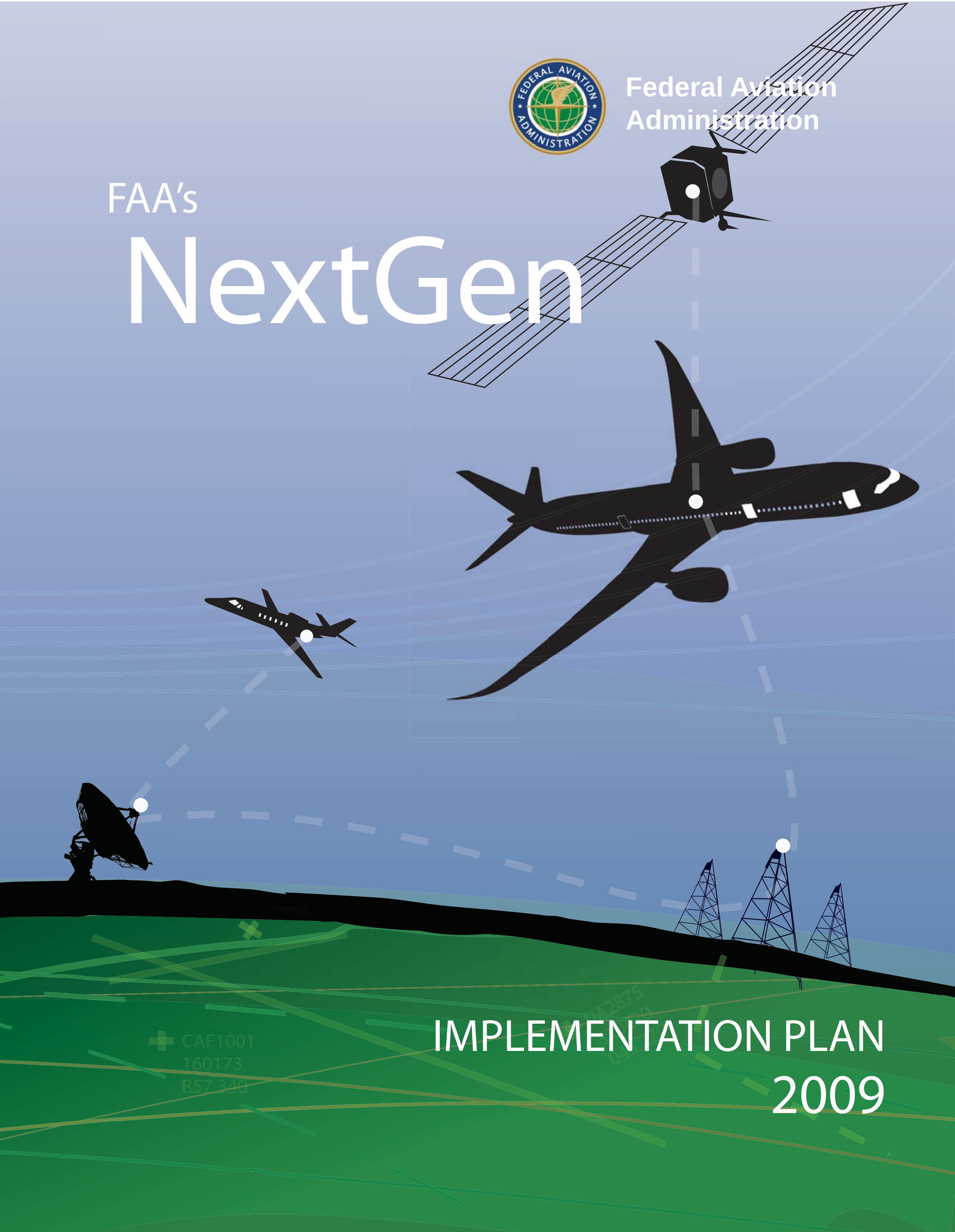
Federal Aviation Administration

FAA's

NextGen



IMPLEMENTATION PLAN

2009

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NextGen Integration and Implementation Office

800 Independence Avenue, S.W.
Washington, DC 20591

202.493.4939

www.faa.gov/nextgen

Victoria Cox
ATO Senior Vice President
NextGen and Operations
Planning

Michael Romanowski
Director
NextGen Integration and
Implementation Office

Gisele Mohler
Manager
NextGen Planning Group

Ann Tedford
Manager
Chief Systems Engineering Group

Pamela Whitley
Manager
NextGen Solution Set
Integration Group

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ATO Communications
ShutterStock

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contents

What is NextGen?

Upgrading a system that manages an operation as diverse and complex as the NAS requires tremendous commitment.

Change is in the Air

At the Federal Aviation Administration, change is in the air. You could also say it is on the ground at airports, in cockpits, and on the minds of aviation professionals everywhere. From flight decks and control towers to runways and radar stations, our national air transportation system is moving toward an unprecedented, paradigm-shifting change. The next 10 years promise to be a pivotal time in the history of air transportation, as we begin a transformation that will change the face of aviation. It is called the Next Generation Air Transportation System —NextGen for short—and it will forever redefine how we manage our national airspace system (NAS).

NextGen means flying more passengers, more cargo, more types of aircraft, more safely, more precisely, and more efficiently, using less fuel, making less noise and creating less environmental impact.

The NAS encompasses virtually everything that has anything to do with air transportation. A vast, multi-layered operation, there is much more to the NAS than will ever meet an untrained eye. In fact, most people are astounded when they learn what is involved with managing our nation's airspace. Consider this: more than 821 billion passenger miles were flown last year in United States airspace. To make that happen, more than 15,000 air traffic controllers provided service to America's 590,000 pilots, who flew 239,000 aircraft in and out of 20,000 U.S. airports. Overall, more than 46 million aircraft operations were safely aided by 59,000 pieces of communications, weather, and navigational equipment that was maintained by more than 7,000 FAA technicians.[1]

The complexity of the NAS is as impressive as it is difficult to grasp. Even more impressive may be the far-reaching impact that the air transportation industry has on the United States' economy. Civil aviation contributes $1.2 trillion annually to our country's economy, or more than 5 percent of the gross domestic product. It generates nearly 11 million jobs with earnings of $369 billion. The industry contributes positively to the U.S. trade balance, creates high paying jobs, keeps just-in-time business models viable, and connects us to friends, family and commercial opportunities.[2]

There is cause for concern, however. Despite the current economic down turn, delays repeatedly impact passenger travel and the forecasts of future demand remain high. New modes, like unmanned aircraft systems and commercial space vehicles, are about to take flight. Continued demands for improving levels of safety and reduced environmental impacts all will bring even greater complexity to NAS operations.

If we are to meet future demand, we must have a comprehensive system upgrade that will allow us to fundamentally change the way we manage air traffic. NextGen will enable critical transitions:

- From ground based to satellite-based navigation and surveillance…
- From voice communications to digital data exchange…
- From a disparate and fragmented weather forecast delivery system to a system that uses a single, authoritative source…
- From operations limited by visibility to sustaining the pace of operations even when impacted by adverse weather or difficult terrain.

Most significant, however, is the one transition that makes all the others possible—moving from disconnected and incompatible information systems to a scalable, network-centric architecture. This will ensure that everyone using the system has easy access to the same information at the same time, when needed.

NextGen will be built on key elements from existing programs and technology, and on new systems under development now. We will begin by making the most of modern aircraft capabilities and those elements of the system that can take advantage of them. Then, over the next decade, we will continue a series of coordinated upgrades to the current ground infrastructure and aircraft systems. This will introduce superior technology and new procedures to enhance operational capabilities and provide numerous efficiencies to the system. The resulting system will be scalable, networked, and fully digital.

With NextGen, we will continue to advance our already exemplary safety record by introducing new analytic tools

[1] FAA Administrators Fact Book, November 2008
[2] "The Economic Impact of Civil Aviation on the U.S. Economy," FAA, October 2008.

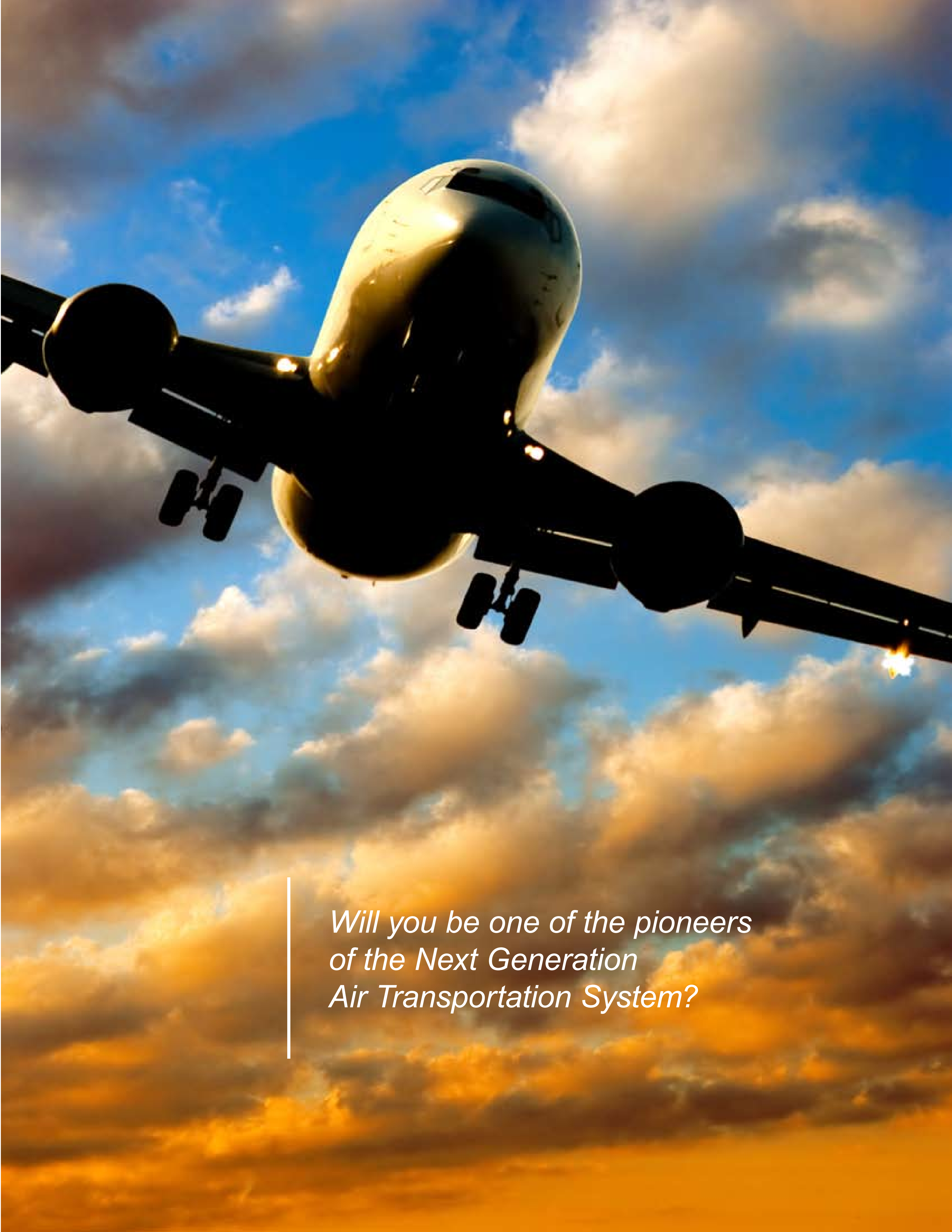
that more proactively detect adverse trends and identify precursors. These tools will allow us to act on potential problems before they take shape.

In addition, airports will benefit from increased safety, better use of existing capacity, greater design flexibility, and reduced environmental impacts. New technologies, standards, and procedures, in addition to new airside infrastructure, will allow airports to realize the benefits of NextGen.

NextGen will foster operational improvements, advances in technology and the development of sustainable alternative fuels that will allow us to reduce aviation's environmental footprint even as our transportation system grows.

With NextGen, we also will seek to establish seamless operations beyond our borders. To do so, the FAA must work with international partners to harmonize standards, procedures, and air and space transportation policies worldwide.

Upgrading a system that manages an operation as intricate and complex as the NAS will require tremendous commitment and perseverance. NextGen's success depends on the participation of a highly-trained workforce with the technical and operational expertise and the business acumen to continue to manage complex programs on time and on budget. Everyone who works in the system—researchers, engineers, program managers, policy makers, pilots, controllers, dispatchers and technicians—each and every discipline has a role and a stake in NextGen. NextGen offers tremendous career opportunities for those who want to lead this chapter in aviation history. ■


Will you be one of the pioneers
of the Next Generation
Air Transportation System?

"Flight delays cost passengers, airlines and the U.S. economy billions..."

— Congressional Joint Economic Committee Report 2008

The FAA is releasing this edition of its NextGen Implementation Plan for two purposes. The first is to more closely align the plan's publication with the release of the FAA's NAS Enterprise Architecture and the budget cycle. The second is to provide a springboard for a new level of engagement with the aviation community on NextGen equipage. This dialogue will be critical for achieving benefits and return on investment for both the community and the government.

In September 2008, the Air Traffic Control Association hosted a forum that allowed the FAA to hear a broad range of industry views on critical NextGen implementation issues and the community's needs for the NextGen Implementation Plan. We heard clearly that the Plan must help a broad audience gain a common understanding of NextGen. We heard that our next publication must be a technically sound document, but not necessarily a technical document. That is, we heard that it should be a document that can be clearly understood by the non-technical audience that comprises the range of decision makers across the private sector and government. We were asked to provide a document that can assist readers by answering a few fundamental questions central to industry's role in implementing NextGen:

1. What does NextGen look like in 2018?
2. What benefits will NextGen deliver in the mid-term, 2012-2018?
3. What are the aircraft avionics equipage needs through 2018?
4. What is the FAA specifically committed to deploy in the near-term that makes the most of existing resources?
5. What activities are underway to support future capabilities?

As a direct result, this edition of the NextGen Implementation Plan is structured to provide special focus on those fundamental questions. However, it is important to note that since both government and community investment is required to achieve NextGen capabilities and benefits, complete answers to some of these questions can only follow much more significant engagement with the community.
Therefore, to help foster that deeper industry engagement, the FAA has committed to launch a NextGen Implementation Task Force through the RTCA[1]. The task force will tackle the most significant issues surrounding NextGen implementation, with a focus on:

- Maximizing benefits of mid-term NextGen operational capabilities
- Addressing business/investment-related issues associated with implementing mid-term NextGen capabilities

The importance of moving ahead on these issues cannot be overstated. Current plans call for the NextGen Implementation Task Force to provide final conclusions and recommendations to the FAA in August 2009. This release of the NextGen Implementation Plan will provide a common point of understanding for the task force's activities.

While the FAA is moving forward with our implementation activities and strengthening our engagement with industry, we are also working more closely than ever with our partners across the federal government. As the FAA-led Joint Planning and Development Office (JPDO) emphasizes its roles for fostering cross-agency coordination and the long-term NextGen vision, excellent progress is being made on several fronts: interagency demonstrations have been established with the U.S. Air Force Air Mobility Command; the Department of Defense (DOD) and the Department of Homeland Security have joined FAA on cooperative efforts focused on integrated surveillance and network enable operations; the FAA and NASA have made significant headway transitioning NASA's air traffic control research to the FAA through new Research Transition Teams; the DOD has established and funded a net-centric operations effort in the JPDO; and the National Weather Service has formalized its commitment to the joint NextGen weather effort.

Section 1 of the NextGen Implementation Plan lays out a set of governing principles that the FAA believes are critical for achieving accelerated, wide-spread aircraft avionics equipage to enable NextGen capabilities. These principles provide focus toward an integrated strategy, centered on the installation of three core avionics capabilities for the mid-term: Area Navigation (RNAV) and Required Navigation Performance (RNP), Automatic Dependent Surveillance-

[1] RTCA, Inc. is a private, not-for-profit corporation that develops consensus-based recommendations regarding communications, navigation, surveillance, and air traffic management system issues. RTCA functions as a Federal Advisory Committee and includes roughly 335 government, industry and academic organizations from the United States and around the world. Members represent all facets of the aviation community, including government organizations, airlines, airspace users and airport associations, labor unions, aviation service and equipment suppliers.

Broadcast (ADS-B), and Data Communications. The FAA expects to work through the RTCA NextGen Implementation Task Force in 2009 to define the recommended implementation of the policy aspects of these principles, while working with individual operators and manufacturers on the aircraft-specific applications of those principles and the associated policies.

