120-76B, AC 90-178	Complete	Allows electronic access to paper products			

Earlier versions of ATN provide interim capabilities. Europe has begun to implement ATN Baseline 1, which operators can retrofit into aircraft without modification of the navigation system. The FAA plans to implement ATN Baseline 2 with a larger set of operational capabilities, such as revised departure clearances, to provide greater incentive for retrofitting aircraft.

Operators of fleets that fly internationally already have adopted FANS 1/A widely for oceanic applications. The implementation strategy for domestic ATC data communications will include some equipage incentives. The FAA is evaluating potential scenarios for best-equipped, best-served in which aircraft with this capability may receive more rapid or efficient reroutes during inclement weather.

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 the visibility is less than one-half statute mile. Enhanced Flight Vision Systems (EFVS) afford the greatest level of access, providing alternative means for achieving lower approach minimums, regardless of the navigation aid or airport infrastructure, by enabling the flight crew to literally see through the clouds using the EFVS technology.

At many airports, the FAA has approved the use of a head-up display (HUD) on a precision approach to lower minimums. While this capability does not provide the ubiquitous access of EFVS, it can be implemented in many aircraft at lower cost.

Another enabler is the Ground Based Augmentation System Landing System (GLS). This program is researching the use of differential corrections to GPS to support Category III approaches. This capability will be the same as Category III ILS, without the need to restrict taxiing aircraft near antennas and at reduced cost to the FAA.

EFVS has been adopted by the high-end business community, while HUD has begun to spread to the air carrier fleet. The GLS program is still in research and development, but new

Current Equipage Levels of Available Enablers		
Enabler	Air Transport	General Aviation
RNP 10	58%	<5%
RNP 4	58%	<5%
RNAV 1, RNAV 2	92%	80%
RNP with RF	57%	<5%
LNAV/VNAV	45%	0%
LPV	<5%	30%
RNP AR	36%	<5%
ADS-B Out	0%	0%
Airborne/Ground CDTI	<5%	<5%
ITP	0%	0%
FANS 1/A (Satcom)	36%	0%
FANS 1/A+ (VDL mode 2)	12%	0%
HUD/ILS	15%	0%
EFVS	<5%	<5%
FIS-B	0%	<5%

Overview of Aircraft Operator Enablers						
Enablers	Operator or Airport		Capability Overview	Target Users	Target Area	Maturity
	Guidance	Schedule				
Engine and Fuel Technologies						
Drop-In Renewable Jet Fuel	ASTM standards (50% HEFA-JET A)	Complete	Expands jet fuel specification to allow production via alternative processes and feedstocks			
Drop-In Renewable Jet Fuel	ASTM standards (Alcohol-to-Fuel Pathways)	2014	Expands jet fuel specification to allow production via alternative processes and feedstocks			
Drop-In Renewable Jet Fuel	ASTM standards (Pyrolysis)	2015	Expands jet fuel specification to allow production via alternative processes and feedstocks			
Engine Efficiencies	Technology available for aircraft design	2015	Provides demonstrated engine technology with lower fuel burn, noise and emissions			

aircraft are being manufactured with the basic capability to reduce the costs of transitioning from ILS when GLS is mature.

The low-visibility enablers are implemented through best-equipped, best-served incentives, so that aircraft with the capability can gain airport access when other operators cannot.

AVIONICS SAFETY ENHANCEMENTS

FIS-B provides ground-derived weather data and real-time NAS status information to aircraft equipped with UAT and appropriate displays. These data are primarily intended to improve safety of operations for general aviation aircraft and are provided over the same UAT signals used for ADS-B.

Electronic Flight Bag 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.

EQUIPAGE LEVELS

The Equipage Level table (see previous page) summarizes the current equipage levels of the mature avionics enablers among civil operators. These estimates are based on coordination with air carrier operators and the annual FAA general aviation and air taxi survey. The high penetration of PBN enablers reflects the maturity of those capabilities, which have been delivered in various forms for over 10 years. Other enablers, such as ADS-B Out, are only recently available and have not been installed.

ENGINES AND FUEL TECHNOLOGIES

Drop-in alternative fuels research continues with the intent of approving a range of ASTM International-approved fuels that provide users improved environmental performance without compromising safety or requiring changes in aircraft, engines or fuel-supply infrastructure.

ASTM approved Fischer-Tropsch alternative fuels blended with Jet A for commercial use in 2009. ASTM also approved blends of sustainable Hydroprocessed Esters and Fatty Acids (HEFA) alternative jet fuels[1] in Fiscal Year 2011. Developers are beginning to test additional advanced alternative jet fuels in support of eventual approval. Currently, ASTM standards for alcohol-to-fuel pathways are targeted for 2014 and pyrolysis is targeted for 2015.

Operator investment is limited to purchasing alternative fuels and fuel blends as they become available in commercial quantities. We expect air carriers to sign long-term fuel purchasing agreements.

Operators may retrofit some airframe and engine technologies on existing aircraft to speed technology insertion, while other technologies such as the high bypass ratio geared turbofan and open-rotor engines will await future generations of aircraft.

FLIGHT OPERATIONS CENTERS

Flight operations centers (FOC) are expected to play a significant role in the evolution toward NextGen. The FOC could be specific to the operator, e.g., an air carrier,

[1] Formerly known as Hydroprocessed Renewable Jet (HRJ) biofuel.

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	ADS-B squitter equipage for surface vehicles operating in the movement area	Airport rescue firefighting equipment, snowplows, inspection trucks		

or a company providing flight planning and flight following support services. To fully participate, FOCs need to develop and maintain information technology systems to achieve three basic objectives: expand data exchange with the FAA through Collaborative Information Exchange (CIX), timely processing of aeronautical status and weather information in flight-planning software and increased flexibility to grant operator flight preferences. Building on the principles of collaborative decision making, the FAA plans to implement a CIX to provide increased situational awareness and improved constraint prediction by incorporating data made available via data exchange mechanisms. Examples are Special Activity Airspace status and surface event information.

In support of these objectives, the FAA will need to refine the data-sharing policies that govern the information to be exchanged between ATC and FOCs. Updating these policies will ensure that the proper data will be shared without compromising safety or the integrity of either the government or stakeholders. The FAA will also need to define technical requirements for the communications infrastructure that will enable data exchange. These requirements will enable operators to properly upgrade existing communications infrastructure and make investments in new technology to ensure future compatibility.

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 FOCs 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 due to 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.

AIRPORT ENHANCEMENTS

Airports are active participants in the implementation of NextGen 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.

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, WAAS/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 Category I minimums. The FAA may opt for an incremental phaseout of the ILS Category I installations by 2025, as both WAAS/LPV and RNAV/RNP provide more cost-effective and flexible instrument approach procedures. The FAA continues to evaluate Ground Based Augmentation System technology, which could augment the existing ILS Category II and 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 a new WAAS/LPV approach procedure. An airport can request that the FAA initiate 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, obstruction mitigation and runway lighting could be eligible for Airport Improvement Program (AIP) funds.

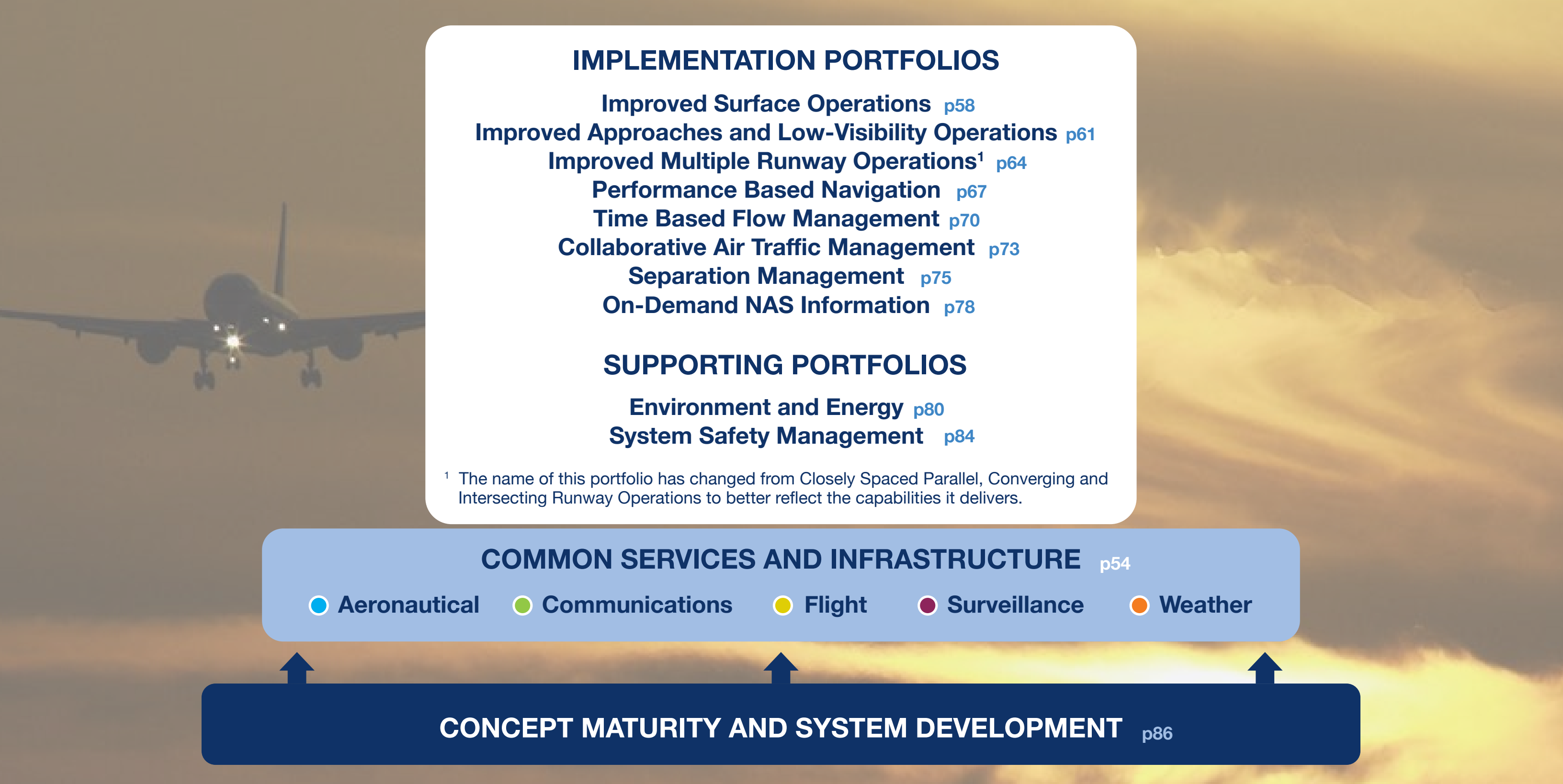
Surface surveillance and management is another key area for airport involvement in NextGen. In 2011, the FAA completed installation of Airport Surface Detection Equipment–Model X (ASDE-X) at 35 airports. Additionally, the agency aims to install enhancements to airport surface detection equipment, known as the Airport Surface Surveillance Capability (ASSC), at nine other airports between 2014 and 2017. At these facilities, airports can install ADS-B squitters on airport-owned vehicles that regularly operate in the movement area. The squitters would broadcast vehicle positions to air traffic control, 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. We are evaluating AIP eligibility for the ADS-B squitters.

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 that will not receive 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. When airports monitor operations on the airport surface more precisely, there is an overall increase in situational awareness.

The FAA recognizes and appreciates the efforts of airports and vendors to develop systems and tools to improve surface situational awareness. To date, the results 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 the emerging surface operational concepts under NextGen. The agency plans to streamline the 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 mid-term and far-term periods to incorporate both existing and new technologies. There may also be dependencies on PBN implementation and aircraft equipage rates. As revisions to CSPO standards become available, airports will be able to incorporate these improvements into their long-term planning (NextGen Ahead and the Improved Multiple Runway Operations portfolio in Appendix B highlight the FAA's work on CSPO).



APPENDIX B

DELIVERING NEXTGEN

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, timelines and locations (when available) to deliver operational improvements.

Work is progressing to deliver related capabilities in eight implementation portfolios and two portfolios with supporting activities that address safety, environmental and energy considerations. See graphic above for a list of the portfolios. The capabilities in the implementation portfolios depend on several common services and new or existing infrastructure, which we manage in a Common Services and Infrastructure portfolio.

Development of capabilities in one portfolio often depends on or impacts development in other portfolios. A change in the schedule of a capability in the Common Services portfolio, for example, could also impact all the increments that capability supports. Development and implementation can also be affected by other internal and external factors, such as program interdependencies, realignment of priorities, concept validation work or funding. This means that we may have to adjust the timeline or the scope of a capability.

The capabilities displayed in the implementation portfolio timelines depict our current plans through 2015. Several increments have been delayed from the time frame shown in last year's update to the NextGen Implementation Plan. However, detailed planning for capabilities beyond the 2015 time frame 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.

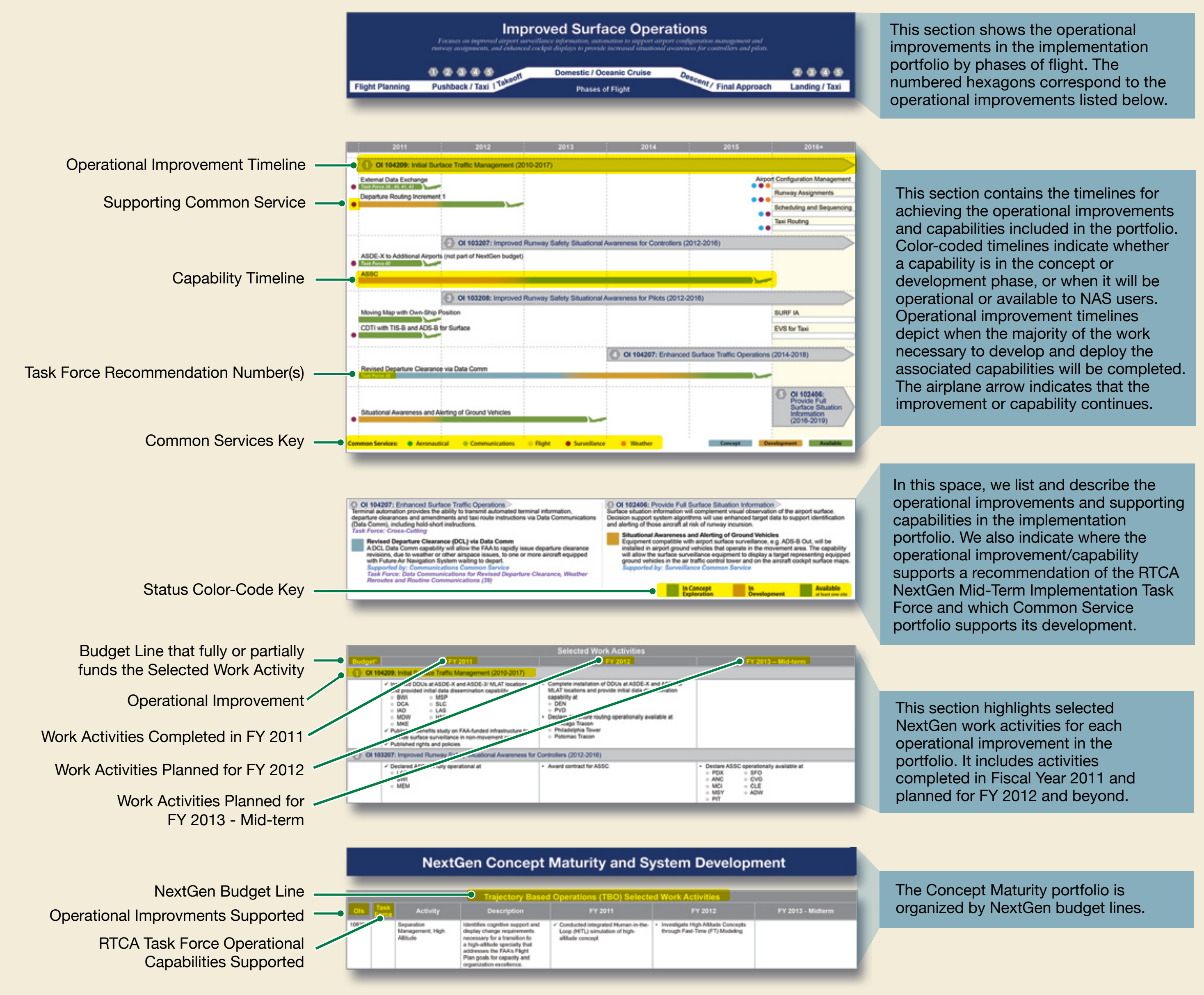
The FAA is using a segment planning approach, which offers additional insight into the development and implementation of capabilities in the 2016 time frame and beyond while facilitating lower-level program planning. While the degree of uncertainty is higher, the segment planning approach guides the 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 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. The Concept Maturity and System Development portfolio consists of pre-implementation activities funded by NextGen capital budget line items.

In last year's update to the NextGen Implementation Plan, we organized Appendix B by operational portfolios. This year, we have further modified the way we present the information to better illustrate what kinds of related work activities are conducted at the various stages of development. For each of the implementation portfolios, you will see a timeline for the operational improvements and their related increments, a description of the operational improvements and increments and selected implementation work activities that support the operational improvements (OI). We have also listed which NextGen budget line item(s) fully or partially fund those work activities. In addition, we have moved the pre-implementation activities included in the implementation portfolios in last year's update to the Plan to the Concept Maturity and System Development portfolio.

