

# Next Generation Air Transportation System

## Integrated Plan





U.S. Department of  
Transportation

December 12, 2004

It is our distinct pleasure to transmit to Congress this Integrated National Plan for the Next Generation Air Transportation System, fulfilling a requirement included in Section 709 of the Century of Aviation Reauthorization Act (P.L. 108-176), signed by President Bush last December. That legislation calls for the development of an integrated plan to “ensure that the Next Generation Air Transportation System meets air transportation safety, security, mobility, efficiency, and capacity needs beyond those currently included in the FAA’s Operational Evolution Plan.”

Our Nation’s air transportation system serves as a critical engine of economic growth and facilitates the safe and efficient movement of people and goods across the globe. After a long downturn in the demand for air transportation, travelers are returning to the system in large numbers. We must be prepared to accommodate this growing demand in the years ahead. Failure to do so will result in costly travel delays throughout the system and will almost certainly compromise our ability to create jobs and grow our economy.

That is why nearly two years ago we launched, with the support of the Departments of Commerce, Defense and Homeland Security, as well as NASA and the FAA, an effort to align our resources while developing a “next generation” air transportation system. This system will take advantage of the latest technologies while fully incorporating the many security improvements that have been introduced in recent years. It will also be more flexible to allow for new air travel options and robust enough to handle up to three times our current level of operations. Finally, it will serve as a model of what we can accomplish when Federal agencies work in concert with one another and leverage private sector capabilities to pursue a common objective.

We look forward to working with Congress to help make this Next Generation Air Transportation System a reality.

Sincerely yours,

A handwritten signature in blue ink, appearing to read "Norman Y. Mineta".

Norman Y. Mineta  
Secretary  
Chairman, Senior Policy Committee

A handwritten signature in blue ink, appearing to read "Marion C. Blakey".

Marion C. Blakey  
FAA Administrator



The United States has been at the forefront of aviation since the day the Wright Flyer made its historic 12-second flight. Since then, Americans have become the most mobile society on Earth. Imagine, though, what would happen to our economy and quality of life if we could no longer depend on air transportation for overnight delivery or we could no longer depend on arriving when we need to arrive?

The U.S. air transportation system as we know it is under stress. The demand for air transportation is outpacing our ability to increase capacity in our airports. Operating and maintenance costs of the air traffic system are outpacing revenues and the air carrier industry is going through significant change. The terrible events of September 11, 2001, radically altered our country and they exposed a new impediment to the future of the air transportation industry. New security requirements are significantly impacting costs and the ability to efficiently move people and cargo. In addition, the growth in air transportation has provoked community concerns over aircraft noise, pollution, and congestion that affect our ability to respond adequately or rapidly enough to our changing world.

Now imagine an alternative world where a traveler or shipper determines departure and arrival times – instead of being confined to a predetermined schedule. Imagine a hassle-free travel experience where safety and security measures, ticketing, and baggage checks are all transparent as the traveler or package moves easily through the airport and on and off the aircraft. Think of the possibilities if owning a recreational plane, micro-jet, or a share of a jet capable of flying in nearly all weather conditions were affordable to more Americans. Imagine improved individual and community quality of life in a world with less aircraft noise and emissions pollution, even as significant increases in air transportation occur. In a post-9/11 world, imagine the benefits of civil and military operations seamlessly integrated sharing necessary travel information with all users of the system world-wide. Consider the opportunity that would arise in communities that have more choices in how to connect with the larger air transportation system and expanded direct global access.

Imagine the results of such a transformed air transportation system on the U.S. and global economy. Such a world is within our reach.

The 108th Congress and the President took the critical first step toward transforming our air transportation system by passing and signing into law Vision 100 – Century of Aviation Reauthorization Act. The legislation created a unique coalition of public and private partnerships to lead this historic effort. The legislation also emphasized the key role of the private sector in developing this plan. Congress has tasked the agencies to be accountable to each other by forming the Senior Policy Committee composed of their respective leaders. This leadership team has established clear direction for the transformation. Realizing the full benefits from complex investments and assuring protection of public safety, security and environmental concerns can only be achieved through a genuine public and private industry partnership.

**Members of the Senior Policy Committee:**

- Secretary of Transportation, Chair
- Secretary of Defense
- Secretary of Homeland Security
- Secretary of Commerce
- Director of the Office of Science and Technology Policy
- Administrator of the National Aeronautics and Space Administration (NASA)
- Administrator of the Federal Aviation Administration (FAA)

The role of Government must shift to allow industry to provide the most cost effective solutions within a performance-based set of security, safety, and environmental rules. This understanding will be reflected in planning, decision-making, and implementing institutional reform that is mandatory for successful transformation. There is also a need to improve incentives to produce air traffic and airport services efficiently - to make sure that these services are put

to their highest and best use. This roadmap in no way implies that government can solve all the problems facing aviation. The goal is not to create an industrial policy by which the government tries to pick winning technologies, but instead to provide a framework to utilize the creative forces of the market. Market forces should play a role wherever possible.

Sparked by this leadership, these agencies, working closely with the private sector, have defined eight strategies for transformation, each individually significant yet interdependent on the other seven. The eight strategies are the first steps toward a roadmap to provide a credible and stable path forward. As the term implies, this roadmap can guide our efforts to arrive at our destination if the paths and connections are clearly identified. With this roadmap, both public and private sectors can develop long-term investment plans and activities that result in the Next Generation Air Transportation System.

Since local governments and the private sector represent the majority of owners and investors in the air transportation infrastructure and its operations, their active participation is essential. Using one of industry's best practices, the integrated product team (IPT), each of the eight transformation strategies will be researched, developed, implemented and maintained through its own IPT. The power of the IPT model centers on the involvement of all parties touched by a process. In this way, each strategy team will be led by an agency with the charge to integrate across the interests of federal, state and local governments, quasi-government research institutions, universities, and most importantly, the manufacturers, service industries, and customers of the air transportation system. Recognizing that the United States has the most creative, innovative and successful industrial base in the world, government is striving to create a framework within which industry can excel.

Achieving the vision of a transformed air transportation system requires us to open our minds to new possibilities, embrace new approaches and create new ways to work together. To secure America's place as a global leader in aviation's second century, we need an air transportation system that supports a strong commercial capability, facilitates private-sector expansion, and creates jobs. For that purpose our strategies are centered on:

- Developing the airport infrastructure to meet future demand by empowering local communities and regions to create alternative concepts of how airports will be used and managed in the future.
- Establishing an effective security system without limiting mobility or civil liberties by embedding security measures throughout the air transportation system – from curb to curb. Creating a transparent

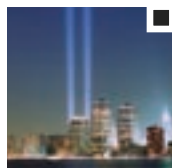
set of security layers will deliver security without creating undue delays, limiting access, or adding excessive costs and time.

- Creating a responsive air traffic system by devising alternative concepts of airspace and airport operations to serve present and future aircraft. As new vehicle classes and business models emerge, such as remotely operated vehicles and spaceports, the safe and efficient operation of all vehicles in the National Airspace System will be critical to creating new markets in aviation and beyond.
- Providing each traveler and operator in the system with the specific situational awareness they need to reach decisions through the creation of a combined information network. All users of the system will have access to the air transportation system data they require for their operations.
- Managing safety through a comprehensive and proactive approach that can integrate major changes, such as new technologies or procedures. This will be done in a timely manner and without compromising aviation's current superior safety record.
- Introducing new policies, operational procedures, and technologies to minimize the impact of noise and emissions on the environment and eliminate ground contaminants at airports. This effort includes exploration of alternative fuels, engine and aircraft designs. These actions will result in reduced environmental impact and sustained aviation growth.
- Reducing the impact of weather on air travel through a system-wide capability for enhanced weather observations and forecasts, integrating them with the tools used by air system operators. This capability will substantially improve airspace capacity and efficiency while enhancing safety.
- Harmonizing equipment and operations globally by developing and employing uniform standards, procedures, and air and space transportation policies worldwide, enhancing safety and efficiency on a global scale.

There has never been a transformation effort similar to this one with as many stakeholders and as broad in scope. The objective of this plan is to provide the opportunity for creative solutions for the future of air transportation, our security and our hope for a vibrant future.

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# Contents

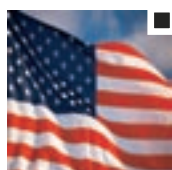


## Chapter 1 Change Is Needed

In less than a century, aviation went from spectacle to spectacular. Today, Americans rely on aviation not just for transportation but for recreation as well.

# 02

- 1.1 Security
- 1.2 Gridlock
- 1.3 Global Leadership



## Chapter 2 A National Vision for Air Transportation in 2025

Transforming the system to meet the needs of the 21<sup>st</sup> Century will ensure U.S. leadership in the global economy. However, major changes are involved in the process.

# 06



## Chapter 3 System Goals and Performance Characteristics

To achieve our vision we need to define the system goals and performance characteristics that will serve as its foundation.

# 07

- 3.1 Retain U.S. Leadership in Global Aviation
- 3.2 Expand Capacity
- 3.3 Ensure Safety
- 3.4 Protect the Environment
- 3.5 Ensure Our National Defense
- 3.6 Secure the Nation



## Chapter 4 Operational Concepts

The Next Generation Air Transportation System will be well equipped to adapt to future demands by using new concepts, technologies, networks, policies, and business models.

# 11

- 4.1 Security Operations
- 4.2 Safety Assurance
- 4.3 Airport Operations
- 4.4 Aircraft Operations
- 4.5 Air Traffic Management Operations



## **Chapter 5** The Next Generation Air Transportation System Roadmap for Success

The U.S. aviation system must transform itself and be more responsive to the tremendous social, economic, political, and technological changes that are evolving worldwide.

- 5.1** Strategies
- 5.2** High-Level Roadmap
- 5.3** Key Challenges

**15**



## **Chapter 6** Approach to Transformation

Achieving the vision for air transportation will be done via collaboration among federal, state, and local government and private industry.