Section 2 lays out how operations will be conducted in the NextGen environment in 2018. This is neither a technical discussion nor a systems description. Those seeking that level of detail are encouraged to visit the FAA's NextGen Web site (www.faa.gov/nextgen), where a substantial amount of information is posted to enable "deep dives" into NextGen technology, architecture, and planning. Instead, the FAA believes it is important that anyone wishing to understand what NextGen will deliver can do so without having to devote countless hours of study to the task.

Section 3 discusses the current understanding of the benefits that NextGen will bring to both the operators and the FAA. The details of information presented in this section, and the modeling and simulation tools that are described, will be central to the NextGen Implementation Task Force efforts on maximizing NextGen benefits and business case understanding.

Section 4 provides a brief overview of several cross-cutting issues that can impact NextGen development and implementation.

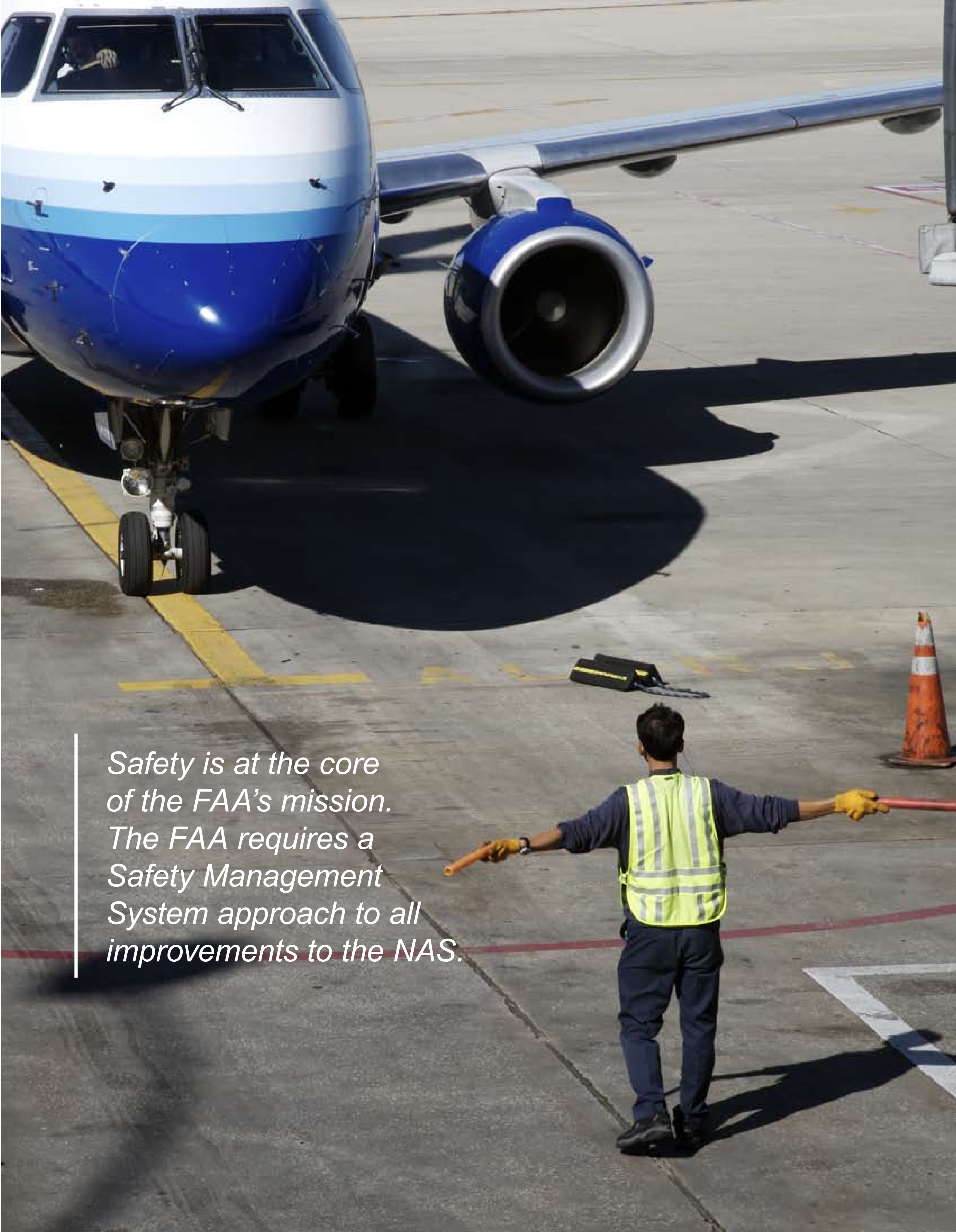
More technical information is provided in the NextGen Implementation Plan appendices. It is important to note that these are also provided in a simplified, summary form. Like the discussions presented in the main body of the plan, the material presented in the Appendices also relies on extensive volumes of information. Again, interested readers are invited to visit the updated NextGen Web site where they can access this detailed information. Of particular significance for many is the FAA's NAS Enterprise Architecture, released in January 2009. This contains the extremely detailed technical foundation for NextGen planning, development and implementation. Amongst other features, it contains detailed, integrated, time-phased technical roadmaps for meeting NextGen capabilities through the mid-term, including:

- Aircraft
- Air/Ground
- Airspace & Procedures
- Automation
- Communication
- Enterprise Support
- Facilities
- Information Systems Security
- Navigation
- Human Systems Integration
- Surveillance
- Weather

Appendix A focuses on the avionics capabilities that the FAA believes are necessary to achieve the NextGen operational capabilities described in Section 2 and the benefits discussed in Section 3. It highlights the synergy enabled by the integration of RNAV/RNP, ADS-B, and Data Communications in the 2012-2018 mid-term timeframe. This technical content will assist the NextGen Implementation Task Force in its deliberations.

Appendix B provides a summary of FAA's NextGen work plan. It highlights the FAA's committed timelines for deploying airfield improvements, air traffic system infrastructure and associated procedures enhancements for NextGen. It also describes enabling activities that support future decision-making, focusing on the work being performed in fiscal year (FY) 2009, but with a window into the end product of that work.

Finally, it is extremely important to note that the FAA's NextGen Implementation Plan is a product of collaborative work being done across the agency. As a summary-level document it outlines the activities that the FAA is specifically pursuing to achieve NextGen over the next 10 years. The capabilities that will be implemented form a solid foundation for improvements beyond the mid-term timeframe. To facilitate alignment between the FAA's plans and those of other federal agencies with NextGen responsibility, the FAA's activities and many of the details that support them will be adopted into the multi-agency NextGen Integrated Work Plan, which is coordinated by the Joint Planning and Development Office (JPDO). ■



Safety is at the core of the FAA's mission. The FAA requires a Safety Management System approach to all improvements to the NAS.

Governing Principles for Accelerating NextGen Equipage

Moving into the mid-term, the FAA proposes "best-equipped, best-served" priority to operators, offering incentives to early adopters of NextGen avionics.

Introduction

NextGen will require investment by both the government and the private sector to be successful in delivering the desired NAS performance improvements. While lesser-equipped aircraft will still be accommodated in the NAS, ensuring that a significant portion of the aircraft fleet is appropriately equipped to take advantage of NextGen improvements is one of the most critical issues in achieving success. It will be extremely difficult for either operators or the FAA to realize the NextGen benefits without the installation of the equipment described in Appendix A. However, the FAA recognizes that a strong business case is necessary for operators to equip their aircraft.

Ensuring that a significant portion of the aircraft fleet is appropriately equipped to take advantage of NextGen infrastructure improvements is perhaps the most critical issue in achieving success.

Governing Principles

The following high-level governing principles establish a foundation for an integrated avionics equipage strategy aimed at accelerating NextGen operational capabilities in the 2012-2018 mid-term timeframe. These principles span possible operational, financial and regulatory actions, and will serve as the basis for future FAA decision-making, specific policy development activities, and engagement with industry stakeholders:

- Target equipage and associated capabilities to maximize operational benefits for the specific locations or airspace that require a higher performance level in order to elevate system performance and to satisfy demand.
  - Leverage and maximize the benefit of existing equipage.
  - Take advantage of normal maintenance cycles to minimize disruptions to operators when installing new equipment.
  - Leverage operational evaluations and other cooperative arrangements with industry to accelerate NextGen equipage.
- Consistent with safe and efficient operations, provide "best-equipped, best-served" priority in the NAS to early adopters.
- Minimize the business risk associated with early deployment of NextGen equipage, such as those resulting from application of initial certification standards; FAA may assume portions of that risk or otherwise incentivize operators.
- Target government-provided financial incentives for new equipment toward aircraft that will meet evolving environmental requirements.
- Harmonize operations, performance requirements and avionics solutions globally to ensure maximum benefits to operators who fly internationally.

The FAA will work with the aviation community in 2009 on further definition and application of these principles. The FAA expects to work through the RTCA NextGen Implementation Task Force on the policy aspects of these principles, while working on aircraft-specific application of the principles and policies with individual operators and manufacturers. ■

NextGen in 2018: Operating in the Mid-Term

By 2018, NextGen is expected to offer operational, economic, and environmental benefits while increasing safety throughout all phases of flight.

Overview

This section describes how the FAA envisions the NAS will operate in 2018, by showing what an operator will experience through all phases of flight. This evolved system is the product of the work described through this document and the additional details provided on the FAA's NextGen Web site. As we transition to this state over the next decade, operators will begin to reap the benefits of NextGen, including improved safety, increased operations and efficiency, and better environmental performance.

The mid-term system is enabled by both systems on the ground and on the flight deck. It makes the most of technologies and procedures that are already in use today, while introducing new systems and procedures that fundamentally change air traffic surveillance, communication and the exchange of information. Additional information regarding the mid-term system, including the FAA's NAS Enterprise Architecture and other documentation, is available on the FAA's NextGen Web site.

While operators who adopt related new avionics will receive the greatest benefit in this timeframe, lesser equipped operators will still be accommodated. The targeted aircraft avionics to support these operations are further discussed in Appendix A. This mid-term system, in turn, provides a foundation for a long-term evolution of the system.

Flight Planning

Unlike today, when flight planning is required in the mid-term, operators will access all related information on the current status of the airspace system through a single source. This information will include airspace blocked for military, security, or space operations. It will include 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 will allow users to begin the planning process with a full picture of potential limitations on their flights from ground operations to the intended flight path trajectory.

However, the improvement to flight planning will go beyond information exchange. During flight planning an electronic representation of the operator's intent will be developed. This intent information can be updated as the flight progresses with tactical and strategic information. It will better accommodate operator preferences and optimize resource usage, even to the point of improving scheduling at the destination. The system will provide a full evaluation, including existing limitations and potential limitations, of the intended flight path. Access to flight planning information will be available to authorized users via a secure network and will include a publish/subscribe capability so that users can receive automatic updates when conditions change along the proposed flight path. This will occur both before and after formal filing of a flight plan and includes the time when the flight is active up until the flight is completed and the flight plan closed.

Access to this real-time, shared information will help operators and system managers to better predict potential conflicts. For operators, it will mean more efficient traffic management and enhanced environmental performance by improving the ability to fine-tune and adjust schedules throughout the day for optimal use of the system. For the FAA, it will mean more comprehensive situational awareness, including user intent, to enable improved management of the NAS.

Flight Planning

Key Ground Infrastructure	Avionics
• 4-D Weather Cube • Data Communications • En Route Automation Modernization (ERAM) • Modernized Aeronautical Information Management System • System-Wide Information Management (SWIM) • Terminal Flight Data Management System Modernization • Traffic Flow Management System	• Data Communications • RNAV/RNP

Push Back, Taxi, and Departure

As the time for the flight approaches, the final flight path agreement will be delivered as a data message to pilots who access the agreement before beginning the flight. To improve the pilot's situational awareness, flight deck displays will portray aircraft movement on a moving map that indicates the aircraft's own position on the airport as well as the position of other aircraft and equipped vehicles in the vicinity. These flight deck displays are important safety tools that will help further prevent runway incursions and other potential on-ground conflicts.

With new tools that improve situational awareness and help manage the flow of aircraft to and from the ramp, controllers will be able to more efficiently manage the use of taxiways and runways, which will mean fewer radio transmissions, shorter wait times, fewer departure delays, increased fuel savings and reduced emissions. The system will recommend the best runway and taxi path to controllers based on the departing aircraft's intended flight path, and the status and positions of all other aircraft on the airport and in the terminal area.

Departure performance will be improved by implementing multiple precise departure paths from each runway end. This will allow each departing aircraft to be placed on its own, separate path, keeping the aircraft safely separated from other aircraft and wake vortices. These multiple paths also will be an important aid to circumnavigating thunderstorms and other severe weather in the airport vicinity.

Precise departure paths will optimize system operations for entire metropolitan areas, reducing delays by allowing each airport to operate more independently. This will provide for better balance of arrivals and departure flow to airports within close proximity. These precise departures can also 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 to surrounding communities.

Push Back, Taxi, and Departure

Key Ground Infrastructure	Avionics
• 4-Dimensional Weather Cube • ADS-B ground stations • Airport Surface Detection Equipment model X (ASDE-X) • Common Automated Radar Terminal System/Standard Terminal Automation Replacement System enhancements • Data Communications • Integrated Departure and Arrival Coordination System • Modernized Aeronautical Information Management System • Surface traffic management decision support tool • System-Wide Information Management (SWIM) • Terminal Flight Data Management System • Traffic Flow Management System	• ADS-B, TIS-B, FIS-B • Data Communications • RNAV/RNP

For airports with closely-spaced parallel runways, wind monitoring systems will allow for simultaneous operations by determining when wake vortices from departing aircraft have sufficiently dissipated and are not hazardous, safely reducing runway waiting time.

The ability to operate simultaneously on closely-spaced parallel runways means airports will gain capacity from their existing runways. Airports may also be able to build new runways without expanding the physical airport boundaries, reducing cost and impact to surrounding neighborhoods and natural habitat.

Together, these capabilities will enhance safety, improve environmental performance, and reduce costs to operators in time and fuel savings.

Climb and Cruise

As the aircraft climbs out from the airport into the enroute airspace, the enhanced surveillance data processing will improve the position information and allow the aircraft and controllers to take advantage of reduced separation standards up to near top-of-climb. This, coupled with the ability to monitor the position of other aircraft from the aircraft's flight deck, will allow the flight to climb in a highly efficient manner, with air traffic personnel assigning spacing responsibility to the flight as it climbs past other flights to reach its cruising altitude. This will allow the aircraft to merge into the overhead stream, often without additional maneuvers.

Data communications will increase efficiency by providing routine and strategic information to the pilot and automating certain routine tasks for both the pilot and controller. Controllers can focus on providing more preferred and direct routes and altitudes, which will save both fuel and time. A decreased number of voice communications also will reduce radio frequency congestion and eliminate verbal miscommunication—a great safety improvement that will reduce operational errors. Providing changes to radio frequencies and other information, such as local barometric pressure and required weather advisories, by data communications link can also reduce errors. When weather impacts numerous flights, clearances for data communications capable aircraft can be sent all at once, increasing controller and operator efficiency.

If potential conflicts with other aircraft or other constraints, such as weather or homeland security interventions, develop along the path, the NextGen system will identify the problem and provide recommended path trajectory or speed changes to eliminate the conflict. The controller will send the pilot the proposed change via a data communications link, if the aircraft is equipped. When pilot and controller have agreed on the change, the change will be loaded into both the ground and aircraft systems. Improved weather information, integrated into controller decision support tools, will improve efficiency of controller decisions and greatly reduce controller workload during bad weather.

There will be times and locations where delays, airspace restrictions or adverse weather will require additional changes to the flight path agreement. When re-routing is required, the flight can be assigned precision offsets to the published route. These offsets will become a way of turning a single published route into a "multi-lane highway." Use of offsets will increase capacity in a section of airspace. These reroutes can be tailored for each flight. 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 can reduce one source of error in communications.

Climb and Cruise

Key Ground Infrastructure	Avionics
• 4-Dimensional Weather Cube • ADS-B ground stations • ATOP • Data Communications • Enhanced/Integrated Traffic Management Advisor • ERAM • TFM-M • Traffic Flow Management System	• ADS-B In and Out, with associated applications like CDTI • Data Communications, including integration with the Flight Management System • FANS (in oceanic airspace) • RNAV/RNP

Improvements also will extend to oceanic operations as the system assures that each aircraft will enter oceanic airspace on its most optimal trajectory. Airspace entry will be specified by entry time, flight path and assigned altitude. As weather and wind conditions change above the ocean, both individual reroutes and changes to the entire route structure will be managed via a data communications link.