How to Read Portfolios

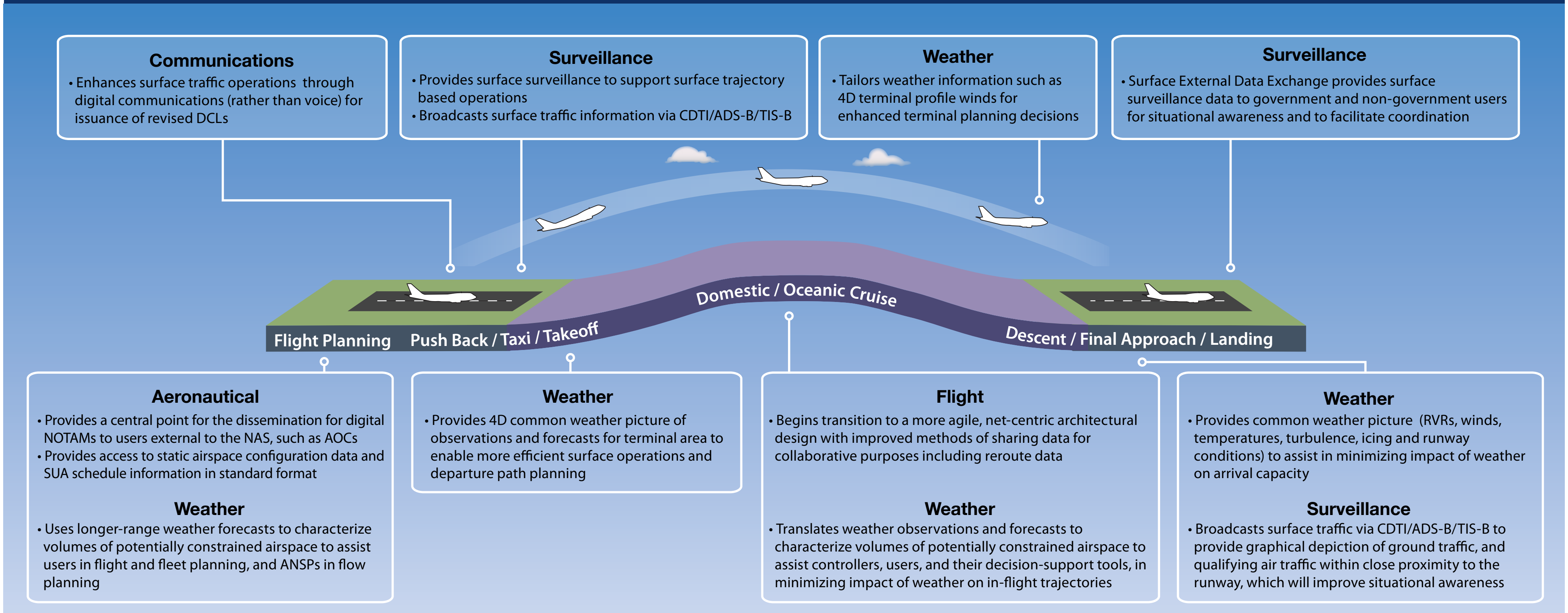


Improved Surface Operations
Improved Approaches and Low-Visibility Operations
Improved Multiple Runway Operations
Performance Based Navigation
Time Based Flow Management
Collaborative Air Traffic Management
Separation Management
Common Services and Infrastructure
Airport
FAA Facility
Metroplex
ANC
Runway 7R/25L extension
ZSE
Adjacent Center Metering (ACM)
Transition to PBN Routing for Cruise Operations
PDX
• Runway 10L/28R extension
• Rehabilitation of Runway 10R/28L
Northern California Metroplex
Optimization of Airspace Procedures in the Metroplex
NCT
ATPA
ZLC
ACM
SLC
External Data Exchange
SFO
Additional 7110.308 Airports
ZOA
ADS-C CDP
Transition to PBN Routing for Cruise Operations
DEN
External Data Exchange
RNP and RNP AR Approaches
ATPA
Southern California Metroplex
Optimization of Airspace Procedures in the Metroplex
LAS
• External Data Exchange
• ASDE-X to Additional Airports
LAX
RNAV SIDs and STARs at single sites
ZAB
Transition to PBN Routing for Cruise Operations
ZLA
ACM
SCT
ATPA
SAN
Traffic Management Advisor
PHX
OPDs using RNAV and RNP STARs
North Texas Metroplex
Optimization of Airspace Procedures in the Metroplex
HNL
External Data Exchange
OPDs using RNAV and RNP STARs

Selected NextGen Capabilities by Portfolio for Implementation in 2011-2012

This map shows the location of selected NextGen capabilities implemented in 2011 and capabilities we are planning to deliver in 2012. Additional details can be found in the individual implementation portfolios on the following pages.

Common Services and Infrastructure



Aeronautical Common Service

New Aeronautical Information Management (AIM) automation infrastructure will be acquired and implemented in a standardized enterprise-compliant fashion, providing a single authoritative source for aeronautical data management.

New Services: airspace configuration and schedule information, and digital Notices to Airmen
Task Force: Surface and Cruise

Communications Common Service

New International Civil Aviation Organization-compliant digital communications infrastructure and technologies will provide a supplemental means for two-way exchange between controllers and flight crews for air traffic control (ATC) clearances, instructions, advisories, flight crew requests and reports.

New Services: tower Data Communications for revised departure clearances and oceanic Data Communications
Task Force: Cross-Cutting

Flight Common Service

New flight information management automation infrastructure will be acquired and implemented in a standardized enterprise-compliant fashion, providing a common interface among National Airspace System (NAS) automation systems, service providers and users.

New Services: terminal data distribution, reroute data exchange and flow information publication
Task Force: Cross-Cutting

Surveillance Common Service

New surveillance infrastructure, technologies and applications will be deployed to improve situational awareness.

New Services: surface surveillance, surface sensors and indicators, surface traffic broadcast, highly accurate position data that supports Surface Trajectory Based Operations (STBO), surface external data exchange service, surface broadcast flight and NAS status information to pilots, and oceanic automation support for separation management
Task Force: NAS Access

Weather Common Service

New weather infrastructure will provide improved weather information in a standard enterprise-compliant fashion.

New Services: common weather picture, net-centric dissemination, enhanced forecasts for aviation, winds and temperatures for trajectory modeling, tailored volumetric retrievals of forecast and observation information, and characterizations of potential weather-constrained airspace

Common Services and Infrastructure

Selected Work Activities						
Budget Line	**Task Force**	**Activity**	**Description**	**FY 2011**	**FY 2012**	**FY 2013 – Mid-term**
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.	✓ Continued to deploy ADS-B ground infrastructure ✓ Pursued ADS-B program expansion to provide surveillance services in non-radar airspace	• Complete final assessment of 3-nautical-mile (nm) separation in en route operations (beyond those achievable in the near term prior to ADS-B equipage)	• Complete NAS-wide deployment of ADS-B, Traffic Information Services–Broadcast (TIS-B) and Flight Information Services–Broadcast (FIS-B) • Provide initial operating capability for surface alerting
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 ATC clearances, requests, instructions, notifications, voice frequency communications transfers and flight crew reports as a supplement to voice communications.	✓ Released solicitation for Data Comm network service provider ✓ Initiated development of revised departure clearance capability in tower	• Achieve final investment decision for procurement of en route Data Comm automation infrastructure and controller-pilot data link communications applications	• Achieve final investment decision on acquisition of the digital very high frequency (VHF) aeronautical mobile communications infrastructure • Initiate development of en route automation enhancements • Enable revised departure clearance capability in the tower environment via VHF Digital Link mode 2 for aircraft equipped with Future Air Navigation System 1/A+
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.	✓ Initiated preliminary development of documentation for FAA Joint Resources Council (JRC) decisions	• Release Screening Information Request • Achieve final investment decision for NVS Segment 1	• Award contract

Common Services and Infrastructure

Selected Work Activities						
Budget Line	**Task Force**	**Activity**	**Description**	**FY 2011**	**FY 2012**	**FY 2013 – Mid-term**
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.	✓ Provided Corridor Integrated Weather System publication ✓ Provided reroute data exchange capability ✓ Provided flight data publication for initial flight data services ✓ Provided Integrated Terminal Weather System publication	• Achieve final investment decision for SWIM Segment 2	• Publish data for: ○ pilot weather report ○ Traffic Flow Management ○ flight data ○ Runway Visual Range • Provide terminal data distribution capability • Provide flight data services with publish/subscribe • Provide flight data publication host air traffic management data distribution system/flight data input/output and AIM Special Use Airspace client
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.	✓ Continued CATMT Work Package 3 concept engineering and planning to support: ○ modernization of the decision-support tool suite ○ collaborative information exchange ✓ Continued the analysis to develop the requirements to implement proven decision-support tools and data-sharing capabilities	• Upgrade the Traffic Flow Management System to include an initial electronic negotiation capability for more efficient flight planning	• Deploy CATMT Work Package 2 capabilities to include: ○ arrival uncertainty management ○ weather integration ○ collaborative airspace constraint resolution ○ airborne reroute execution
NextGen Network Enabled Weather (NNEW)		NNEW	Provides common, universal access to aviation weather data.	✓ Completed SWIM compliance overview ✓ Initiated investment analysis	• Achieve initial investment decision for NNEW Work Package 1: ○ Weather and Radar Processor ○ weather information network server (WINS) ○ FAA Bulk Weather Telecommunications Gateway (FBWTG) functionality and may also include Weather Message Switching Center Replacement weather communications functionality	• Achieve final investment decision for NNEW Work Package 1
Demonstra-tions	28	Colorado Wide Area Multilateration (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.	✓ Approved design covering critical and multilateration services for Colorado Phase 2 service volumes	• Complete key site installation	• Deploy phase 2 system that includes WAM and ADS-B at DRO, GUC, MTJ and TEX

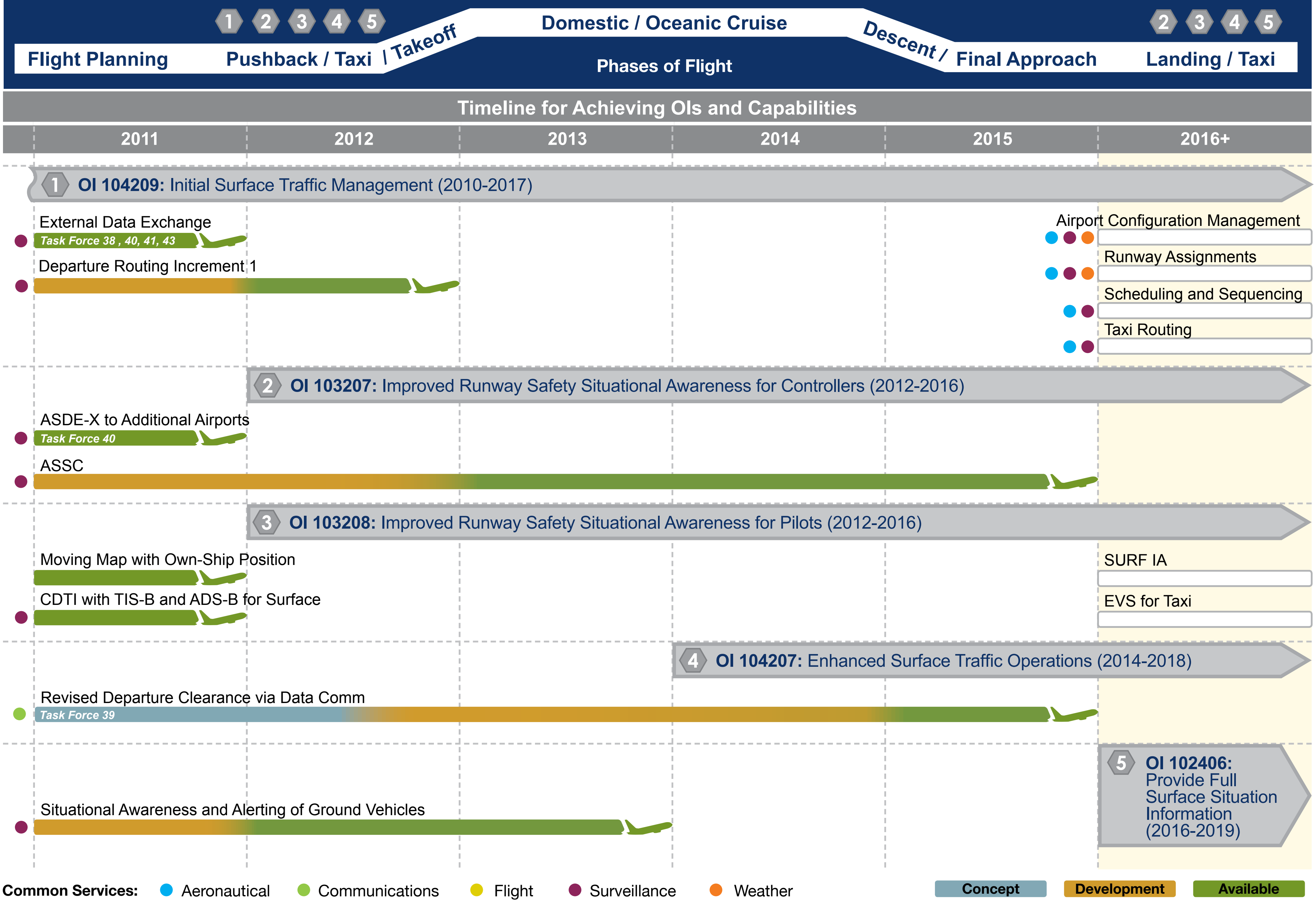
Common Services and Infrastructure

Selected Work Activities						
Budget Line	**Task Force**	**Activity**	**Description**	**FY 2011**	**FY 2012**	**FY 2013 – Mid-term**
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.	✓ Prepared initial business case for NextGen Facilities segment 1, project 1	• Achieve initial investment decision for segment 1, project 1	• Prepare initial business case for segment 1, project 2
Airport Improvement Program[1]		Airfield development	Continues the development of new runways and extensions to increase capacity and efficiency.	✓ Completed PDX Runway 10L/28R extension ✓ Completed PHL Environmental Impact Statement and signed the Record of Decision ✓ Completed additional JFK taxiway improvements ✓ Completed Phase II of the Atlanta Metropolitan Aviation Capacity Study ✓ Continued surveys to support development of Wide Area Augmentation System (WAAS)/ Localizer Performance Vertical (LPV) guidance approach procedures that increase access to airports ✓ Funded metropolitan area airport infrastructure improvements at non-Core airports	• Complete ANC Runway 7R/25L extension • Complete rehabilitation of PDX Runway 10R/28L • Complete ATL Runway 9L/27R extension • Continue Future Airport Capacity Task (FACT3) to identify capacity-constrained airports in 2020 and 2030 • Complete 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 • Consider obstruction removal and lighting needs so that airports with LPV approach procedures can achieve lower minima • Continue ADS-B vehicle squitter demonstration program at BOS • Continue research into low-cost surface surveillance framework	• Complete FACT3 and identify follow-on strategic planning initiatives • Complete SAT Runway 3/21 extension • Complete CMH Runway 10R/28L relocation • Complete ORD Runway 10C/28C • Complete FLL Runway 9R/27L • Continue additional JFK taxiway improvements • Continue planning and environmental projects

[1] Not considered NextGen funding

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.



Descriptions of OIs and Capabilities

1 OI 104209: Initial Surface Traffic Management

Departures are sequenced and staged to maintain throughput. Air Navigation Service Provider (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

External Data Exchange
The FAA has established a data exchange infrastructure that enables the sharing of airport surface movement data with authorized stakeholders. These data come from airports equipped with Airport Surface Detection Equipment–Model X (ASDE-X) or Airport Surface Surveillance Capability (ASSC) and a Data Distribution Unit (DDU). The FAA is implementing this data dissemination architecture and is actively sharing movement-area surface surveillance data with authorized and participating National Airspace System (NAS) domains, other government entities and non-government operators and entities.
Supported by: Surveillance Common Service
Task Force: Surface Connectivity (38), Surface Situational Awareness Phase 1 (40), Surface Situational Awareness Phase 2 (41) and Traffic Flow Management (TFM) Common Operational Picture (43)

Departure Routing Increment 1
Assessments of weather and Traffic Management Initiative impacts on departure routes and associated flights will be provided to tower traffic management coordinators and supervisors to improve departure operations.
Supported by: Surveillance Common Service

Airport Configuration Management
To improve responsiveness and effective use of airport resources, this capability provides automation to analyze, schedule, implement and disseminate airport configuration changes, including airport configuration change modeling for impact assessment. This capability provides a manually requested "what-if" capability to assess the impact of airport configuration change and supports the dissemination of the selected configuration and scheduled time of the change.
Supported by: Aeronautical, Surveillance and Weather common services

Runway Assignments
To assist in efficient runway allocation and use, the air traffic control automation system assigns an aircraft to a runway based on the flight's departure fix and enables ANSP personnel to accept or modify the runway assignment.
Supported by: Aeronautical, Surveillance and Weather common services

Scheduling and Sequencing
For improved departure schedule integrity, this capability generates and displays a projected runway schedule showing arrival and departure demand. It provides TFM constraints to tower controllers, such as expected departure clearance times, and generates and disseminates flight state data.
Supported by: Aeronautical and Surveillance common services

Taxi Routing
For improved taxi route efficiency, this capability provides for manual input to close and re-open taxiways, runways and their segments, integrated with controller displays.
Supported by: Aeronautical and Surveillance common services

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., ASDE-X, to additional airports, will be developed to improve runway safety.
Task Force: Surface

ASDE-X to Additional Airports
This increment provides for the completion of programmed ASDE-X installations at 35 airports and enables air traffic control to detect potential runway conflicts by providing detailed coverage of movement on runways and taxiways. By collecting data from a variety of sources, ASDE-X is able to track surface traffic operating in the airport movement area and obtain identification information from vehicle and aircraft transponders.
Supported by: Surveillance Common Service
Task Force: Surface Situational Awareness, Phase 1 (40)

ASSC
Nine airports in the NAS that use the ASDE-3/Airport Movement Area Safety System for situational awareness and surveillance of the airport surface will not receive an ASDE-X upgrade. Instead, they will receive ASSC, which will receive inputs from multilateration sensors, Automatic Dependent Surveillance–Broadcast (ADS-B) and Airport Surveillance Radar/Mode Select terminal radars. ASSC 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.
Supported by: Surveillance Common Service

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.