- 6.1** Changes in Government-Private Interactions
- 6.2** Changes within Government

**22**

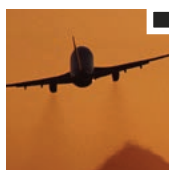


## **Chapter 7** Transformation Strategies

The strategies outline the plans that the integrated product teams will expand and execute.

- 7.1** Develop Airport Infrastructure to Meet Future Demand
- 7.2** Establish an Effective Security System without Limiting Mobility or Civil Liberties
- 7.3** Establish an Agile Air Traffic System
- 7.4** Establish User-specific Situational Awareness
- 7.5** Establish a Comprehensive, Proactive Safety Management Approach
- 7.6** Develop Environmental Protection that Allows Sustained Aviation Growth
- 7.7** Develop a System-wide Capability to Reduce Weather Impacts
- 7.8** Harmonize Equipage and Operations Globally

**25**



## **Chapter 8** Next Steps

The U.S. Government and industry partners are ready to move forward in the process of building the system of the future.

**35**



## Chapter 1: Change Is Needed

In less than a century, aviation went from spectacle to spectacular. Today, Americans rely on aviation not just for transportation but for recreation as well. Its growth has been fueled by the ability of aviation to offer very safe, affordable, fast, predictable movement of goods and people. Millions of Americans fly every day for business, vacation, and to visit family and friends. Thanks to the speed and predictability of air transportation, we have become accustomed to year-round access to all varieties of food, flowers, and other products. Businesses depend on just-in-time air shipments for production efficiency and to keep inventory costs low. Without the unique benefits of air transportation, our quality of life would be dramatically reduced. Whether those benefits will continue to be available in the future will depend upon actions we begin taking now. The system is already showing signs of stress and it is clear that projected demand will soon surpass the system's capacity.

The U.S. aviation system must transform itself and be more responsive to the tremendous social, economic, political, and technological changes that are evolving worldwide. We are entering a critical era in air transportation, in which we must either find better, proactive ways to work together or suffer the consequences of reacting to the forces of change. The consequence of a do-nothing approach to this public policy problem is staggering. As the Commission on the Future of the United States Aerospace Industry noted, consumers stand to lose \$30B annually due to people and products not reaching their destinations within the time periods we expect today.

We are nearing a time when we will have to develop a new approach to air transportation. The current approach – ground based radars tracking congested flyways and passing information from control

center to control center on the ground throughout the flight of an aircraft – is becoming operationally obsolete. The density of air traffic is making the current system increasingly inefficient. Bottlenecks are showing up now, and large increases in air traffic will cause mounting delays and increased need for structuring or limiting service in many parts of the nation. Driven by the increasing pace of change, the old evolving approach is insufficient for system modernization. In terms of improving the system over the next 25 years, it is clear that business as usual will not succeed.<sup>1</sup>

Technology is giving us opportunities for an entirely new approach—one that utilizes modern communication techniques, advanced computers, precision plotting through GPS and modern computer-based decision assistance programs. This new approach to air navigation could open up the sky to much greater and more efficient utilization of airspace. It also holds great promise for improved aviation security. For example, this system opens the possibility for automated protection zones around critical infrastructure sites, where computers would take control of an unauthorized aircraft approaching a critical facility and divert it to land at a nearby airfield where security personnel can take control of the situation.



<sup>1</sup> National Research Council, "Securing the Future of U.S. Transportation," 2003.

Three factors threaten the ability of aviation to grow and continue to serve the nation:

### 1.1 Security

We must continue to squarely and aggressively face terrorism. Following 9/11, the government acted swiftly and firmly to protect us from aviation terrorism. Additional steps were taken to strengthen all parts of aviation security and our military was called upon to perform the new and difficult job of domestic air patrol. Americans understand and support the new security requirements. However, such actions cost more than \$4 billion per year, and employ tens of thousands of our nation's security personnel at a time when many other threats are also in need of attention. The flying public has also spent its precious time to support improved security throughout the airports. We need to find ways to secure aviation without detracting from the affordability, speed, and predictable advantages we desire in air transportation. Key factors in this problem include the projected growth of 120 million additional international passengers that will have to clear customs and security, the tripling of cargo



and passengers, the introduction of new types of vehicles, and new potential threats.<sup>2</sup> Aviation security will require the coordination of missions for national defense, homeland security, drug and law enforcement, and air traffic management. Gaps must be closed immediately to confront an ever-widening range of threats. Efficiencies must be found to enable the anticipated growth in air commerce.

### 1.2 Gridlock

Paradoxically, aviation's own success will erode the unique speed, predictability, and affordability benefits of air travel if the air transportation system does not expand and adapt at the same pace as the market demands. Historically, growth in aviation was possible because significant investments were made to expand the national airport system and because of our ability to incorporate productivity enhancing technologies into the system. Today, in the most densely populated areas of the U.S., we are barely keeping pace with demand. In the year 2000, millions of Americans were stranded in airports experiencing delays of more than an hour and, in rare cases, to six hours or more. Using present forecasts and maintaining aggressive plans for improvements, the Federal Aviation Administration (FAA) predicts that even more major airports will be congested in the 2020 time frame<sup>3</sup> (see Figure 1). Failure to address the impact of air travel congestion on the mobility of Americans could cost consumers up to \$20 billion a year by 2025.<sup>4</sup>

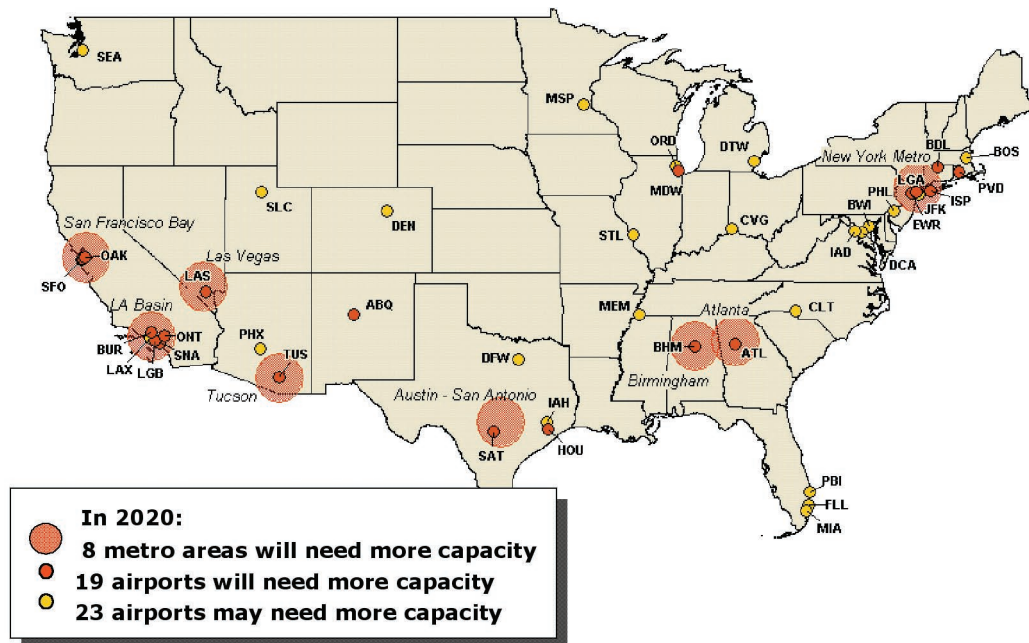


Figure 1. Congestion Continues to Build

<sup>2</sup> Federal Aviation Administration, *Aerospace Forecast, Fiscal Years 2004-2015*, March 2004

<sup>3</sup> Federal Aviation Administration, *Future Airport Capacity Task – Final Report*, June 2004.

<sup>4</sup> Cavolowsky, John, and Lee Olsen, *Socio-Economic Demand Forecast Study*, NASA and FAA, January 2004.



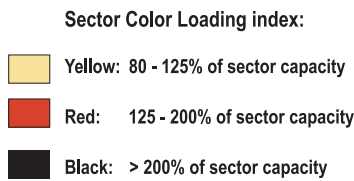
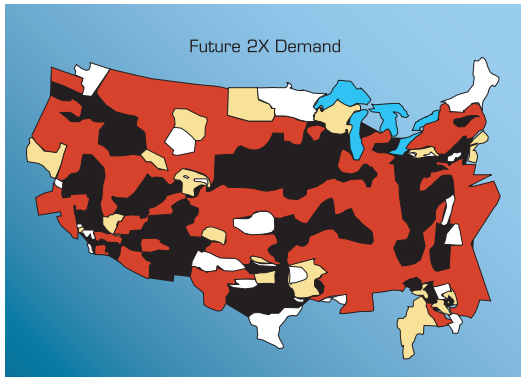


Figure 2. Significant Stress Even at a Two-fold Increase

Imagine losing our current ability to plan for same-day travel or no longer being able to depend on scheduled travel the same day as our work activities demand. This potential loss in the speed and predictability of air travel will result if the growth of aviation outpaces advances in the ability to control the flow of that traffic efficiently through the airspace. Already, the first systems for limiting demand have been put in place just to manage today’s traffic. Transformation must begin now to prepare for future growth.