Descent and Approach

NextGen capabilities will provide a number of improvements to terminal area operations that save fuel, increase predictability, and minimize maneuvers such as holding patterns and delaying vectors.

Enhanced traffic management tools will analyze flights approaching an airport from hundreds of miles away, across the facility boundaries that limit the capability today, and will calculate scheduled arrival times to maximize arrival capacity. This will provide controllers with automated information on airport arrival demand and available capacity to improve sequencing and better balance arrival and departure rates.

Information such as proposed arrival time, sequencing and route assignments will be exchanged with the aircraft via a data communications link to negotiate a final flight path. The final flight path will ensure that the flight has no potential conflicts, and that there is an efficient arrival to the airport, while maintaining overall efficiency of the airspace operation.

With the improved precision of NextGen systems, separation between aircraft can be safely reduced. This will allow for more efficient transitions to the approach phase of flight to high density airports because controllers will have access to more usable airspace. Therefore, descending aircraft can be managed as a unified operation and the airspace can be structured to have multiple precision paths that maintain individual flows to each runway.

Where feasible, equipped aircraft will be able to fly precise vertical and horizontal paths, called optimized profile descents, from cruise down to the runway, saving time and fuel while reducing noise. Airports and their surrounding communities will benefit from these reduced environmental impacts.

Today, the structure of arrival and departure routes does not allow for the most efficient use of the airspace. By redesigning airspace, precision three-dimensional paths can be used in combination to provide integrated arrival and departure operations. More importantly, this more flexible airspace will give controllers better options to safely manage departure and arrival operations during adverse weather, restoring capacity that is currently lost in inclement conditions. Poor visibility conditions dramatically reduce capacity for closely spaced runways. These capacity losses ripple as delays throughout the system. NextGen capabilities will allow us to continue using those runways safely by providing precise path assignments and appropriate safe separation between aircraft assigned on parallel paths, restoring capacity and reducing delays throughout the NAS.

Descent and Approach	
Key Ground Infrastructure	**Avionics**
• 4-Dimensional Weather Cube • ADS-B ground stations • ASDE-X • Common Automated Radar Terminal System/Standard Terminal Automation Replacement System enhancements • Data Communications • Enhanced/Integrated Traffic Management Advisor • Ground-Based Augmentation System • Terminal Flight Data Management System • Traffic Flow Management System	• ADS-B In and Out • Data Communications • FANS • Ground Based Augmentation System (GBAS) avionics • RNAV/RNP • VNAV

Landing, Taxi, Arrival

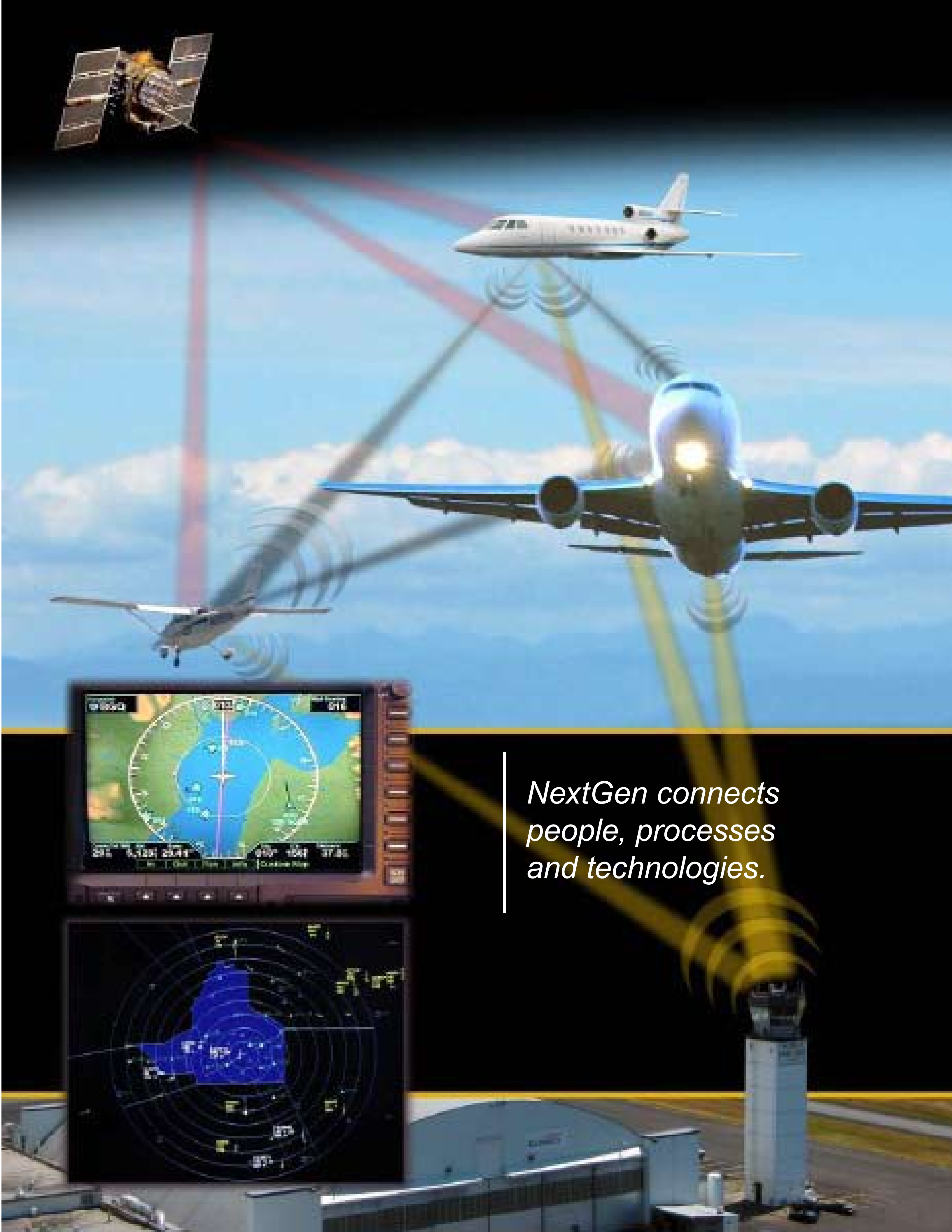
Before the flight lands, both the preferred taxiway to be used for exiting the runway and the taxi path to the assigned parking will be available to the flight crew via a data communications link. This will be enabled by the ground system, which will recommend the best runway and taxi path to controllers based on the arriving aircraft, and the status and positions of all aircraft on the airport.

Cockpit and controller displays will monitor aircraft movement and provide alerts to the pilot and the controller, when necessary, using the same safety and efficiency tools as during departure operations. This will reduce the potential for runway incursions.

Additionally, appropriate surface and gate area vehicle movements will be shared between air traffic control, flight operation/dispatch offices, and the airport authority. This information will let operators in ramp areas know the projected gate arrival times for inbound flights. This will ensure smooth, efficient traffic flows into and out of ramp areas, and allow additional lead time for airline personnel to be in place to meet inbound flights. ■

Landing, Taxi, Arrival	
Key Ground Infrastructure	**Avionics**
• 4-Dimensional Weather Cube • ADS-B ground stations • Airport Surface Detection Equipment model X (ASDE-X) • Common Automated Radar Terminal System/Standard Terminal Automation Replacement System enhancements • Data Communications • Enhanced/Integrated Traffic Management Advisor • Integrated Arrival and Departure Coordination Tool • Modernized Aeronautical Information Management System • Surface traffic management decision support tool • System-Wide Information Management (SWIM) • Terminal Flight Data Management System • Traffic Flow Management System	• ADS-B, TIS-B, FIS-B • Data Communications • RNAV/RNP

Airfield Improvements		
New Runways	**Runway Extensions**	**Airfield Reconfiguration**
• Dulles • Houston • Denver	• Fort Lauderdale • Portland • Atlanta • Salt Lake City	• Philadelphia • Chicago, phase 2 • Los Angeles north runway complex



NextGen connects people, processes and technologies.

NextGen Benefits

Weather causes 70% of delays. NextGen will reduce delays and increase safety while improving efficiency, capacity and environmental performance.

Overview

Implementing NextGen over the next 10 years will enable significant safety, environmental, and operational improvements. This is clearly seen through our initial NextGen demonstrations, operational trials and deployments. This early work has also provided invaluable data and insights to allow FAA to use the power of modeling and simulation to assess the integrated NextGen benefits across a range of future scenarios.

Our preliminary modeling of a series of NextGen capabilities shows that by 2018 total flight delays will be reduced by 35-40 percent, saving almost a billion gallons of fuel. This is compared to the "do nothing" case, which shows what would happen if we operate in 2018 the same way as today. The number of operations we might expect in 2018 varies more widely; a conservative estimate suggests at least 85,000 more operations in the system, with the possibility of seeing three times that number, when economic conditions improve. (For more information on modeling assumptions, see sidebar on page 22)

By 2018, total flight delays and fuel use will be reduced, while more flights can be accommodated.

The current model includes one-third of the NextGen changes. It is important to note that our modeling and simulation results are preliminary, and as the model matures the FAA expects these benefits values will increase. As NextGen planning evolves, we will reduce uncertainty in our assumptions in areas like equipage rates and economic conditions and we will develop and validate additional modeling capability for currently un-modeled NextGen capabilities, such as improved traffic flow around adverse weather.

Because NextGen benefits are integrally linked to equipage rates, it is imperative that the FAA works closely with all aspects of the aviation community on NextGen deployment. The information provided in this section represents only a starting point for increased coordination with the community—coordination that will initially lead to an increased understanding of NextGen benefits and ultimately to the improved ability for the aviation community to make their own business cases for NextGen investments.

Enhanced Safety

Our current airspace system is the safest in the world, and it is the safest that it has ever been. However, new means are required to ensure this remains the case as we transform the NAS. NextGen will continue that trend in the face of increasing traffic and the introduction of very light jets, unmanned aircraft systems and commercial space flights. To continue to minimize risk as we introduce a wave of new systems and procedures over the next decade, the aviation community will continue to rely on safety management systems (SMS), integrated safety cases, and other proactive management processes, which allow us to assess the safety risk of all proposed changes. Proactive safety management also allows us to analyze trends and uncover problems early on, so that preventive measures are put in place before any accidents can occur. FAA's Aviation Safety and Information Analysis and Sharing (ASIAS) program provides a suite of tools that extract relevant knowledge from multiple, disparate sources of safety information. ASIAS also helps the FAA and our industry partners to monitor the effectiveness of safety enhancements. In use today, ASIAS will ensure that the operational capabilities that produce capacity, efficiency and environmental benefits are first and foremost inherently safe.

Specific operational capabilities also enhance safety. By providing pilots and controllers with better situational awareness that allows them to avoid potential dangers, ADS-B In and other complementary improvements have already reduced the accident rate in southwest Alaska by 47 percent. The FAA will extend this capability by installing ADS-B ground equipment across the entire U.S. by 2013. This will allow pilots of equipped aircraft to see airborne traffic, weather conditions, and flight-restricted areas on their cockpit displays. Furthermore, ADS-B will provide surveillance to areas that currently do not have radar coverage, including the Gulf of Mexico.

Surface management systems, like those being tested at John F. Kennedy International Airport and Memphis International Airport, help make the most of the airfield infrastructure. Integrating ASDE-X, ADS-B and surface moving maps can increase shared situational awareness. This will help the FAA and operators move aircraft and vehicles safely and more efficiently around the airport surface, and reduce the likelihood of runway incursions.

Approaches with vertical guidance, such as LPV approaches, may allow more access to many smaller airports. These approaches allow safer access under low visibility conditions." Further, as information about

aircraft operational intent is synthesized through NextGen automation, air domain security will be enhanced by more rapid identification and investigation of flight path anomalies.

Increased Operations and Efficiency

Capacity and efficiency problems develop when demand for the use of runways and airspace outstrips available resources. These imbalances can be temporary (e.g., poor weather on a route or a disabled aircraft on a runway) or long-term (e.g., demand for runway use at the major New York area airports and surrounding airspace). These imbalances limit the predictability of the system, causing delays, excess fuel burn and emissions, and excess travel distances. Ultimately, NextGen is designed to optimize every phase of flight.

NextGen calls for communities, airports and the FAA to continue to work together to build new runways. New runways provide significant capacity and operational improvements. In November 2008 three major new runways opened at: Seattle-Tacoma, Washington Dulles, and Chicago O'Hare international airports. The new Chicago runway, for example, will provide the airport with capacity for an additional 52,300 annual operations with a small reduction in average delays. In Seattle, the new runway will allow efficient operating capability of the airport during peak periods. Likewise, the new runway at Dulles will provide capacity for an additional 100,000 annual operations.

However, by themselves new runways will not be sufficient to handle the projected demand. We must deliver the newest NextGen technologies and procedures to the runways in order to maximize the benefits.

NextGen's operational capabilities will provide air traffic controllers with improved tools to handle more complex traffic while improving service. Some of these capabilities take advantage of existing avionics, such as RNAV and RNP. The rate at which users equip for those capabilities that do require new avionics will influence the magnitude and timeframe in which NextGen benefits are realized.

Modeling and Simulation

To develop the initial benefit projections, the FAA evaluated a subset of NextGen improvements against the number of operations we would expect to see using various economic scenarios with varying levels of operational demand. We see NextGen providing improved overall performance and significant benefits in all scenarios.

It is vital to understand the context of the results, particularly as they relate to the number of expected operations. The FAA's analysis, which is based on the agency's Aerospace Forecasts, calculates the number of operations that are expected to occur under the scenario that is being studied. NextGen improvements will likely add the potential to accommodate a much greater number of operations than are currently forecasted, leaving us additional room for growth. This is because the number of expected operations is dependent on many factors external to the FAA's implementation of new infrastructure and NextGen capabilities. For example, they are dependent on the fleet evolution and particularly the level to which the fleet is equipped to take advantage of NextGen capabilities. They are also dependent on driving economic factors like the demand for air travel and the price of fuel. Because these factors can change, it is necessary to assess a range of conditions to understand potential NextGen benefits.

Likewise, other expected benefits, like reduced delays and decreased fuel burn (with their corresponding environmental benefits), are tied to the number of expected operations. Therefore, care must be used when viewing and relaying this information.

These benefits figures were generated by the FAA's national airspace model, using a range of traffic forecasts. The model looks at all en route sectors and every

As we look further ahead, the new aircraft equipage coming into use by 2018 holds the promise of significant advances in system performance. For example, more than 650 helicopters fly among more than 5,000 oil platforms in the Gulf of Mexico. Today these helicopters cannot easily be seen by radar nor always communicate with air traffic controllers. As a result, they can only fly when they can maintain visual separation from other aircraft. In poor visibility conditions helicopter flights in the Gulf are reduced by 90 percent, according to the Helicopter Association International. ADS-B will change that; air traffic controllers will be able to see equipped helicopters and keep them safely separated. ADS-B also will improve operations for aircraft in high altitude airspace over the Gulf. Today, without surveillance coverage, those aircraft are required to maintain 120 nautical miles longitudinal separation for safety; with ADS-B, separation can be safely reduced to as low as 5 nautical miles.

Other changes to separation standards could allow some airports to increase the use of their closely spaced runways in poor visibility conditions, without the need for new infrastructure or new aircraft avionics. These initial separation changes will be available in several years. Work is underway today for additional separation reductions that will require avionics. Ultimately, new separation standards could allow an airport to build runways closer together or maximize the use of existing runway configurations. This will increase an airport's capacity within its existing boundaries, providing better service to its community without the need for additional land.

instrument flight rules flight in the United States, plus any visual flight rules flight at the 73 largest airports. It is able to assess the interactions between complex elements of the NAS. To date, this tool has proven quite accurate in predicting NAS performance. For example, the model was able to calculate, within 4 percent, the overall fuel used by the commercial fleet in 2007.

For the initial NextGen assessments, we modeled approximately one-third of NextGen improvements, such as airfield improvements, reduced separation standards, performance-based navigation procedures, and airspace redesign.

We are also using simulations and operational demonstrations to better understand the benefits of applying specific new concepts in the operational environment. As we move forward, we will use the simulations to understand how NextGen improvements address problems at specific airports and regions and what ripple effect those changes might have at the national level. Our simulations will also be useful for assessing environmental performance.