Moving Map with Own-Ship Position
Cockpit displays, for instance Electronic Flight Bags, may incorporate airport moving map displays that provide constantly changing views of an airport's runways, taxiways and structures to help pilots identify and anticipate the airplane's location on the surface.

Cockpit Display of Traffic Information (CDTI) with Traffic Information Service–Broadcast (TIS-B) and ADS-B for Surface
Surface traffic information is available via TIS-B for moving map displays, and available from aircraft operating with approved ADS-B capability. Using TIS-B and ADS-B, surface CDTI will provide a graphical depiction of ground and air traffic, and qualifying air traffic within close proximity to the runway. This will improve situational awareness for a variety of operations.
Supported by: Surveillance Common Service

Surface Indications and Alerts (SURF IA)
SURF IA is a runway safety application for flight crews of aircraft with CDTI/TIS-B/ADS-B where situations that may lead to or already represent a collision risk are highlighted on the moving map. Avionics for SURF IA are likely to require software and display quality assurance levels higher than those for CDTI only.

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

Improved Surface Operations

3 Cont'd

Enhanced Vision Systems (EVS) for Taxi
The FAA and industry are partnering to develop a taxi benefit for aircraft equipped with certified enhanced vision systems. Currently, EVS-equipped operators can use their enhanced vision systems 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 minima are lower than an airport's weather operating minima and if their aircraft are equipped with EVS. 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.
Task Force: Cross-Cutting

Revised Departure Clearance (DCL) via Data Comm
A DCL Data Comm ATC capability will enable rapid delivery of automated departure clearance revisions, due to weather or other airspace issues, to one or more departing aircraft equipped with Future Air Navigation System avionics.
Supported by: Communications Common Service
Task Force: Data Communications for Revised Departure Clearance, Weather Reroutes and Routine Communications (39)

5 OI 102406: Provide Full Surface Situation Information

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.

Situational Awareness and Alerting of Ground Vehicles
Equipment compatible with airport surface surveillance, e.g., 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 in the air traffic control tower and on the aircraft cockpit surface maps.
Supported by: Surveillance Common Service

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

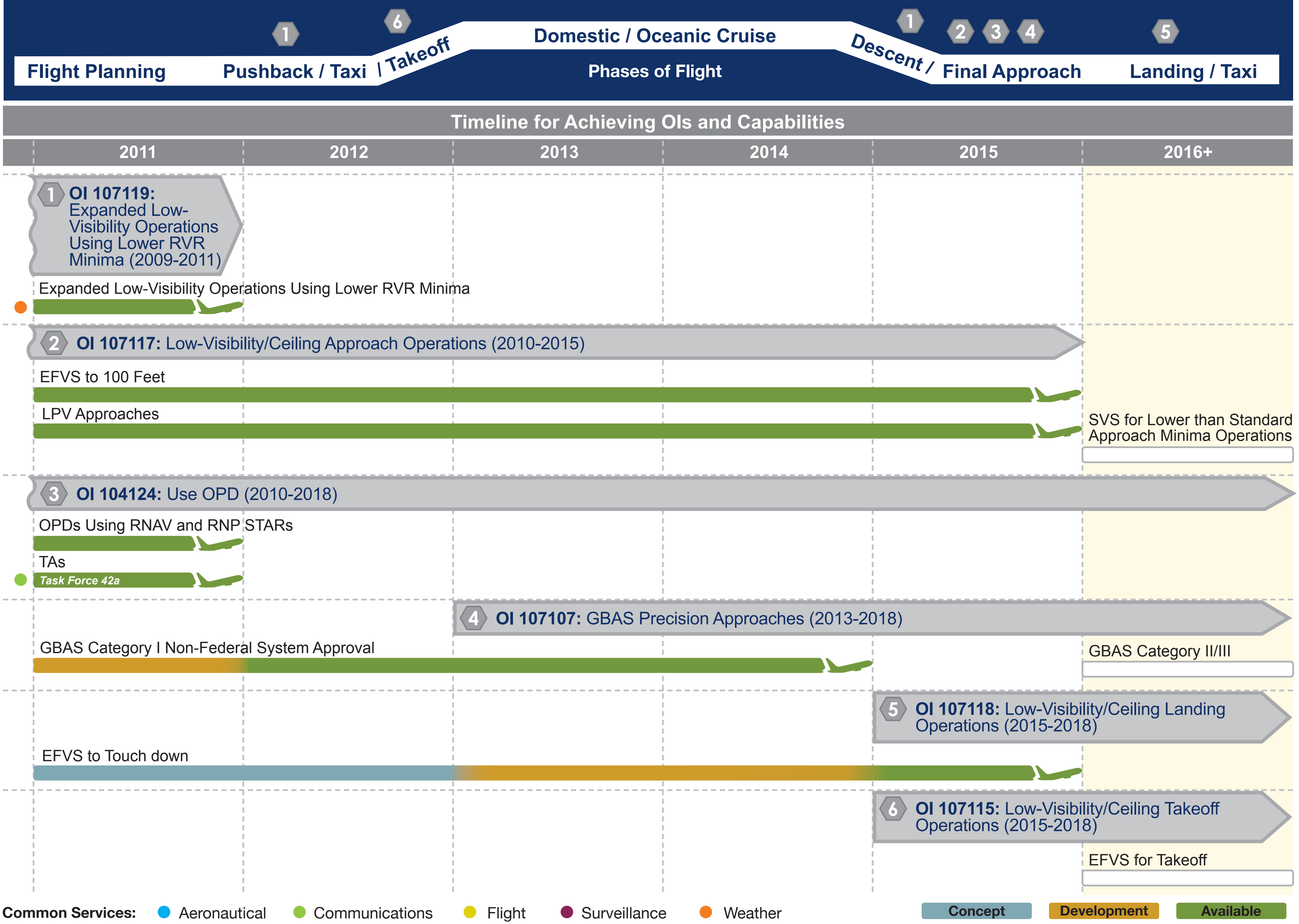
Selected Work Activities

Budget[1]	FY 2011	FY 2012	FY 2013 – Mid-term
1 OI 104209: Initial Surface Traffic Management (2010-2017)			
	✓ Installed DDUs at ASDE-X and ASDE-3/multilateration (MLAT) locations. Provided data dissemination capability at: ○ BWI ○ LAS ○ DCA ○ HNL ○ IAD ✓ Completed initial draft of benefits study on FAA-funded infrastructure to provide surface surveillance in non-movement area ✓ Prepared update to FAA Order 1200.22D	• Complete installation of DDUs at ASDE-X and ASDE-3/ MLAT locations. Provide data dissemination capability at: ○ DEN ○ MSP ○ MDW ○ SLC ○ MKE ○ ORD • Published FAA Order 1200.22E	• Declare departure routing operationally available at: ○ C90 ○ N90
2 OI 103207: Improved Runway Safety Situational Awareness for Controllers (2012-2016)			
	✓ Declared ASDE-X fully operational at: ○ LAS ○ BWI ○ MEM	• Award contract for ASSC	• Declare ASSC operationally available at: ○ PDX ○ MSY ○ CVG ○ ANC ○ PIT ○ CLE ○ MCI ○ SFO ○ ADW
3 OI 103208: Improved Runway Safety Situational Awareness for Pilots (2012-2016)			
	✓ Published installation guidance for ADS-B In systems		
4 OI 104207: Enhanced Surface Traffic Operations (2014-2018)			
Supported by NextGen Data Comm	✓ Initiated development of revised departure clearance capability in tower	• Achieve final investment decision for Data Comm tower service	• Declare revised DCL via Data Comm operationally available to suitably equipped operators
5 OI 102406: Provide Full Surface Situation Information (2016-2019)			
	✓ Finalized vehicle ADS-B specification	✓ Published vehicle ADS-B advisory circular 150/5220-26 • Declare situational awareness and alerting of ground vehicles operationally available at BOS	• Declare situational awareness and alerting of ground vehicles operationally available at: ○ DEN ○ ORD

[1] The selected work activities shown can be fully or partially funded by the NextGen budget.

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.



Improved Approaches and Low-Visibility Operations

Descriptions of OIs and Capabilities

1 OI 107119: Expanded Low-Visibility Operations Using Lower RVR Minima

Lowering Runway Visual Range (RVR) minima from 2,400 feet to 1,800 feet (or lower, depending on the airport and requirement) at selected airports using RVR systems, aircraft capabilities and procedural changes provide greater access to Core, satellite and feeder airports during low-visibility conditions.

Task Force: Surface

Expanded Low-Visibility Operations Using Lower RVR Minima
Supported by: Weather Common Service

2 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 Instrument Landing System (ILS) and other cockpit-based technologies or combinations of cockpit-based technologies and ground infrastructure.

Enhanced Flight Vision System (EFVS) to 100 Feet
The FAA is engaged in making new rules to enhance the benefits of having EFVS capability by allowing operators to dispatch and begin instrument approaches in more weather conditions than currently authorized.

Localizer Performance with Vertical Guidance (LPV) Approaches
LPV and Localizer Performance (LP) approaches are more cost-effective to implement in comparison with the installation of additional ground-based navigation aids (NAVAID) and the development of approach procedures for those NAVAIDs. Increasing the number of LPV/LP approaches will provide further incentives for users to equip with Global Positioning System (GPS)/Wide Area Augmentation System (WAAS). This improvement will provide increased utility to the more than 40,000 general aviation aircraft that are already WAAS-capable. In addition to LPV approach implementation, the FAA will deliver LP approaches to runways that do not qualify for LPVs due to obstacles.

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 (Category (Cat) II, special authorization (SA) Cat I, SA Cat II) or in lieu of certain ground infrastructure.

3 OI 104124: Use Optimized Profile Descent (OPD)

OPDs permit aircraft to remain at higher altitudes on arrival to the airport and use lower power settings during descent.

Task Force: Cross-Cutting

OPDs Using Area Navigation (RNAV) and Required Navigation Performance (RNP) Standard Terminal Arrival Routes (STAR)
OPD procedures are being implemented as RNAV STARs (eventually as RNP STARs, where necessary) with vertical profiles that are designed to allow aircraft to descend using reduced or even idle thrust settings from the top of descent to points along the downwind or final approach.

Tailored Arrivals (TA)
TAs are pre-planned, fixed routings assigned by oceanic air traffic control facilities and sent from the Oceanic Automation System (Ocean21) via data communications to suitably equipped aircraft (aircraft equipped with Future Air Navigation System 1/A) as an arrival clearance into coastal airports.
Supported by: Communications Common Service
Task Force: Communications for Revised Departure Clearance, Weather Reroutes and Routine Communications (42a)

4 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 Cat I is being implemented as a non-federal system on a per-airport request basis.

GBAS Category II/III
International Civil Aviation Organization-compliant standards for operational use of GBAS Cat II/III systems will be published by 2015.

5 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 Touch Down
The FAA is engaged in rulemaking that would permit EFVS to be used to touch down.

6 OI 107115: Low-Visibility/Ceiling Take-off Operations

Leverages same combination of head-up display, EFVS, SVS or advanced vision system to allow appropriately equipped aircraft to take off in low visibility conditions.

EFVS for Takeoff
The FAA is evaluating the use of EFVS for low-visibility takeoff operations and for authorization of increased operational benefit, beyond situational awareness and safety, for equipped users.

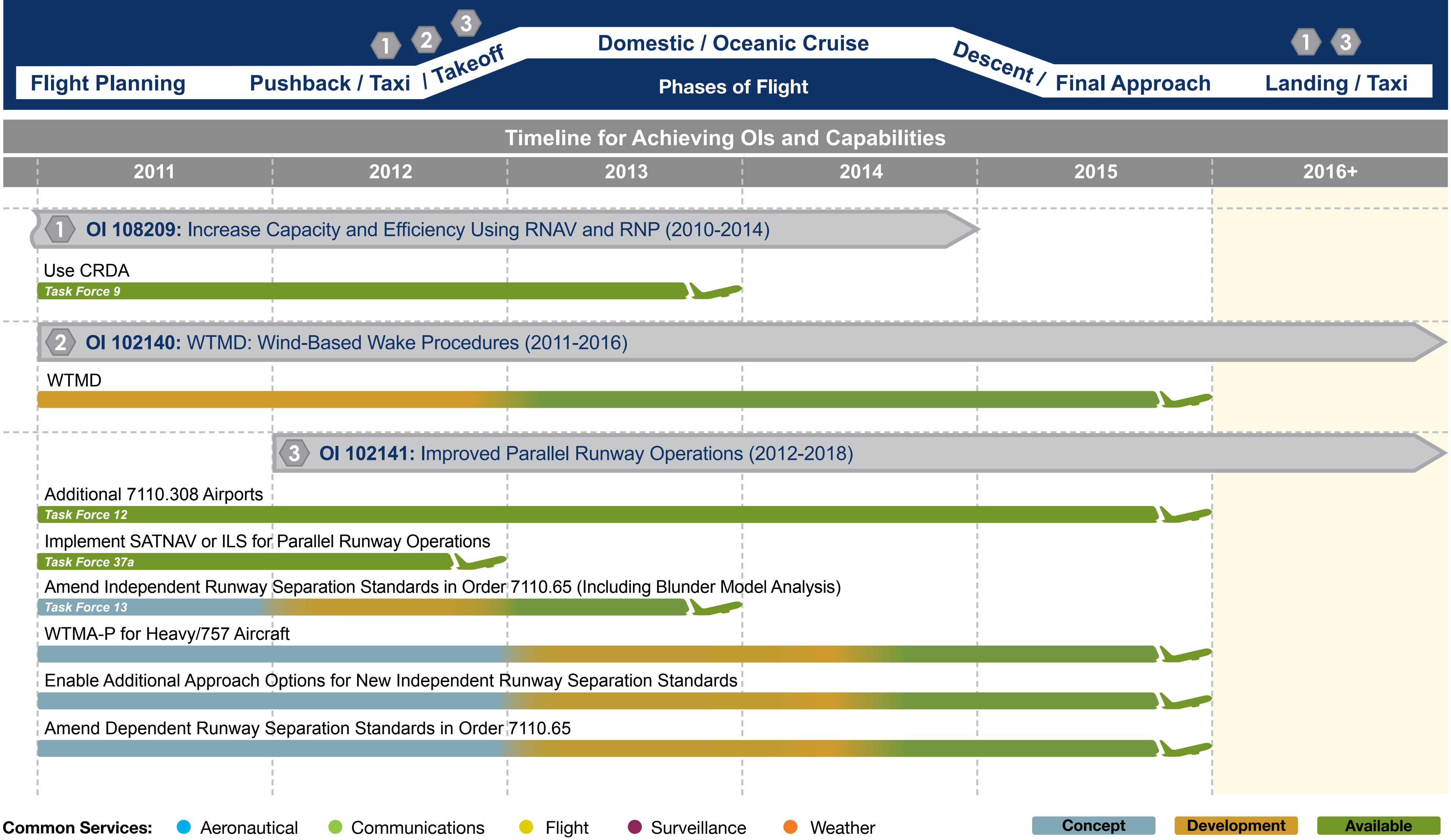
In Concept Exploration | In Development | Available at least one site

Improved Approaches and Low-Visibility Operations			
Selected Work Activities			
Budget[1]	**FY 2011**	**FY 2012**	**FY 2013 – Mid-term**
1 **OI 107119:** Expanded Low-Visibility Operations Using Lower RVR Minima (2009-2011)			
Supported by NextGen Flexible Terminal Environment	✓ Declared operationally available for suitably equipped operators ○ CLE runway 24L		
2 **OI 107117:** Low-Visibility/Ceiling Approach Operations (2010-2015)			
	✓ Published 517 WAAS/LPV and LP procedures ✓ Coordinated notice of proposed rulemaking (NPRM) for EFVS to 100 feet among FAA lines of business	• Publish 500 WAAS/LPV and LP procedures • 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
3 **OI 104124:** Use Optimized Profile Descent (2010-2018)			
	✓ Declared OPDs using RNAV and RNP STARs operationally available at: ○ CHS ○ HNL ○ PHX		
4 **OI 107107:** Ground Based Augmentation System (GBAS) Precision Approaches (2013-2018)			
Supported by NextGen Flexible Terminal Environment	✓ Collected radio frequency interference (RFI) data from GBAS Cat I system at IAH	• Declare GBAS Cat I system at IAH operationally available	
5 **OI 107118:** Low-Visibility/Ceiling Landing Operations (2015-2018)			
	✓ Coordinated EFVS to touch down NPRM among FAA lines of business	• 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

[1] The selected work activities shown can be fully or partially funded by the NextGen budget.