Over the next 20 years, approximately 20 additional airports will grow to more than half a million departures and arrivals a year – the size of Detroit’s operations.<sup>5</sup> These growth centers will crisscross the United States with significantly more air traffic than the present

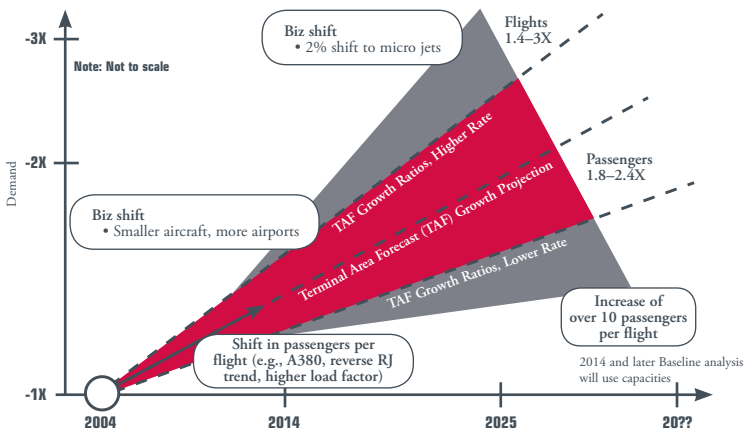


Figure 3. Planning for a Range of Futures

system can handle. The current method of handling traffic flow will not be able to adapt to the higher volume and density demanded of it in the future, even if twice as many or more resources are devoted to it. While demand in some markets may want to grow to three times its present level, even at twice the present number of flights, most of the system will be saturated with air traffic well above presently acceptable levels (see Figure 2).

It is not only the number of flights, but also the extent and form of the new growth that poses a problem. Many indicators show an increasingly diverse future marketplace demanding a broader range of air transportation services. For example, a shift of 2% of today’s commercial passengers to micro-jets that seat 4-6 passengers would result in triple the number of flights in order to carry the same number of passengers. Such a shift will have a significant effect on the safety, security, capacity, and environmental stewardship missions related to aviation. At the other extreme, growth in vehicles carrying over 600 passengers would impose a smaller strain in terms of the number of flights, but with a much different set of infrastructure needs. Add to this other non-conventional vehicles, including unmanned vehicles developed for special operations such as forest fire fighting, and the challenges grow. The uncertainties in the form of future demand (see Figure 3) call for a highly flexible solution to avoid over-building with the wrong infrastructure or under-building for the pace of expansion.

The potential gridlock problem has been characterized in five future scenarios that address possible circumstances: the affordability of fossil fuels, the emergence of new markets in Asia that dominate air transportation development, the environmental and health concerns pervading normal every-day routine, the increasing importance of timeliness, and the continuing or increasing level of world tension. Those potential scenarios represent ways in which the system may need to change or respond such as by demanding higher utilization of regional service for point-to-point operations or more small aircraft and airports, requiring many more large-carrier overseas flights, or requiring much more fuel-efficient and environmentally friendly vehicles.<sup>6</sup>

Finally, the growth in air transportation has stressed the balance between local aviation and other interests. This could deprive communities of the opportunity for direct access to the global marketplace. Worse, many communities may even be unable to sustain satisfactory, affordable service.

5 Federal Aviation Administration, *Future Airport Capacity Task - Final Report*, June 2004.

6 Joint Planning and Development Office Future Working Group, *Final Report*, 27 May 2004.

### 1.3 Global Leadership

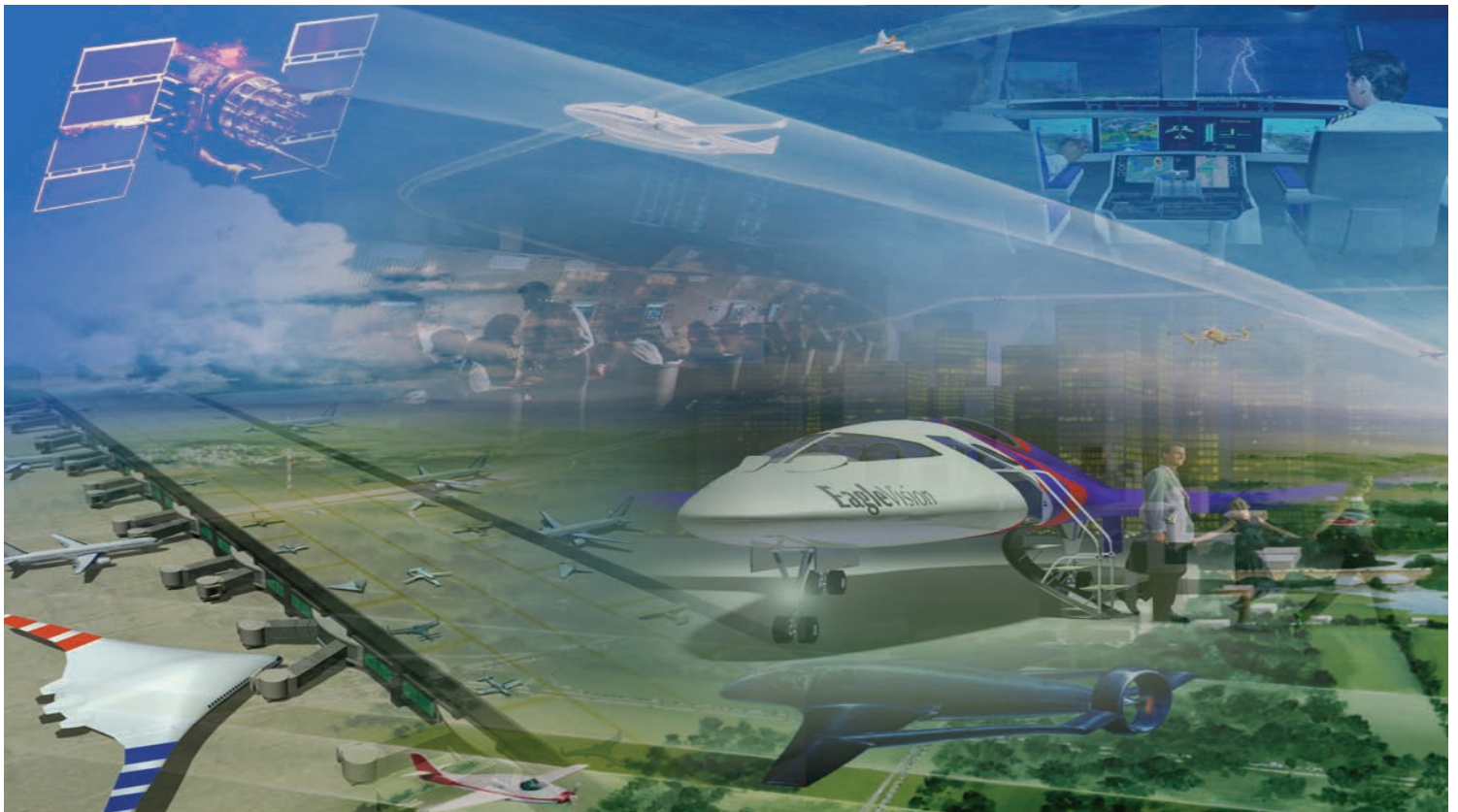
The United States has been a leader in aviation since its very inception 100 years ago. That leadership is a result of the energy and creativity of America's private sector which has supported our economic health through developing a highly skilled workforce, encouraging technical innovations, and producing aviation products used around the globe. The private sector has also been supported by the U.S. leadership in establishing the institutional framework and standards necessary for this sector. Unless we establish a vision and framework that encourages and enables further private sector innovation, our competitiveness in aviation is likely to diminish. Loss of competitiveness in this area would mean a loss in high-paying jobs and a weakening of our economic strength through a shift in the balance of trade. We cannot afford to be a second-tier aviation supplier in the second century of aviation.

Just as in the domestic arena, the government should avoid picking winners and losers in the international economy. However, it does accept responsibility for ensuring that international competition provides U.S. firms with a fair opportunity to compete for markets. The air transportation and aerospace markets, in particular, are highly influenced by international agreements that set standards and provide for market access. In some cases, the air transportation system and key suppliers are owned or financed by governments in other countries. Federal research and institutional arrangements to support transformation will assist U.S. negotiators as they strive to provide for a fair and equitable international competitive environment for U.S. firms. As the U.S. "Hushkit" controversy with Europe demonstrated, the ability of U.S. firms to operate overseas is closely interconnected with trade policy, international standards and our ability to generate technological advances to global problems.

The economic stake of maintaining leadership is high. Civil aviation products and services generate a significant surplus for U.S. trade accounts and contribute to the \$100 billion a year in tourism from abroad. Air transportation has spawned a highly technical workforce. Aviation technologies, products, and services underpin the advanced capabilities of our national defense and homeland security.<sup>7</sup>

Congress, commissions, state authorities, and others have all recognized that government and industry need to take a different approach to the business of aviation. If the United States is going to be ready for the changes that are to come in the next two decades, we need an integrated plan—one where government creates a stable institutional framework that encourages the creativity of the private sector.

<sup>7</sup> PL 108-176 Sec 4 (1-4)



## Chapter 2: A National Vision for Air Transportation in 2025

Transforming the framework for aviation will require major changes. Flight procedures will be tailored to aircraft and aircrew performance. Increased automation combined with new procedures will have fewer ties to geographical airspace differences. The combination of automation and procedures will overcome the complex issues associated with allowing all operators continued access in a mixed environment of commercial, military, and general aviation aircraft with differing levels of capability. The result of these changes will allow closer spacing of aircraft, which, in turn, will increase capacity. International standardization of the procedures and technology developed under an integrated safety management approach will create an equivalent level of safety across the globe.

**A transformed air transportation system that provides services tailored to individual customer needs, allows all communities to participate in the global economy, and seamlessly integrates civil and military operations.**

Ultimately these transformations will spur new business models. The entire concept of the airline schedule will be redefined as the boundaries between traditional carriers and on-demand service providers begin to merge. This proliferation of options will effectively enable customers to choose air transportation services tailored to their needs. For example, customers will have the means to shorten their curbside-to-curbside travel time. The options also provide more communities direct access to global air transportation services enabling business and leisure connectivity worldwide.

To meet future demand, travelers and shippers need to be able to access information regarding their options using advanced information technology. While traveling, information technology will notify passengers of itinerary changes or travel conditions and present comparable alternatives. Thus, the predictability of air travel will increase. We cannot eliminate delays, but we can give the traveler and the shipper the best information available to make decisions on the spot.