NextGen benefits are closely linked to maximizing use of existing and new avionics equipage. The national airspace model will be a critical tool as the FAA begins working with operators this year to help them identify ways to maximize benefits and build business cases for NextGen equipage.

Likewise, as we continue to move forward with deploying NextGen capabilities it is important that we track the right metrics to ensure the necessary performance and benefits. Our simulations will provide insights into appropriate metrics that will be developed and tracked in cooperation with the aviation community.

Reduced Environmental Impact

NextGen will reduce aviation's environmental footprint through a combination of enhanced air traffic procedures, improvements in environmental technologies for aircraft and engines, introduction of sustainable alternative fuels, and use of an environmental management system to make continual improvements in environmental protection. The efficiencies that reduce delays also save fuel and reduce emissions.

The benefits begin today with RNAV/RNP. Aircraft capable of more precise navigation can fly paths that reduce noise

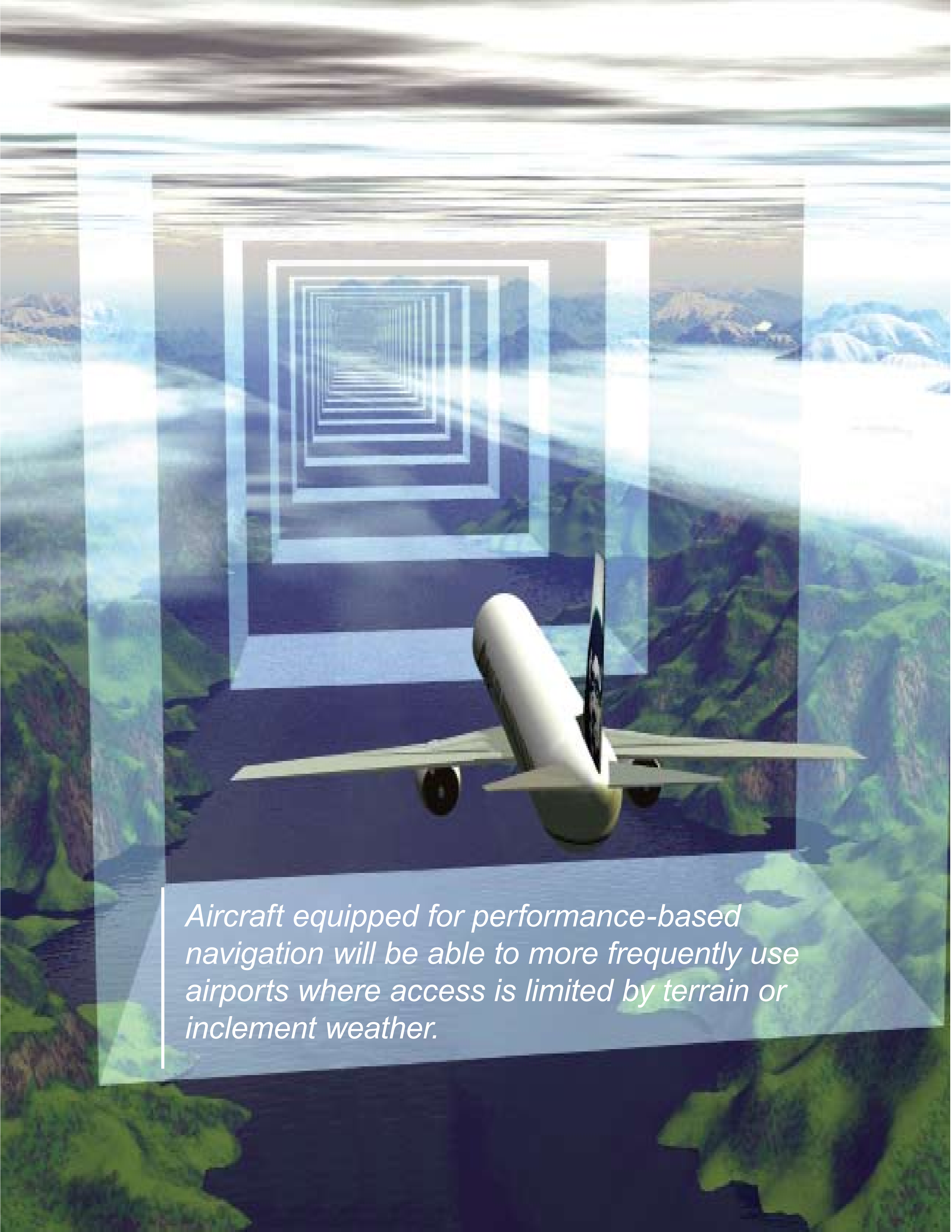
over communities and environmentally sensitive areas. Southwest Airlines recently announced it is investing $175 million to make its entire fleet RNP-capable and to employ performance-based navigation throughout its routes. According to Southwest's own analyses, these procedures should reduce fuel usage significantly, leading to 150,000 metric tons less carbon emissions per year once the project is completed.

Recent demonstrations of NextGen concepts have shown promising results regarding the use of optimized profile descents. On average, the Boeing 777s flying full-tailored arrivals used about 193 gallons less fuel, while 747s averaged 334 gallons less.

Recent demonstrations of NextGen concepts have shown promising results regarding the use of optimized profile descents. Between December 2007 and December 2008, the FAA partnered with Boeing, United Airlines, Japan Airlines and Air New Zealand to test oceanic tailored arrival procedures. These arrivals permit approaches into coastal destinations and are designed to reduce fuel burn, emissions, and noise. During more than 1,000 flights into San Francisco, the participating aircraft collectively reduced carbon dioxide emissions by 6.3 million pounds, and reduced fuel usage by 2 million pounds, according to data compiled by Boeing. On average, the Boeing 777s flying full-tailored arrivals used about 193 gallons less fuel, while 747s averaged 334 gallons less. In instances where only partially-tailored arrivals were possible, the 777s still averaged a savings of around 55 gallons of fuel, while the 747s cut fuel use by nearly 160 gallons per flight. Other similar trials are in process elsewhere in the United States.

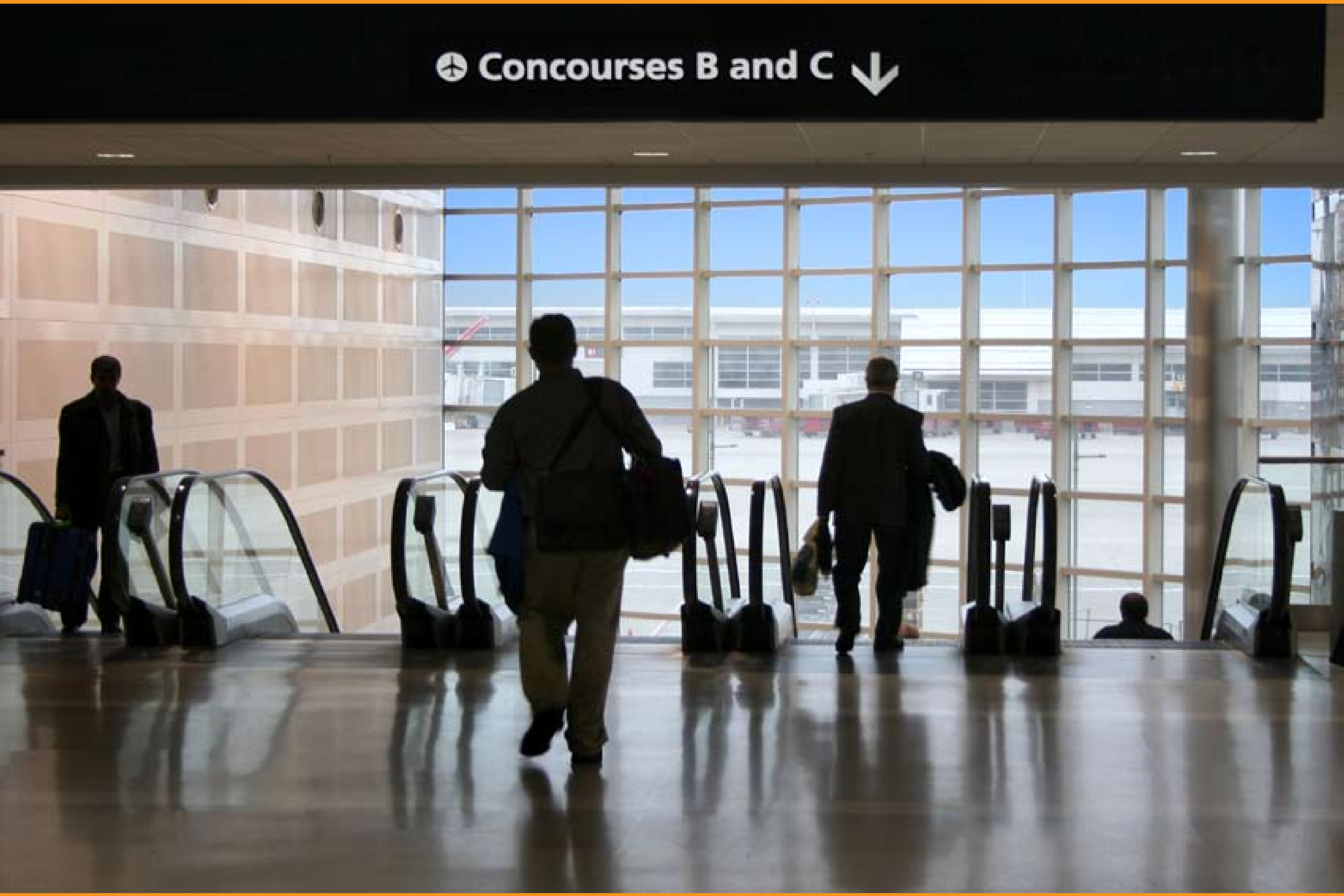
Improvements in aircraft airframe and engine technology and the use of sustainable alternative fuels are essential to achieving the substantial environmental gains NextGen can support. The FAA and industry seek to accelerate the maturing of low noise, emissions and energy technology through the Consortium for Lower Energy Emissions and Noise (CLEEN) initiative, and to foster sustainable alternative fuels through the Commercial Aviation Alternative Fuel Initiative (CAAFI).

Environmental benefits with the airport industry include comprehensive "green" airport plans, recycling plans and programs, LED lighting replacement programs for energy efficiency, increased use of electric ground support equipment, and increased use of gate power and preconditioned air at existing terminal gates. ■



Aircraft equipped for performance-based navigation will be able to more frequently use airports where access is limited by terrain or inclement weather.

Business Focus Areas



Achieving NextGen benefits, such as reducing congestion and delays, requires a collaborative approach among the FAA, other government agencies and industry stakeholders.

NextGen technologies, procedures and infrastructure are developed in a portfolio framework, which is a comprehensive method of monitoring and managing multiple interrelated projects that ensures all pieces work seamlessly together. However, the FAA has identified several over-arching issues that have the potential of impeding NextGen implementation if they are not resolved. Each of these issues may affect several development areas and require collaboration of multiple lines of business to resolve. Therefore, resolution of these issues, and others that may arise, is being managed collaboratively by the NextGen Management Board.

Mixed Equipage

NextGen will be implemented airport by airport, region by region, aircraft by aircraft, over a period of years. The FAA proposes moving from the concept of "first-come, first-served" to "best-equipped, best-served." While early adopters will reap the greatest benefits, lesser equipped aircraft must still be accommodated. The FAA must work with the aviation community on an operational transition plan that adequately accommodates all types of operators with varying levels of equipage, while maximizing overall system performance and enhancing safety.

Closely Spaced Parallel Runways

Significant capacity and efficiency are lost when poor weather conditions limit operations on parallel runways spaced closer than 4,300 feet. The FAA seeks to remedy that constraint using a combination of revised standards and new technologies. In October 2008, the FAA endorsed a sustained multi-year program that would introduce improvements incrementally, including changes to both operations and airport design standards. Initial changes will help airports make better use of existing infrastructure. Later on, new airport design standards may allow airports to build additional runways within existing boundaries, significantly increasing capacity without the expense and local impact of acquiring new land. It currently takes 10 to 15 years to complete a new runway, and so the FAA must press forward if we are to benefit from new airport design standards in the mid-term.

NextGen Workforce Development

NextGen is a tremendous career opportunity for those who want to participate in leading-edge, full-scale transformation of the NAS. While the agency has most recently focused on hiring controllers and airway systems specialists, the development and implementation of NextGen will require the FAA to hire several hundred new employees over the next two years. These individuals will have expertise in disciplines such as program and financial management, systems engineering, contracting, and aviation research. They will support the Air Traffic Organization, Office of Aviation Safety, Office of Airports, and others. Recognizing the importance of attracting and retaining the proper skill

sets for NextGen, the FAA requested that the National Academy of Public Administration (NAPA) examine the personnel requirements for NextGen's development and implementation. The FAA is now working across organizational lines to address the NAPA recommendations, including continually evaluating staffing needs versus NextGen demands, streamlining its hiring processes, and aggressively pursuing enhanced training and retention programs.

Managing Environmental Constraints/Challenges

Though aviation's environmental footprint today is small, less than 3.5 percent of human-caused climate change[1], national and international concerns about its environmental impact could constrain the industry in the future, if not properly addressed. An environmental management system approach will be used to integrate environmental and energy considerations into core NextGen business and operational strategies. Technological advances, including development and use of alternative fuels, are critical for managing aviation's environmental and energy challenges.

Global Strategy

The FAA must pursue comprehensive alignment between NextGen and similar international efforts. The FAA must maintain a leadership role with international bodies, notably the International Civil Aviation Organization (ICAO) and

1 "Report to the United States Congress: Aviation and the Environment", Partnership for Air Transportation Noise and Emission Reduction (PARTNER), 2004. PARTNER is an FAA/NASA/Transport Canada Center of Excellence.

the Civil Air Navigation Services Organization (CANSO), for the development of global standards, procedures and terminology. We must support bilateral and multilateral partnerships with air navigation service providers to ensure harmonization of NextGen technologies and procedures such as ADS-B and optimized profile descents. We must foster strategic regional partnerships that promote cooperative development activities, such as the Atlantic Interoperability Initiative to Reduce Emissions (AIRE) and the Asia and South Pacific Initiative to Reduce Emissions (ASPIRE). We must also continue in-depth collaboration with global industry and key partners such as the SESAR Joint Undertaking on the development of avionics requirements and other key enabling technologies. The agency must promote clear and consistent goals and positions that support these efforts, and effectively integrate them into initiatives of the broader federal government and of the global civil aviation community.

Information Security Governance

NextGen will require that information security be integrated within the three domains (air, ground, and the intersection of air-ground). Additionally, an integrated approach to governing a cyber security infrastructure must be established to support trusted exchange of information between NextGen partners. This infrastructure must be responsive to operational needs, and, in the case of NextGen, also comply with information security mandates imposed on U.S. government critical infrastructure. The infrastructure architecture must also allow for the implementation of information security services across legacy and planned systems. Information security services at the enterprise level will provide a degree of responsiveness and flexible protection that is not achievable on a domain-by-domain or system-by-system basis. An integrated information security strategy and governance process, addressing all three domains, will be implemented to support the transition to NextGen. ■

Global air transportation brings the world closer together.

Aircraft Equipage for the Mid-Term

Cooperative development of equipage policies and schedules by both the FAA and the aviation community is imperative.

Appendix A: Aircraft Equipage for the Mid-Term

This Appendix outlines the avionics equipage that the FAA is targeting for mid-term operations as described in Section 2 of the NextGen Implementation Plan. The targeted avionics build on many of the capabilities that are either installed or available for today's aircraft. These avionics will provide years of useful capability and benefits for equipped operators, leading to a positive return on their investment.

The governing principles in Section 1 provide the basis for the target aircraft capabilities. The FAA is proposing a two-pronged approach to achieve the NextGen mid-term benefits: leveraging existing aircraft capabilities and introducing new aircraft capabilities. We will work with the RTCA Implementation Task Force to identify target locations and capabilities, and assist operators in developing their business cases for mid-term avionics equipage.

The targeted avionics builds on many of the capabilities that are either installed or available for today's aircraft.

Leveraging Existing Aircraft Capabilities

The NextGen implementation plan takes advantage of the following existing aircraft capabilities throughout the mid-term. Standards exists to allow certification and use of these capabilities. The FAA continues to work with the community on its application of products and operations. (Acronyms are displayed on page 59.)