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.



Descriptions of OIs and Capabilities

1 OI 108209: Increase Capacity and Efficiency Using Area Navigation (RNAV) and Required Navigation Performance (RNP)

Both RNAV and RNP will enable more efficient aircraft trajectories. RNAV and RNP, combined with airspace changes, increase airspace efficiency and capacity.
Task Force: Runway Access

Use Converging Runway Display Aid (CRDA)
This activity is assessing the current use of CRDA functionality and facilitating the development of procedures to extend its use. It also supports the implementation of an arrival/departure window tool at selected sites.
Task Force: Increase Capacity and Throughput for Converging and Intersecting Runways (9)

2 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
Procedures are developed through 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 blowing an aircraft's wake away from the parallel runway's operating area.

3 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. It will expand the application of FAA Order 7110.308 beyond the locations and the 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)

Implement Satellite Navigation (SATNAV) or 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.
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 and implements this change at approved locations.
Task Force: Revise the Blunder Assumptions (13)

Wake Turbulence Mitigation for Arrivals-Procedures (WTMA-P) for Heavy/757 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.

Enable Additional Approach Options for New Independent Runway Separation Standards
This increment will enable use of additional Global Positioning System-based approach options with vertical guidance that may include Lateral Navigation/Vertical Navigation, RNP, and RNP Authorization Required for use in performing simultaneous independent parallel instrument approaches to runways at reduced lateral runway separation, i.e., less than 4,300 feet. 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 Instrument Landing System (ILS) is out of service or where no ILS currently exists.

Amend Dependent Runway Separation Standards in Order 7110.65
Based on data collected and analyzed in connection with the amendment of independent runway separation standards in FAA Order 7110.65 (including blunder model analysis), it is likely that a reduced diagonal stagger separation standard can be supported and meet the required level of safety. Work accomplished under this increment will support the safety analysis and additional work required to identify a revised separation standard and revise 7110.65 to permit this operation.

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

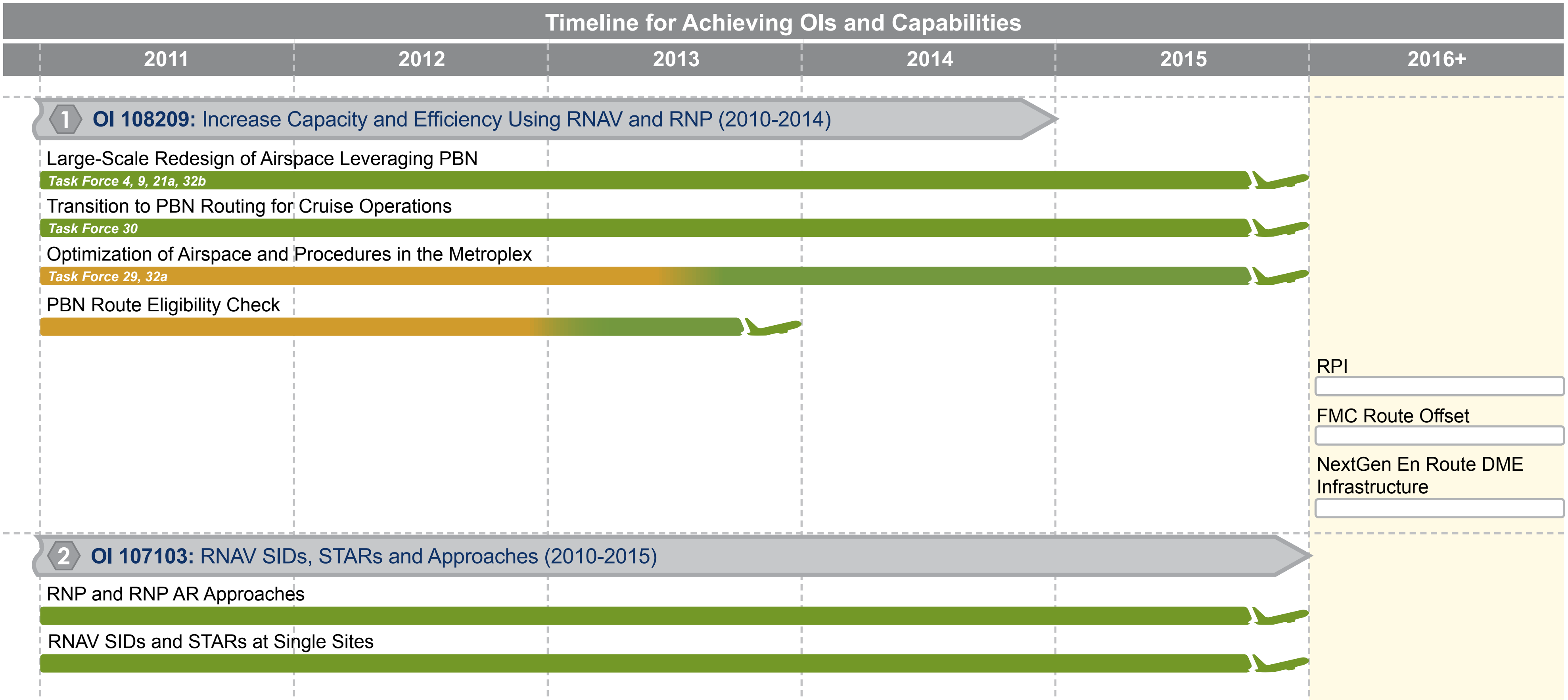
Improved Multiple Runway Operations

Selected Work Activities			
Budget[1]	FY 2011	FY 2012	FY 2013 – Mid-term
1 **OI 108209:** Increase Capacity and Efficiency Using Area Navigation (RNAV) and Required Navigation Performance (RNP) (2010-2014)			
	✓ Analyzed operations to determine potential CRDA benefits ✓ Developed site procedures and policy	• Develop CRDA training program for air traffic control specialists	• Implement expanded use of CRDA
2 **OI 102140:** Wake Turbulence Mitigation for Departures (WTMD): Wind-Based Wake Procedures (2011-2016)			
Supported by NextGen Flexible Terminal Environment	✓ Delivered WTMD training package for controllers at IAH	• Demonstrate WTMD at IAH	• Deliver WTMD system at: ○ SFO ○ MEM
3 **OI 102141:** Improved Parallel Runway Operations (2012-2018)			
Supported by NextGen Flexible Terminal Environment	✓ Completed blunder analysis report	• Review safety risk management document on proposed standards for independent runway separation • Expand the application of FAA Order 7110.308 at EWR and/or SFO	• Validate or revise blunder model

[1] The selected work activities shown can be fully or partially funded by the NextGen budget.

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.



Common Services: Aeronautical, Communications, Flight, Surveillance, Weather

Concept | Development | Available

Descriptions of OIs and Capabilities

1 OI 108209: Increase Capacity and Efficiency Using Area Navigation (RNAV) and Required Navigation (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 and Overarching

Integrated Airspace and Procedures

Large-Scale Redesign of Airspace Leveraging Performance Based Navigation (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 (OAPM) project become candidates for other integrated airspace and procedures efforts. Included in this increment are the legacy airspace management program projects. 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 Airport, 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 augments the conventional navigational aid (NAVAID)-based Jet and Victor airways with RNAV routes, including Q- and T-routes. RNAV routes offer an efficient way to navigate the airspace instead of NAVAID-to-NAVAID routing.
Task Force: Develop RNAV-Based En Route System (30)

OAPM
OAPM is a systematic and expedited approach to implementing PBN procedures and associated airspace changes in major metropolitan areas. Expected improvements from OAPM include efficient descents, diverging departure paths and decoupling of operations among airports within the metroplex airspace.
Task Force: Optimize and Increase RNAV Procedures (32a and 29)

Navigation System Infrastructure

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.

Air Traffic Tools/Automation

PBN Route Eligibility Check
En route air traffic control automation systems will check the eligibility of aircraft to operate on performance-restricted routes.

Relative Position Indicator (RPI)
RPI is a tool that can assist both air traffic controllers and traffic managers in managing the flow of traffic through a terminal area merge point.

Flight Management Computer (FMC) Route Offset
Automation provides controllers with support to amend an aircraft's flight plan to indicate that it has been placed on, or has been taken off, an FMC lateral offset.

2 OI 107103: RNAV Standard Instrument Departures (SID), Standard Terminal Arrival Routes (STAR) and Approaches

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

Task Force: NAS Access

RNP and RNP Authorization Required (AR) Approaches
RNP and RNP AR approaches are PBN 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 and RNP AR approaches is the ability to use curved, guided path segments known as radius-to-fix (RF).

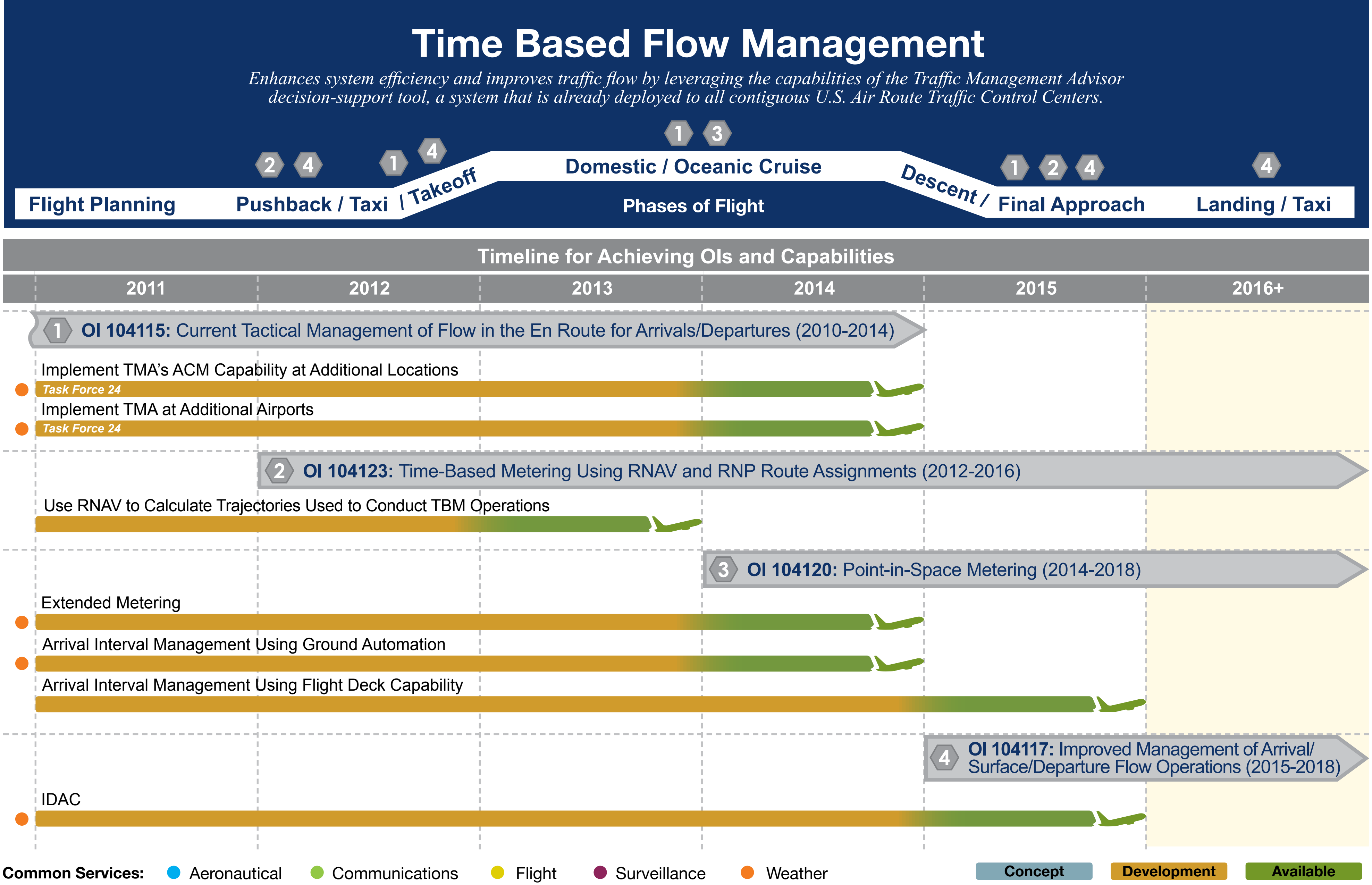
RNAV SIDs and STARs at Single Sites
These RNAV procedures address location-specific requirements and seek to add efficiency and optimize existing initial capability PBN procedures.

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

Performance Based Navigation

<table>
<tr><th colspan="4">Selected Work Activities</th></tr>
<tr><th>Budget[1]</th><th>FY 2011</th><th>FY 2012</th><th>FY 2013 – Mid-term</th></tr>
<tr><td colspan="4">1 OI 108209: Increase Capacity and Efficiency Using RNAV and RNP (2010-2014)</td></tr>
<tr><td>Supported by NextGen PBN-Metroplex RNAV/RNP</td><td>✓ Implemented Stage 2A: West Gate Expansion of New York/New Jersey/ Philadelphia Metropolitan Area Airspace Redesign
✓ Initiated ZAU airspace divestitures to GUS to enable a 10-sector low-altitude redesign which will improve efficiency and reduce complexity
✓ Completed HND procedure optimization
✓ Initiated design teams for implementation of PBN-optimized airspace and procedures at:
○ Washington Metroplex
○ North Texas Metroplex
✓ Initiated study teams for implementation of PBN-optimized airspace and procedures at:
○ Charlotte Metroplex
○ Northern California Metroplex
○ Atlanta Metroplex
○ Houston Metroplex
✓ Completed ZOA 13 Q-routes implementation</td><td>• Implement remaining stages of New York/New Jersey/ Philadelphia Metropolitan Area Airspace Redesign
○ Stage 2B: PHL route expansion and 3rd dispersal heading
○ Stage 3: North Gate realignment
○ Stage 4: full airspace integration
• Complete Las Vegas optimization environmental assessment
• Initiate design teams for implementation of PBN-optimized airspace and procedures at:
○ Charlotte Metroplex
○ Southern California Metroplex
○ Atlanta Metroplex
○ Houston Metroplex
• Select sites for next set of study teams for implementation of PBN-optimized airspace and procedures
• Complete ZAB (1 route) Q 37 route implementation
• Complete implementation of ZNY 4 Q-routes
• Declare PBN route eligibility check operationally available at key sites
• Complete ZSE 9 Q-routes implementation
• Complete ZBW 3 T-routes implementation</td><td>• Implement Las Vegas procedure optimization
• Implement Stage 3: West Side of Chicago Airspace Program (coincident with O'Hare Modernization Project runway 10C/28C completion)
• Complete implementation of PBN-optimized airspace and procedures for metroplexes</td></tr>
<tr><td colspan="4">2 OI 107103: RNAV SIDs, STARs and Approaches (2010-2015)</td></tr>
<tr><td></td><td>✓ Published 155 PBN procedures including:
○ 49 RNAV Routes
○ 55 RNAV SIDs/STARs
○ 51 RNP AR</td><td>• Complete 4 STARs at BOS
• Complete 12 RNPs at DEN
• Complete 2 SIDs at MSP
• Complete 2 STARs at LAX
• Complete 18 SIDs and 4 STARs at MEM
• Complete 4 SIDs at MIA</td><td>• Complete 2 RNPs, 13 SIDs and 12 STARs at MSP
• Complete 14 SIDs and 19 STARs (2 with OPDs) at DEN
• Complete 1 SID and 1 STAR at LAX
• Complete 5 SIDs at PHX
• Complete 12 RNPs and 4 STARs at SEA
• Complete 3 RNPs at SLC
• Complete 4 STARs and 4 RNPs at TPA</td></tr>
</table>

[1] The selected work activities shown can be fully or partially funded by the NextGen budget.


Time Based Flow Management
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.
Flight Planning
2 4
Pushback / Taxi
1 4
/ Takeoff
1 3
Domestic / Oceanic Cruise
Phases of Flight
Descent /
1 2 4
Final Approach
4
Landing / Taxi
Timeline for Achieving OIs and Capabilities
2011
2012
2013
2014
2015
2016+
1 OI 104115: Current Tactical Management of Flow in the En Route for Arrivals/Departures (2010-2014)
Implement TMA's ACM Capability at Additional Locations
Task Force 24
Implement TMA at Additional Airports
Task Force 24
2 OI 104123: Time-Based Metering Using RNAV and RNP Route Assignments (2012-2016)
Use RNAV to Calculate Trajectories Used to Conduct TBM Operations
3 OI 104120: Point-in-Space Metering (2014-2018)
Extended Metering
Arrival Interval Management Using Ground Automation
Arrival Interval Management Using Flight Deck Capability
4 OI 104117: Improved Management of Arrival/ Surface/Departure Flow Operations (2015-2018)
IDAC
Common Services:
Aeronautical
Communications
Flight
Surveillance
Weather
Concept
Development
Available

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 (NAS) efficiency and capacity in the arrival and departure phases of flight.
Task Force: Cruise

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

2 OI 104123: Time-Based Metering Using Area Navigation (RNAV) and Required Navigation Performance (RNP) Route Assignments

RNAV, RNP and time-based metering (TBM) 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 RNAV to Calculate Trajectories Used to Conduct TBM Operations
The Terminal Radar Approach Control (TRACON) RNAV routes for both standard instrument departures and standard terminal arrival routes will be used for TBFM to calculate the terminal component of aircraft trajectories.

