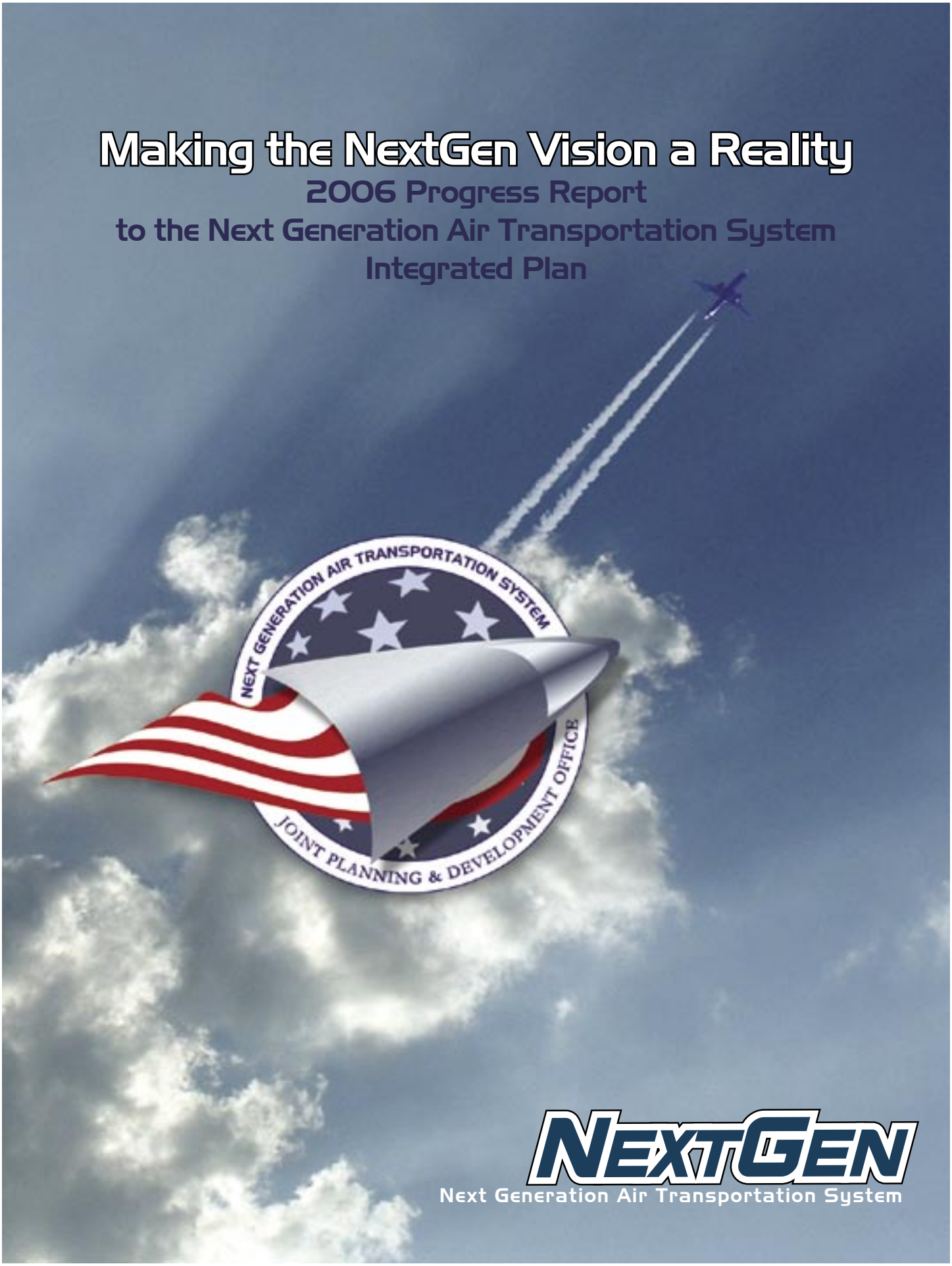
Making the NextGen Vision a Reality

2006 Progress Report
to the Next Generation Air Transportation System
Integrated Plan



NextGen

Next Generation Air Transportation System

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Joint Planning and Development Office

Making the NextGen Vision a Reality

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Executive Summary

Our work on the Next Generation Air Transportation System (NextGen), continues to be an exciting and challenging undertaking. NextGen is unprecedented in scope and duration. It is visionary in character, but at the same time focuses on a very real and current concern, namely the future of our nation's air transportation system.

We know that demand for aviation services is growing and that the time is not far off when it will be difficult to successfully manage air traffic demand with the current system. That is why Congress, through Vision 100 in 2003, endorsed the concept of the Next Generation Air Transportation System (NextGen) and directed the formation of the Joint Planning and Development Office (JPDO) to facilitate this process. NextGen is about a long-term transformation of our nation's air transportation system. This is a transformation based on meaningful integration and collaboration between all NextGen partners, including the private sector. It focuses on leveraging new technologies, such as satellite-based navigation, surveillance, and networking. We are setting the stage for the development of an air transportation system that will be safe, scalable to growing demand, and responsive to evolving business models.

It is a new approach to the way we view the future of the system, and it demands a new level of collaboration, planning, and vision.

The most important products in development for NextGen are the definitional tools and documents that explain what the system is, what its capabilities are, and how they all fit together. Having these kinds of planning tools is essential for an initiative of this of scope. With that in mind, the JPDO is working with all of its government partners and the private sector in developing the Concept of Operations and the Enterprise Architecture.

The Concept of Operations explains how the system will work and what it will look like. This is important in developing the structure, policy, procedures, and the changes in the function that will be needed to make the system a reality. The Enterprise Architecture is much like a set of blueprints. It defines the key capabilities of NextGen, how they fit together, the timing of their implementation, and how they affect the various members of the aviation community. The Enterprise Architecture will serve as a guide in developing our future needs for research and capital investment. An important part of this process is mapping how programmatic changes and investments track to Operational Improvements. In other

words, what progress are we making? We have developed an Operational Improvement Roadmap to explain how the various improvements fit together and how they link to the long term NextGen vision.

NextGen requires an intense and deliberate process of planning, execution, and integration. Using the Concept of Operations and the Enterprise Architecture as a guide, we are working closely with the Office of Management and Budget (OMB) and the NextGen government partners. This includes coordinating agency and departmental research programs, capital budgets, and our long-term planning. Accomplishing this objective, particularly for a plan with such a broad scope, is a challenge, but successful implementation is essential to the economic viability of aviation and our national security.