RNAV and RNP (terminal and en route operations): A number of aircraft already have these capabilities, and the FAA is developing policy that captures the existing GPS and WAAS-equipped aircraft into this set. RNAV 1 and 2 use will continue to expand and then transition to RNP 1 and RNP 2. By the end of the mid-term, this capability will be used almost exclusively in IFR operations as RNAV/RNP procedures replace ground-based procedures.

VNAV: Currently, there is a large population of aircraft with the ability to use barometric altitude, through a flight management system, to fly a specified vertical profile. Its use is currently limited to approach operations where lower minima can be achieved for suitably equipped and approved operators. By accounting for this capability in the design of arrival and departure procedures, traffic flows can be de-conflicted more efficiently. The use of this capability is focused on major airports where it is an important component of integrated arrival and departure management.

Curved path capability (radius to fix): This capability is available on large air transport aircraft, and has recently been adopted within the regional, business and very light jet markets. Arrival and departure routes at certain airports will take full advantage of this, so that aircraft without this capability would be the exception. Throughout the NAS, approach procedures with curved-path transitions will provide operational incentives for aircraft to equip.

RNP AR (Approach and Departure): This capability is expected to be available in a large portion of the air carrier and business jet community. At major airports, this will be used as a backup to ILS and as a means to provide visual meteorological conditions (VMC)-like ground tracks in instrument conditions, combining RNP AR capability with a short ILS final. At IFR airports throughout the NAS, this capability will be used where beneficial.

LPV: This capability, which provides vertically-guided approach service down to 200 feet using WAAS, is available on more than 20,000 aircraft. We expect equipage to continue to grow until LPV use is common by IFR operators outside of major airports.

EFB: Electronic flight bags will be used in nearly all air carrier and taxi operations, to provide the flight crew with charts, manuals, and weather data. Portable EFBs will enhance safety by allowing pilots to see their own aircraft's position on surface moving map displays. Installed EFBs, integrated with the rest of the cockpit, provide this safety enhancement and a platform that can be used to support some of the advanced capabilities for initial implementation, described below.

Data Communications (FANS-1/A+, ATN Baseline 1): Basic capabilities will be provided initially with a harmonized data communications system. Initial capabilities will be provided through globally harmonized initial data link capabilities (FANS-1/A+ and ATN) for domestic en route operations supported by a mix of Flight Management System (FMS)-integrated and Communications Management Unit (CMU)-based aircraft implementations.

Flight Information Services - Broadcast: Flight information services broadcast (FIS-B) will be adopted by a number of aircraft that lack weather radar.

Introduction of New Aircraft Capabilities
Coupled with the capabilities described in the previous section, the following new aircraft capabilities are targeted for initial implementation in the mid-term:

Data Communications (ATN Baseline 2): Segment 2 builds on initial capabilities, providing widespread FMS integration and advanced applications.

GNSS Landing System (GLS): Category I GLS capability will be available to properly equipped aircraft, and Category II/III GLS is expected to achieve initial implementation.

ADS-B Out: ADS-B Out provides high accuracy and frequent aircraft position reports that can be used by ATC to provide radar-like separation in non-radar areas. A Notice of Proposed Rulemaking was issued in 2008.

ADS-B In: ADS-B In provides information to the cockpits of properly equipped aircraft that can be used for multiple applications, including:

Cockpit Display of Traffic Information (CDTI): Using traffic information service broadcast (TIS-B), CDTI will provide a graphical depiction of air traffic, which will improve situational awareness for a variety of operations. This capability is expected primarily in aircraft without Traffic Collision Avoidance System (TCAS), and when implemented in conjunction with an ADS-B In guidance display.

Guidance Display: This capability uses ADS-B In to provide relative guidance, predominantly based on speed control, to maintain a given spacing from a selected target. This display is implemented in conjunction with CDTI, and can be located on the CDTI or separately (it will be in the forward field of view). This capability supports a number of ADS-B In-enabled benefits, including merging and spacing and limited delegated separation.

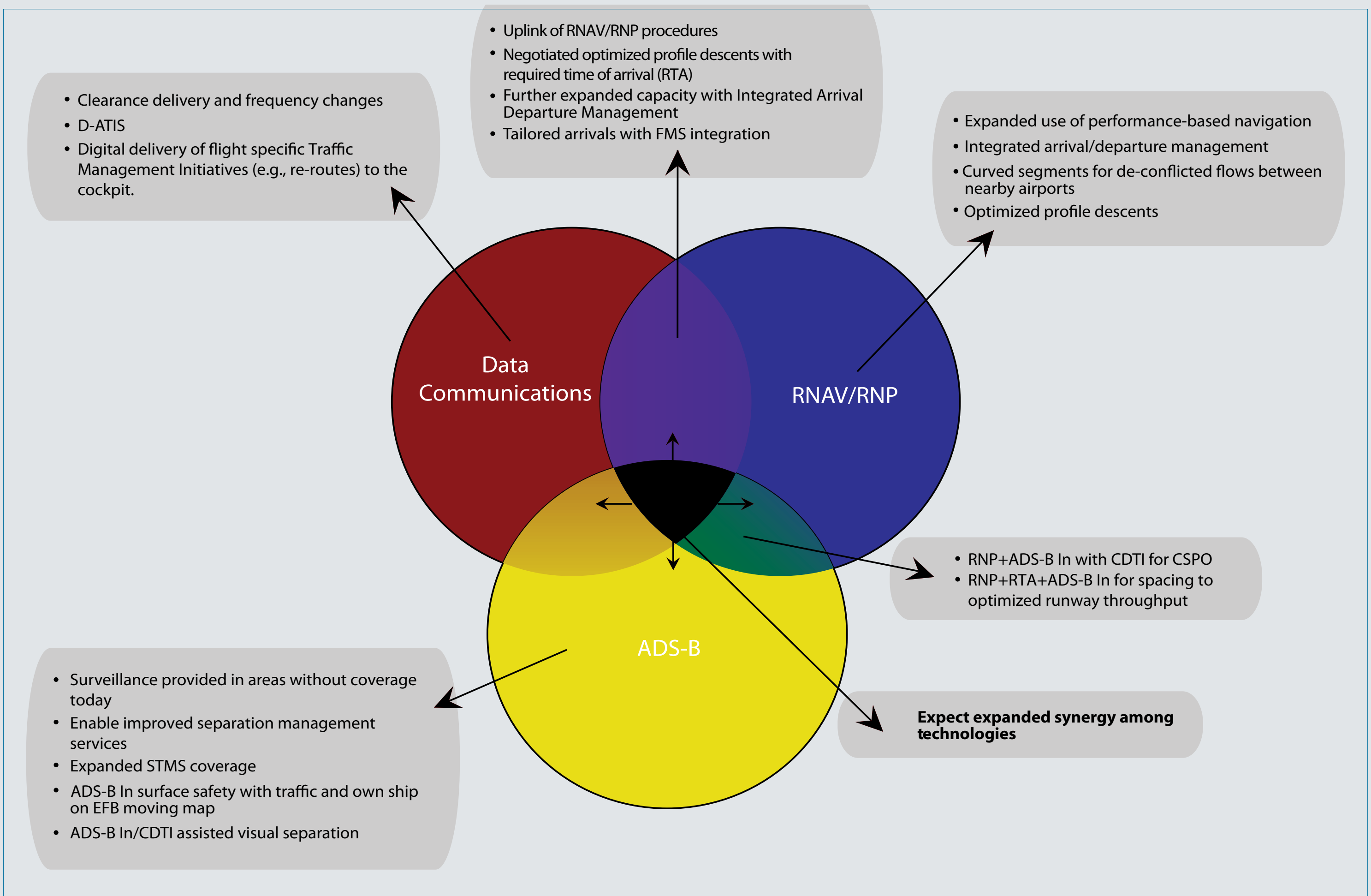
Paired Approach Guidance: Still in the applied research phase, this capability will leverage precision navigation (e.g., from GLS or LPV) and ADS-B In to support paired approaches by multiple aircraft to closely-spaced runways. Initial implementation of this capability begins in the mid-term; runway separation standards will also be finalized in the mid-term, which can be used for future airfield development. ■

Plan for New Aircraft Capability Guidance

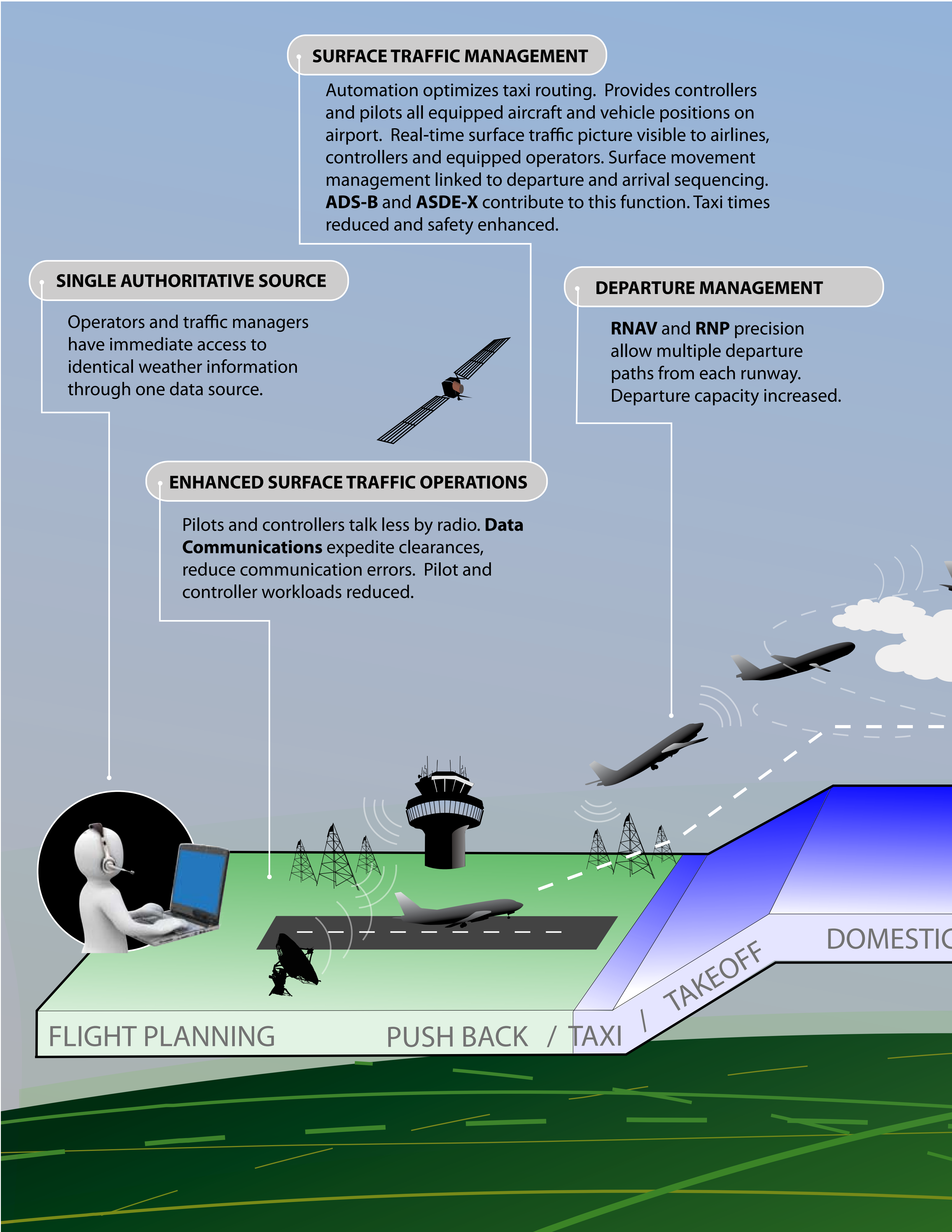
Avionics Enablers	Aircraft and Operator Guidance		Aircraft Implications	Flight Crew Implications
	Guidance	Schedule		
Data Communications: ATN Baseline 2	AC20-140B, AC120-70C	2014	Based on RTCA SC-214	AC 120-70C
CDTI (ADS-B IN)	AC, TSO	2010	Receive capability in 1090ES or UAT, display of traffic, and ability to select traffic to follow	
CDTI with alerting (ADS-B IN)	AC, TSO	2011	CDTI, plus display of target speed to maintain desired spacing (distance or time) and alerting if minimum requirement is exceeded	
ADS-B Guidance Display (ADS-B IN)	AC, TSO	2012	Along-track guidance (achieve spacing in time/distance).	
Paired approach guidance	TBD	2015	Builds on ADS-B guidance display to address wake vortex and collision risk	
GLS (CAT II/III)	Project specific policy	2012	GBAS Landing System (CAT II/III) (detailed requirements being developed)	Common expect procedures with ILS

This table shows when the standards for various avionics equipage will be published.

Integrated Mid-Term Capability



The figure illustrates capabilities provided by the three key NextGen technologies for communications, navigation, and surveillance. Some of these capabilities are enabled by more than one of these technologies. As NextGen development continues, we expect to identify additional capabilities that result from the synergy of the three technologies. Each of these technologies, alone and in combination, provide benefits. In order for benefits to be fully realized, however, the complementary activities (ground infrastructure, procedures, and training, etc.) must be operational and other aircraft performance requirements (noise and emissions) will have to be met.


SURFACE TRAFFIC MANAGEMENT
Automation optimizes taxi routing. Provides controllers and pilots all equipped aircraft and vehicle positions on airport. Real-time surface traffic picture visible to airlines, controllers and equipped operators. Surface movement management linked to departure and arrival sequencing. ADS-B and ASDE-X contribute to this function. Taxi times reduced and safety enhanced.
SINGLE AUTHORITATIVE SOURCE
Operators and traffic managers have immediate access to identical weather information through one data source.
DEPARTURE MANAGEMENT
RNAV and RNP precision allow multiple departure paths from each runway. Departure capacity increased.
ENHANCED SURFACE TRAFFIC OPERATIONS
Pilots and controllers talk less by radio. Data Communications expedite clearances, reduce communication errors. Pilot and controller workloads reduced.
FLIGHT PLANNING
PUSH BACK / TAXI / TAKEOFF
DOMESTIC

CRUISE

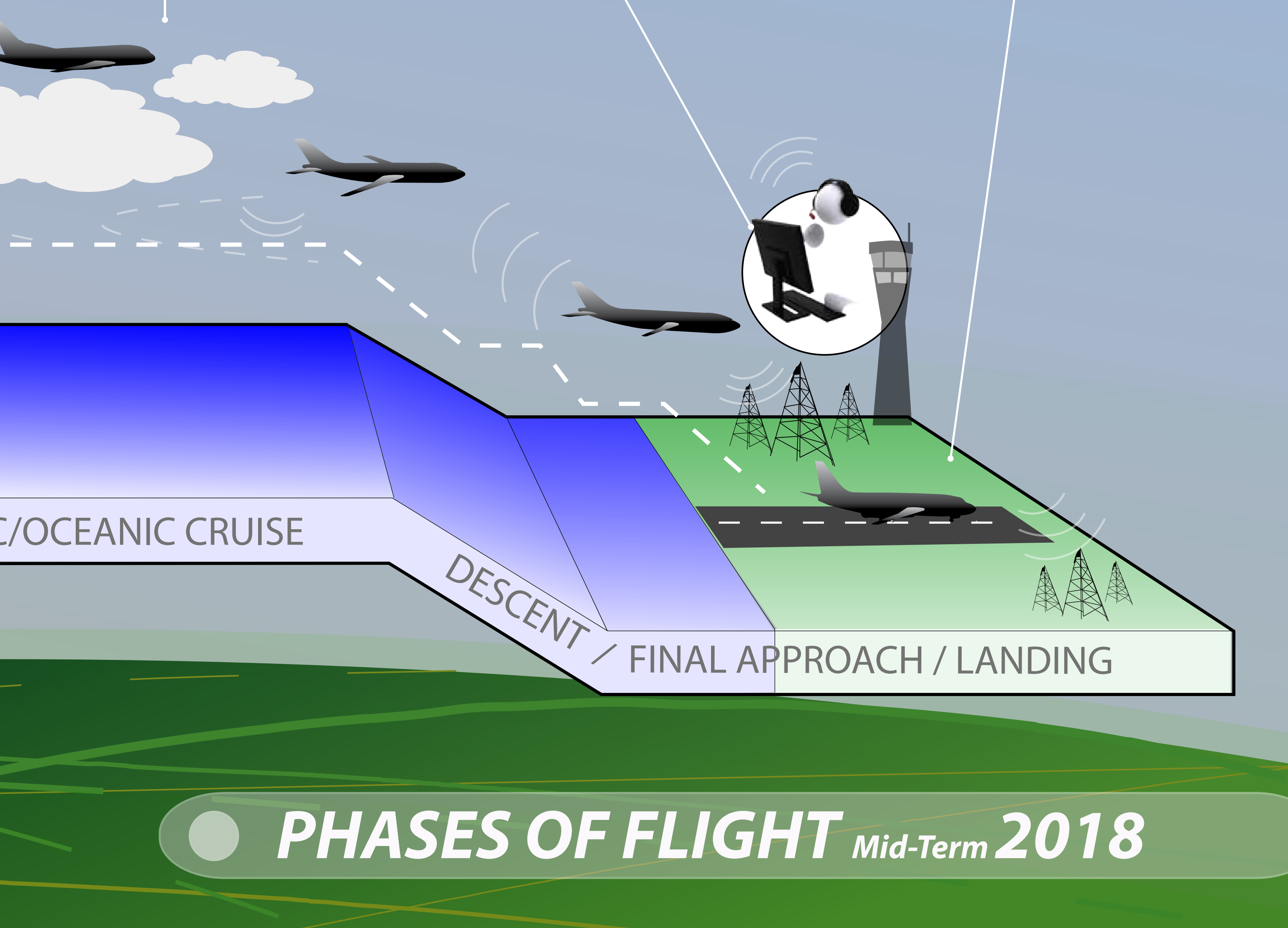
RNAV, **RNP** and **RVSM** utilize reduced separation requirements increasing airspace capacity. Aircraft fly most optimal path using trajectory-based operations considering wind, destination, weather, and traffic. Re-routes determined with weather fused into decision-making tools are tailored to each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

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.