# Chapter 3: System Goals and Performance Characteristics

To achieve our vision, we need to define the system goals and performance characteristics that will serve as its foundation. Accordingly, we aim to:

- Retain U.S. leadership in global aviation
- Expand capacity
- Ensure safety
- Protect the environment
- Ensure our national defense
- Secure the nation

As we continue to refine this effort we will periodically revisit these goals to ensure we have established the most cost beneficial system.

## 3.1 Retain U.S. Leadership in Global Aviation

Air transportation fuels the global economy by delivering goods and facilitating the movement of people for business and personal purposes. Already a third of U.S. exports by value are shipped by air.<sup>8</sup> Air transportation will expand with global commerce. The number of international air travelers will triple by 2025.<sup>9 10 11</sup> The expansion will include direct access to a wider range of foreign destinations and global markets through liberalization agreements such as Open Skies Agreements.

Continued expansion depends in part on productivity gains and cost savings. Costs associated with system improvements will not put undue burdens on military, commercial, and private aircraft owners.

The aviation-manufacturing sector—airframes, avionics, air traffic control and surveillance technologies—all play an important role in the U.S. economy and remain a critical aspect of our national defense. The vitality of U.S. aviation manufacturers will strengthen as government concentrates on establishing performance-based

standards while industry develops innovative products to capture new markets.

Specialty services tailored to individual customer needs, such as on-demand general aviation, will become part of the system.<sup>12</sup> Over the next 20 years, market projections for microjets and unmanned vehicles number in the tens of thousands.<sup>13 14</sup> In the same period, it is projected the cumulative value of aircraft sales and aircraft service markets will exceed \$2 trillion.<sup>15</sup> It is essential that we establish a clear vision for the future of this sector based on the least restrictive regulatory environment possible consistent with safety and security requirements. Only when that vision is spelled out will we unleash the energy and creativity of America's aerospace industry in ways that will ensure the future of the air transportation system.

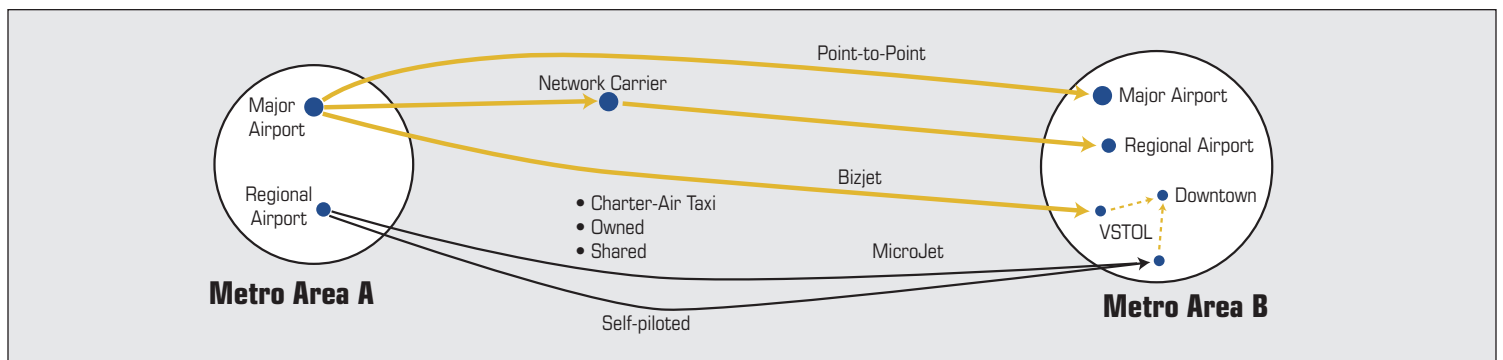
### Objectives

- Retain our role as the world leader in aviation
- Reduce costs for air transportation
- Enable services tailored to traveler and shipper needs
- Encourage performance-based, harmonized global standards for U.S. products and services to keep new and existing markets open

## 3.2 Expand Capacity

The air transportation system of 2025 must accommodate a wide-range of customers and an even wider spectrum of issues including:

- Access requirements for private, commercial, civil, and military aviation
- Unforeseen changes in traveler and shipper needs
- Access to a more global economy
- Continuously evolving safety and security concerns



8 Bureau of Census, 2003.

9 Based upon extrapolated growth rates reported in Federal Aviation Administration, FAA Aerospace Forecasts FY 2004 – 2015, March 2004.

10 Boeing, Current Market Outlook, 2004.

11 Airbus, Global Market Forecast, 2003.

12 Federal Aviation Administration, Future Airport Capacity Task - Final Report, June 2004.

13 Dollyhigh, Samuel, Analysis of Small Aircraft as a Transportation System, NASA September 2002.

14 Teal Group, World Unmanned Aerial Vehicle Systems – Market Profile and Forecast, 2003.

15 Boeing, Current Market Outlook, 2004.

The only way we will meet those customers' evolving needs is to build new capacity, while making better use of our airports and airspace.

Existing operations will grow in a variety of dimensions. The number of passengers to be supported may range from the present 2 million per day or increase up to 4 to 5 million. These passengers will be carried by hundreds of thousands of flights of various types — scheduled carriers, business aviation, and owner-operated general aviation. They will operate from the same airports and airspace with triple the present volume of cargo. The system will have a number of decision makers: tens of thousands of general aviation and airline pilots operating aircraft, hundreds of thousands of airport workers and aircraft operator employees at over 5,000 airports. The air transportation system will provide sufficient capacity to satisfy the demand resulting from growth in existing operations as well as growth in new and emerging market segments.

The airport and airspace capacity in 2025 must be more responsive, adaptable, and dynamic. The system will accommodate changing needs, both globally and locally, by leveraging new technologies and new operational procedures. The air traffic management system will be capable of shifting resources from servicing one geographic area to another with minimal training and little or no relocation of equipment or personnel. The system will be nimble enough to adjust in cost effective ways to varying levels of demand. The system will allow more creative sharing of airspace capacity for civil, law enforcement, military, and commercial users through ever-present access to operational information.

While growth of traditional air transportation system users is likely to continue, the system will also need to accommodate new aviation vehicles and business models. In just one area, a U.S. government study estimates there may be as many as 5,000 microjets employed by on-demand air taxi services by 2010 and 13,500 by 2022.

Microjets alone may represent 40 percent of daily operations by 2025.<sup>16</sup> An even higher percentage of operations by new vehicle types is anticipated when unmanned aerial vehicles (UAV) and other new entrants are considered.

#### *Objectives*

- Satisfy future growth in demand (up to 3 times current levels) and operational diversity
- Reduce transit time and increase predictability (domestic curb-to-curb transit time cut by 30%)
- Minimize the impact of weather and other disruptions (95% on time)

### **3.3 Ensure Safety**

The U.S. air transportation system in 2025 will continue to be the safest form of transportation. Despite the anticipated growth in all sectors of the air transportation system the actual loss of property and, more importantly, human life will continue to decline. This will be accomplished through an integrated safety management approach and new air vehicles that will introduce inherently safer design characteristics. The approach will provide a proactive means for building safety into the air transportation system we are developing and safely managing it through the transition. Adoption of the safety management approach will deliver safety benefits on a global scale. As an additional benefit, this approach will shorten the civil aviation implementation cycle times for products and procedures.

#### *Objectives*

- Maintain aviation's record as the safest mode of transportation
- Improve the level of safety of the U.S. air transportation system
- Increase the safety of worldwide air transportation

### **3.4 Protect the Environment**

As aviation grows, we must reduce aircraft noise and emissions as well as contaminants from airports. Aviation simply must become a better neighbor. Improved environmental protection will be a vital element to ensure U.S. air transportation viability and global leadership.<sup>17</sup> Certain regions of the world already have adopted policies that limit aviation growth to protect the environment. Noise and emissions at the Nation's largest airports would limit capacity if they are not aggressively addressed.



<sup>16</sup> Rolls Royce Forecast, NBAA Convention News, Page 22, October 13, 2004  
<sup>17</sup> Federal Aviation Administration, Future Airport Capacity Task - Final Report, June 2004.

This environmental compatibility will be achieved through a combination of improvements in aircraft performance and operational procedures, land use around airports, policies and incentives to accelerate technology introduction into the fleet, and aircraft de-icing procedures. The Next Generation Air Transportation System (NGATS) will apply advances in design, engineering, and emerging technologies to ensure that growth in the number of aircraft and airports does not exceed approved environmental limits. Further gains will be realized from new policies and approaches in regulation and mitigation. Long-term, reinvigorated research and development and refined technology implementation strategies will help to keep pace with changing environmental requirements.

Policy and financial incentives will be used to accelerate the introduction of environmental technology improvements in aircraft, including propulsion technologies, materials development, and airframe designs. Intelligent flight planning, coupled with improved flight management capabilities, will enable more fuel-efficient profiles throughout the flight envelope. Noise and local emission reduction efforts will be coordinated among multiple aviation operations in large metropolitan areas.

By 2025, the impact of aviation on community noise and local air quality will be reduced in absolute terms, even with anticipated growth in air traffic. Uncertainty in the emerging issues of climate change and health effects of emissions will be reduced to a level that enables appropriate actions to be undertaken to address these effects. Airports will be valued neighbors keeping the public well informed about aviation and environment issues. Airlines and airframe/engine manufacturers will be recognized as global leaders in jointly addressing mobility and environmental needs.

*Objectives*

- Reduce noise, emissions, and fuel consumption
- Balance aviation’s environmental impact with other societal objectives

**3.5 Ensure Our National Defense**

The future air transportation system must be able to facilitate the nation’s ability to respond rapidly to emerging threats while maintaining commercial and civilian access to our airspace. Integrating the information and communication systems of defense agencies is essential to ensuring that our nation is prepared to combat threats.