3 OI 104120: Point-in-Space Metering

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.

Extended Metering
Provide flow deconfliction for metered aircraft at the meter reference points (in addition to meter fixes).
Supported by: Weather Common Service

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 maneuver aircraft to meet metering times while providing the opportunity for aircraft to fly optimized descents to the meter fix TRACON facility boundary).
Supported by: Weather Common Service

Arrival Interval Management Using Flight Deck Capability
Allow for flight efficiency improvements by enabling additional optimized descent opportunities while maintaining throughput, and by delivering operationally acceptable spacing between subsequent arrivals on final approach.

4 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 increases NAS 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.
Supported by: Weather Common Service

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

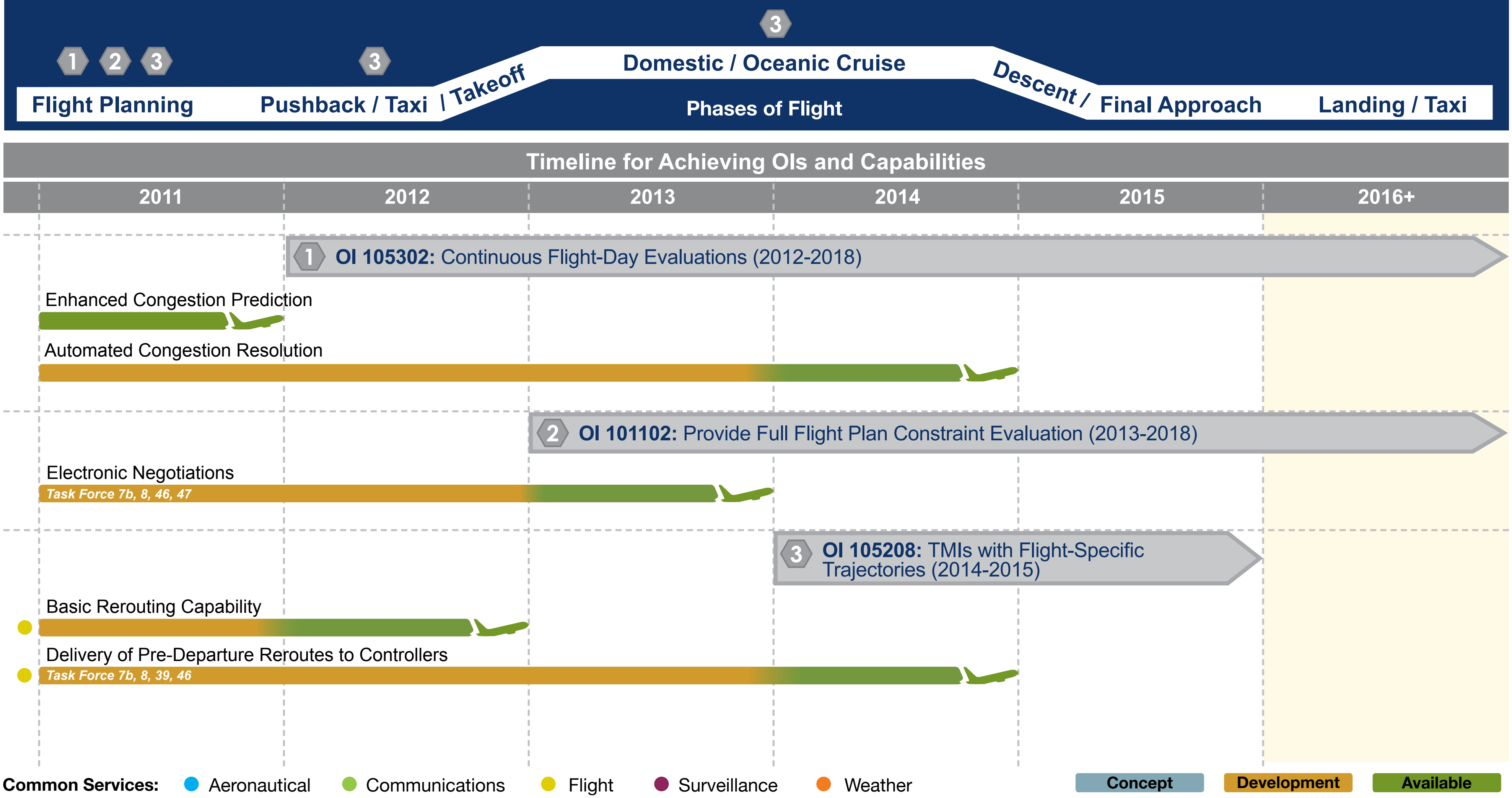
Time Based Flow Management

Selected Work Activities			
Budget[1]	**FY 2011**	**FY 2012**	**FY 2013 – Mid-term**
1 **OI 104115:** Current Tactical Management of Flow in the En Route for Arrivals/Departures (2010-2014)			
Supported by NextGen TBFM	✓ Conducted initial key site survey for TBFM/TMA ✓ Implemented TMA at additional airports: ○ SAN	• Develop site integration and deployment plan • Implement TMA's ACM capability at additional airports: ○ SFO	• Implement TMA at additional airports: ○ TEB ○ MMU ○ CLE ○ DCA ○ BWI • Implement TMA's ACM capability at additional airports: ○ ATL ○ LAX ○ SAN ○ IAD
2 **OI 104123:** Time-Based Metering Using RNAV and RNP Route Assignments (2012-2016)			
Supported by NextGen TBFM	✓ Initiated requirements analysis for use of RNAV route data to calculate trajectories used to conduct TBM operations	• Initiate software development	• TBM using RNAV and RNP route assignments operationally available at an ARTCC
3 **OI 104120:** Point-in-Space Metering (2014-2018)			
Supported by NextGen TBFM and ADS-B	✓ Completed analysis phase for an improved training program for traffic management ✓ Deployed coupled scheduling capability for key site evaluation as a precursor to ground interval management ✓ Refined concept and developed system-level requirements for ground interval management	• Complete course design phase for an improved training program for traffic management • Update concept and requirements document • Begin development of flight deck interval management minimum operational performance standards	• Deliver improved Traffic Management Coordinator training to traffic management • Declare arrival interval management using ground automation available in the NAS • Declare arrival interval management using flight deck capability available for suitably equipped operators
4 **OI 104117:** Improved Management of Arrival/Surface/Departure Flow Operations (2015-2018)			
Supported by NextGen TBFM	✓ Initiated requirements analysis for the integrated departure/arrival capability	• Initiate software development	• Declare IDAC operationally available at an ARTCC and an airport

[1] The selected work activities shown can be fully or partially funded by the NextGen budget.

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.



Descriptions of OIs and Capabilities

1 OI 105302: Continuous Flight Day Evaluations

Continuous (real-time) constraints are provided to Air Navigation Service Provider (ANSP) traffic management decision-support tools and the National Airspace System (NAS) users.

Enhanced Congestion Prediction
The enhanced congestion prediction increment provides improved capabilities to assess the impact of a set of reroutes on the level of demand and other performance metrics for a point of interest.

Automated Congestion Resolution
The automated congestion resolution increment recommends reroutes for flight-specific Traffic Management Initiatives (TMIs). This allows the traffic manager to adjust the target parameters and evaluate the required trajectory adjustments.

2 OI 101102: Provide Full Flight Plan Constraint Evaluation

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

Electronic Negotiations
The electronic negotiations increment provides flight planners with information about congestion along their intended routes and proposes flight-specific rerouting.
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)

3 OI 105208: TMIs with Flight-Specific Trajectories

This capability will increase the agility of the 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

Basic Rerouting Capability
This capability is the means by which Traffic Flow Management System-generated reroutes are defined and transmitted via System Wide Information Management.
Supported by: Flight Common Service

Delivery of Pre-Departure Reroutes to Controllers
This increment will give En Route Automation Modernization additional capabilities to receive amended routes pre-departure and provide updated flight data to tower controllers.
Supported by: Flight Common Service
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)

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

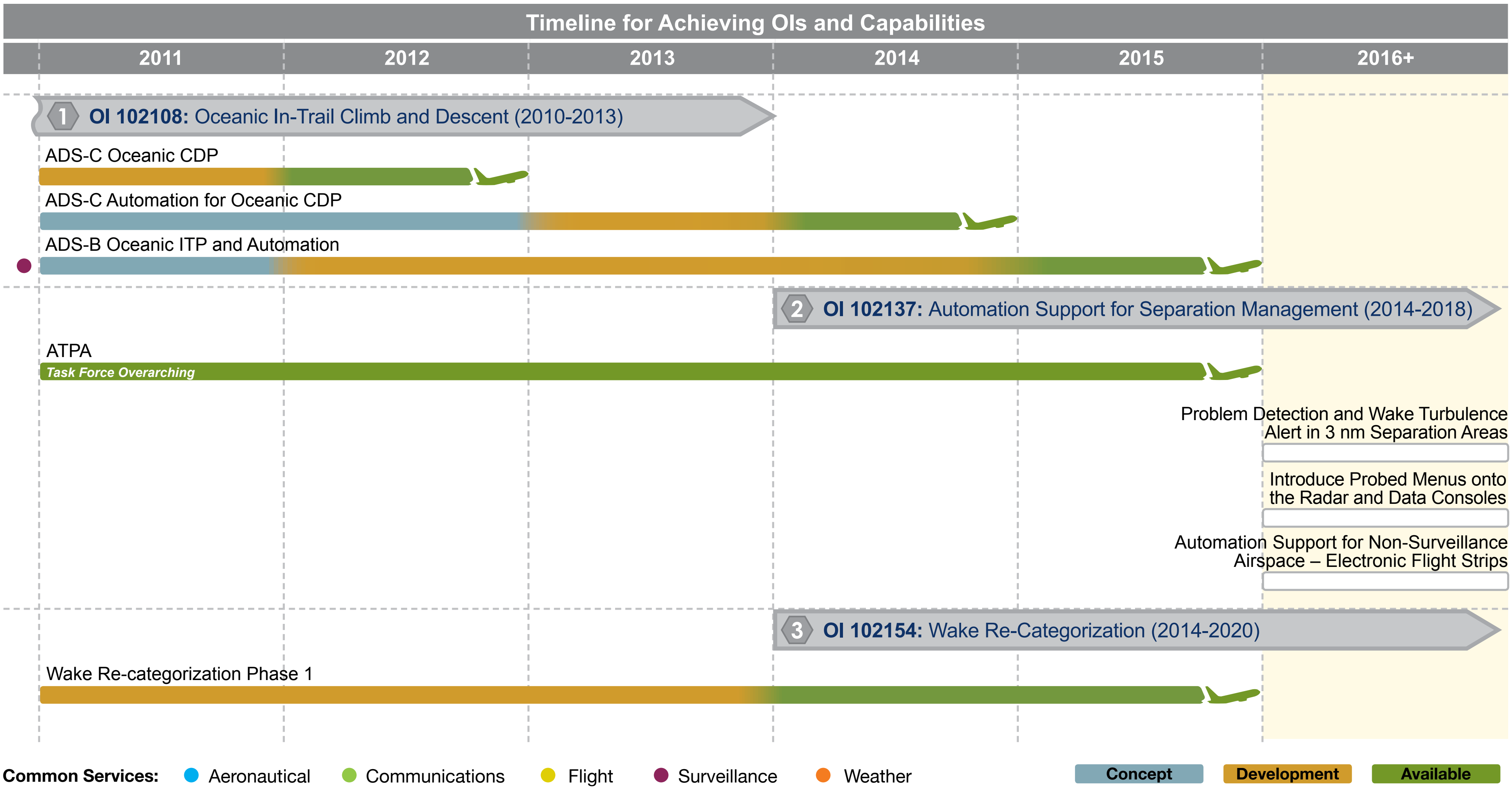
Selected Work Activities

Budget[1]	FY 2011	FY 2012	FY 2013 – Mid-term
1 OI 105302: Continuous Flight Day Evaluations (2012-2018)			
Supported by NextGen CATMT	✓ Completed traffic flow management capabilities roadmap	• Complete requirements analysis for automated congestion resolution	• Declare automated congestion resolution operational for strategic and tactical constraints
2 OI 101102: Provide Full Flight Plan Constraint Evaluation (2013-2018)			
	✓ Completed requirements analysis for electronic negotiations	• Complete factory acceptance testing for electronic negotiations • Complete operational testing with user flight planning interfaces for electronic negotiations	• Declare electronic negotiations operationally available for strategic constraints
3 OI 105208: TMIs with Flight-Specific Trajectories (2014-2015)			
Supported by NextGen CATMT	✓ Declared initial operating capability for basic rerouting	• Conduct system integration for pre-departure reroute capability	• Declare pre-departure reroute capability available at all air traffic control towers

[1] The selected work activities shown can be fully or partially funded by the NextGen budget.

Separation Management

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



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 (CDP)
The ADS-C CDP (previously known as ADS-C in-trail procedure, or ITP) is a new concept that allows a properly equipped aircraft (aircraft equipped with Future Air Navigation System (FANS) 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 altitude.

ADS-C Automation for Oceanic CDP
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 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 ITP and Automation
The ADS-B ITP will enable aircraft equipped with ADS-B and appropriate onboard automation to climb and descend through altitudes where current non-ADS-B separation standards would prevent desired altitude changes.
Supported by: Surveillance Common Service

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

Automated Terminal Proximity Alert (ATPA)
ATPA is an air traffic control automation tool that provides situational awareness and alerts to controllers on color displays of Common Automated Radar Terminal System and on Standard Terminal Automation Replacement System displays. ATPA provides decision support information to controllers to make spacing adjustments needed to safely achieve optimal final approach spacing and efficiency.
Task Force: Achieving Existing 3- and 5-mile Separation Standards

Problem Detection and Wake Turbulence Alert in 3-Nautical-Mile (nm) Separation 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.

Introduce Probed Menus onto the Radar and Data Consoles
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.

Automation Support for Non-Surveillance Airspace — Electronic Flight Strips
The en route automation will use electronic flight data, eliminating the need for paper flight strips. This capability will provide automation support to areas without radar or ADS-B and for aircraft in these areas that are not ADS-B equipped. The automation will distinguish non-surveillance flights on the display.

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.

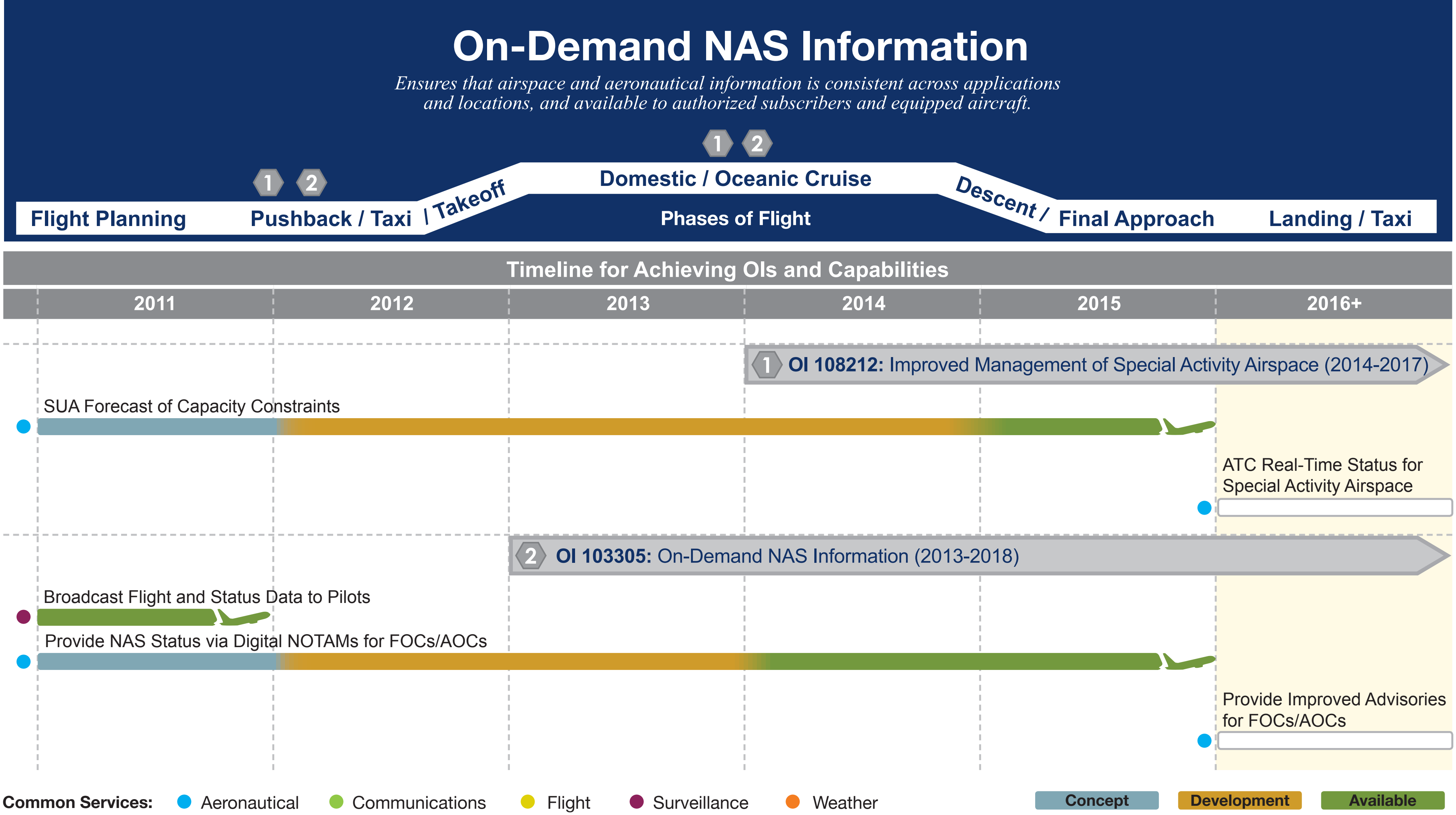
Wake Re-Categorization Phase 1 — Aircraft Re-Categorization
Wake re-categorization is a joint effort between the FAA and the European Organization for the Safety of Air Navigation (EUROCONTROL) that identifies changes to the International Civil Aviation Organization (ICAO) aircraft weight categories for improved throughput at capacity-constrained, high-density airports while maintaining or improving wake safety. The re-categorization will require document changes to reflect the new separation standards.