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. Noise, emissions and holding are reduced.



PHASES OF FLIGHT *Mid-Term* 2018

NextGen Commitments and FY09 Work Plan

The FAA is implementing a series of operational changes that are improving the performance of the NAS, such as this new runway at Chicago O'Hare International Airport, which opened in November 2008.

Appendix B: NextGen Commitments and FY09 Work Plan

The FAA has created a portfolio framework that supports the required tracking, planning, reporting, and execution needed to successfully implement a large-scale integration project like NextGen. The full NextGen Portfolio contains elements from all phases of the agency's acquisition management system. It contains acquisition and implementation commitments for transformational programs like ADS-B; enabling activities that advance and demonstrate concepts and that lead to the development of system technical requirements; and applied research into areas like human factors.

For management purposes, the FAA has organized its NextGen Portfolio into seven solution sets, each focusing on a series of related operational capabilities that together will bring about the mid-term system.

Applied research is a mature level of research that helps us find solutions to specific problems. (In comparison, basic research is a broader exploration of future possibilities; applied research builds on that knowledge to address targeted needs.) Examples include operational concept development, mid-term developmental guidance, and standards development. The FAA's National Aviation Research Plan details our NextGen applied research activities; a high level summary of this information is also captured in the FAA's NAS Enterprise Architecture, which maps that applied research to the ultimate NextGen operational capabilities it supports. Applied research is not addressed in this supplement to the plan, but more information can be found through the NextGen Web site.

Enabling activities focus on the development of concepts of use and technical requirements for proposed new systems or enhancements to existing systems, along with prototypes and demonstration activities. They provide critical information to help the agency make investment decisions. Some of these activities require several years to complete; the section titled "FY09 Solution Set Work Plan" highlights those that will be completed in this fiscal year. The complete FY09 Work Plan can be found on the FAA's NextGen Web site.

The FAA has committed to implementing a series of operational changes that will improve the performance of the NAS immediately, while building the foundation for NextGen capabilities to come. These include airfield improvements; advances in surveillance, navigation, communications, and traffic flow management; and new automation and information exchange technology. This section includes information about the five NextGen transformational programs (ADS-B, Data Communications, System Wide Information Management, NextGen Network Enabled Weather, and NAS Voice Switch). These programs enable specific fundamental paradigm shifts to the way we manage air traffic, communicate, and exchange data. ADS-B is a fully-funded program whose deployment has begun; the other programs are in early stages of development.

The section titled "Schedule of Implementation Commitments" provides deployment schedules for these commitments, which include existing and upcoming programs that provide a foundation for NextGen mid-term capabilities. Check marks indicate completed milestones. Implementation is considered complete when all relevant training, policies, and procedures are in place.

Schedule of Implementation Commitments

Project	FY08	FY09	FY10	FY11	FY12
ADS-B		✓ TIS-B and FIS-B implemented in Miami area	— Surveillance and Broadcast Services in the Gulf of Mexico, Louisville, Philadelphia, Houston, and Juneau areas	— Additional infrastructure deployments	— Additional infrastructure deployments Note: All 794 ground stations will be deployed by 2013.
SWIM	✓ Awarded the Service Container software contract ✓ Developed SWIM Service Specification Document and Registry Interface Requirements Document	— Final Investment Decision for Segment 1B — Initial Segment 2 JRC preparations	— Final Investment Decision for Segment 2		— Segment 2 implementation begins FY12.
NextGen Network Enabled Weather	✓ Published weather product data format standards ✓ Conducted IT demonstrations, including capabilities of the virtual 4-D Weather Data Cube	— Publish NNEW Metadata guidelines — Demonstrations of the 4-D Weather Data Cube, including interagency interoperability	— Risk reduction activities for candidate IOC publisher/ subscribe systems	— Integrate and test NNEW systems	— Final NNEW evaluation and demonstrations
NAS Voice Switch	✓ Initiated investment analysis process and engineering studies		— Initial investment decision	— Final investment decision	
Data Communications	✓ Initial investment decision made for Segment 1 ✓ Frequency spectrum management to optimize allocation and reduce interference ✓ Conducted human-in-the-loop simulation	— Operational and regulatory activities — Operations and human factors research		— Final for Segment 1 investment decision	

Schedule of Implementation Commitments

Project	FY08	FY09	FY10	FY11	FY12
Runways, Taxiways and Airfield Improvements	✓ Chicago O'Hare Runway 10L/28R extension ✓ Center Taxiway at LAX, completing southside reconfiguration of LAX	✓ Washington Dulles Runway 1L/19R ✓ Seattle-Tacoma Runway 16R/34L ✓ Chicago O'Hare Runway 9L/27R ✓ Dallas-Fort Worth end-around taxiway — Philadelphia Runway 17/35 extension — JFK Airfield Improvements – Taxiway YA extension – JFK Taxiway K/KA ✓ Record of Decision for extension of Ft. Lauderdale Runway 9R/27L — Environment Assessment for Portland Runway 10L/28R extension	— Boston Logan, centerfield taxiway — Charlotte Runway 17/35 — Record of Decision for Philadelphia airfield reconfiguration — JFK Airfield Improvements – Taxiway KK extension – Southwest quadrant taxiway – Taxiway FB extension – High-speed exits for Taxiways PA, N, L – New fillets to accommodate A380	— JFK Airfield Improvements – Improved taxiway access from Runway 31L	— JFK Airfield Improvements – New taxiway south of Runway 31L and west of Runway 4L — Chicago O'Hare Runway 10C/28C

Initiate Trajectory-Based Operations

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.

Mid-term Operational Capabilities:
– *Delegated Responsibility for Separation*
– *Oceanic In-Trail Climb and Descent*
– *Automation Support for Mixed Environment*
– *Initial Conflict Resolution Advisories*
– *Flexible Entry Times for Oceanic Tracks*
– *Point-in-Space Metering*
– *Flexible Airspace Management*
– *Increase Capacity and Efficiency Using RNAV and RNP*

Schedule of Implementation Commitments

Project	FY08	FY09	FY10	FY11	FY12
ERAM *ERAM capability forms a foundation for NextGen automation*		— ERAM will be fully operational at 6 of 20 en route centers.	— ERAM will be fully operational at remaining 14 en route centers. — Final investment decision for ERAM post-Release 3	— Follow on ERAM capabilities will continue	
TMA *TMA capability forms a foundation for future strategic traffic flow management*	✓ Implemented at all 20 en route centers ✓ Adjacent center time-based metering for Newark and Philadelphia arrivals				

FY09 Solution Set Work Plan

Description/Title	What	Why	Who	When			
Separation Management - Modern Procedures (Separation Automation Enhancements, D-side and R-side) *Provides enhanced decision support tools to ATC workstations for assistant and radar controllers.* *Note: Other controller enhancement tools are planned for the radar controller (R-side) console display, designed to provide visual cues to increase controller situational awareness.*	Conduct computer human interface assessment of changes to the D-side workstation to support functionalities for ERAM	Preliminary assessment determines requirements and system design; ensures enhancements conform to computer human interface (CHI) standards and best practices necessary for delivery of automation tools for mixed environment in 2013. This is linked to the capability called Automation Support for Mixed Environment.	**ATO-E** **Domain Engineering Group** **Craig Marina**	Q1	Q2	Q3	Q4
Separation Management - High Altitude *Looks at high altitude air traffic management in the ARTCCs, including airspace design, established routes, procedures, and application of separation standards.*	Conduct airspace design analysis and identify operational and system requirements	Lays the foundation for development of High Altitude Generic Airspace Concept Phase 1; eventually leads to development of initial standards and procedures for self-separation in 2017.	**ATO-P** **Air Traffic Systems Concept Development Group** **Michele Merkle**	Q1	Q2	Q3	Q4
Trajectory Management - Oceanic *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.*	Develop initial mid-term In-Flight Oceanic Trajectory Management-4D Research & Development Roadmap to NextGen capabilities	Demonstrate trajectory-based operations in transitional airspace between oceanic and domestic en route, using oceanic data link and Advanced Technologies and Oceanic Procedures (ATOP) automation in 2011.	**ATO-W** **Advanced Technology Development Prototype Group** **Thien Ngo**	Q1	Q2	Q3	Q4
Flight and State Data Management - Flight Object *Allows standardization of flight information for enhanced data exchange across the NAS and external systems.*	Provide the FAA data to support development of International Flight Data Object (IFDO) standards	Facilitate the exchange of important operational data with air traffic management system for better flight management; provide capability to exchange flight planning information in near real-time basis in 2016. (This activity targets the NAS Enterprise Architecture decision on mid-term automation system investment decision.)	**ATO-P** **NextGen Integration and Implementation** **Diana Liang**	Q1	Q2	Q3	Q4
Capacity Management - NextGen DME (Distance Measuring Equipment) *The DME network will be sustained to support en route navigation and to serve as an independent backup navigation source to Global Positioning System (GPS) and GPS/Wide Area Augmentation System (WAAS).*	Initiate contract to procure DMEs	Select contractor to deliver ~ 50 high power DME units by the end of FY14 (the final number is currently under evaluation and will be known in the June '09 timeframe). This capability will increase capacity and efficiency and provide a redundant en route network for an area navigation (RNAV) for en route area operations at major airports. (Next generation of DMEs available to support RNAV throughout the NAS in 2015.)	**ATO-W** **Ground Based NAVAIDS Group** **Steve Brunley**	Q1	Q2	Q3	Q4

Increase Arrivals/Departures at High Density Airports

The focus of this solution set is to increase the arrivals and departures in areas where demand for runway capacity is high or where there are multiple runways with airspace and taxiing interaction and finally for close proximity airports with potential and airspace/approach interference.

Mid-term Operational Capabilities:
- *Improved Operations to Closely-Spaced Parallel Runways*
- *Initial Surface Traffic Management*
- *Time-Based Metering Using RNP and RNAV Route Assignments*
- *Integrated Arrival/Departure Airspace Management*

Schedule of Implementation Commitments

Project	FY08	FY09	FY10	FY11	FY12
RNAV/RNP *RNAV Standard Instrument Departures (SIDs) and Standard Terminal Arrival Routes (STARs)*	✓ Published 78 (goal was 50)	— 50 per year, including ✓ Chicago O'Hare ✓ Newark ✓ San Diego – Teterboro	— 50 per year	— 50 per year	— 50 per year Note: FAA is working with industry to develop priority deployment lists for RNAV/RNP.
Simultaneous Non-Interferring Operations (SNI)	✓ Established 5 helicopter RNAV (GPS) procedures in New York as Helicopter PBN testbed	— Developing helicopter route implementation plan	— Begin helicopter route development (qty TBD) — Develop helicopter departure implementation plan	— Helicopter route development (qty TBD) — Begin helicopter departure procedure development	
RNP Authorization Required (AR)s	✓ Published 63 (goal was 25)	— 50 per year, including: – Monterey – Chicago/Midway – Houston – Phoenix	— 50 per year	— 50 per year	— 50 per year
RNAV routes	✓ Published 49 (goal was 12)	— 12 per year	— 12 per year	— 12 per year	— 12 per year
Reduced Separation for Dependent Arrivals to Closely Spaced Parallel Runways		✓ National order allowing 1.5-mile staggered diagonal separation between aircraft on approach to parallel runways at Boston, Cleveland, Philadelphia, St. Louis, and Seattle	— Additional enabling activities for reduce separation are listed under "Separation Management for Closely Spaced Parallel Runways" in the FY09 Work Plan.		

Schedule of Implementation Commitments

Project	FY08	FY09	FY10	FY11	FY12
ASDE-X *ASDE-X is a safety system that also provides a foundation for follow-on surface management capabilities (see Integrated Surface Data).*	✓ Washington Dulles ✓ Detroit Metro Wayne County Airport ✓ Fort Lauderdale International Airport ✓ Phoenix Sky Harbor Airport ✓ John F. Kennedy International Airport ✓ Los Angeles International Airport	— Boston Logan International — Newark Liberty International	— Denver International Airport — George Bush Intercontinental Airport — Philadelphia International Airport — Minneapolis International Airport — John Wayne-Orange County Airport — Dallas/Fort Worth International Airport — Salt Lake City International Airport — Baltimore-Washington Thurgood Marshall International Airport — Chicago Midway International Airport — Honolulu International — Hickam AFB Airport — Miami International Airport — Ronald Reagan Washington National Airport — San Diego International Airport	— New York LaGuardia International Airport — Las Vegas McCarran International Airport — Memphis International Airport	
Integrated Surface Data *from ASDE-X to Traffic Flow Management System – provides improved traffic predictions*	✓ Receiving ASDE-X data from: – Dulles – John F. Kennedy – Memphis – Seattle – Louisville	— Installation of ASDE-X Data Distribution boxes at – Phoenix – Atlanta – Newark	— Installation of ASDE-X Data Distribution boxes at: –Laguardia Airport		

Schedule of Implementation Commitments

Project	FY08	FY09	FY10	FY11	FY12
Airspace and Procedures Enhancements *New York/New Jersey/ Philadelphia*	✓ De-conflict Newark arrivals over SHAFF intersection. ✓ Simultaneous visual approaches to Runway 4L/R at Newark. ✓ Enhanced procedures for Caribbean arrivals: established Caribbean tactical reroutes for arrivals to manage Newark arrivals. ✓ New procedures to allow arrivals to Runway 29, while landing Runway 4R at Newark. ✓ Simultaneous Approaches to Runways 31L/R at JFK. ✓ Accessing J134/J149 from ELIOT intersection. ✓ Established helicopter RNAV (GPS) procedures in New York.	— Stage 1: – Establish procedural changes in core facilities and RNAV overlays	— Stage 2: – Relocate and expand west airways – Reconfigure Philadelphia airspace	— Stage 3 – Relocate and expand North airways – Facilitate Stage 4 elements	— Stage 4: – Relocate and expand south airways – Relocate and expand east airways – Change altitude restrictions – Create optimal descent procedures
Airspace and Procedures Enhancements *Chicago Airspace Project*	✓ Stage 2: – Southbound departure routes for Chicago Midway	— Stage 2: South Enhancements – Additional southbound departures – Southeast high and wide arrival procedures for Chicago O'Hare west flow (supports triple arrivals from east with new Runway 09L/27R)			— Stage 3: West and north enhancements – Additional westbound departures – High and wide arrival procedures for Chicago O'Hare east flow (supports triple arrivals from west with new Runway 10C/28C, scheduled for FY13)
Airspace and Procedures Enhancements *Western Corridor – Southern Nevada Airspace*			— Optimize existing airports and airspace		