Integrated capabilities will support national defense by improving our ability to share information among agencies and organizations responsible for protecting our country. Sharing information and

obtaining a common picture of our skies will enable a proactive approach to protection. It also will facilitate rapid responses to a variety of threats. For example, improved information regarding aircraft that may be entering restricted airspace will likely reduce the need for combat air patrols.

The future air transportation system also will improve support for military missions. Commercial carriers will be able to provide more capable and economical transportation services and access to global airspace. Additionally, global harmonization of standards, procedures, and operations will reduce the investment necessary to ensure U.S. military access to international airspace.

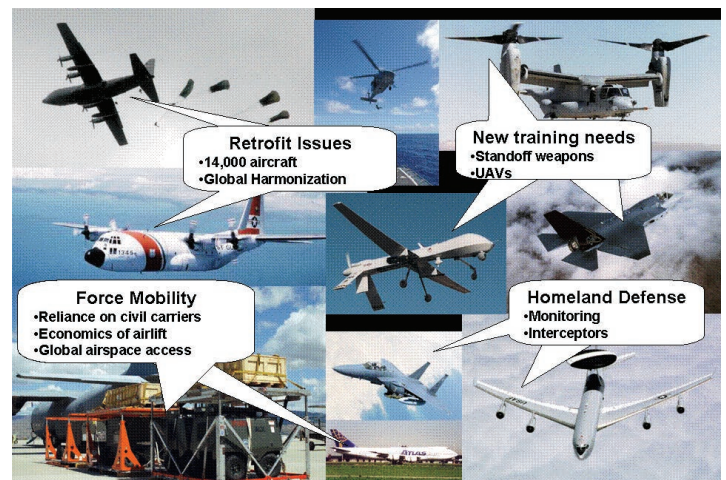
The availability of improved tracking and surveillance technologies will allow continued commercial and civilian access to our national airspace while mobilizing defense activities. The future system will feature the ability to define flexible airspace, quickly changing boundaries required by military and civilian operations. This will enhance the ability to support military missions and ensure continuous quality service to other airspace users.

*Objectives*

- Provide for the common defense while minimizing civilian constraints
- Coordinate a national response to threats
- Ensure global access to civilian airspace

**3.6 Secure the Nation**

In light of the continuing threat of terrorism, new defense tactics and technologies must be put in place without compromising efficiency. These measures must address a wider range of threats, while at the same time lowering the cost and impact of these measures on pilots and the traveling public.



Growth in air travel and air cargo will challenge our ability to manage security risks while ensuring efficiency of operations. The advent of increased operations at thousands of small airports will increase ease of access to the system and the difficulty of securing it. Similarly, UAVs will be used to aid security monitoring, but could also create a new threat as they become more widely available to commercial users.

An integrated, multi-layered security approach for air transportation will help ensure the security of U.S. borders and airspace and minimize risks associated with an expanding range of potential security threats. Effective, seamless countering of these terrorist threats and mitigating their risk will demand the full cooperation and partnership of all air transportation stakeholders. Additionally, security measures will benefit from consolidated threat information and workforce response to protect the system itself from hostile actions without limiting personal liberty.

Future air transportation screening and detection systems will enable positive identification of travelers while minimizing unauthorized access. Baggage and cargo screening systems will not only reveal explosives and weapons, but will also detect chemical, biological, radiological, and nuclear threats. The future system will be highly resistant to disruptions, incidents, and false positive alarms. Therefore, in spite of increases in demand for the air transportation system, security systems will process travelers, baggage, and cargo with greater speed, accuracy, and efficiency.

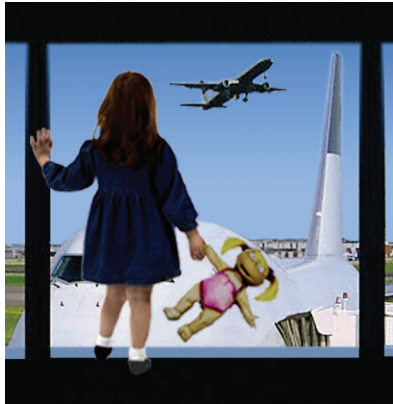
#### *Objectives*

- **Mitigate new and varied threats**
- **Ensure security efficiently serves demand**
- **Tailor strategies to threats, balancing costs and privacy issues**
- **Ensure traveler and shipper confidence in system security**

## Chapter 4: Operational Concepts

The Next Generation Air Transportation System (NGATS) will be well equipped to adapt to future demands by using new concepts, technologies, networks, policies, and business models. Air traffic control will be integrated using its ability to share timely, accurate, and secure information with a common operational picture.

Multi-layered systems with up-to-the-minute information and new technologies will ensure America's security. The safety of air travel will be designed into every air transportation component. Airports will ensure convenience and security for travelers and shippers while increasing capacity. The air transportation system will take full advantage of enhanced aircraft performance capabilities, but it will also accommodate aircraft with less sophisticated equipment and different performance characteristics. Improvements in air traffic management systems will result from employing advanced information management technology, enhanced sensor and detection capabilities, upgraded aircraft performance capabilities, and more accurate and tailored weather forecasts.



### 4.1 Security Operations

The future air transportation system will be designed with security measures embedded and interwoven throughout the system. Security systems will operate seamlessly across all aspects of air transportation. Airport security screening will be non-intrusive and integrated with other airport-based processes such as check-in, customs, immigration, agriculture screening, manifest processing, and load planning.

Passenger screening will begin well before arrival with the implementation of new, reliable, unobtrusive, and more accurate forms of identification. To achieve the desired level of security, passenger and baggage identification and security detection systems will employ cheaper, smaller, and faster technologies. In addition, security systems employed for air transportation will be integrated across other modes of transportation.

Command and control protocols will be established, allowing agencies to retain responsibility while enabling a coordinated national response for protecting the homeland against all threats. Law enforcement and other agencies responsible for the nation's security must have access to a common integrated operating picture via secure data link, air-to-ground communication systems, and airborne internet. This common operating picture permits secure and accurate communication among command and control entities.

Information must flow freely to establish and monitor continuity of operations within the air transportation system. Position and intent information received from individual aircraft needs to be fully integrated with surveillance systems that will create a national surveillance network which will support homeland security and national defense needs, as well as the needs of air traffic management. This new model ensures that when an object is detected on the ground or within the airspace, information about that object will be made available to the correct agency. This enables a coordinated response from appropriate authorities.

Distribution, process, correlation, and display systems enhance the quality of a common operating picture that will quickly identify abnormal deviations, erratic or errant behavior, and transfer information to the appropriate authorities.

Security strategies will be tailored to address a wider range of threats, considering cost and impact on operations, and ensuring that security solutions are balanced. New systems will mitigate impacts of chemical, biological, radiological, and nuclear threats. Sensor technology and countermeasures will be used to detect and render Man-Portable Air Defense Systems ineffective.

System-wide safety and security monitoring allows analysis of failure, threat, and vulnerability trends in real-time, based on data gathered throughout the system. Whenever an incident occurs, it will be quickly isolated, assessed, and managed. More precise real-time diagnoses of risk will enable air traffic flows that ensure continued access to airspace, while protecting assets and infrastructures.

### 4.2 Safety Assurance

The air transportation system in 2025 will remain the world's safest form of transportation. However, achieving this outcome will require a new approach, one that will ensure that safety requirements are established at the front end of every aviation process to prevent accidents before they happen. A more comprehensive safety approach will be implemented by airport authorities, civil aviation authorities, air traffic service providers, aircraft equipment manufacturers, and other government agencies involved in aviation.

This new approach changes the regulatory authority's role from testing, inspecting, and certifying individual system elements to comprehensive approval and periodic audits of the safety management programs within the civil aviation industry. Safety risk management and design assurance responsibility reside squarely with the aviation industry programs. This in no way abrogates the



regulatory authority's safety assurance obligations to the public. Compliance with regulations will remain the elementary basis of this new approach. However, the regulatory authority will be able to dedicate more resources to addressing safety issues before they become safety problems.

Accordingly, safety needs to be embedded at the core of all procedures, products, policies, or technologies associated with aviation. A comprehensive air and space safety management doctrine will create high-level standards and procedures for government and industry safety management programs. It will give any aviation regulatory authority the confidence that resulting products or operations were conceived, designed, developed, and implemented with safety as a core feature with appropriate compliant regulatory requirements.

These standards cannot be put in place without implementing a data analysis capability to identify and resolve accident precursors. This new capability will transform today's incompatible databases scattered throughout government and industry into a proactive safety analysis tool. Procedures and mechanisms will be in place to move safety management from the reactive mode to a data-driven, proactive mode that continuously searches for accident precursors. Data collecting and sharing among stakeholders will be key. To get the detailed level of data needed for this analysis tool will require implementing a non-punitive reporting system to alleviate concerns about the corrective action process.

Finally, this new approach to safety management must be adopted globally and made consistent with the International Civil Aviation Organization (ICAO) standards. We are committed to working with our international partners to get this accomplished.

### 4.3 Airport Operations

Landing and departure capacity at busy airports will increase through greater use of parallel runways, relaxation of single runway occupancy restrictions, and improved wake vortex sensing and prediction systems. These systems and procedures will be integrated with other automated approach, landing, and departure systems to ensure that capacity demands are met. Coordinated planning among air traffic management, aircraft operators, and ground service providers can virtually eliminate surface delays. Precision approaches will potentially be available to every runway in the nation without relying on costly ground-based equipment. This will provide the needed flexibility to adapt to changing air transportation needs and will help to ensure worldwide interoperability for airspace users.

The airport system in 2025 will need to provide sufficient infrastructure to accommodate user demand. To attract travelers and operators, increased competition among major commercial, secondary, and reliever airports can be expected. Airports will respond with measures to stay cost effective, while remaining convenient for travelers and shippers alike. To maintain positive community relationships, multiple airports in a geographic region will coordinate planning to provide a range of facilities that balance transportation needs with environmental standards for noise and emissions.