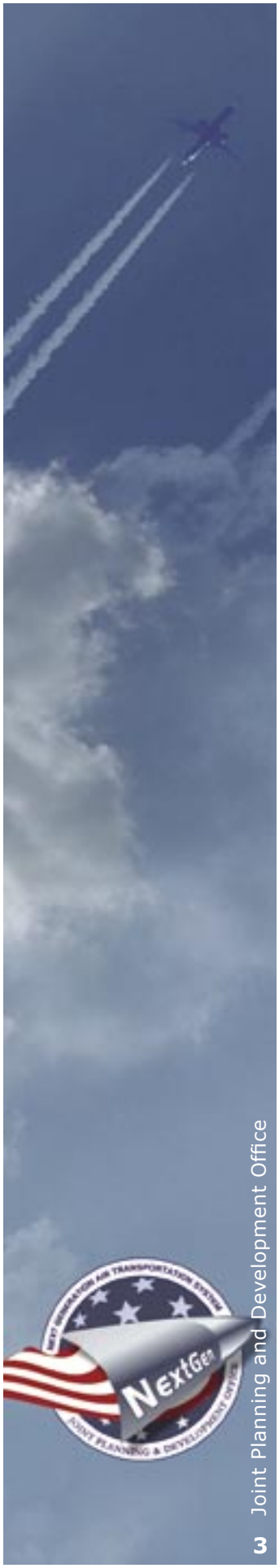
NextGen implementation has already begun. Right now, two critical foundational technologies are being implemented. Automatic Dependent Surveillance Broadcast (ADS-B) is an essential element in developing our satellite-based surveillance capabilities. ADS-B is different from traditional ground-based surveillance and control systems. With ADS-B the controller, the pilot, and other aircraft see the same information at the same time. Another critical initiative is System Wide Information Management (SWIM). This networking-based initiative is an essential part of developing NextGen's Network-Enabled Operations (NEO). In an Internet-like fashion it will link information of all kinds (position, weather, restricted airspace notices, etc.) to all relevant users in the system. Both of these programs have been funded by the FAA.

The FAA plays an essential role in the development and fielding of NextGen. To make this implementation possible, and to ensure that shorter-term changes to the National Airspace System are made in a timely and coordinated fashion, the agency has established the Operational Evolution Partnership (OEP). The OEP has developed, and is implementing, an evolving partnership plan to ensure continuity between what is and what is to come.

Furthermore, in the coming year, the JPDO and its partners will sponsor a series of operational demonstrations. These demonstrations will allow us to analyze the performance of NextGen capabilities in a real world environment. This will include tests of oceanic trajectory-based operations, performance-based services, required navigation performance in high density environments, and advanced networking capabilities in an air traffic environment.

These are the first steps of implementation. By making these investments, we set the stage for realizing benefits in the near-term, through enhanced system capacity and efficiency.

NextGen is an exciting and challenging initiative. It requires a new level of commitment and vision on the part of all our partners to develop the aviation system of the future and to continue to make our air transportation system the engine of economic growth it has been for the past half century.



Introduction

When the U.S. Congress chartered the development and launch of a Next Generation Air Transportation System[1], it did so in recognition of what has been a substantial increase in aviation activity. The numbers now show that during peak periods of operation as many as 5,000 general aviation, business, and commercial airplanes will be in the air. Currently, the system handles 750 million enplanements each year. We expect this number to reach one billion by 2015.

Forecasts indicate a significant increase in demand, ranging from a factor of two to three by 2025. The system is already straining in some areas, and the current system design will not provide the relief required. Unless new technology, development of key infrastructure, and improved procedures are put into place now, particularly given that system capacity will reach its maximum by 2015, the ability of aviation to continue to play its traditionally dynamic role in our economy will be substantially diminished.

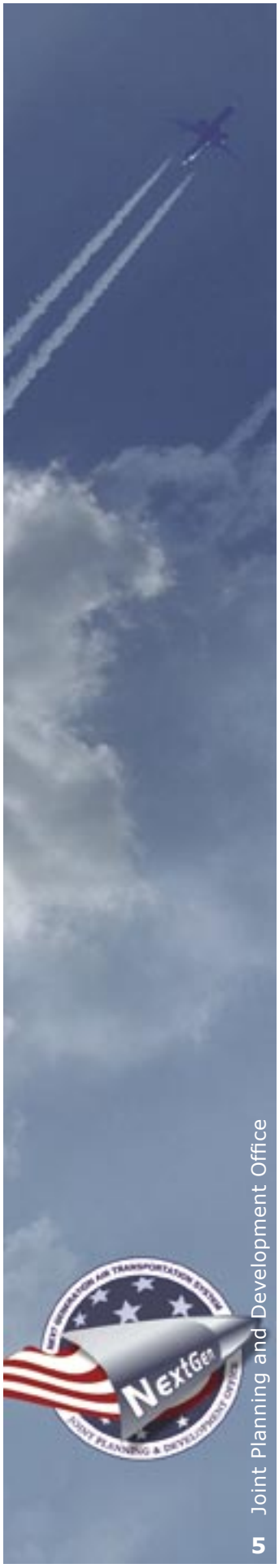
The FAA previously tried to modernize the existing system. **Next-Gen does not modernize the existing system – it completely transforms it.** And it does so with cooperation across government and industry. Future demand on our current capabilities will require a completely new system.

The JPDO brings together the resources and momentum of the Departments of Transportation, Homeland Security, Defense, and Commerce, as well as NASA, the FAA, and the White House Office of Science and Technology Policy. Working in tandem with aviation groups, airport sponsors, state aviation organizations, manufacturers and the aerospace industry, the JPDO formulates a single vision that will effectively address America's needs for safety, capacity, and security in aviation.

[1] VISION 100 – Century of Aviation Reauthorization Act (P.L. 108-176).

As explained in the recent National Aeronautics Research and Development Policy, "Meeting projected demand for increased passenger travel and cargo shipments over the next 25 to 50 years will require considerable increases in the capacity of the air transportation system. . . The Federal Government, through the JPDO and in accordance with Public Law 108-176, has defined a vision for the Next Generation Air Transportation System (NGATS) that will guide system-wide transformation to meet these needs."[2]

NextGen is a blueprint for aviation; a system that uses modern technology and state-of-the-art procedures to handle increases in the volume of air traffic. In an industry that currently generates 5.4 percent of America's GDP, and over 9 percent when this is expanded to include aviation related industries, as well as $640 billion in revenues and 11 million jobs, it is a blueprint that can ill afford to miss the mark. This project is already well under way. What follows is a report about where it stands.



[2] "National Aeronautics Research and Development Policy," Executive Office of the President, National Science and Technology Council, Dec, 2006.