Schedule of Implementation Commitments

Project	FY08	FY09	FY10	FY11	FY12
Airspace and Procedures Enhancements *Houston Area Airspace Transition System (HAATS)*	✓ Phase 3A – Fifth departure route to northeast – Airspace realignment and new sectors in I90, ZHU, ZFW	— Phase 3B – Third eastbound departure route – New Severe Weather Avoidance Plan (SWAP) arrival route from the southeast – Realign southeast arrivals and departures to accommodate new routes	— Phase 3C – Expand airspace to the west by establishing College Station approach control services at Houston TRACON and modifying certain airspace boundaries – Third westbound departure route – Shift southwest arrivals to IAH and Houston southwest of the current location – New SWAP arrival route from the southwest – Dual capacity arrival routes from the northwest		
Airspace and Procedures Enhancements *High Altitude Airspace Management Program*		— Transition point-to-point second J80 route to Q42 — Initial transition of New York choke points routes to point-to-point navigation routes using NAS Reference System (NRS) — Initial transition of national playbook routes to point-to-point navigation using NRS			

FY09 Solution Set Work Plan

Description/Title	What	Why	Who	When			
International Air Traffic Interoperability *Ensures FAA ATC automation systems seamlessly interface and operate with the international aviation community, from departure/arrival to/from outside the United States.*	Conduct a demonstration of gate-to-gate concept across the Atlantic Ocean including continuous descent procedures into Miami Airport	AIRE is to demonstrate operations with environmental benefits across the Atlantic Ocean supporting the FAA's international collaboration to validate 4D TBO and performance-based ATM alternatives for the Oceanic In-trail Climb and Descent initiative. This supports NextGen Oceanic Procedures development with Initial Operations Capability planned in 2010.	**ATO-W Advanced Technology Development Prototype Group Jim McDaniel**	Q1	Q2	Q3	Q4
High Density Airport (HAD) Capacity and Efficiency Improvement Project *This concept attempts to take advantage of existing ground technologies and functionality as a first step toward trajectory based operations. It leverages airborne navigational capabilities that already exist on most commercial production and many in-service airplanes.*	Conduct a human in the loop simulation including the controller and the flight deck with aircraft with 3D capability	The 3D paths permit more orderly and predictable traffic patterns and use path clearances rather than the conventional speed, altitude, and heading clearances to manage aircraft spacing. A site demonstration will be conducted to collect additional data to enhance efficiency, provide greater capacity, and reduce fuel consumption.	**ATO-P AT Systems Concept Development Group Charles Buntin**	Q1	Q2	Q3	Q4
Trajectory Management - Surface Tactical Flow *This project will demonstrate and document requirements for a series of capabilities that build on the NextGen vision for surface trajectory-based operations.*	Demonstrate early surface TBO concepts at Memphis	Identify requirements to deliver capability in 2017 for taxi conformance efficiency. Surface flow management will reduce surface engine operating times, resulting in fuel savings and reduced environmental impacts, and lead to collaborative resource allocation and avoidance of surface gridlock.	**ATO-P Advanced Technology Development Prototype Group Tom Prevost**	Q1	Q2	Q3	Q4
Trajectory Management - Arrival Tactical Flow *Initiate acquisition activities to expand automation algorithms and integrate airport surface, tower, and terminal approach information leading to better and more efficient trajectory planning.*	Complete Time-Based Flow Management (TBFM) final investment decision	Baselines the TBFM program to award a contract to expand and enhance the legacy traffic management advisor.	**ATO-R TFM Programs Group Midori Tanino**	Q1	Q2	Q3	Q4
Unmanned Aircraft Systems (UAS) 4D Trajectory Based Demonstration *Demonstration to evaluate the viability to ensure the safe integration of the UAS in the National Airspace System.*	Conduct flight trials of Unmanned Aircraft Systems in Florida to facilitate cross agency planning and integration required to develop data communication requirements and procedures for NAS operations	Demonstrate UAS concept to safely operate in the NAS without undue risks; assess UAS with data communication to support trajectory based operations.	**ATO-P Advanced Technology Development Prototype Group Jim Rogers**	TBD (pending final determination as a new start)			

Increase Flexibility in the Terminal Environment

This solution set covers the terminal and airport operations for all airports. The focus of FLEX is on advanced separation procedures and improves trajectory management.

<u>Mid-term Operational Capabilities:</u>

– Wake Turbulence Mitigation for Departures (WTMD)
– Ground-Based Augmentation System (GBAS) Precision Approaches
– Use Optimized Profile Descent
– Provide Full Surface Situation Information
– Enhanced Surface Traffic Operations

Schedule of Implementation Commitments

Project	FY08	FY09	FY10	FY11	FY12
Category II Operations on Type 1 ILS	✓ Boston 33L ✓ Pittsburgh 28R ✓ Anchorage 07L ✓ Fairbanks19R ✓ Seattle-Tacoma 34L/34C/34R ✓ Boise 10R ✓ St Petersburg 17L	— Dallas Love 13 — Philadelphia 27R — Atlanta 26R/27L — Burlington 15 — Sarasota 14/32 — Providence 23 — Savannah 09 — Richmond 16 — Denver 17L/17R/16R/8/25/26 — Newark 22L — Salt Lake City 17 — Teterboro 06 — Colorado Springs Muni 17L — Tucson 11L — Snohomish County 16R — Los Angeles 25R — NY La Guardia 22 — Los Angeles 24L — Windsor Locks 24 — Oakland 27R — Albany 01 — Sacramento 22L — Charlotte 05 — San Francisco 28L — Greensboro 05/23R — Santa Ana 19R — Washington Dulles 12/19L — Santa Rosa 32 — Raleigh/Dunham 05L/05R — Stockton 29R — Bangor 33 — Anchorage 07L — Islip 06 — Fairbanks 19R	— 38 candidates will be evaluated and, if found suitable, completed by January 2010.		

Schedule of Implementation Commitments

Project	FY08	FY09	FY10	FY11	FY12
LPV/LP procedures *(LPV/LP procedures to be published at all qualifying runways by 2018)*	✓ Published 417 (goal was 300)	— 500 per year	— 500 per year	— 500 per year	— 500 per year
Terminal Automation Modernization – Replacement (TAMR)		— Initial investment decision		— Final investment decision	
Terminal Flight Data Management (TFDM)			— Final investment decision for Segment 1	— Initial investment decision for Segment 2	— Final investment decision for Segment 2
Ground-based Augmentation System		— Newark LAAS installation			

FY09 Solution Set Work Plan

Description/Title	What	Why	Who	When			
Separation Management - Wake Turbulence Mitigation for Departures (WTMD) *Begins the process of reducing aircraft separation during take-offs on CSPR runways to mitigate decreased airport acceptance rates (AAR) due to increased separation for trailing aircraft from large aircraft.*	Submission of the RFP to industry	Request proposals from industry to install a Wake Turbulence Mitigation for Departure System to determine if wake turbulence (separation) delay can be reduced.	**ATO-T Terminal Weather Group J. Hill**	Q1	Q2	Q3	Q4
Wake Turbulence - Re-Categorization *Redefine the basis for the air navigation service provider's (ANSP) required minimum spacing between aircraft to mitigate the effects of wake turbulence and contribute towards more efficient use of airspace.*	Develop a recommendation for an alternative set of wake separation standards.	In 2013, replace today's safe but capacity inefficient procedures for separating aircraft to ensure wake turbulence mitigation with ATC automation tools to manage aircraft in a mixed navigation and wake performance environment. (Capability - Automation Support for Mixed Environment).	**ATO-R Operation Services Group Steve Lang**	Q1	Q2	Q3	Q4
Flight and State Data Management - Surface/Tower/ Terminal Systems Engineering *TFDM integrates flight data management, decision support services provided by the Arrival/Departure Management Tool (A/DMT); provides clearances for surface movements and exchange of flight information between ANSP providers and users of flight information.*	Tower Flight Data Management (TFDM) Engineering Model: deliver the preliminary requirements document	Identify requirements necessary to develop an engineering model for the TFDM system; delivers Enhanced Surface Traffic Operations and Full Surface Situation Information capabilities in 2014.	**ATO-T Systems Engineering Group Kip Spurio**	Q1	Q2	Q3	Q4
	Arrival Departure Management Tool (A/DMT) Engineering Model: deliver the preliminary requirements document	Identify requirements necessary for (the A/DMT) system design, scope, and specifications.	**ATO-T Systems Engineering Group Kip Spurio**	Q1	Q2	Q3	Q4
	Trajectory modeling for the terminal area; deliver the preliminary requirements document	Identify requirements necessary for designing a prototype decision support tool that predicts aircraft flight trajectory in the terminal domain.	**ATO-T Systems Engineering Group Kip Spurio**	Q1	Q2	Q3	Q4
Separation Management - Closely Spaced Parallel Runway Operations *This enables parallel runway improvements, reducing impact to airport/runway throughput in lower visibility conditions. Together with the Precision Runway Monitoring (PRM) system (already in use at Atlanta's Hartsfield International Airport), the system allows controllers to land planes almost simultaneously on parallel runways, saving time and simplifying operations for controllers and airlines alike.*	Conduct initial simulator trials of CSPO	Identify requirements to provide enhanced procedures (including cockpit and ground improvements) that enable parallel runway improvements, reduce impact to airport/runway throughput in lower visibility conditions in 2013.	**ATO-P Chief SE Group Ron Stroup**	Q1	Q2	Q3	Q4

FY09 Solution Set Work Plan

Description/Title	What	Why	Who	When			
Separation Management - Approaches, New Navigation Initiatives *There are approximately 271 RVR systems in the NAS, of which 212 are forward scatter NG RVR Systems and 54 are older transmissometer systems. A new PC-Based RVR contract was awarded and first article systems were delivered for testing March 2007.*	Complete installation of a RVR at one airport site for validation and data collection to support implementation of RVR enhancements to improve lower visibility operations	Provide real-time data for system development and solution implementation for lower approach minima during periods of Instrument Meteorological Conditions (IMC).	**ATO-W** **Tech Ops** **Mitch Narins**	Q1	Q2	Q3	Q4
	Complete installation of low power (terminal) DME at one site for validation and data collection. (RNAV DME)	Support the use of Category I runways during runway visual range (RVR) conditions down to 1,800 feet; allow use of DME-DME area navigation (RNAV) down to 1,000 feet above ground level and enable more aircraft to achieve lower altitudes during IMC.	**ATO-W** **Tech Ops** **Mitch Narins**	Q1	Q2	Q3	Q4
Separation Management - Approaches, Optimize Navigation Technology *Includes existing approach lighting systems, other lighted navigation aids, precision and non-precision approach systems, terminal, and en-route navigation systems.*	Award the Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights) (MALSR) lamp contract	Procure contractor services to conduct analyses of the physical, electrical (electronic), and economic evaluation to systems to determine what type of technology insertion or changes in the system would result in improved operating efficiency to increase flexibility in the terminal environment in 2014.	**ATO-W** **Tech Ops** **Lansine Toure**	Q1	Q2	Q3	Q4
Trajectory Management - Arrivals (RNAV/RNP with 3D and Required Time of Arrival) *Trajectory Based Management will be accomplished using fully defined 3D paths to more orderly and predictable traffic patterns and has the potential to reduce controller workload and allow the airplane to precisely follow a continuous path using the accuracy of Required Navigation Performance operations.*	Complete Concept development for RNAV/RNP 3D and control by Required Time of Arrival (RTA) procedures	Leverages existing ground technologies and functionality while exploiting airborne navigational capabilities already available on most commercial production and in-service airplanes.	**ATO-P** **Chief** **Systems Eng Group** **Ron Stroup**	Q1	Q2	Q3	Q4
	Conduct modeling and simulation to optimize procedure design 3D RNAV and RNP	Validate the concept, identify requirements and collect additional data to enhance efficiency and provide greater capacity and reduce fuel consumption. This increases aircraft flow and will introduce additional routes and flexibility to reduce delays in 2012 and capability for enhanced surface traffic operations.	**ATO-P** **Chief** **Systems Eng Group** **Ron Stroup**	Q1	Q2	Q3	Q4
Flight and State Data Management - Avionics *Focuses on taxi conformance monitoring (avionics) for efficiency.*	Complete Concept of Operations for flight deck moving maps that support taxi instructions, taxi conformance monitoring, and surface separation	Identify requirements and procedures. Clearance delivery and pushback into movement or non movement areas is accomplished by voice and/or data communications to the aircraft, aided by situational awareness derived from surveillance sensors and conformance monitoring tools presented directly on the ANSP display in 2014.	**ATO-P** **Advanced Technology Development Prototype Group** **Tom Prevost**	Q1	Q2	Q3	Q4

Improve Collaborative Air Traffic Management

This solution set focuses on delivering services to accommodate flight operator preferences to the maximum extent possible.

Mid-term Operational Capabilities:

– Continuous Flight Day Evaluation
– Traffic Management Initiatives with Flight Specific Trajectories (Go Button)
– Improved Management of Airspace for Special Use
– Trajectory Flight Data Management
– Provide Full Flight Plan Constraint Evaluation with Feedback.

Schedule of Implementation Commitments

Project	FY08	FY09	FY10	FY11	FY12
Collaboration Air Traffic Management (CATM)	✓ Final investment decision made for CATM Work Package 2 – Arrival Uncertainty Management – Weather Integration – Collaborative Airspace Constraint Resolution – Airborne Reroute Execution	— Final investment decision for CATM Work Package 3 – Integrated Departure Arrival Capability – Collaborative Information Exchange – TSD Re-engineering			
Aeronautical Information Management (AIM)		— Initial investment decision	— Final investment decision for Segment 1		— Final investment decision for Segment 2

FY09 Solution Set Work Plan

Description/Title	What	Why	Who	When			
Flow Control Management - Strategic Flow Management Integration (Integration Execution of Flow Strategies into Controller Tools) *Provides for improvements of the en-route ATC automation. These improvements include automatic identification of aircraft affected by the Traffic Management Initiative (TMI); electronic communication of the TMI information in a timely manner to the relevant ATC operational positions; tools to implement the TMI; to help monitor how well aircraft are conforming to the TMI; and tools that suggest controller actions to achieve the flow strategy.*	Perform preliminary requirements analysis, design, development and testing of the en route automation to receive pre-departure reroutes from TFM and display them to en route controllers	Supports the flight specific TMI initiatives by integrating flow strategies into Controller tools.	**ATO-E Domain Engineering Group Craig Marina**	Q1	Q2	Q3	Q4
Flow Control Management - Strategic Flow Management Enhancement *Explores the long-term TFM concept to establish the TFM roadmap that will identify overlap, dependencies, gaps, and future needs.*	Develop Traffic Flow Management (TFM) Roadmap; identify and investigate the components that will be integrated into the overall NextGen solutions	Serves as the basis for a target architecture for the midterm (2018) that can support the NextGen strategic flow while delivering the midterm functionality. (Provides capability for Full Collaborative Decision Making and NAS EA decisions for CATM WP4.)	**ATO-R TFM Programs Group Midori Tanino**	Q1	Q2	Q3	Q4
Flow Control Management - Strategic Flow Management Departures (Departure Trajectory Flow Management) *Explores departure flow planning capability improvement through information analysis, prototype development, and demonstration.*	Conduct information analysis and prototyping to incorporate data such as surface, ICAO flight plan, TIM, and weather data into departure flow planning	Identify requirements for system design and development that achieves a capability for timely, effective, and informed decision-making based on improved situational awareness in 2017.	**ATO-R TFM Programs Group Midori Tanino**	Q1	Q2	Q3	Q4
Flight and State Data Management - Common Status and Structure Data (SSD) *Develops an infrastructure for a single and reliable aeronautical information exchange service used for providing a common operating picture of aeronautical information supporting air traffic management.*	High Level CSSD Concept of Operations and Enterprise Architecture	Analyze the use of a cross-domain data brokerage or information exchange capability to collect, provide configuration management for, and distribute a common picture of aeronautical information between ATM stakeholders. Delivers capability for On-Demand NAS Information and Continuous Flight Day Evaluation in 2013.	**ATO-R Aeronautical Information Mgt Group Brett Brunk**	Q1	Q2	Q3	Q4

FY09 Solution Set Work Plan (cont'd)