When airport infrastructure expansion cannot be accomplished using existing resources, due either to physical or political constraints, alternative means will be employed to match demand with capacity to reduce or avoid congestion and travel delays. Airports and air traffic services may use market-based mechanisms such as peak period pricing to ease congestion and ensure that the maximum economic value is obtained from resources in high demand.

Operators nationwide will make greater use of satellite or reliever airports in an effort to avoid congestion and higher airport fees. However, some incentives may still be required to encourage affordable service to small communities. Air traffic services will use airspace over major metropolitan areas or along major travel routes in a manner that reflects the priorities for using that capacity.

### 4.4 Aircraft Operations

Avionics play a key role in transforming the U.S. air transportation system. Future aircraft will sense, control, communicate, and navigate with increasing levels of autonomy. These new vehicle capabilities will in turn allow for development of new concepts in air traffic management. Improved technologies, human-computer interfaces, and training techniques increase flight deck situational awareness. Enhanced flight deck technologies keep flight crews informed of location in both geographic reference and in relation to nearby aircraft. Increased use of automation keeps an individual constantly aware of what is happening and warns of impending issues, while allowing the individual to handle non-routine situations and act as part of the designed redundancy built into the system.

In designated airspace, flight crews can cooperatively separate aircraft from each other using on-board automation capabilities. Ground automation may facilitate the interaction of aircraft, but pilots will retain managerial control over the flight.



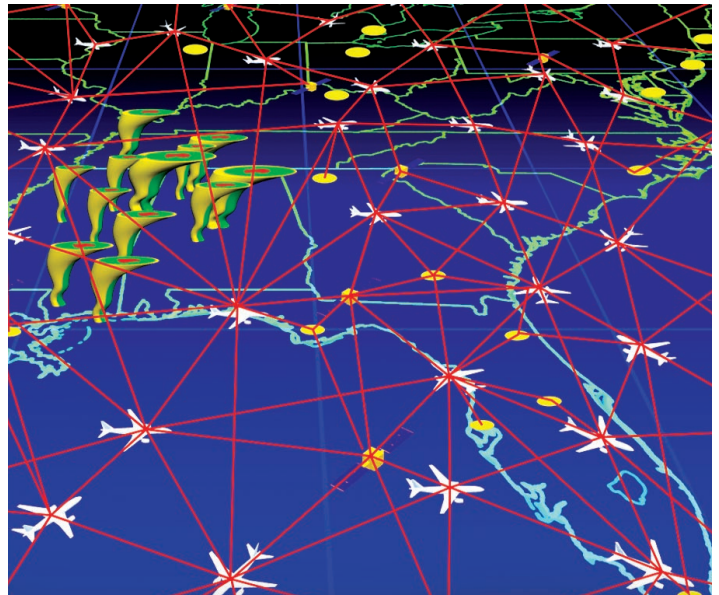
New vehicle capabilities may include single-pilot or autonomous operations without pilots, quieter approaches, and greater safety. New air vehicle designs will increase the level of crash survivability by incorporating design features that reduce the effects of the crash on the airframe and occupants. The use of new materials, fuels, and design processes will make aircraft more resistant to impact damage and flammability. Flight deck automation will reduce potential aircraft from being maneuvered into unsafe situations. This will prevent controlled flight into terrain, aircraft collision, and airspace violations. Furthermore, the remote piloting capabilities may enable ground intervention in case of pilot incapacitation or for security reasons. Automatic health monitoring combined with self-healing systems in aircraft will improve reliability and predictability of service. Clearly, beneficial uses of new technologies will be supported with all the necessary decisions on procedures, roles, and assumptions about the operating environment and efficiency. This will ensure that operational procedures and policies are understood and accounted for in the design of the technologies.

While many of today's aircraft will be operating in 2025, the diversity of the commercial operating fleet will increase dramatically as new aircraft and new operational envelopes are designed. Future commercial aircraft will incorporate many environmentally compatible propulsion technologies and quieter, more efficient airframes. New materials, including composites and nanotechnology applications will lower noise, improve efficiency, and reduce emissions. These aircraft will have lower emissions per passenger trip than today's larger commercial jets, and noise footprints will fall well within acceptable airport noise limits. Reduced operations costs and improved operational efficiencies, through more fuel-efficient engines and airframes, will allow a new generation of aircraft owners to enter the system. These aircraft operations will share airspace with current aircraft flying under visual rules.

Harmonized civil and military equipment as well as operations that require communications, navigation, and spectrum availability will be vital in planning and executing global missions. International harmonization of equipment standards and procedures will also address key cost drivers such as maintenance and training. Global procedures for operating and spacing aircraft, based on the capability of an individual aircraft and the flight crew's operational performance will mean common operations worldwide.

#### 4.5 Air Traffic Management Operations

Achieving the vision for 2025 will employ a different approach to monitoring and managing the air traffic management system. New technologies and procedures will allow for a responsive air traffic management system in a dynamically changing environment.



Additionally, these procedures and technologies will include the ability to provide services to airspace users on-demand from any location.

In addition to the improvements previously described for aircraft and airports, performance of the new air traffic management system will be enhanced by:

- Reduced separation standards
- Flexible spacing and sequencing of aircraft on the ground and in the air
- Use of new equipment, procedures, and infrastructures enabling increased service of under-utilized airspace, airports, and runways
- Improved and tailored weather forecasts
- New and enhanced technologies and procedures, reducing environmental effects of noise and emissions

A new model for managing air and ground surveillance information will be in place. Reduced costs for associated infrastructures can be expected from operating from a common government capability.

To accommodate shifts in demand from a wide variety of users, air traffic control will migrate from control of individual flights to air traffic management where airspace is allocated based on traffic flows. Although there will be a continued need to handle flight specific exceptions on a tactical basis, the role of dispatchers, flight planners, controllers, and flow managers will emphasize end-to-end strategic flow management with minimal individual flight

interventions. Automation will assist flow managers in monitoring flight conformance to ensure compliance with flow restrictions. Additionally, decision-makers will use information management systems to collaborate, develop, and update flow plans as well as react and recover from system disruptions.

Data link communications will replace voice communications between aircraft and air traffic management systems improving the accuracy and timeliness of information exchange. Data link communication will be routine for air traffic management and operational control purposes. Voice communications will only be used for data link equipped aircraft under extraordinary circumstances and for routine and operational control of aircraft without data link capabilities.

Ultimately, air traffic management services will be tailored and flights will be managed based on individual aircraft and flight crew performance capabilities. An aircraft's ability to communicate, accurately navigate, be tracked by other aircraft or ground systems, and provide precise operational control will determine the extent of services provided within the system. Additionally, end-to-end flow planning, coupled with enhanced aircraft flight management systems, must create fuel-efficient flight profiles. Flights requesting use of high demand airspace or airports will contract for use of these resources through a variety of mechanisms.

New technologies and operational procedures can eliminate the differences between procedures for instrument meteorological conditions or visual meteorological conditions. Aircrews and air vehicle operators need access to technologies that will provide a clear three-dimensional picture of terrain, obstacles, runways, and taxiways so that capacity will not be reduced during most inclement weather conditions and other system disruptions. Further, disruptive weather and other environmental impacts on end-to-end flow management will be reduced through a combination of improved forecasts and strategic flow management support tools.

Lastly, in the future, air traffic management services will become less tied to a geographic location and be more readily configurable and scalable. Shifts in demand from military, civil, and commercial aviation users can be accommodated by shifting or sharing air traffic services from one geographic area to another with minimal training and little or no relocation of equipment or personnel. Ultimately, air traffic management facilities will be able to take full advantage of aircraft and ground system automation, resulting in facility consolidation and virtual facilities.

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## Chapter 5: The Next Generation Air Transportation System Roadmap for Success

While achieving the vision for air transportation will be done via collaboration among federal, state, and local governments and private industry, the essential purpose of the vision will be to establish a stable and transparent framework that encourages private sector innovation. All of these efforts will be coordinated through eight major strategies that broadly address the goals and objectives for the Next Generation Air Transportation System (NGATS). Supporting these strategies will be a combination of research, development, and implementation activities. These activities will involve a review of policy and financial mechanisms as well. The eight major strategies, along with their key research areas, are presented in this next section.

### 5.1 Strategies

#### 1. *Develop Airport Infrastructure to Meet Future Demand*

##### Strategy:

- Provide a system that meets or exceeds user demand by integrating airport, airspace and air traffic management design, development, and deployment. Airport infrastructure must address the need to expand in a way that meets future capacity while satisfying the other objectives. This strategy provides customers a wide-range of options for air transportation in an efficient cost-conscious manner.

##### Research areas:

- Develop requirements and concepts for servicing a variety of future demands, from maximizing overall metropolitan area capacity to servicing smaller communities. Ground-side questions include airport access alternatives and associated transportation, security, and information systems requirements, such as regional airports and city check-in by specific location.

#### 2. *Establish an Effective Security System Without Limiting Mobility or Civil Liberties*

##### Strategy:

- Establish a global security system to ensure reservation-to-destination security for travelers and the stream of commerce. Travelers and shippers will be confident that no undue security or health risks exist in the transportation system, and that movements and civil liberties are not unduly impeded by security measures.

##### Research areas:

- Explore integrated, scalable security methods and implementation to mitigate potential threats to the air transportation system.

- Develop advanced sensors, information systems, and mitigation strategies for identifying threats and recovery from attack.
- Develop automated security screening of passengers, baggage, and cargo integrated into the normal flow of people and items.
- Improve chemical, radiological, biological, and health sensors, including automation for detection and recognition of hazardous items.

#### 3. *Establish an Agile Air Traffic System*

##### Strategy:

- Establish an agile air traffic system that accommodates future requirements and readily responds to shifts in demand from all users. The system will be responsive to market elasticity, have the flexibility to deliver capacity and efficiency improvements, and ensure that equipment and personnel are able to support a wide range and number of operations tailored to customer needs.