The Joint Planning and Development Office:
From Planning to Implementation

The development of NextGen continues to be an exciting challenge. It covers an unusually long period of time, involves multiple government agencies, and by its very nature, requires a strong alliance with the private sector. This means that if the JPDO is to be successful it must have sound and collaborative relationships with its government and private sector partners.

In 2006, we consolidated our technical and business planning activities to improve consideration of constraints, alternatives, and trade-offs. **Our emphasis in this work is to move from the planning phases of NextGen into implementation.** This is a long-term and highly integrated process, one that involves a close working relationship between the JPDO and its Executive Branch partners. These are the Departments of Transportation, Homeland Security, Defense, and Commerce, as well as NASA, the FAA, and the White House Office of Science and Technology Policy. Working in close collaboration with the JPDO, they will take the lead in implementing NextGen's initiatives and programs.

NextGen Plan — Key Documents

The following figure identifies the documents that comprise the NextGen plan and defines their purpose.

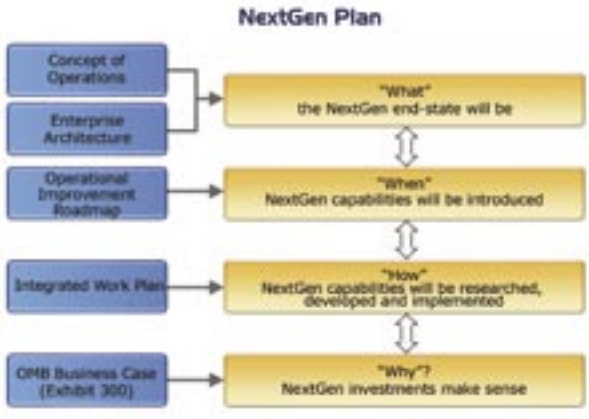


Figure 1 - NextGen Documents

Concept of Operations and Enterprise Architecture — *What is the NextGen Vision?*

During 2006, the JPDO working with its stakeholders, developed a draft of the Enterprise Architecture. A "curb-to-curb" version will be published mid-2007. As the consolidated "picture" of the future, the Architecture defines the key capabilities of NextGen, how they fit together, the timing of

their implementation, and how they impact the various members of the aviation community. It comprehensively defines the four core principles and eight key capabilities of the 2025 NextGen as described in the 2005 Progress Report.

Information concerning the NextGen Concept of Operations can be found at: *http://www.jpdo.aero/2006-progress-report/conops.html*

The first draft of the Concept of Operations was another major milestone in 2006. It describes how the future system will work operationally, including the roles of humans and technology. Considering the scope of NextGen and the time period it covers, the development of an agreed upon Concept of Operations and Enterprise Architecture represents a substantial step forward. It is also a testament to how both the private sector and the government can collaborate, cooperate, and coordinate in producing a plan to transform the airspace system.

Operational Improvement Roadmap — *When NextGen will be introduced*

Information concerning the NextGen Enterprise Architecture can be found at: *http://www.jpdo.aero/2006-progress-report/enterprise-architecture.html*

In parallel with the Concept of Operations and Enterprise Architecture, we have also built a roadmap for achieving the operational improvements that are a part of NextGen. In other words, we have started showing how and when different pieces of the system will fall into place. The Roadmap highlights a transition to the end state and underscores the substantial benefits along the way. The first version of the Roadmap was completed in the spring of 2006 and will be updated on a regular basis.

Integrated Work Plan — *How capabilities will be developed*

We are also drafting an Integrated Work Plan that includes the many activities required to achieve the operational improvements in the Roadmap. The Integrated Work Plan provides a central planning capability for all our Integrated Product Teams. Like the Roadmap itself, the Plan will be refined and synchronized against the Enterprise Architecture. The Integrated Work Plan will provide critical information for FY09 budget and program planning.

OMB Business Case (Exhibit 300)

To support the FY09 budget process, JPDO will be creating an Exhibit 300, or Business Case, for NextGen. We anticipate this will be the vehicle for officially capturing the costs, benefits, and risks of programs supporting NextGen.

Agency Budget Guidance

This year, for the first time, and to support the FY08 budget process, we issued comprehensive budget guidance to partner agencies. The guidance laid out both research and implementation activities critical to NextGen. We then worked with partner agencies to incorporate many of these activities into budget requests.

NextGen — *What will it cost?*

The objective of NextGen is to increase the capacity, safety, and efficiency of the air transportation system. To meet the anticipated growth and complexity of the future operating environment, the JPDO is working with its partner agencies to ensure investment in key technologies and initiatives. While increasing future capacity and safety, these initiatives should also lead to long-term operational savings.

The First Five Years

Over the next five years, we estimate that FAA's NextGen investment portfolio, key investments that will enable the transition to NextGen, will require $4.6 billion. That is $4.3 billion in the Air Traffic Organization Capital appropriation and $300 million in Research, Engineering, and Development.

Of the $4.3 billion, an estimated $1.3 billion would be directed to ongoing programs that directly support NextGen. An estimated $3 billion is for efforts that will be rolled out over the next five years.

We are working to refine these estimates, particularly with our users, as we implement new cost-based financing mechanisms. These are presented in the FAA's reauthorization proposal. We believe that the magnitude of the estimated NextGen investments require a robust dialogue about system financing. The goal should be a financing structure that adequately supports the transformation to NextGen.

Other JPDO Partner Agencies

The JPDO is also developing preliminary estimates of the future requirements of the other contributing agencies to NextGen. In FY08, they are investing a total of about $300 million in NextGen, primarily in research and development.

Longer-Term Costs

Based on the current five year picture, we can anticipate major FAA investment areas for the period from FY13 through FY17. Total federal requirements for the first ten years (FY08 through FY17) range from $8 billion to $10 billion. Estimates for the end state, or through 2025, range from $15 billion to $22 billion.

Outside Estimates

MITRE has developed a preliminary estimate for the cost of equipping aircraft with NextGen avionics. It concludes that a wide range of costs are possible, depending on the bundling of avionics and the alignment of equipage schedules. The most probable range of total avionics costs to system users is $14 billion to $20 billion. This range reflects uncertainty about equipage costs for individual aircraft, the number of very light jets that will operate in high-performance airspace, and the amount of out-of-service time required for installation.

Getting Industry Input

In order to set the groundwork for both our cost and benefit development activities, we hosted three investment analysis workshops this year. Each workshop focused on certain core stakeholder groups. There were cost/benefit workshops for air carriers, general aviation, and airports. Each of these created a forum for considering NextGen's operational benefits to industry and the most cost-effective means of achieving them.