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

Separation Management

Budget[1]	FY 2011	FY 2012	FY 2013 – Mid-term
Selected Work Activities			
OI 102108: Oceanic In-Trail Climb and Descent (2010-2013)			
Supported by NextGen Trajectory Based Operations and ADS-B	✓ Completed the ADS-C CDP operations trial briefing package ✓ Began ADS-B ITP operational evaluation flights in the Pacific	• Complete ADS-C CDP operational trial • Conduct ADS-C CDP automation transition • Complete ITP operational evaluation interim analysis • Complete ITP operational evaluation flights in the Pacific	• Complete ADS-B NAS-wide infrastructure deployment
OI 102137: Automation Support for Separation Management (2014-2018)			
Supported by Flexible Terminal Environment	✓ ATPA service available at Common Automated Radar Terminal System facilities with color displays at: ○ C90 ○ STL ○ MSP	• ATPA service available at CARTS facilities with color displays at: ○ DEN ○ SCT ○ NCT ○ SDF ○ A80 ○ PCT ○ N90 • Conduct ATPA integration and developmental test	• Implement ATPA in a Standard Terminal Automation Replacement System facility
OI 102154: Wake Re-Categorization (2014-2020)			
Supported by NextGen System Development	✓ Completed 6 Category SRMD Coordination	• Complete draft changes to FAA Orders for implementing the 6 Category wake separation standards • Complete draft supporting SRMD and implementation strategy for changes to NAS automation	• Complete development of requirements for implementing the dynamic wake separation standards and processes • Complete development of aircraft type leader/follower-based wake separation standards along with implementing procedures and processes

[1] The selected work activities shown can be fully or partially funded by the NextGen budget.


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 2
1 2
Flight Planning
Pushback / Taxi
/ Takeoff
Domestic / Oceanic Cruise
Phases of Flight
Descent /
Final Approach
Landing / Taxi
Timeline for Achieving OIs and Capabilities
2011
2012
2013
2014
2015
2016+
1 OI 108212: Improved Management of Special Activity Airspace (2014-2017)
SUA Forecast of Capacity Constraints
ATC Real-Time Status for Special Activity Airspace
2 OI 103305: On-Demand NAS Information (2013-2018)
Broadcast Flight and Status Data to Pilots
Provide NAS Status via Digital NOTAMs for FOCs/AOCs
Provide Improved Advisories for FOCs/AOCs
Common Services:
Aeronautical
Communications
Flight
Surveillance
Weather
Concept
Development
Available

On-Demand NAS Information

Descriptions of OIs and Capabilities

1 OI 108212: Improved Management of Special Activity Airspace (SAA)

Changes to status of airspace for special use are readily available for operators and Air Navigation Service Providers. 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.

Special Use Airspace (SUA) Forecast of Capacity Constraints
This increment translates the SUA activation schedule and knowledge of the airspace configurations into predicted traffic flow constraints. Route impact assessments would therefore include forecast airspace capacity loss and route blockage, including SUAs.
Supported by: Aeronautical Common Service

Air Traffic Control 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 systems flights, space flight and re-entry, restricted or warning areas and flight training areas are managed on an as-needed basis.
Supported by: Aeronautical Common Service

2 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.

Broadcast Flight and Status Data to Pilots
This increment provides nationwide service coverage to deliver Traffic Information Services–Broadcast for both Universal Access Transceiver (UAT) and 1090 MHz Mode S Extended Squitter. The increment also provides nationwide service coverage to deliver Flight Information Services–Broadcast for UAT. Flight information services from the essential services specification are available for UAT operators.
Supported by: Surveillance Common Service

Provide NAS Status via Digital Notice to Airmen (NOTAM) for Flight Operations Centers (FOC)/Airline Operations Centers (AOC)
This increment enables the issuance of digital NOTAMs for those airspace constraints affecting a flight based on its trajectory.
Supported by: Aeronautical Common Service

Provide Improved Advisories for FOCs/AOCs
This increment ensures that NAS and aeronautical information is consistent, allowing users to subscribe to and receive the most current information from a single source. The information follows the Aeronautical Information Exchange Model standard and is distributed via System Wide Information Management (SWIM).
Supported by: Aeronautical Common Service

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

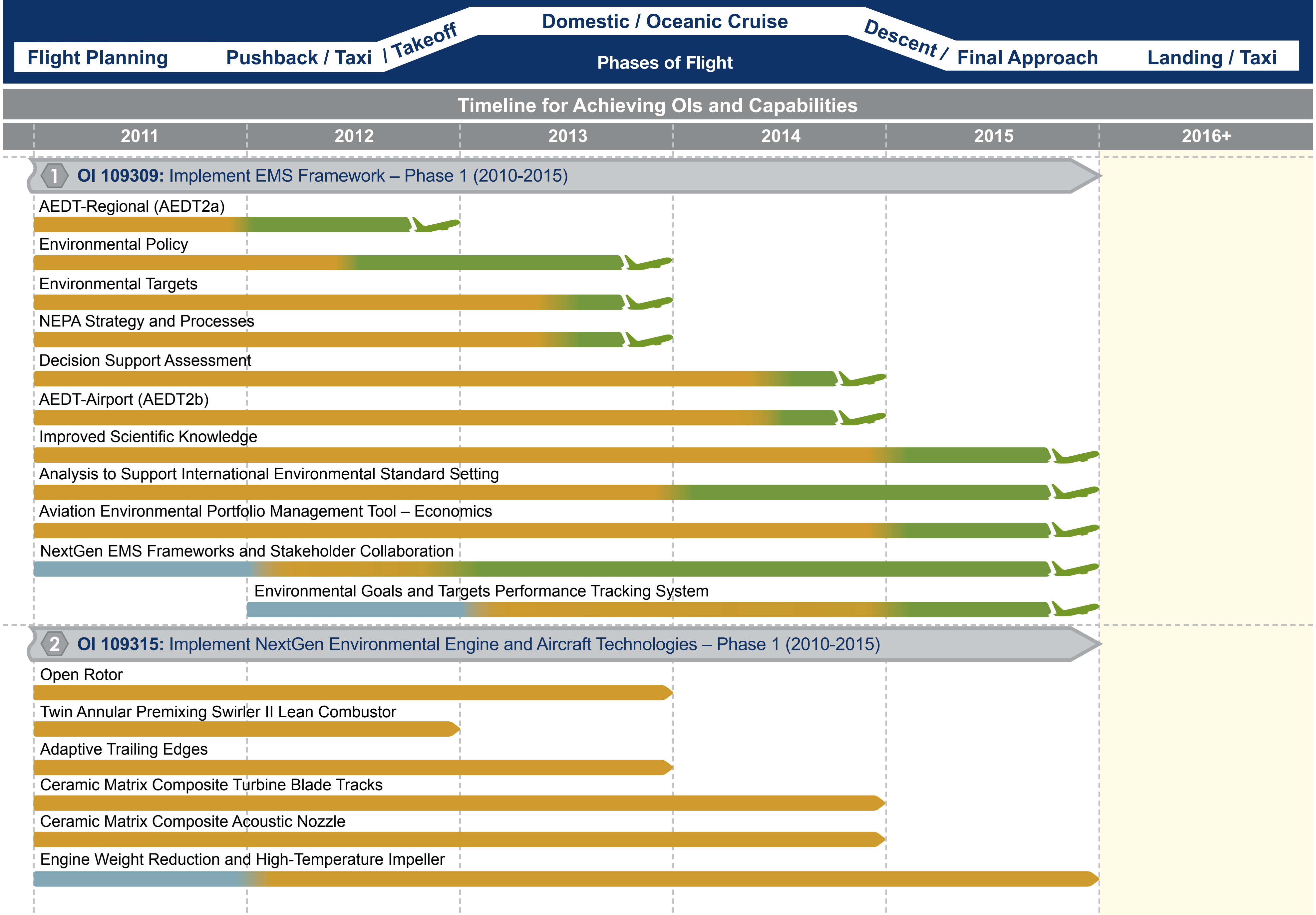
Selected Work Activities

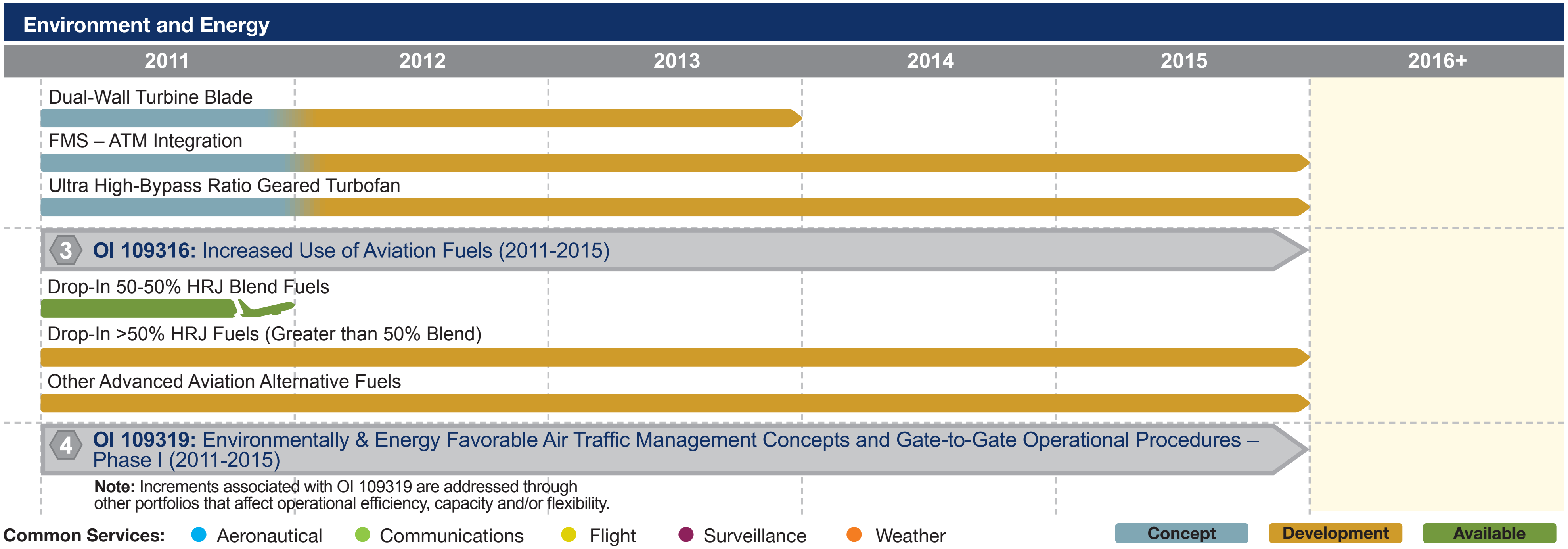
Budget[1]	FY 2011	FY 2012	FY 2013 – Mid-term
1 OI 108212: Improved Management of Special Activity Airspace (2014-2017)			
Supported by NextGen Collaborative Air Traffic Management (CATM), CATMT and SWIM	✓ Conducted central scheduling enterprise demonstration ✓ Conducted Open Geospatial Consortium (OGC) SAA pilot demonstration of SWIM SAA data provision to airlines	• Deploy SWIM enterprise messaging nodes based on internal user demand at: ○ ATL ○ ZLC • Complete prototype development and demonstrations of Airport Survey Collection, SUA editing capability, and Aeronautical Common Service information • Conduct airborne access to SWIM Operational and Technical Requirements Industry Day • Develop the requirements for Aeronautical Information Management (AIM), SWIM, and Traffic Flow Management System (TFMS) interface for SUA	• Develop AIM, SWIM, and TFMS interface requirements • Initiate work on collaborative information exchange, which integrates SUA data into the TFMS system and displays it on the Traffic Situational Display • Develop aeronautical information data storage enhancements for SUA management and airport data • Conduct operational testing of SUA services
2 OI 103305: On-Demand NAS Information (2013-2018)			
Supported by NextGen ADS-B, CATMT and SWIM	✓ Developed initial functional requirements for Aeronautical Common Service infrastructure (business process management, data management, identity management, integration of commercial off the shelf tools and SWIM core services)	• Prototype Aeronautical Common Service infrastructure through integration of commercial off-the-shelf tools	• Configure NAS enterprise messaging service (NEMS) to support AIM software deployment

[1] The selected work activities shown can be fully or partially funded by the NextGen budget.

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.





Descriptions of OIs and Capabilities

1 OI 109309: Implement Environmental Management System (EMS) Framework – Phase 1

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

Aviation Environmental Design Tool (AEDT) — Regional (AEDT2a)
The AEDT will provide capabilities for integrated environmental analysis at regional levels for fuel burn, emissions and noise.

Environmental Policy
This enabling activity will refine and formalize NextGen environmental and energy policy, including NextGen environmental goals.

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

National Environmental Policy Act (NEPA) Strategy and Processes
This enabling activity establishes effective strategic approaches for addressing the NEPA requirements of NextGen improvements.

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 (those related to flow contingency management and trajectory flow).

AEDT — Airport (AEDT2b)
The AEDT will provide capabilities for integrated environmental analysis at airport levels for fuel burn, emissions and noise.

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.

Analysis to Support International Environmental Standard-setting
This enabling activity addresses analysis and benefit assessment to support the development and implementation of International Civil Aviation Organization (ICAO) environmental standards, such as for aircraft carbon dioxide emissions and more stringent noise levels.

Aviation Environmental Portfolio Management Tool (APMT) — Economics
Capabilities of the APMT will be enhanced continuously 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.

NextGen EMS Frameworks and Stakeholder Collaboration
Standardized approaches will be identified for aviation stakeholders 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.

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.

Descriptions of OIs and Capabilities (cont'd)

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
Twin Annular Premixing Swirler II Lean Combustor
Adaptive Trailing Edges
Ceramic Matrix Composite Turbine Blade Tracks
Ceramic Matrix Composite Acoustic Nozzle
Engine Weight Reduction and High-Temperature Impeller
Dual-Wall Turbine Blade
Flight Management System (FMS) – Air Traffic Management (ATM) Integration
Ultra High-Bypass Ratio Geared Turbofan

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)[1] 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 50-50 Percent HRJ Blend Fuels
This enabling activity will result in ASTM International approval in 2011 of a 50-50 blend of HRJ and Jet-A fuel for use in commercial aviation.

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

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 (advanced fermentation, alcohol oligomerization, pyrolysis, etc.) by 2015. Efforts include environmental and performance feasibility through air quality and life-cycle emissions analyses, fuel properties analysis, engine performance evaluation and ground tests and flight demonstrations. 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.

[1] HRJ has been relabeled as HEFA by ASTM.