##### Research areas:

- Conduct research to evaluate alternative allocations of air traffic management services and functions between the ground and the air, and the automation and the human, to address critical system attributes such as capacity, agility, cost, human factors, reliability, safety, performance, and transition paths.
- Determine the requirements for communications, navigation, and surveillance infrastructure to meet the traffic and performance needs of the future in a cost-effective manner while accommodating all air traffic, defense, and security stakeholders.
- Define and evaluate fundamental communications, navigation, and surveillance architecture options, such as moving to digital data links and away from voice command and control, satellite-based-only or continued reliance on ground-based communications systems, spectrum and bandwidth needs and likely spectrum availability.
- Investigate feasible architecture options that allow all aircraft to operate the same within specific airspace.
- Develop cost-effective concepts, technologies, and procedures for providing comprehensive air traffic services at small airports.
- Define a portfolio of the most effective alternatives for expanding airfield capacity.
- Undertake research on cost-effective technologies, procedures, or other actions needed to make instrument

capacities equal to visual weather capacities at the most critical airports. The results will address fundamental system architecture questions, enable or modify the trend toward adoption of net-centric architectures that distribute intelligence and functions to smarter and smaller nodes in the system and permit routine system access by unmanned aerial vehicles (UAVs), commercial space launch, and other new vehicles.

#### 4. *Establish User-Specific Situational Awareness*

##### **Strategy:**

- Establish globally compatible information-sharing capabilities to provide on-demand, real-time knowledge to support more distributed decision-making roles of users, operators, and service providers. Each stakeholder will be able to reach informed decisions through increased knowledge of current conditions, plans and events affecting the system.

##### **Research areas:**

- Define integrated requirements for shared situational awareness. Define all user groups of the system and their specific requirements. Determine what temporal and performance requirements will be levied on the system. Determine data sharing and access policies that seek to ensure security while enabling appropriate access to data. Determine how to deal with liability issues.
- Define system architectures that are readily responsive to the demand for flexibility. Establish standards to authorize changes to information security criteria. Determine to what extent user requirements should be supported and their associated costs. Determine who pays for what services. Determine what organizations will be responsible for what part of the system, and determine which organization will be assigned overall system responsibility.

#### 5. *Establish a Comprehensive Proactive Safety Management Approach*

##### **Strategy:**

- Develop and implement a common and comprehensive risk management doctrine at the national level that is applied to aviation and space travel. Encourage and participate in global safety practices to ensure the safety of the traveling public and cargo. Develop and implement a cutting-edge operational data analysis capability that identifies safety issues. Promote expansion of U.S. capability to meet national and international safety goals and objectives.

##### **Research areas:**

- Explore key issues such as risk propagation in complex systems required for design of and transition to a capability for advanced safety assessment methodologies enabling multiple, major changes to be made to the system in a decade without compromising safety — increased traffic density, distributed control, increased small jet use, increased use of smaller airports, change in human roles, new procedures, and introduction of UAVs.
- Leverage lessons and methods from industries that have developed advanced risk assessment methods due to the absence of statistically meaningful accident data.
- Explore policy and liability issues related to a standardized data-sharing program, an analysis capability using the data-sharing program to identify accident precursors, and a safety assessment doctrine for introducing new procedures and technologies such as strategies for managing system safety and labor issues while introducing changes.
- Develop and implement a program of education, training, and enforcement to address ongoing safety risks.

#### 6. *Develop Environmental Protection that Allows Sustained Aviation Growth*

##### **Strategy:**

- Develop and implement new models, metrics, policy approaches, operational improvements, and technology innovation to mitigate environmental impact related to the growth of aviation to foster public acceptance of air transportation growth.

##### **Research areas:**

- Explore aircraft, engine technology, and flight procedures to minimize environmental impacts such as noise, emissions, climate changes, and concern over fuel costs and availability. This includes achieving a better understanding of the trade-offs between noise and emissions.
- Explore zero-emission airport ground operations such as aircraft ground movement and service vehicles, and eliminate ground environmental contaminants, including de-icing fluid runoff.
- Explore the impact of alternative environmental policy approaches on the air transportation system.
- Explore potential models and metrics to support the development of environmentally friendly air transportation.

## 7. *Develop a System-Wide Capability to Reduce Weather Impacts*

### **Strategy:**

- Achieve increased safety and efficiency in the national aviation system by deploying and integrating scientific and operational advances in weather technology, enabling aviation system users to mitigate the negative impact of adverse weather.

### **Research areas:**

- Develop enhanced weather observations and forecasts, and integrate them with decision-support tools to enhance capacity and efficiency of the airspace while improving safety.
- Develop integrated user requirements and appropriate spatial, temporal, and probabilistic characterizations of each hazard in the airspace, and establish the means of disseminating these characterizations to the users of the air transportation system.

## 8. *Harmonize Equipage and Operations Globally*

### **Strategy:**

- Ensure global interoperability for the NGATS by developing and supporting implementation of global air and space transportation policies, standards, and procedures. U.S. leadership toward global standards will improve safety, security, mobility, environmental quality, and economic viability.

### **Research areas:**

- Identify air transportation system technologies, air traffic management operational concepts, policies, and procedures that require or benefit from global standardization or interoperability.
- Assess current plans for transformation in other countries and international organizations.
- Identify similarities and potential conflicts between air transportation developments in the United States and in other countries.

Detailed plans for each of the strategies are under development and outlined in Chapter 7. The Joint Planning and Development Office (JPDO) is working with member agencies and the private sector to roadmap high-level strategies and key events. Additionally, the JPDO is identifying the research and development needs, on-going activities, the key players in each area and their roles, and significant gaps towards the execution of the strategies. By understanding the overall research landscape, the JPDO will be able to (1) identify priorities

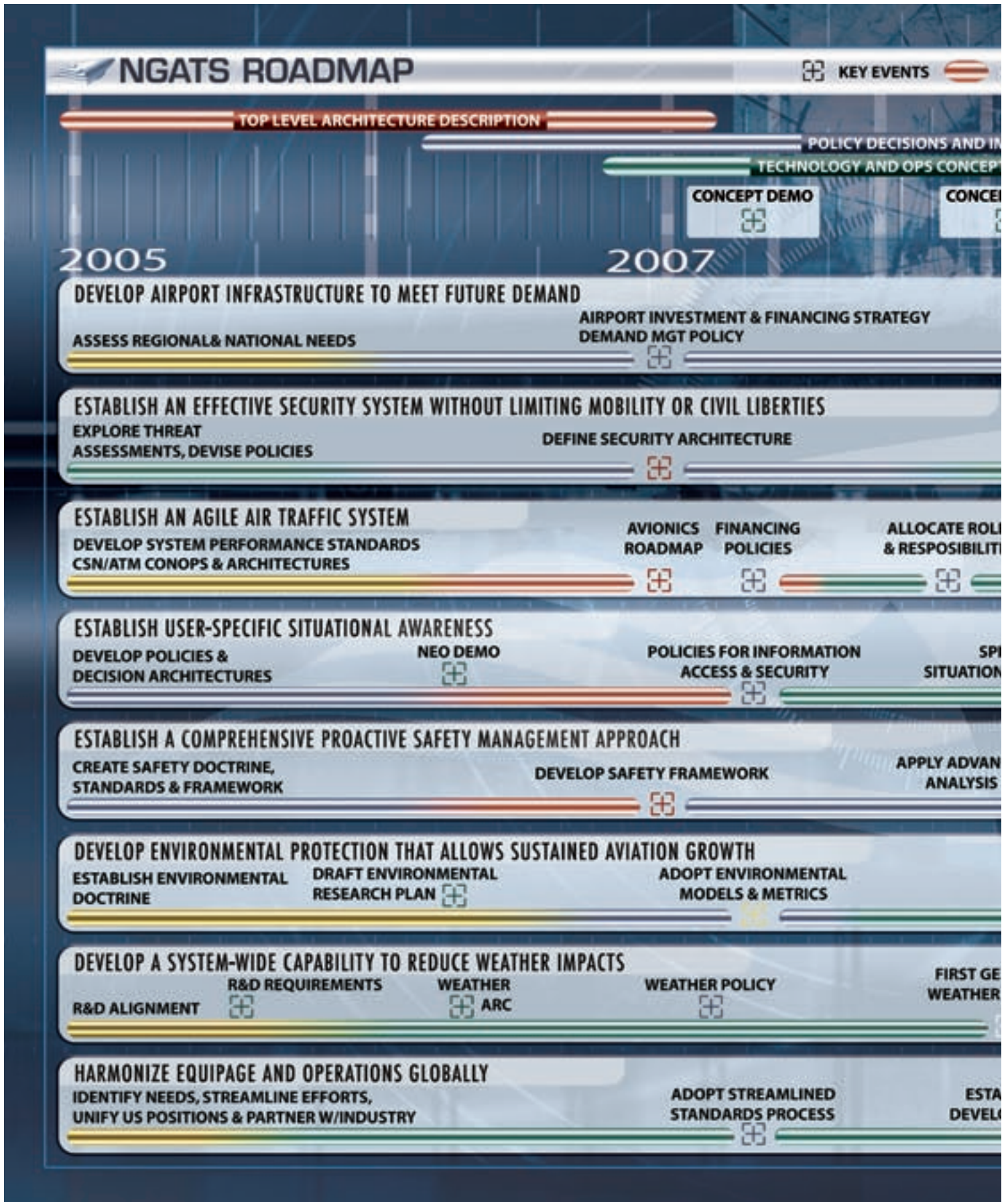
and interdependencies; and (2) manage the convergence of results.

## 5.2 High-Level Roadmap

Many of the steps toward transformation will involve changes in policy, procedures, and technology. Industry, local governments, the aviation community, and the agencies involved with this project will work together to assess the effectiveness of change, its cost to implement, and the level of change that is complementary to the overall goals and objectives.