For example, since one of the most important inputs for our cost/benefit estimates is equipage, the workshops provided critical industry input. During our air carrier workshop, we gained insights into the kinds of incentives, as well as the types of equipage schedules, that would encourage air carriers to participate. Similarly, the general aviation and airports workshops provided information on cost drivers which we will consider in refining NextGen implementation plans. Most importantly, the workshops opened a dialogue that will be invaluable as we analyze long-term plans.

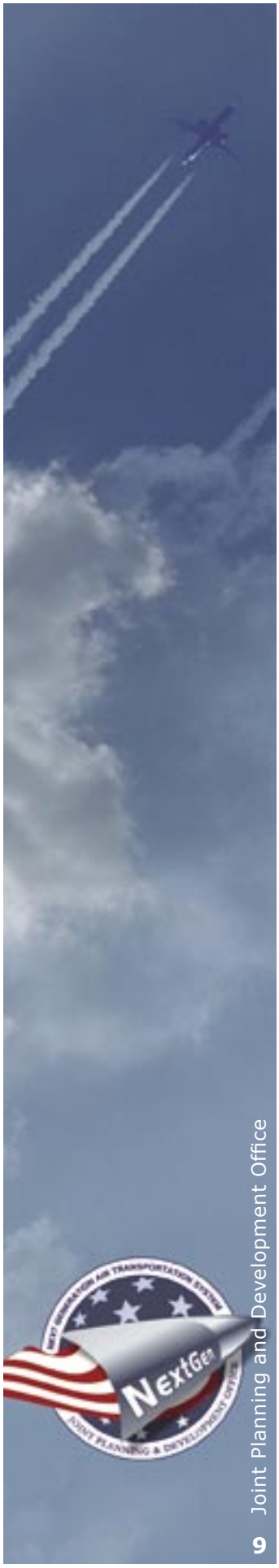
Comparison with Work in Europe

Recently our European counterparts released a preliminary cost estimate for the Single European Sky Air Traffic Management Research (SESAR) initiative. SESAR is a system that, while smaller in scope and size, has similar air traffic management goals to those of NextGen. They consider different system scenarios and, accordingly, a range of total costs from $25 billion to $37 billion (U.S.) through 2020. They further estimate that 60 percent of those costs will be associated with avionics and 40 percent with ground infrastructure.

SESAR, like NextGen, has a lot of work remaining to refine assumptions and better define the system. Further, it is important to note that European aviation does not share the same characteristics as U.S. aviation. There is, for example, a much larger general aviation presence in the U.S. than in Europe. And while SESAR focuses on air traffic management, NextGen takes what is called a "curb-to-curb" approach, including not only air traffic control, but also airports, airport operations, security, and passenger management. Nevertheless, in making this comparison, it is helpful to find that our aggregate estimates are generally comparable.

Future Cost Estimating Work

The JPDO sees its work in estimating costs as an ongoing process. As we work with the industry, and further refine our estimates, we will gain additional insight into the business, management, and technical issues and alternatives that will go into the long-term process of implementing the NextGen process. Throughout this effort, our cost estimates will continue to evolve.



Evolving Nature of the Industry

The estimates assume a world similar to today's in which the FAA is the primary provider of air traffic services and infrastructure. While that assumption is likely to remain valid for the near-term, we anticipate that as we develop our estimates and extend them into the future, we will encourage other alternatives. By seeking appropriate opportunities to foster competition and achieve an optimal mix of public and private participation, we anticipate that benefits can be maximized and some costs can be reduced.

Making Ideas Real: *Research, Demonstrations, and Risk Reduction*

In 2006, the JPDO presented research needs for the coming years and defined the first set of demonstrations and infrastructure development aimed at reducing risk and achieving near-term benefits. This first set of demonstrations exploits existing infrastructure, makes use of established working relationships among partner agencies, and will support mid-term NextGen objectives.

Research Focus — *Developing Critical Capabilities*

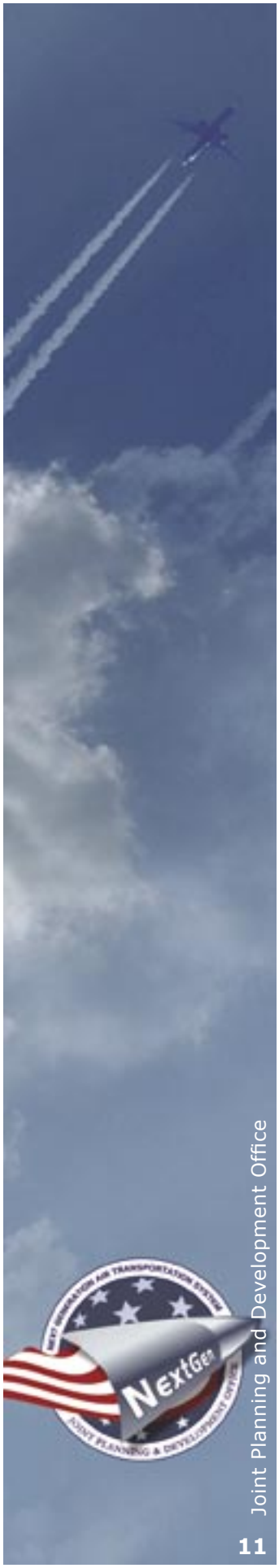
Integrated research planning is an essential element in the development of NextGen. Research conducted by all of the JPDO partner agencies and our private sector stakeholders leads to the development and fielding of critical capabilities. That is why the integration of research needs into our planning process is critical. The JPDO is building a research and development plan that will document NextGen research needs and the organizations that will perform the work. The plan will be delivered to OMB in August 2007 and help inform the FY09 process.

Demonstrations and Infrastructure Development — *Proving Technologies and Processes*

Demonstrations offer a unique opportunity to test the new concepts and capabilities that will go into making the NextGen vision a reality, while at the same time providing the opportunity to learn critical lessons about the functionality of essential technologies and processes. This not only makes these concepts "real," it also helps in further assessing our infrastructure and equipage requirements. This is a critical input into our resource guidance and planning. Some of the demonstrations and infrastructure development planned for the next eighteen months include:

Oceanic Trajectory-Based Operations:

Aircraft flying over oceanic airspace currently use designated routes. Sometimes these are not the most efficient in terms of time and fuel consumption. Trajectory-based flight uses plans tailored before and



Required Navigation Performance (RNP)
RNP is a set of standards that measures performance accuracy of an aircraft in a defined airspace, approach, route, etc. To fly an RNP route, the aircraft must meet the associated performance specification. In practice, due to the increased navigational precision of aircraft performance flying under RNP, air traffic control can reduce spacing without compromising safety for that population center.