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

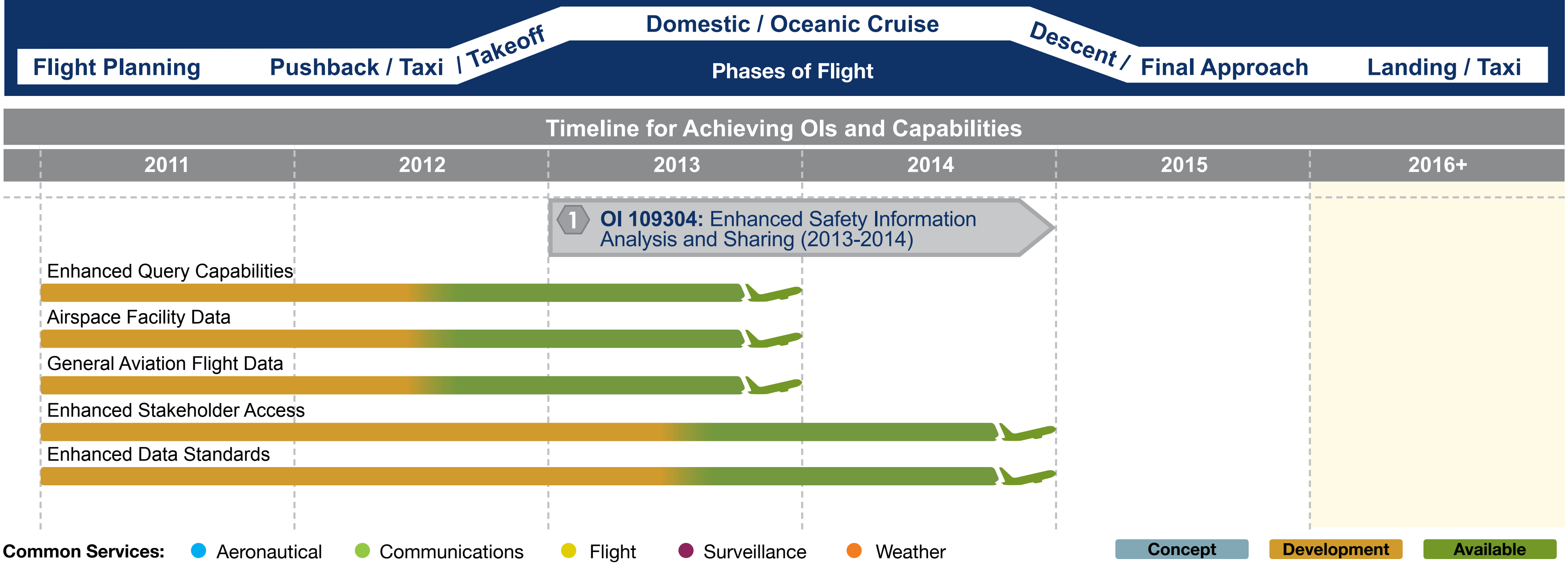
Environment and Energy

Selected Work Activities			
Budget[1]	FY 2011	FY 2012	FY 2013 – Mid-term
1 OI 109309: Implement EMS Framework – Phase 1 (2010-2015)			
Supported by NextGen System Development	✓ Circulated draft aviation environment and energy policy across FAA lines of business	• Draft aviation environment and energy policy for FAA approval • Draft quantitative NextGen targets for noise, climate and energy • Investigate metrics for aircraft carbon dioxide emissions standards • Publicly release AEDT-regional tool (AEDT2a)	• Coordinate and publicly issue aviation environment and energy policy • Refine quantitative targets supporting NextGen goals for noise, air quality, climate and energy • Develop approach for integrating NEPA considerations into existing FAA guidance • 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 (2010-2015)			
Supported by NextGen System Development	✓ Matured and demonstrated at the following technical readiness levels (TRL): ○ Twin Annular Premixing Swirler II Lean Combustor (TRL 4) ○ Adaptive Trailing Edges (TRL 5)	• Mature and demonstrate at the following TRLs: ○ Twin Annular Premixing Swirler II Lean Combustor (TRL 5) ○ Adaptive Trailing Edges (TRL 6) ○ Ceramic Matrix Composite Turbine Blade Tracks (TRL 5) ○ Ceramic Matrix Composite Acoustic Nozzle (TRL 6) ○ Engine Weight Reduction and High-Temperature Impeller (TRL 5) ○ Dual-Wall Turbine Blade (TRL 5)	• Mature and demonstrate at the following TRLs: ○ Open Rotor (TRL 5) ○ Twin Annular Premixing Swirler II Lean Combustor (TRL 6) ○ Adaptive Trailing Edges (TRL 7) ○ Ceramic Matrix Composite Turbine Blade Tracks (TRL 6) ○ Ceramic Matrix Composite Acoustic Nozzle (TRL 7) ○ Engine Weight Reduction and High-Temperature Impeller (TRL 6) ○ Dual-Wall Turbine Blade (TRL 6) ○ Flight Management System (FMS) – Air Traffic Management (ATM) Integration (TRL 5) ○ Ultra High-Bypass Ratio Geared Turbofan (TRL 5)
3 OI 109316: Increased Use of Alternative Aviation Fuels – Phase 1 (2011-2015)			
Supported by NextGen System Development	✓ Received ASTM International approval of 50-50 blend of HRJ and Jet-A fuel for use in aviation	• Develop 100 percent HRJ alternative aviation fuel (biofuel) characterization Fuel Readiness Level (FRL) 3-4	• Conduct flight test demonstration of 100 percent HRJ alternative fuel (FRL 7)

[1] The selected work activities shown can be fully or partially funded by the NextGen budget.

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.



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.

Enhanced Query Capabilities
This enabling activity focuses on developing the capability to query multiple databases with one search directive, through the transformation of a query or set of search parameters to be applied to individually housed and maintained data sets.

Airspace Facility Data
This enabling activity expands ASIAS to include additional data from FAA's Air Traffic Organization (ATO), including National Airspace System (NAS) facility performance data. This will provide an understanding of the impacts that unplanned facility service interruptions have on safety.

General Aviation Flight Data
This enabling activity focuses on the development of data standards and integration capabilities to include general aviation (GA) digital flight data (similar to Flight Operational Quality Assurance (FOQA) data) into ASIAS, including business jet operations.

Enhanced Stakeholder Access
This enabling activity will continue to develop the ASIAS web portal to allow full collaboration among participants, including access to selected aggregated, fused data sets and expanded analytical capabilities by ASIAS participants for their internal analysis.

Enhanced Data Standards
This enabling activity continues to develop and implement data standards within the ASIAS community, focusing on the implementation of new FOQA data standards and standards for voluntarily submitted text reports, such as the Aviation Safety Action Program (ASAP) and the Air Traffic Aviation Safety Action Program (ATSAP).

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

System Safety Management

Selected Work Activities			
Budget[1]	**FY 2011**	**FY 2012**	**FY 2013 – Mid-term**
OI 109304: Enhanced Safety Information Analysis and Sharing (2013-2014)			
Supported by NextGen System Develop-ment	✓ Provided capability across all commercial aviation nodes to fuse data from public and non-public sources while maintaining data protection ✓ Evolved more sophisticated text mining capabilities across data sources, including flight operations, maintenance, dispatch, air traffic control operations and aviation safety reporting system ✓ Provided initial ability to automatically monitor for unknown risk based on complex text mining capabilities and seamless data sources ✓ Integrated data from at least one additional class of operations domestic airspace ✓ Conducted demonstration project with Joint Planning and Development Office participants for analysis of safety metrics and directed studies	• Deploy capabilities that fuse text and digital data from proprietary and government sources • Develop information retrieval system for single search directive across proprietary and government data sources of digital and textual data • Incorporate NAS facility performance and additional data from ATO into ASIAS database, i.e., outage data, traffic management data, sector complexity data • Develop metrics for measuring system safety comparing operational and degraded services for unplanned facility service interruptions fusing facility and operational safety data • Establish agreements with the FAA Center of Excellence for General Aviation Research and National Business Aircraft Association for exploratory use of general aviation digital flight data • Develop risk-based, statistically significant goals for incorporation of general aviation (focusing on business operations) within ASIAS	• 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 • 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 • Access by FAA and ASIAS participants to data visualization tools on the ASIAS portal that allow the users to customize parameters and visualization for their own analysis • Establish required data standards for all voluntary safety reports used by ASIAS, including ASAP for all domains and ATSAP reports

[1] The selected work activities shown can be fully or partially funded by the NextGen budget.

Concept Maturity and System Development

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)
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.

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.

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

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

Safety, Security and Environment (SSE)
This solution set involves activities directly related to ensuring that NextGen systems contribute to steadily reducing risks to safety and to information commensurate with increases in system capacity, while mitigating adverse effects on the environment and ensuring environmental protection that allows sustained aviation growth.

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) Selected Work Activities						
OI	Task Force	Activity	Description	FY 2011	FY 2012	FY 2013 – Mid-term
108209		Separation Management, High Altitude	Identifies cognitive support and display change requirements necessary for a transition to a high-altitude specialty that addresses the goals for capacity and organization excellence.	✓ Initiated laboratory infrastructure enhancements to support High Altitude concept validation human-in-the-loop (HITL) simulation	• Conduct integrated HITL simulation of high altitude concept	
102108		Oceanic Tactical Trajectory Management	Addresses current performance gaps in the areas of capacity, productivity, efficiency, safety and environmental impacts in oceanic environment.	✓ Conducted Automatic Dependent Surveillance–Contract (ADS-C) Climb and Descent Procedure (CDP) operations trial	• Conduct ADS-C CDP automation transition	• Conduct Oceanic Conflict Advisory Tool operational trial
108209		Capacity Management – NextGen Distance Measuring Equipment (DME)	Provides the necessary equipment enhancements, relocation and replacements to ensure that DME facilities are available.	✓ Awarded contract	• First article (design approval, test plan, procedures and safety assessment of contract data requirements list)	
108209		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 (PBN) route eligibility checking for inclusion in En Route Automation Modernization (ERAM) Release 3.	✓ Completed requirements for separation management prototypes	• Evaluate trajectory model enhancements	• Conduct D-position Computer Human Interface (CHI) mini-operational evaluation

Arrivals/Departures at High Density Airports (HD) Selected Work Activities

OI	Task Force	Activity	Description	FY 2011	FY 2012	FY 2013 – Mid-term
104122		Capacity Management – Integrated Arrival and Departure Operations (Big Airspace)	Provides an integrated approach to arrival and departure management throughout major metropolitan airspace by incorporating terminal and transition airspace and procedures into one service volume.	✓ Completed a preliminary operational safety assessment and an assessment of procedural changes needed to support this concept		
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.	✓ Conducted field evaluations of Collaborative Departure Queue Management tool and flight operator surface application	• Complete the evaluation report on the field assessment conducted at MCO and MEM in 2011 on the feasibility of procedural changes in the surface tactical flow arena for flight operators and the air traffic control tower	• Complete Surface Trajectory Based Operations (STBO) field evaluations of Collaborative Departure Scheduling and Time-Based Taxi Route Generation Tool at MEM and MCO and provide report detailing results of new capabilities
104209	40	Trajectory Management – Surface Tactical Flow - Enhanced Data Exchange (EDX) for Airport Surface Data Distribution	Establishes a net-centric approach to deliver Airport Surface Detection Equipment–Model X (ASDE-X) data to external aviation stakeholders.	✓ Added additional airports to EDX capability ✓ Enhanced infrastructure to improve reliability		
104209		Trajectory Management – Surface Conformance Monitoring	Focuses on the potential safety and workload benefits that can be achieved through a comprehensive taxi route management and conformance monitoring capability.	✓ Conducted third surface conformance (2D) HITL simulation	• Conduct a HITL simulation of surface conformance monitoring with a focus on refining surface conformance algorithms to prepare for surface conformance field evaluations	• Conduct a HITL simulation of Time-Based STBO surface conformance monitoring to evaluate the performance of pre-established taxi routes vs. controller-generated taxi routes in a Surface Conformance Monitoring environment, and to evaluate controller workload
		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.		• Develop an initial shortfall analysis to identify possible limitations of TBFM capabilities	• Develop Acquisition Management System products required for Investment Analysis Readiness Decision (IARD for TBFM Work Package 3)

Flexible Terminal Environment (FLEX) Selected Work Activities						
OI	Task Force	Activity	Description	FY 2011	FY 2012	FY 2013 – Mid-term
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.	✓ Awarded Category II/III Local Area Augmentation System ground facility prototype contract	• Complete modification and evaluation report on development of the GBAS at EWR to combat radio frequency interference (RFI)	• Complete testing of commercially developed RFI-Robust GBAS Category III Prototype Ground System
107119		Separation Management, Approaches, NextGen Navigation Initiatives	Develops and baselines specifications and initiates solution development including acquisition and testing of navigation aid equipment.	✓ Implemented lower RVR minima at: ○ PHL - Runway 27R ○ SFO - Runway 28L ○ DEN - Runway 16R ○ IAH - Runway 9 ○ CLE - Runway 24L	• Complete a surface navigation shortfall analysis to support the development of related requirements to support implementation of the NextGen Concept of Operations	• Complete the business case analysis and perform operational site testing and demonstrations of Terminal RNAV DME-DME
107118 107119		Separation Management, Approaches, Optimize Navigation Technology	Develops and baselines specifications and initiates solution development including acquisition and testing of navigation aid equipment.	✓ Continued initial development and design of Medium-Intensity Approach Lighting System with Runway Alignment Indicator (MALSR) Light-Emitting Diode (LED) Lamp Solution ✓ Continued initial development and design of LED Precision Approach Path Indicator (PAPI) System Solution	• Conduct design qualification test for LED PAPI development	
102141 102144		Separation Management, Wake Turbulence Mitigation for Arrivals (WTMA)	Evaluates WTMA feasibility prototype at a candidate airport. Concludes detailed benefit and safety assessments for the implementation of WTMA procedures.	✓ Completed WTMA feasibility prototype evaluation using implementation on chosen simulated automation system	• Complete an initial evaluation of the WTMA prototype for operation feasibility	• Complete Engineering development of WTMA information displays, NAS interfaces and associated Interface Requirements Documents
	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 reroutes and aircraft messaging for RTA.	✓ Conducted RTA proof of concept demonstration	• Conduct an expanded Required Time of Arrival Demonstration to determine the feasibility of the RTA capabilities using current technologies in the NAS	• Draft Plan for limited implementation

Flexible Terminal Environment (FLEX) Selected Work Activities (cont'd)						
OI	Task Force	Activity	Description	FY 2011	FY 2012	FY 2013 – Mid-term
103207 104209 102406	43 38 9 41	Flight and State Data Management, Surface/Tower/Terminal Systems Engineering	Redefines and extends the Terminal Flight Data Manager (TFDM) and Arrival/Departure Management Tool (A/DMT) concept of operations, funding will be used to update current analysis proposals and assess acquisition risks.	✓ Conducted TFDM evaluations and demonstrations ✓ Conducted HITLs to finalize TFDM concept of use	• Complete AMS technical and business analysis products required for Initial Investment Decision for the TFDM investment decision	• Final Investment Decision for the core TFDM system
		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.		• Conduct an assessment of NAS operational requirement to support the development of a detailed RVR deployment schedule	• Conduct analyses of all qualifying runways in NAS to move from Standard Cat I, Cat II, and Cat III to increased categories of service
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.	✓ Completed first stage analyses to re-evaluate the blunder model for CSPO and determine the impact on reducing lateral runway separation standards	• Conduct 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 Satellite Navigation Instrument Landing System (SAT/NAV/ILS) with High Update Radar Interim Report
		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.		• Conduct 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	• Develop investment analysis documentation

Collaborative Air Traffic Management (CATM) Selected Work Activities						
OI	**Task Force**	**Activity**	**Description**	**FY 2011**	**FY 2012**	**FY 2013 – Mid-term**
103305		Flight and State Data Management, Flight Object	Develops engineering and enterprise architecture artifacts, system alternatives and allocation and Flight Object Management System Concept; demonstrates the international flight object usage outside the lab environment.	✓ Delivered the Flight Object global flight identifier report ✓ Delivered the initial Flight Object benefit report	• Develop a data dictionary for Flight Information Exchange Model 1.0 to support the implementation of international standards	• Conduct international Flight Object demonstration
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.	✓ Delivered digital airport structure and configuration information to support situational awareness	• Demonstrate the initial CSSD services with the digital airport data	• Demonstrate prototype Special Activity Airspace Editor
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.	✓ Conducted analysis for airborne reroute requirements	• Develop requirements of key airborne reroute capabilities for ERAM Post Release 3 to support improved system flexibility and efficiency	• Study, analyze, develop high fidelity prototype and conduct operational evaluations to define requirements and risk mitigation for implementation in ERAM
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 shortfall analysis report	• Complete the concept requirements and definition plan for the Traffic Flow Management System/CATMT Work Package 4	• Complete IARD
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.	✓ Applied industry standards exchange formats for inclusion in decision-support tools	• Conduct initial assessment of requirement for a Unified Flight Planning and Filing (UFPF) evaluation model platform and finalize the evaluation plan	• Conduct Demo 3: NAS Common Reference and UFPF Interoperation in SWIM environment
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 an initial concept for best-equipped, best-served.	✓ Initiated analysis of equipage and avionics capabilities required through the mid-term to support best-equipped, best-served	• Develop the Greener Skies research plan to identify scenarios, performance capabilities and associated ATC rules for modeling and simulation • Conduct analysis to determine integration and dependency challenges for policy implementation of best-equipped, best-served	• Complete evaluation of new airspace and procedure design

Reduce Weather Impact (RWI) Selected Work Activities						
OI	Task Force	Activity	Description	FY 2011	FY 2012	FY 2013 – Mid-term
		Weather Forecast Improvements	Provides improved weather forecasts and tailors weather data for integration into decision support tools for collaborative and dynamic NAS decision making.	✓ Conducted risk-reduction activities ✓ Conducted market survey for NextGen Weather Processor capabilities	• Achieve Initial investment decision for NextGen Weather Processor Work Package 1	• Achieve Final investment decision for NextGen Weather Processor Work Package 1

Safety, Security and Environment (SSE) Selected Work Activities						
OI	Task Force	Activity	Description	FY 2011	FY 2012	FY 2013 – Mid-term
		Security Integrated Tool Set (SITS)[1]	Finalizes the business case, safety management document, NAS Enterprise Architecture artifacts and requirements documents.	✓ Archived program documentation		