New Air Traffic Management (ATM) Requirements *Develop operational requirements for the use of Traffic Collision Avoidance Systems (TCAS) in a precision RNP operating environment; establish standards for various frequency bands used for mobile wireless communications; and identify new requirements for advanced air traffic management automated decision support tools.*	Complete development of an L-band Digital Communications System prototype to allow initiation and validation of an L-band communications standard	Provides globally harmonized standards that will support future NextGen data communications requirements.	**ATO-P NextGen Integration and Implementation Pam Whitley**	Q1	Q2	Q3	Q4
	Develop concepts of use for C-band airport surface wireless communications, including preliminary requirements and supporting architecture documentation	Validate the IEEE 802.16e C-band standard to support the integration of both mobile and fixed surface assets concept of use.	**ATO-P NextGen Integration and Implementation Pam Whitley**	Q1	Q2	Q3	Q4
	Assess TCAS effectively in the NextGen environment	Identify operational shortfalls and preliminary performance requirements, including interoperability with ground separation assurance functionality, to improve TCAS effectively in the NextGen environment.	**ATO-P NextGen Integration and Implementation Pam Whitley**	Q1	Q2	Q3	Q4
	Complete development of test bed infrastructure to enable initiation and validation of an aviation specific IEEE 802.16e wireless communication standard	Develops and validates an airport surface wireless communications network standard that supports NextGen surface applications including ADS-B, SWIM, ASDE-X, and surface TBO, while leveraging existing commercial IEEE 802.16e standard.	**ATO-P NextGen Integration and Implementation Pam Whitley**	Q1	Q2	Q3	Q4
	Develop concepts of use for an L-band terrestrial communications system, including preliminary requirements and supporting architecture documentation.	Defines an air-ground and air-air communications system that addresses future communications needs for all continental airspace users, and enables NextGen services such as full TBO, UAS operations, and SWIM-Air applications.	**ATO-P NextGen Integration and Implementation Pam Whitley**	Q1	Q2	Q3	Q4
ATC/Technical Operations Human factors - Controller Efficient/Air Ground Integration *Human factors research provides higher efficiency levels in air traffic control and identifies the new role for controllers as more responsibility shifts to the flight crew.*	Conduct human factors assessment of NextGen activities including modeling, demonstrations to identify gaps, and provide recommendations for resolution	Derive measures of controller performance for use in selection, training, and system development necessary to achieve the capacity targets of NextGen for self-separation; define responsibilities between pilots and controllers and between humans and automation.	**ATO-P Human Factors Research & Engineering Group Dino Piccione**	Q1	Q2	Q3	Q4
	Initial assessment of human performance during merging/ spacing operations and develop test and mitigations for potential errors	Derive measures of controller performance for use in selection, training, and system development.	**ATO-P Human Factors Research & Engineering Group Dino Piccione**	Q1	Q2	Q3	Q4
	Initial evaluation of impact optimized profile descent operations will have on ATM display, automation systems, and pilot and controller workload	Define requirements for integrated en route and terminal situation displays, procedures, and impacts to human systems integration.	**ATO-P Human Factors Research & Engineering Group Dino Piccione**	Q1	Q2	Q3	Q4

Reduce Weather Impact

This solution set includes improvements to weather information and its use to improve safety, capacity, and efficiency.

Mid-term Operational Capabilities:
– Trajectory-Based Weather Impact Evaluation

Schedule of Implementation Commitments

Project	FY08	FY09	FY10	FY11	FY12
NextGen Weather Processor (NWP)	✓ Completed concept and requirements documents	— Investment decision (IARD) for NWP Work Package 1 (WP1) and NNEW WP1 functionality to enter investment analysis	— Initial Investment Decision for NWxP WP1 w/6-hour convective forecast	— Final investment decision for NWP WP1	— Final investment decision for NWP WP2 to accept enhanced aircraft observations (turbulence and humidity)

FY09 Solution Set Work Plan

Description/Title	What	Why	Who	When			
Weather Observation Improvements *Optimize weather observation capabilities, e.g., integrated radar technology or other new sensors, to support NAS operations.*	Complete multi-function phased array radar technology research plan	Identify requirements and system design to optimize weather observational information required for NextGen to support accurate forecasts of future weather impacting NAS operations, leading to a NextGen surface observing capability starting in FY16 and a NextGen Weather Radar capability starting in FY20.	**ATO-P** **New Weather Capabilities Group** **Guillermo Sotelo**	Q1	Q2	Q3	Q4
Weather Forecast Improvements *Develop NextGen weather capabilities to improve forecast accuracy and timeliness to enable better weather decision making in the NAS.*	Establish advanced 0-6h convective forecast demonstration	Provide improved forecasts and weather information tailored for integration into traffic management decision support systems.	**ATO-P** **New Weather Capabilities Group** **Guillermo Sotelo**	Q1	Q2	Q3	Q4

Improve Safety, Security, and Environmental Performance

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.

Mid-term Operational Capabilities:
Safety:
- *Safety Management System Implementation*
- *Safety Management Enterprise Services*
- *Aviation Safety and Information Analysis and Sharing*

Security:
- *Operational Security Capability for Threat Detection and Tracking, NAS Impact Analysis and Risk-Based Assessment*
- *SSA and Information Systems Security (ISS) Integrated Incident Detection and Response*
- *Information on System Security and Surveillance Integration/Protection*

Environmental Performance:
- *Enhanced Air Traffic Procedures, Improved Environmental Technologies and Sustainable Alternative Aviation Fuels, and Integrated Environmental Modeling*
- *Environmental Management System (EMS) Implementation and Environmental Policy Support.*

FY09 Solution Set Work Plan

Description/Title	What	Why	Who	When
Security Integrated Tool Set (SITS) *Provides planning and coordination of security measures in the NAS.*	Perform risk-reduction activities to identify operational and system requirements in the air domain security concept	Due to the relative immaturity of this mission area, these analyses and exercises will further refine the system definition and reduce the overall risk in system acquisition and initial SITS capability.	**ATO-R** **Traffic Flow Management Programs Group** **Joe Lahoud**	TBD (pending final determination as a new start)
***Systems Safety Management Transformation** *Implement a cross-cutting risk management system and manage the overall NextGen transformation process to ensure that safety is not only maintained but improved.*	Aviation Safety Information Analysis and Sharing (ASIAS) - Complete baseline of the enhanced ASIAS planning documentation, including information on infrastructure, data/information protection policies, information access policies, procedures, equipment, tools, processes, data architectures, resources and budgets, building upon existing ASIAS baseline	Allow data sharing among aviation users, and deliver analysis capabilities (critical in the continuing effort to reduce the fatal accident rate).	**AVS** **Aviation Safety Info Analysis** **Rob Pappas**	TBD (pending final determination as a new start)

FY09 Solution Set Work Plan (cont'd)

Environment & Energy - Noise/ Emission Reduction & Validation Modeling	Conduct analysis to explore advanced algorithms and approaches for terminal procedures that reduce noise and air quality emissions and quantify potential benefits and design and conduct a simple experiment to demonstrate viability and validate benefits	Identify requirements for new environmental technologies that optimize the reduction of greenhouse gas emissions, improve air quality, and reduce jet noise. (Advanced Terminal operational procedures are needed to achieve even greater reductions in environmental impacts.)	**AEE Aviation Policy, Planning, & Environment Lourdes Maurice**	TBD (pending final determination as a new start)
	Conduct analysis to explore advanced algorithms and approaches for surface (taxi/ramp) operations that reduce emissions, and quantify potential benefits and design and conduct a simple experiment to demonstrate viability and validate benefits	Define existing and planned environmental mitigation methods to counter NAS constraints of today and for NextGen metrics to better assess and control noise, air quality impacts that may influence climate impacts from anticipated NextGen commercial aircraft operations. (Advanced surface operational procedures are needed to achieve even greater reductions in environmental impacts.)	**AEE Aviation Policy, Planning, & Environment Lourdes Maurice**	TBD (pending final determination as a new start)
	Conduct evaluation of potential benefits of CLEEN aircraft technologies on the NAS	Ensure more energy efficient aircraft operate in the NAS, in addition to application of alternative fuels; accelerate the development of technologies under the Consortium for Low Energy, Emissions, and Noise (CLEEN) program.	**AEE Aviation Policy, Planning, & Environment Lourdes Maurice**	TBD (pending final determination as a new start)
	Initiate expansion of existing integrated environmental models to analyze noise and emissions regional impacts of new NAS operations	Assess and predict the impact of change; develop and institute reduction techniques and assess their cost-benefit.	**AEE Aviation Policy, Planning, & Environment Lourdes Maurice**	TBD (pending final determination as a new start)

Transform Facilities

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.

Mid-term Operational Capabilities
– Integration, Development, and Operations Analysis Capability
– NextGen Facilities
– Net-Centric Virtual Facility

FY09 Solution Set Work Plan

Description/Title	What	Why	Who	When			
Future Facilities Investment Planning *Deliver a facility infrastructure that supports the transformation of air navigation service delivery unencumbered by legacy constraints.*	Complete initial investment readiness decision for NextGen network facilities	Identify requirements and system design for NextGen facilities to provide expanded services supported by cost-effective and flexible systems for information sharing and backup in 2016.	**ATO-P Systems Engineering Future Facilities Chuck Dudas**	Q1	Q2	Q3	Q4
Integration, Development, & Operations Analysis Capability *Supports concept development and evaluation of air traffic management services in a trajectory-based NAS.*	Establish initial laboratory infrastructure to support a NextGen integration and evaluation capability at the Technical Center	Provide a real-time, flexible, scalable, and component/object oriented simulation environment where concepts, technologies, and systems can be developed, tested, and validated.	**ATO-P Laboratory Services NextGen Integration Vince Lasewicz**	Q1	Q2	Q3	Q4
Virtual Tower (Staffed and Autonomous) *Provide full air traffic management services from a ground level facility to flights in and out of one or more airports.*	Finalize NextGen towers demonstration test plan	Validate the Staffed NextGen Towers (SNT) operational concept and develop preliminary program requirements.	**ATO-P AT Systems Concept Dev Gp Michele Heiney**	Q1	Q2	Q3	Q4
NextGen Test Bed *Build a microcosm of future integrated NAS environment for the areas of interest.*	Complete alternatives assessment for location of NextGen test bed.	NextGen capabilities transform the NAS, and an open test bed environment that allows government and industry to develop and validate innovative solutions is necessary.	**ATO-P Technology Development and Prototyping Gp Paul Fontaine**	Q1	Q2	Q3	Q4

Acronyms

NextGen's operational capabilities will provide air traffic controllers with improved tools to handle more complex traffic while improving service.

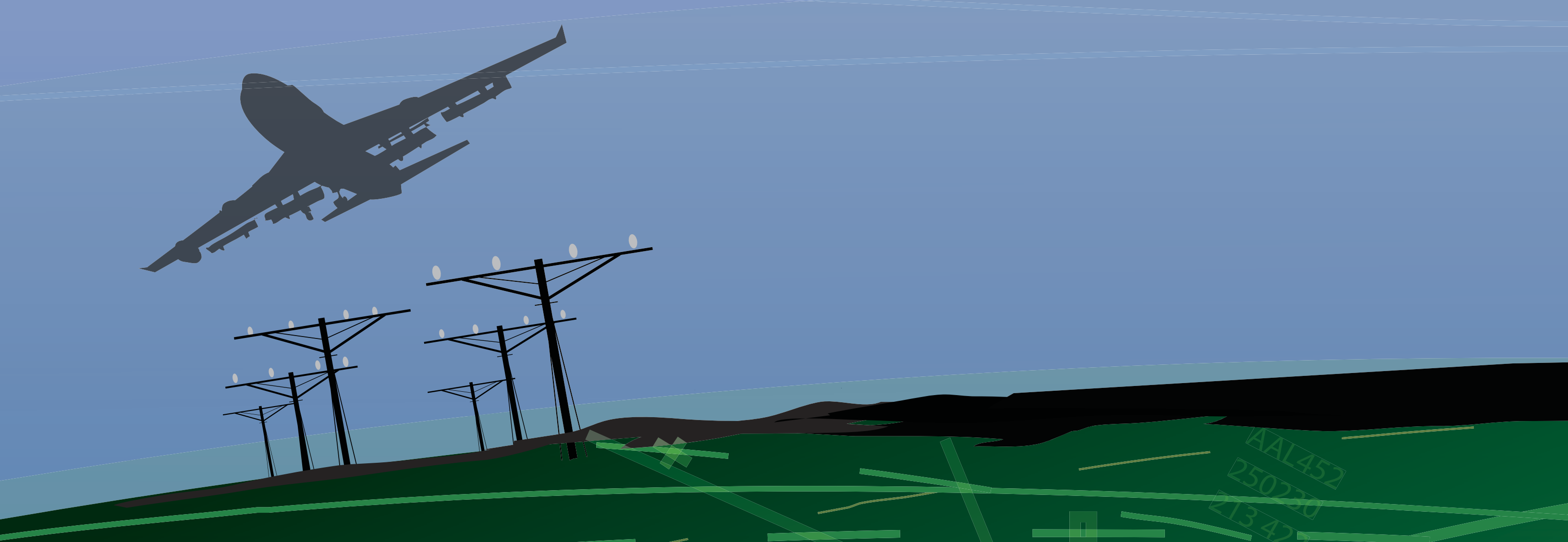
Acronyms

ADS-B	Automatic Dependent Surveillance - Broadcast
AIM	Aeronautical Information Management
AIRE	Atlantic Interoperability Initiative to Reduce Emissions
ANSP	Air Navigation Service Provider
ARTCC	Air Route Traffic Control Center
ASDE-X	Airport Surface Detection Equipment – Model X
ASPIRE	Asia and South Pacific Initiative to Reduce Emissions
ASIAS	Aviation Safety Information Analysis and Sharing
ATC	Air Traffic Control
ATM	Air Traffic Management
ATMAC	RTCA's Air Traffic Management Advisory Council
ATN	Aeronautical Telecommunications Network
ATO	Air Traffic Organization
ATOP	Advanced Technologies and Oceanic Procedures
CAAFI	Commercial Alternative Aviation Fuels Initiative
CANSO	Civil Air Navigation Services Organization
CARTS	Common Automated Radar Terminal System
CDTI	Cockpit Display of Traffic Information
CLEEN	Consortium for Lower Energy Emissions and Noise
CMU	Communications Management Unit
CSPO	Closely Spaced Parallel Operations
CSPR	Closely Spaced Parallel Runways
D-ATIS	Digital Automated Terminal Information System
EMS	Environmental Management System
EFB	Electronic Flight Bags
EFVS	Enhanced Flight Vision System
ERAM	En Route Automation Modernization
FAA	Federal Aviation Administration
FANS	Future Air Navigation System; refers to the data communications system used in oceanic airspace
FIS-B	Flight Information Services – Broadcast
FMS	Flight Management System
FY	Fiscal Year
GBAS	Ground-based Augmentation System
GLS	Global Navigation Satellite System Landing System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IOC	Initial Operating Capability
ITWS	Integrated Terminal Weather System
JFK	John F. Kennedy International Airport
JPDO	Joint Planning and Development Office
JRC	Joint Resources Council
LAAS	Local Area Augmentation System
LAX	Los Angeles International Airport
LED	Light Emitting Diodes
LP	Localizer Performance
LPVs	Localizer Performance with Vertical Guidance approaches

NAPA	National Academy of Public Administration
NAS	National Airspace System
Navaid	Navigational Aid
NextGen	Next Generation Air Transportation System
NMI	Nautical miles
NNEW	NextGen Network Enabled Weather
NVS	NAS Voice Switch
NWxP	NextGen Weather Processor
PARTNER	Partnership for Air Transportation Noise and Emissions Reduction
REDAC	FAA's Research, Engineering and Development Advisory Committee
RNAV	Area Navigation
RNP	Required Navigation Performance
RNP AR	Required Navigation Performance Authorization Required
RVR	Runway Visual Range
RVSM	Required Vertical Separation Minima
RWSL	Runway Status Lights
SAAAR	RNP Special Aircraft and Aircrew Authorization Required procedure
SESAR	Single European Sky Air Traffic Management Research
SIDS	RNAV Standard Instrument Departures
SMS	Safety Management System
STA	Scheduled Time of Arrival
STARS	Standard Terminal Automation Replacement System
STMS	Surface Traffic Management System
SVS	Synthetic Vision System
SWIM	System-Wide Information Management
SUA	Special Use Airspace
TAF	Terminal Area Forecast
TBO	Trajectory Based Operations
TFM-M	Traffic Flow Management - Modernization
TIS-B	Traffic Information Services - Broadcast
TMA	Traffic Management Advisor
TRACON	Terminal Radar Approach Control
UAT	Universal Access Transceiver
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
VNAV	Vertical Navigation
WAAS	Wide Area Augmentation System
WARP	Weather and Radar Processor
WTMD	Wake Turbulence Mitigating Departures


NextGen is building for the future.

Contents



NextGen Integration and Implementation Office

Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591

www.nextgen.faa.gov