Trajectory-Based Operations
The NextGen will use Trajectory-Based Operations. These are time-based flight paths from beginning-to-end, including ground segments. These will be the basis for planning and executing system operations. The trajectory-based design must both improve system efficiency and meet security, safety, and environmental compatibility goals.

during the flight to avoid congestion and take advantage of direct routes. This demonstration will create a proof-of-concept and working prototypes for an operational environment with flight profile predictability on long-duration international flights, where fuel burn is a prime concern. It will test means for implementing flexible flight plan management in actual operations. Trajectory-based oceanic operations will lead to more efficient use of airspace, more precise spacing, and reduced fuel usage.

High Density Airports Time-Based RNP:

Aircraft operations in a super density environment are one of the key NextGen capabilities. This demonstration seeks to fully utilize airspace in high density areas, resulting in a set of requirements and procedures for initial stages of super density operations. This demonstration focuses on accelerating the deployment of this capability by emphasizing procedures that reduce minimum separation distances in order to provide for the most efficient use of the runways and airspace.

Infrastructure Engineering for Trajectory-Based Operations:

To make Trajectory-Based Operations a reality requires more information exchange between users of the air traffic system. This engineering work will test the ability of various system users to obtain and apply critical aircraft information, such as position, direction, speed, and intent, along time-based paths in controlled airspace. This fourth aspect, the time-based segment of flight planning, makes this capability important in anticipating and avoiding potential conflicts between aircraft.

Initial Performance-Based Services Variable Separation:

NextGen's performance-based concept calls for aircraft separation standards to vary according to aircraft capability. This engineering analysis will lead to a set of requirements and algorithms necessary to implement these standards.

The Future Takes Shape: *Implementing Tomorrow's Capabilities Today*

Building the Foundation for NextGen — *Transformational Programs and Contributors*

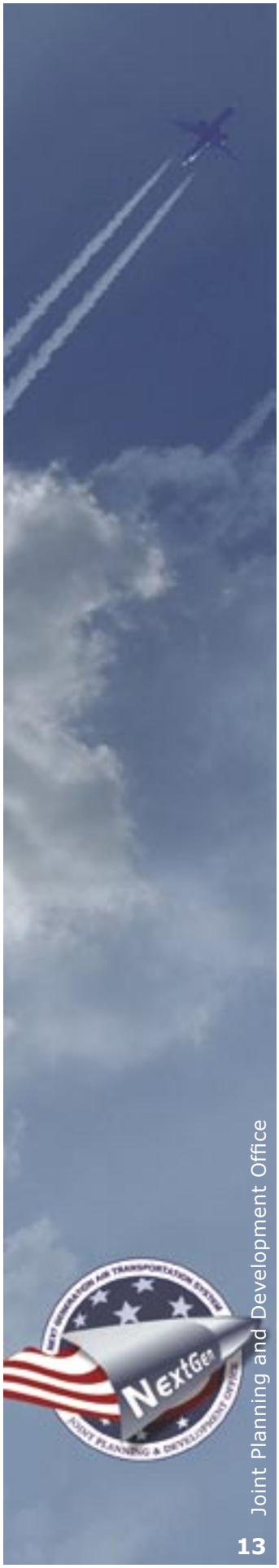
NextGen is about the long-term future of aviation. It deals with capabilities that will substantially expand and enhance our nation's air transportation system. While much of the work conducted by the JPDO focuses on defining the character of this vision, how it will work, and how the research and future investments need to be planned, it is also noteworthy that a host of foundational programs necessary to make NextGen a reality are already in development, and several are nearing deployment.

Many of these systems, while forming the foundation for NextGen, will also provide immediate benefits to the National Airspace System (NAS).

These programs and initiatives are contained in the FAA's FY08 budget and are categorized in two different segments. The first are the transformational programs, essentially the foundational infrastructure of NextGen, and the second are the NextGen contributors. These contributors are supporting the essential capabilities of NextGen. In addition to the transformation and contributing programs, building the foundation of NextGen requires addressing a number of top-level policy issues in the near-term, and a continuing focus on global harmonization.

Transformational Programs — *ADS-B and SWIM*

The transformational programs supported in the FY08 budget focus on the foundational technologies behind NextGen: namely, the development of network-enabled operations and satellite-based surveillance. Two of these programs, the Automatic Dependent Surveillance-Broadcast (ADS-B), and System Wide Information Management (SWIM) were defined in the 2005 Progress Report as "jump start" proposals.



In light of this recommendation and building on the successes of ADS-B in Alaska (Capstone) and in the Ohio Valley, the FAA in FY07 funded a national ADS-B and SWIM initiative.

The success in getting these programs under development is considered a major step forward for the JPDO and NextGen.

Automatic Dependent Surveillance-Broadcast (ADS-B)

ADS-B is a technology that will be the backbone of a future system that will revolutionize air navigation and surveillance. In fact, some companies, such as United Parcel Service of America, Inc. (UPS), are already using ADS-B in their daily operations and are realizing savings in jet fuel and significantly reducing noise and emissions.

ADS-B uses GPS satellites and ground-based transmitters to allow aircraft to broadcast their positions with greater frequency and accuracy than the current land-based radar systems at a reduced infrastructure cost. With ADS-B, pilots will see what the air traffic controller sees.

Suporting SWIM - the NEO Demonstration

Network-Enabled Operations are fundamental to the operations of NextGen. It is the ability to link together information from a wide range of sources, security, air traffic, weather, and defense. It is one of NextGen's biggest challenges. In 2005, there was a step forward. A demonstration, focused on a mock security threat, proved that we could connect several legacy systems together from different agencies to create a shared user view of the air traffic environment. In 2007, we are going to take this a step further, testing security and disaster recovery scenarios.

System Wide Information Management (SWIM)

Providing an initial Network-Enabled Operations (NEO) capability to all the users of the air transportation system is a high priority for the JPDO and the NextGen partner agencies. It is fundamental to the success of NextGen and for improving safety, security, and efficiency. In a network centric system, the right information will get to the right person at the right time. SWIM is the program that will provide the framework to make this happen.

This means that the FAA, Department of Homeland Security and the Department of Defense get the entire picture, such as the aircraft, position, and flight-plan. Information will be available in real-time in a secure environment to decision makers in all conditions. This would include normal operational conditions as well as in a system-wide crisis.

Other Transformational Programs

Other work that is directly related to establishing this foundation of NextGen includes Data Communications, Network-Enabled Weather, and the NAS Voice Switch. These programs, just like ADS-B and SWIM, provide both near-term benefits to the NAS as well as laying the foundational capabilities in communications, network development, and computing that are necessary to support NextGen.