[1] Program has been delayed until FY 2017

System Networked Facilities (FAC) Selected Work Activities						
OI	Task Force	Activity	Description	FY 2011	FY 2012	FY 2013 – Mid-term
		Integration, Development, 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.	✓ Enhanced and sustained the NextGen Integration and Evaluation Capability (NIEC) at the William J. Hughes Technical Center ✓ Integrated new technologies into existing NIEC capabilities that will enable the customer to: ○ iteratively evaluate design concepts and alternatives ○ determine quantitative metrics to define and validate human performance, usability, workload and safety indicators ○ design and conduct experiments to assess software, hardware and prototypes for research, system analyses and/or definition and refinement of requirements ○ provide interfacility capabilities ○ enhance NIEC data collection capabilities	• Design and implement airline operations center capability for NIEC	• Incorporate TBFM and Aircraft Simulation Display to Industry (ASDI) and improve weather utilities for streaming live scenarios
		NextGen Test Bed/ Demonstration Sites	Continues to expand the NextGen Test Bed capabilities in Daytona Beach, Fla., and initiate planning activities in Texas. 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 at one or more physical sites in line with the NextGen gate-to-gate concept.	✓ Completed Florida Test Bed Segment 2 system requirements document	• Proved additional Florida Test Bed infrastructure to enhance demonstration capabilities	• Provide network capabilities for Florida Test Bed participants to remotely connect to systems within the test bed by leveraging existing FAA research and development domain infrastructure for administration, monitoring, testing and integration activities

Demonstrations and Infrastructure Development (DEMO) Selected Work Activities

OI	Task Force	Activity	Description	FY 2011	FY 2012	FY 2013 – Mid-term
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 System Wide Information Management (SWIM), Airborne Execution of Flow Strategies, GBAS Demonstration and Future Planning.	✓ Conducted Demo 3 (ADS-B/TIS-B/FIS-B with limited NAS Voice System prototype and Voice Over Internet Protocol)	• Identify a commercial service provider for an airborne access to SWIM demonstration that will aid in the evaluation of the feasibility of transmitting information from the SWIM platform to the aircraft • Develop a plan for Airborne Execution of Strategic Flows that will aid in the planning, development and evaluation of its feasibility within the NAS • Coordinate 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 the ICAO to define Aviation System Block Upgrades (ASBU), a set of modular targets for each country to work toward within specific timeframes, in relation to the Atlantic Interoperability Initiative to Reduce Emissions (AIRE) and SWIM activities

System Development Selected Work Activities

OI	Task Force	Activity	Description	FY 2011	FY 2012	FY 2013 – Mid-term
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.	✓ Conducted airborne access to SWIM concept of use ✓ Conducted airborne access to SWIM operational and technical requirements industry day ✓ Conducted system design for future air-ground data communications requirements implementing flexible airspace management ✓ Initiated requirements definition for common trajectory implementation ✓ Conducted initial analysis of common trajectory needs and develop initial implementation strategy ✓ Conducted engineering trade study for weather radar replacement ✓ Provided analysis, requirements and pseudo-code supports for effective collision risk safety net in an environment of closely spaced parallel RNP route from top-of-descent to the runway	Terminal Collision Avoidance System • Complete 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	• Complete concept of operations for 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
108206		Operations Concept Validation, Validation Modeling	Addresses developing and validating future end-to-end operational concepts with special emphasis on researching changes in roles and responsibilities between the FAA and airspace.	✓ Developed draft second-level NextGen concept of operations for the NAS (2025)	• Provide an annotated outline for revisions to the NextGen Mid-Term Concept of Operations to help refine the future end-to-end operational concept	• Update flow-based trajectory management research management plan and fast time analysis of TFM departure predictability

System Development Selected Work Activities (cont'd)						
OI	Task Force	Activity	Description	FY 2011	FY 2012	FY 2013 – Mid-term
		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. • Develops and implements the Aviation Safety Information Analysis and Sharing system, which provides the capability to integrate data from public and non-public sources spanning commercial aviation, while maintaining data protection. This capability and the use of advanced data-mining tools allow the early identification and mitigation of emerging risks to the aviation system. • 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.	System Safety Assessment (SSA) ✓ Baselined risk assessments for system-wide risks associated with current operations in (1) terminal area airspace, (2) transition airspace or (3) en route airspace SMS ✓ Develop a method that can be used for continual surveillance of design approval holder compliance with SMS	SSA • Demonstrate terminal area operational risk model to assess impact of NextGen operational improvements for three airports	SSA • Complete report and software documentation on risk analysis function for surface and terminal area operations (all 35 major airports in the United States) SMS • Integrated Hazard Tracking System FAA-wide. Acquire and implement Phase 1 FAA-wide hazard tracking system SRM • Provide guidance on a unified framework in risk assessment and risk management (RARM) process and on unified standard to improve RARM quality

System Development Selected Work Activities (cont'd)						
OI	Task Force	Activity	Description	FY 2011	FY 2012	FY 2013 – Mid-term
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.	✓ Developed NextGen common workstation demo display simulation ✓ Developed initial mid-term NextGen en route workstation human factors requirements ✓ Developed initial Terminal Radar Approach Control workstation requirements	• Conduct a demonstration of the human error/safety database for off-nominal NextGen conditions • Establish collaborative air traffic management - human factors requirements • Plan NextGen human factors air-ground integration human-in-the-loop	• Investigate controller roles in a simulated strategic air traffic environment for en route and terminal domains
		Staffed NextGen Towers (SNT)	Demonstrates the concept of SNT and develops the requirements, specifications and supporting documentation for it. SNT may allow for the cost-effective expansion of services to a larger number of airports, and reduce tower construction costs.	✓ Conducted demonstration activities ✓ Continued detailed engineering analysis and requirements validation activities ✓ Developed performance standards and SNT alternatives ✓ Developed initial investment decision documentation, including business case analysis report, implementation strategy and planning and basis of estimate ✓ Updated Enterprise Architecture products and amendments ✓ Maintained SNT equipment at field site (Dallas/Fort Worth)	• Issue report from second SNT field demonstration • Update SNT program requirements document	• Complete surface surveillance operational suitability (formerly Airport Surface Detection Equipment–Model X) documentation • Develop initial procedures for surface surveillance operational suitability
		Operational Assessments	Conducts integrated assessments to ensure that safety, environmental and system performance considerations are properly addressed throughout the integration and implementation of NextGen.	✓ Assessed and integrated the local, regional and NAS-wide analysis capability of the Aviation Environmental Design Tool (AEDT), and developed plans for further enhancements ✓ Assessed and integrated the local, regional and NAS-wide analysis capability of Aviation Portfolio Management Tool (APMT) and developed plans for further enhancements ✓ Developed options to integrate environmental assessment capability with NextGen NAS models ✓ Developed NextGen NAS-wide environmental mitigation and cost-beneficial options for decision support ✓ Enhanced safety model to support NextGen operational assessments ✓ Enhanced operational performance model to support NextGen operational assessments	• Generate the final reports for the user's guide and technical transfer software for the Aviation Environmental Design Tool to enhance environmental assessment capability • Update NextGen cost and benefits estimates	• Report on APMT Economics for domestic and regional NAS-wide NextGen environmental analysis

System Development Selected Work Activities (cont'd)						
OI	Task Force	Activity	Description	FY 2011	FY 2012	FY 2013 – Mid-term
		Wake Turbulence Re-categorization	Develops new sets of tailored leader aircraft and follower aircraft wake separation standards whose application would depend on flight conditions and aircraft performance to enable increased capacity of flights into and out of airports to accommodate future demands.	✓ Determined optimal set of aircraft flight characteristics and weather parameters for use in setting wake separation minima ✓ Developed metrics for setting tailored leader/follower aircraft wake mitigation separation standards	• Complete an initial concept of operations document for more efficient leader/follower wake turbulence separation standards	• Complete preliminary requirement documentation to incorporate leader/follower pair-wise static wake separation standards into the FAA ATC automation platforms • Finalize the implementation of six-category wake separation standards into the FAA ATC automation platforms

AIRPORT AND FACILITY IDENTIFIERS

CORE 30 AIRPORTS

ATL	Atlanta
BOS	Boston
BWI	Baltimore-Washington
CLT	Charlotte
DCA	Washington National
DEN	Denver
DFW	Dallas/Fort Worth
DTW	Detroit
EWR	Newark
FLL	Fort Lauderdale-Hollywood
HNL	Honolulu
IAD	Washington Dulles
IAH	Houston
JFK	New York Kennedy
LAS	Las Vegas McCarran
LAX	Los Angeles
LGA	New York LaGuardia
MCO	Orlando
MDW	Chicago Midway
MEM	Memphis
MIA	Miami
MSP	Minneapolis-St. 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
CHS	Charleston (South Carolina)
CLE	Cleveland
CMH	Columbus (Ohio)
CVG	Cincinnati
DRO	Durango (Colorado)
GUC	Gunnison (Colorado)
GUS	Grissom Air Reserve Base
HND	Las Vegas Henderson
MCI	Kansas City
MKE	Milwaukee
MMU	Morristown (New Jersey)
MTJ	Montrose (Colorado)
MSY	New Orleans
PDX	Portland (Oregon)
PIT	Pittsburgh
PVD	Providence (Rhode Island)
SAT	San Antonio
SDF	Louisville (Kentucky)
STL	St. Louis
TEB	Teterboro (New Jersey)
TEX	Telluride (Colorado)

FAA FACILITIES

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

ACRONYMS

2D	Two-Dimensional
3D	Three-Dimensional
4D	Four-Dimensional
AC	Advisory Circular
ACM	Adjacent Center Metering
A/DMT	Arrival/Departure Management Tool
ADS-B	Automatic Dependent Surveillance–Broadcast
ADS-C	Automatic Dependent Surveillance–Contract
AEDT	Aviation Environmental Design Tool
AeroMACS	Aeronautical Mobile Airport Communications System
AIM	Aeronautical Information Management
AIP	Airport Improvement Program
AIRE	Atlantic Interoperability Initiative to Reduce Emissions
AMS	Acquisition Management System
ANSP	Air Navigation Service Provider
AOC	Airline Operations Center
APMT	Aviation Portfolio Management Tool
AR	Authorization Required
ARC	Aviation Rulemaking Committee
ARTCC	Air Route Traffic Control Center
ASAP	Aviation Safety Action Program
ASBU	Aviation System Block Upgrades
ASDE-X	Airport Surface Detection Equipment–Model X
ASDI	Aircraft Simulation Display to Industry
ASIAS	Aviation Safety Information Analysis and Sharing
ASPIRE	Asia and Pacific Initiative to Reduce Emissions
ASSC	Airport Surface Surveillance Capability
ASTM	Standard-setting organization
ATC	Air Traffic Control
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication Network
ATO	Air Traffic Organization
ATPA	Automated Terminal Proximity Alert
ATSAP	Air Traffic Aviation Safety Action Program
CARTS	Common Automated Radar Terminal System
CAP	Chicago Airspace Program
CAT	Category
CATM	Collaborative Air Traffic Management
CATMT	Collaborative Air Traffic Management Technologies
CDM	Collaborative Decision Making
CDP	Climb/Descent Procedure
CDQM	Collaborative Departure Queue Management
CDTI	Cockpit Display of Traffic Information
CHI	Computer Human Interface
CIP/FIP AK	Alaska Current Icing Product/Forecast Icing Product
CIX	Collaborative Information Exchange
CLEEN	Continuous Lower Energy, Emissions and Noise
COO	Chief Operating Officer
CO_2	Carbon Dioxide

CRDA	Converging Runway Display Aid
CSPO	Closely Spaced Parallel Operations
CSSD	Common Status and Structure Data
Data Comm	Data Communications
DCIS	Data Comm Integrated Services
DCL	Departure Clearance
DEMO	Demonstration
DDU	Data Distribution Unit
DME	Distance Measuring Equipment
DoD	Department of Defense
EDX	Enhanced Data Exchange
EFVS	Enhanced Flight Vision System
EMS	Environmental Management System
ERAM	En Route Automation Modernization
EUROCAE	European Organization for Civil Aviation Equipment
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
FBTM	Flow Based Trajectory Management
FBWTG	FAA Bulk Weather Telecommunications Gateway
FIS-B	Flight Information Services–Broadcast
FLEX	Flexibility in the Terminal Environment
FMC	Flight Management Computer
FMS	Flight Management System
FOC	Flight Operations Center
FOQA	Flight Operational Quality Assurance
FRL	Fuel Readiness Level
FY	Fiscal Year
GA	General Aviation
GBAS	Ground Based Augmentation System
GIS	Geographic Information System
GLS	Ground Based Augmentation System Landing System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HD	High Density Airports
HEFA	Hydroprocessed Esters and Fatty Acids
HITL	Human-in-the-Loop
HRJ	Hydrotreated Renewable Jet
HUD	Head-Up Display
IARD	Investment Analysis Readiness Decision
ICAO	International Civil Aviation Organization
IDAC	Integrated Departure/Arrival Capability
IFP	Instrument Flight Procedure
ILS	Instrument Landing System
ITP	In-Trail Procedure
JPDO	Joint Planning and Development Office
JRC	Joint Resources Council
KPI	Key Performance Indicator
LED	Light-Emitting Diode
LNAV	Lateral Navigation
LPV	Localizer Performance with Vertical Guidance
MALSR	Medium-Intensity Approach Lighting System with Runway Alignment Indicator

MLAT	Multilateration
MSP	Multi-Sector Planning
NAC	NextGen Advisory Committee
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NATCA	National Air Traffic Controllers Association
NAVAID	Navigation Aid
NCR	NAS Common Reference
NEPA	National Environmental Policy Act
NextGen	Next Generation Air Transportation System
NIEC	NextGen Integration and Evaluation Capability
NM	Nautical Mile
NNEW	NextGen Network Enabled Weather
NOTAM	Notice to Airmen
NPRM	Notice of Proposed Rulemaking
NVS	NAS Voice System
NWP	NextGen Weather Processor
OAPM	Optimization of Airspace and Procedures in the Metroplex
OCEAN21	Oceanic Automation System
OEP	Operational Evolution Partnership
OGC	Open Geospatial Consortium
OI	Operational Improvement
OMP	O'Hare Modernization Project
OPD	Optimized Profile Descent
PAPI	Precision Approach Path Indicator
PBN	Performance Based Navigation
RARM	Risk Assessment and Risk Management
RF	Radius-to-Fix
RFI	Radio Frequency Interference
RNAV	Area Navigation
RNP	Required Navigation Performance
ROTG	RNAV off the Ground
RPI	Relative Position Indicator
RTA	Required Time of Arrival
RTCA	Aviation industry group
RTT	Research Transition Team
RVR	Runway Visual Range
RVSM	Reduced Vertical Separation Minimum
RWI	Reduced Weather Impact
SA	Special Authorization
SAA	Special Activity Airspace
SAS	Safety Analysis System
SATNAV	Satellite Navigation
SBAS	Satellite Based Augmentation System
SC-214	RTCA Special Committee for Standards for Aviation Data Communications Services
SESAR	Single European Sky Air Traffic Management Research
SID	Standard Instrument Departure
SITS	Security Integrated Tool Set
SMS	Safety Management System
SNT	Staffed NextGen Towers
SRM	Safety Risk Management
SRMD	Safety Risk Management Document
SSA	System Safety Assessment
SSE	Safety, Security and Environment
STAR	Standard Terminal Arrival Route

STARS	Standard Terminal Automation Replacement System
STBO	Surface Trajectory Based Operations
SUA	Special Use Airspace
SURF IA	Surface Indications and Alerts
SVS	Synthetic Vision System
SWIM	System Wide Information Management
TA	Tailored Arrival
TBD	To Be Determined
TBO	Trajectory Based Operations
TBFM	Time Based Flow Management
TCAS	Traffic Alert and Collision Avoidance System
TFDM	Terminal Flight Data Manager
TFM	Traffic Flow Management
TFMS	Traffic Flow Management System
TIS-B	Traffic Information Services–Broadcast
TMA	Traffic Management Advisor
TMI	Traffic Management Initiative
TOAC	Time of Arrival Control
TRACON	Terminal Radar Approach Control
TRL	Technical Readiness Level
TSO	Technical Standard Order
UAS	Unmanned Aircraft System
UAT	Universal Access Transceiver
UFPF	United Flight Planning and Filing
USAF	United States Air Force
VDL	VHF Digital Link
VHF	Very High Frequency
VMC	Visual Metrological Conditions
VNAV	Vertical Navigation
WAAS	Wide Area Augmentation System
WAM	Wide Area Multilateration
WINS	Weather Information Network Services
WG-78	EUROCAE Working Group for Data Link Application, NextGen and SESAR
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

NextGen is a comprehensive overhaul of our National Airspace System to make air travel more convenient and dependable, while ensuring your flight is as safe, secure and hassle-free as possible.

In a continuous rollout of improvements and upgrades, the FAA is building the capability to guide and track air traffic more precisely and efficiently to save fuel and reduce noise and pollution. NextGen is better for our environment and better for our economy.

- **NextGen will be a better way of doing business.**
- **NextGen will reduce aviation's impact on the environment.**
- **NextGen will help us be even more proactive about preventing accidents with advanced safety management.**
- **NextGen will get the right information to the right person at the right time.**
- **NextGen will lay a foundation to continually improve air travel and strengthen the economy.**
- **NextGen will help communities make better use of their airports.**
- **NextGen will enable us to meet our increasing national security and safety needs.**
- **NextGen will bring about one seamless global sky.**

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