JPDO is working through its partner agencies to implement a new approach to the role of weather information in the management of aircraft operations. Key to this undertaking is emphasizing better decision making when dealing with adverse weather. This philosophy represents a new dynamic in the application of weather information

in the national airspace and is an improvement that has the potential to substantially increase the efficiency and overall capacity of the system. This vision of Network-Enabled Weather relies on a common weather database as well as forecasts and predictive tools available to all users in the system to facilitate common situational awareness. The end result will be an enhanced ability to manage air traffic in adverse weather.

NextGen Contributors — *Supporting Essential Capabilities*

There is a wide range of other investments in the NAS that offer critical supporting technologies and capabilities that are needed in support of the initiative. These include the En Route Automation Modernization (ERAM), Advanced Technologies and Ocean Procedures (ATOP), the FAA Telecommunications Infrastructure (FTI), and Wide Area Augmentation System (WAAS). Each of these, by developing or contributing to some aspect of the NextGen initiative, is an essential component to our future system-wide design.

Industry, through individual applications of new technologies in operational environments, such as the use by UPS in Louisville, Kentucky of ADS-B technology, or with research into specific technology concerns, such as the study being conducted by the NextGen Institute on backup systems to GPS-based surveillance capabilities, is a critical player, whose efforts are making a direct contribution to building the NextGen foundation.

NextGen Institute: Industry Contribution and Relationship

Industry is a partner in the development of NextGen. Working through the NextGen Institute, representatives from the private sector have played an active role in building the JPDO's products. This year alone the Institute added 48 new members, bringing the total number of participating private sector organizations to 226. The Institute hosted the NextGen Cost/Benefit Workshops. Also in 2006, in a project for the JPDO, the Institute was asked to develop a set of potential "backup" area navigation solutions for NextGen.

Shaping Future Policy — *Ensuring NextGen Progress*

In addition to research and investment in new technologies and capabilities, NextGen will also require new policy and new business models.

The Enterprise Architecture and the Concept of Operations in laying out the developmental sequences for key capabilities also provide a guide to the essential policy decisions that need to be made as NextGen is implemented. During the coming year, the JPDO will, through its policy research agenda, and a series of policy analyses, discussions, and forums, be preparing options and recommendations for consideration by the JPDO's Senior Policy Council.

In 2006, based on early work defining NextGen, the JPDO identified the near-term, top-level policy issues that must be addressed to ensure NextGen progress and the initiative's ultimate success. These non-prioritized issues and some prospective questions include:

1. **Safety Management System (SMS)** – SMS is a proactive data-driven approach for improving system safety. It does this prospectively, before incidents occur, rather than applying forensics to obtain data after the fact. Should that system be extended to cover all federal agencies that fly in the NAS?

2. **Net-Enabled Information Sharing** – NextGen requires a transformation in the sharing and management of information. The development of network capabilities that are functional in a real time air traffic control environment is critical. What policies need to be developed or changed in order to ensure that key system users and the intelligence community all work together toward a system that will allow them to seamlessly share information?

3. **Integrated Surveillance Approach** – NextGen based surveillance capabilities such as ADS-B will replace ground-based surveillance and navigational capabilities. If radars that are no longer needed for air traffic control are retained for security purposes, who should pay to maintain them?

4. **Navigation Backup** – NextGen relies on GPS-based navigation capabilities. What system should be used as a backup for GPS?

5. **Transportation Network Infrastructure** – Aviation users will operate through a series of networks and digitally-based data exchange systems that will use a range of wireless based technologies. How can we ensure sufficient spectrum is available for the wireless portion of the aviation information network?

6. **Required Communications-Navigation-Surveillance, Performance and Equipage** – Aircraft owners who require access to specific airspace will have to equip their aircraft to meet the requirements in these environments. Should users be required to equip with the avionics needed to benefit from NextGen or should they merely be given an incentive to equip?

7. **Implications of Increased Automation** – As NextGen evolves, the human role in air traffic management will change. For example, there will be automated flight planning and route management. Will stakeholders, including passengers, accept an increased number of air traffic control functions being performed by automated systems, or will they insist on retaining the current level of human involvement in air transportation? What are the training and operations challenges regarding human and automation interface? What are the liability implications of this change?

8. **Environment vs. Capacity** – As air traffic demand continues to grow, NextGen will need to address key environmental issues. What needs to be done to provide sufficient technology development and timely methods for fleet insertion to reduce levels of aviation noise and local air quality emissions, thereby greatly reducing environment as a constraint on capacity?

9. **Approach to NextGen Business Case** – The Business Case must focus on the synergistic benefits of the multiple capabilities of NextGen. Since the JPDO is developing such a holistic, system-wide cost benefit analysis for NextGen, what changes to the current case-by-case type of cost-benefit analysis are necessary?

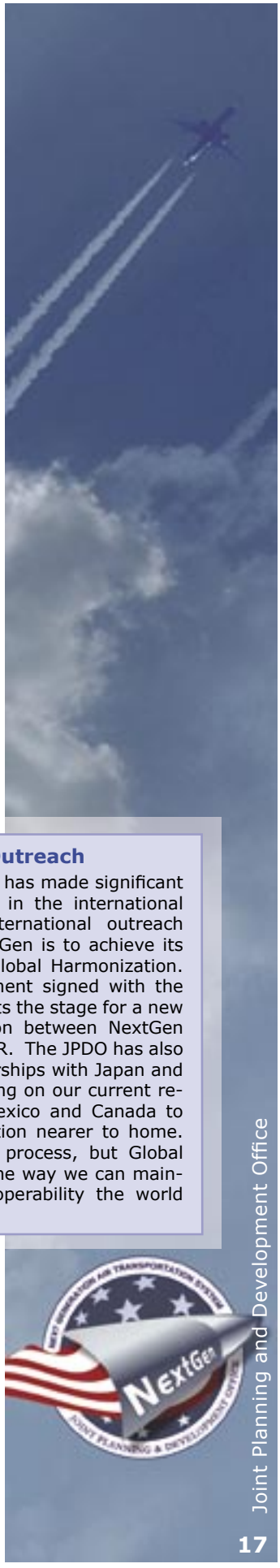
As NextGen matures more policy issues will arise. However, JPDO's goal, working in the context of its key planning documents, is to address these issues in a timely fashion so that key policy concerns are and resolved. Each of these issues will be a matter for consideration on by the Senior Policy Council during the coming year.

Global Harmonization — *NextGen in the International Environment*

NextGen faces some unique challenges in the international environment. We need to build a global system based on interoperability and harmonization. This approach could offer significant savings to the users and at the same time present the aviation industry with new and beneficial commercial opportunities. Global Harmonization is the guiding principle in the JPDO's international strategy for NextGen.

There have been several important steps in this direction. In June 2006, FAA Administrator, Marion Blakey, concluded an agreement with Jacques Barrot, Vice-President of the European Commission, in charge of Transport, which formalized cooperation between the NextGen initiative and its European counterpart, the SESAR program.

Beyond Europe, JPDO and NextGen partner agencies such as the FAA are seeking out partnerships with our international counterparts. In 2006, the JPDO established steering groups with China, Japan, Canada, and Mexico to facilitate cooperative activities on the design of NextGen. These groups are moving forward to pursue joint initiatives, including ADS-B, SWIM, and Enterprise Architecture.



International Outreach

This year the JPDO has made significant strides in working in the international environment. International outreach is essential if NextGen is to achieve its strategic goal of Global Harmonization. The recent agreement signed with the European Union sets the stage for a new level of cooperation between NextGen and Europe's SESAR. The JPDO has also established partnerships with Japan and China and is building on our current relationships with Mexico and Canada to facilitate collaboration nearer to home. It is a continuing process, but Global Harmonization is the way we can maintain smooth interoperability the world over.

The Skies Ahead:
This Year and Beyond

The Nature of the Commitment — *A Pledge to the Future*

NextGen, with its vision of a transformation of the National Airspace System, is focused well into the future. NextGen covers a 20-year period of evolutionary progress toward the future National Airspace System, not a one-time implementation of some undefined super technology. A successful transformation requires an inspired commitment by government and private industry to steady and regular progress. Our commitment needs to transcend future changes in leadership and government organization. To do this, we need to define how NextGen will function, how this new initiative will guide future research goals, capital investment decisions, and policy development. This process is essential to the successful transformation of the system.

How NextGen will function

1) Delivering the final definitional documents

The JPDO's mission is no small task, but this year, working with its partner agencies and the aviation industry, NextGen has taken some important steps forward. In mid-2007, the JPDO will be releasing the Concept of Operations and the Enterprise Architecture. Both documents will continue to evolve and change. That is the nature of the development process, but the basic definition and the outline for the initiative will be in place.

From that point, the JPDO will be in a position to use these two documents to further focus on its key mission: namely the alignment and coordination of the budget priorities, programs, and initiatives of the JPDO partner agencies. This is essential if NextGen is to develop its capabilities on schedule.

The key to making this process work is to apply these definitional documents as a guide to funding our annual and long-term activities and budgets.

2) Developing and refining NextGen cost profile

Given the nature of that approach, one of the most important commitments the JPDO will have this year is to develop and refine the cost of NextGen. Estimated costs for near-term programs and research will be more accurate, while longer-term estimates, given the likely changes in technology and requirements, are broader in range.

Continuing to refine the cost estimate built on sound industry-based practices is essential in setting the stage for our budgetary requirements.

3) Supporting partner agency implementation of existing technologies, and demonstration of new technologies and capabilities

The JPDO is working not only to set the stage for future research and investment, but we are also actively pursuing the development of key technologies and capabilities that will lay the groundwork for NextGen. These initial capabilities represent some of the fundamental components of the initiative and they will be the basis for our future research and investment. This, too, is an iterative process.

ADS-B
ADS-B is different from traditional surveillance and navigation systems. It is far more accurate than radar and the data collected by this satellite-based system is visually available to all system users. With ADS-B the pilots have the same information as controllers on the ground. ADS-B is also far more cost efficient. The ADS-B units are relatively inexpensive and will replace the costly ground-based radars and navigational systems that are currently in use.

During the coming year, JPDO will work with partner agencies to prepare for initial testing and deployment of some of these foundational programs. There will also be demonstrations that will allow the aviation community to understand how NextGen will use its basic capabilities in a working air traffic environment. This will offer opportunities to learn from these tests and demonstrations in a way that will allow us to better understand future technology needs and equipment requirements.

Future research and decisions

1) Set the future direction of our research

Further, in its 2008 research guidance to its partner agencies, the JPDO focuses on the future phases of NextGen development. Some of the important research areas in the 2008 guidance include, examining alternative safety and fault implications for various architecture alternatives, working towards developing a common weather database, continuing research work on four dimensional (4D) trajectories, a focus on developing real-time wake vortex sensing capabilities, and beginning to work on a better understanding of the human role in a NextGen operating

system. The JPDO and its partner agencies are building a research and development plan that will document NextGen research needs and the performing organizations. The plan will be delivered to OMB in August 2007 and help inform the FY09 process.

2) Solidify and expand cooperation with partners

The JPDO established significant inroads with a number of partners and stakeholders in 2006. For example, in August 2006, the JPDO leadership met with key leadership at the Air Force's Air Mobility Command. This interaction helped to identify several areas of mutual interest. In many cases, the Air Force had already invested considerable resources in these initiatives. For example, the Command's efforts towards achieving seamless integration of weather data into flight operations management and their experience in dealing with global compatibility issues have direct parallel implications to NextGen. JPDO is also working closely with the National Weather Service, which is under the National Oceanic and Atmospheric Administration, within the Department Commerce, to unify efforts in weather research and program development. By working together and collaborating as partners, such as in these examples, the JPDO can leverage much of this valuable work in further developing key system capabilities. Continued interaction with organizations like this, both in the public and private sector, is an essential part of the NextGen strategy and demonstrate the true spirit of the legislation.

3) Institutionalization with the ATO

FAA's Air Traffic Organization (ATO), in cooperation with the JPDO, is restructuring the Operational Evolution Partnership (OEP) as the FAA's roadmap for NextGen. As an example of institutionalization taking root, the FAA Airports, ATO, the MITRE Center for Advanced Aviation System Development (CAASD), and the JPDO's Systems and Engineering Analysis Division collaborated on the update to the report entitled "Capacity Needs in the NAS." The updated report identifies the OEP airports, non-OEP airports, and metro areas where NextGen capacity improvements are needed.

Efforts similar to these will serve as templates for JPDO's work with other departments and agencies.

Implementation of the system

NextGen implementation is critically linked to the activities and priorities of our sponsoring and partner agencies. In particular, many of the key elements of NextGen's near-term investment and capability development are tied closely to the FAA's Flight Plan, the agency's basic guidance on its future plans and priorities. The following outlines some of these critical near-term and longer focus areas:

1) Required Navigation Performance

Required Navigation Performance (RNP) is a set of standards that measures location accuracy in the airspace. Increased navigational precision by aircraft can reduce spacing within the system without compromising

safety while at the same time increasing airport capacity. A total of at least 200 RNP approach procedures are expected by 2011.

2) Automatic Dependent Surveillance-Broadcast (ADS-B), Traffic Information Service-Broadcast (TIS-B), and Flight Information Service-Broadcast (FIS-B)

There has been substantial progress in implementing ADS-B. There is now a national ADS-B office, and the program has entered into a partnership with industry for future work in the Gulf of Mexico. The contract to deploy the system is likely to be awarded this summer and the Notice of Proposed Rulemaking (NPRM), important to the deployment of the system, is expected by the end of the year.

ADS-B is an aircraft-based surveillance service being deployed in selected areas of the NAS. This technology broadcasts once-per-second from the aircraft with its position, velocity, and identification. This enables the use of TIS-B and FIS-B.

TIS-B is a ground-based broadcast service that provides secondary surveillance radar. The TIS-B service is intended to improve the pilot's ability to visually see other traffic in the air and on the airport surface so that pilots can more effectively apply traditional "see-and-avoid" techniques.

FIS-B provides weather and other non-control, aeronautical information that allows pilots to operate more safely and efficiently.

Improvements in the capabilities available to aircraft with integrated displays, data-link, and traffic information will increase situational awareness. By implementing ADS-B, TIS-B, and FIS-B, we will continue to deliver dependent surveillance technologies and systems to key sites.

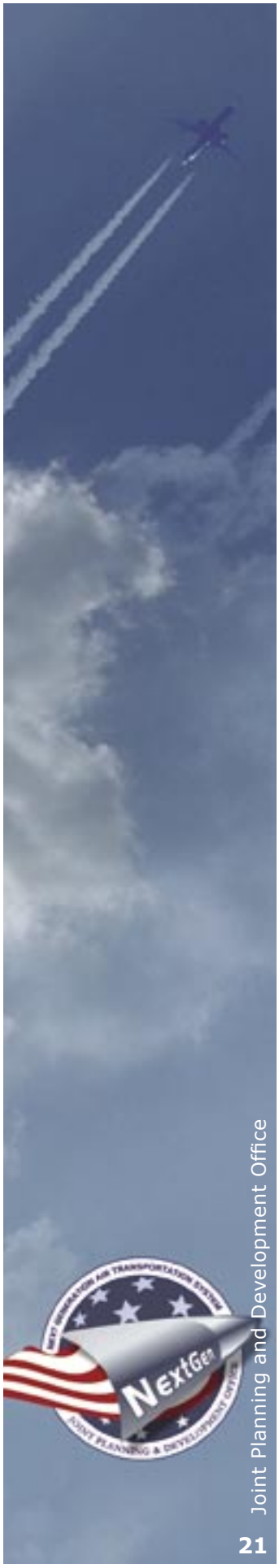
3) Capstone Program

The Capstone Program in Alaska is a long-term, highly successful application of ADS-B in a non-radar environment. ADS-B is one of Next-Gen's essential foundational technologies. It will continue its development with the goal of deployment throughout Alaska. Since initial deployment, general aviation accidents in Alaska have decreased by 40 percent. The practical information provided by this FAA program has already proven invaluable in guiding the development of NextGen.

4) Safety Management System (SMS)

The safety programs of NextGen must evolve from the traditional post-accident data analysis to an integrated forensic and prognostic evaluation and management of hazards and their potential risk. The key to success is the implementation of an integrated, national SMS encompassing all facets of the future air transportation system.

By improving the collection, consolidation, and analysis of safety data, it will be possible to identify emerging threats in a prognostic manner to prevent future accidents.



The NextGen SMS Standard will ensure consistency across all our industry partners and other federal agencies. This will provide the level of safety improvement commensurate with the increase in operations.

5) Implementation of the National Aeronautics Research and Development Policy

On December 20, 2006, President George W. Bush signed an Executive Order calling upon the Departments of Commerce, Defense, Energy, Homeland Security, State, and Transportation, NASA, the FAA, National Science Foundation, the International Trade Commission, and the Executive Office of the President to develop a National Aeronautics Research and Development Plan. This was a major milestone.

The JPDO, through its partner departments and agencies and in collaboration with the private sector, will be responsible for planning, coordination, and oversight of both research and implementation activities for the NextGen in meeting the nation's civil, military, and homeland security needs.

6) Continuous Descent Approach (CDA)

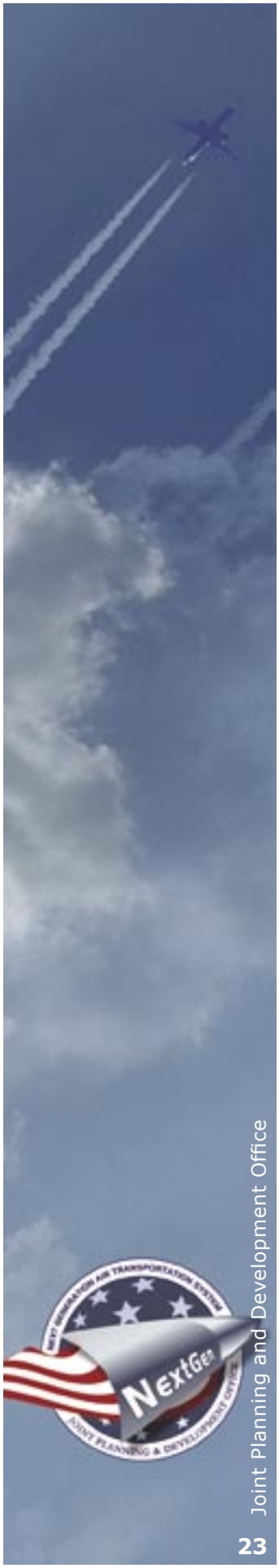
A Continuous Descent Approach is a procedure that optimizes the aircraft approach from the beginning of its descent to the touch down on the runway. Because this optimized approach profile minimizes the power levels required for the engines, noise, and emissions levels are substantially reduced.

In supporting our environmental stewardship, the JPDO will be working with several airports to implement CDA for night operations and initiate research into CDA applicability to airports with greater traffic levels, general mixed fleet, and mixed operations. A demonstration of CDA in a practical environment is one of the JPDO's 2007 objectives.

Conclusion

2006 has been a successful year for the JPDO. We have set the stage for the future of NextGen in our foundational documents, the Enterprise Architecture and the Concept of Operations. These will guide our future plans in resource planning, our research, and our work in policy development. We have begun development and implementation of some of our foundational technologies and we have also set the stage for a range of demonstrations that will highlight essential NextGen capabilities.

However, these are just the first critical steps in setting the course for this unprecedented initiative. The challenge is in maintaining a common vision and a commitment to the transformation of the national air transportation system. If we can succeed in this, if we can forge a new way for government to function across agency lines, and if we can build new paths for working with industry, then we can achieve the benefits and the rewards of the NextGen initiative. The future of aviation and our nation depends on our collective success.



Joint Planning and Development Office

NEXTGEN

Next Generation Air Transportation System

Joint Planning and Development Office

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