The following figure provides a high level view of the roadmap, reflecting the confluence of major activities and milestones for the transformation to the NGATS, and schedules for each of the eight transformation strategies.

Diagram Key: [Key Event Icon] denotes key events or decisions in the roadmap, and solid lines denote time-phased activities. Events preceding 2012 are specified. Most events beyond 2012 are generic milestones that represent incremental building blocks of a spiral development process. Both key events and time-phased activities are color coded to reflect primary areas of policy, architecture, analysis, research and development (R&D), or investment/implementation. Timelines at the top of the roadmap indicate three overarching activities: • Definition of the NGATS architecture • Policies that may need to be implemented • Technologies and operational changes that need to be implemented. These are incorporated into timelines, often as spiral development activities. Finally, the approach of conducting major demonstrations of technology and new operational paradigms is reflected in the diamonds at the bottom of the roadmap. While on the surface, the roadmap looks like eight separate timelines, the milestones and activities for any given strategy are connected and often interdependent with



milestones from other strategies. For example, the avionics roadmap depends on weather and security architectures, all three of these are integral to the enterprise architecture, and all of these architectures must reflect the regional and national airport needs. Transformation will occur in discrete transition steps, and many evolutionary changes are already underway. As the system architecture and details of the strategies are defined, on-going changes will be aligned to support the transformation and new initiatives will commence. By 2012, the technology and operations concept R&D and architecture definition will be mature and the policy decisions made, setting the stage for the more revolutionary transformational steps. The key steps to achieve vision transformational goals will be better understood, research on concepts and technologies will provide initial results, and the overall operational concept of the NGATS as well as for the plan for implementation will be clarified.





### 5.3 Key Challenges

At a national level, key policy and technical challenges need to be addressed for the strategies to be successful. These challenges must be resolved through the research and maturation of the strategies. Guiding principles for resolving differing stakeholder positions and transitional issues will be tailored to work these key areas of concern.<sup>18</sup>

- **Alignment of responsibilities and decision-making across stakeholders**

Creating a more integrated system will involve redistributing operational and decision-making responsibilities among multiple federal, state and local governments, and private entities.<sup>19</sup> A major policy challenge is to understand the role of all stakeholders and the mechanisms for shared decision-making in a more integrated public-private operation. This new approach applies to all aspects of air transportation, including integrated public-private sector operations for security, a shift in the distribution of public and private roles and responsibilities for air traffic operations, and handling the cultural change associated with this shift for all involved parties. It will be a new way of doing business, a difficult task for a system that has achieved preeminence around the world in its present structure.

- **Alignment of investments and coordination of transition**

Successful transition depends on how quickly the benefits can be delivered. If not synchronized with the natural occurring windows of opportunity, such as technology updates, change can be prohibitively expensive. For example, accommodation of mixed levels of aircraft capability, due in some cases to long aircraft life cycles, may limit operational benefits and increase cost. It will be equally difficult to align planning and investing cycles for many government entities that have a role in air transportation improvements. This includes balancing the potential cost savings from consolidation of buildings and equipment across multiple missions, and decommissioning facilities with political pressure for the status quo. Investments among all of the stakeholders need to be aligned and coordinated to minimize risk exposure and unbalanced commitments.

- **Definition of equity and contribution toward national goals**

Striking a balance between competing goals of many air transportation system stakeholders also will be a challenge. Goals for growth in air transportation must be balanced with needs for safety, environment, and security. A comprehensive safety management system, environmental doctrine, and multi-layer security architecture are part of this plan.

Questions will arise on the balance of these goals. For example, how are security and national defense needs balanced with personal liberty and privacy issues? What is the balance between security needs and access to widely available information? Who will have access to parts of the system that still have resource limitations? What is the potential trade-off among local, national, and international environmental pressures with the higher levels of air traffic? Will policies exist to provide air transportation access for the public good to areas of the market that will not provide access on its own? What is the appropriate level of contribution by different stakeholders such as airlines, general aviation, government, and passengers to funding the maintenance and improvement of the air transportation system?

- **Innovation in managing the safety effects of changes**

Ensuring safety while implementing complex transformational changes represents a major challenge. To accelerate the introduction of transformational changes, a comprehensive safety management approach built on new means of modeling, predicting, and mitigating the overall safety effects is needed. We must understand system safety and, based on this, determine acceptable safety levels for new concepts.

- **Responding to future demand and complexity**

New modes of operation and a shift in roles and responsibilities will be required, resulting from significant increases in traffic level and diverse traffic types. As responsibilities change, liability issues arise. The use of automation in complementing human roles to handle increased traffic and in mitigating potential threats to the system becomes increasingly important.



Meeting the Needs of Legacy and Future Fleet Aircraft

*National Research Council, "Securing the Future of U.S. Air Transportation," 2003.*

<sup>19</sup> *National Research Council, "Securing the Future of U.S. Air Transportation," 2003, pg. 15.*

- **Creative treatment of a mixed legacy and future fleet**

From an operational perspective, achieving seamless operations with a mixture of legacy and new aircraft represents a significant challenge. Thus, strategies with potential major policy implications to influence aircraft equipage and improve uniformity of the fleet need to be explored. Another promising direction will build on a policy that creates performance-based services that allow mixed environmental operations that are tailored to each aircraft capabilities.

- **Assessing the merits of transformation**

A major challenge cutting across all strategies is the assessment of overall effectiveness of transformation to the air transportation system including operational, technology, and policy changes. Given the complex interactions of goals and operations, an innovative approach for assessing operational concepts must account for the interdisciplinary nature of the problem.<sup>20</sup> We need to better measure the effects of the changes we implement. With the broad scope of proposals outlined in this plan, our research and development must take into account the need for precise measurements of performance. Reliance on anecdotal information should not be confused with data-driven assessments. Likewise, this measurement needs to take place at both strategic and tactical levels.

<sup>20</sup> National Research Council, "Securing the Future of U.S. Air Transportation," 2003, pg. 20.

## Chapter 6: Approach to Transformation

The resolution of the challenges described earlier is interwoven across many government agencies as well as private corporations. The ability to manage effectively across government agencies and fuel government/industry partnerships as the engine of transformation has never been more critical to this country. This initiative represents a sea change in how such efforts will be leveraged.

The technical transformation of the Next Generation Air Transportation System (NGATS) must be driven by industry efforts to promote the economic efficiency of the system, to realize the full benefits from complex investments and to assure protection of the public in terms of safety, security and environmental concerns. The NGATS approach will embrace the role that institutions and institutional reform can play in modernization and improving service delivery, and this understanding will be reflected in its planning and decision-making.

There is a need to improve incentives to produce air traffic and airport services efficiently and to make sure that these services are put to their highest and best use. Market forces should play a role wherever possible in determining when and where capacity expansion takes place. Therefore, to provide the greatest value to society, care has to be taken to craft the appropriate public and private sector roles and institutions. In addition, the NGATS approach must provide the proper incentives to aircraft operators, airports, participating agencies, and other stakeholders to encourage modernization while maintaining a safe and efficient air transportation system. It is also likely that as technological capabilities are developed, differing combinations of technologies will yield disparate potential outcomes. Transformation will require us to employ foresight when combining technological, institutional, and policy developments.



A New Era in Intergovernmental, Public and Private Partnerships

### 6.1 Changes in Government-Private Interactions

In partnership with industry, the JPDO will encourage research and demonstrations that foster innovative uses of technology and policy approaches to ensure the optimal development of the future system. As appropriate, federal advisory committees will be used to ensure all plans and decisions receive broad review and public comment. These committees will include senior-level executives from across industry empowered to provide advice on strategy and transition issues. Furthermore, they will be able to gauge industry reaction and support for system developments and to develop and gain industry support for major decisions.

We will also establish mechanisms for direct input and participation from experts in the private sector in the generation and execution of the Integrated Plan. The JPDO has already employed a series of workshops designed for gathering inputs on future planning scenarios, and will continue this means for direct expert input. At times the office may also make use of broad area announcements and other tools to solicit ideas or tangible contributions from the community at large. This input will be augmented through a system of engineering and integration acquisition with the use of an industry team approach. Each Integrated Product Team (IPT) will identify specific means for private sector involvement through formal advisory committees, working groups, collaborative research agreements, and other available means as appropriate to their mission. Combining these efforts will ensure the establishment of a collective enterprise among the key stakeholders to achieve the transformation, as well as ensuring we fulfill our critical obligation to create a process that is fully open to public scrutiny. Moreover, the agencies retain statutory responsibility to manage their programs, making use of acquisition strategies that provide the government the best value and ensure the implementation of the solutions developed through their efforts. Implicit in this transformation approach is the mechanism for accelerating the pace at which industry innovations are applied into the NGATS.

### 6.2 Changes within Government

Planning and executing a transformational program through partnership requires identifying the key partners, establishing an organizational framework, and implementing processes that support their collaboration. Transformation must be realized by allocating responsibility for portions of the task among the multiple federal agencies and industry partners that have relevant missions, capabilities, and budgets.

In Public Law 108-176 Congress recognized the need to do business differently. It identified the essential federal agency partners and called for them to work together to leverage their efforts.

To ensure this change occurs, Congress created two key entities. First, an executive-level interagency team, called the Senior Policy Committee (SPC). This committee is composed of each agency Secretary/Administrator, or designee and is chaired by the Secretary of Transportation. Second, the legislation required the Secretary of Transportation to establish a Joint Planning and Development Office (JPDO) within the Federal Aviation Administration (FAA) to manage the work related to the Next Generation Air Transportation System (NGATS). The JPDO is ultimately accountable to the SPC and reports directly to the FAA Administrator. The Director of the JPDO is answerable to the Air Traffic Organization with the responsibility to ensure smooth transition and implementation of National Airspace System infrastructure. In the roles and mechanisms next described, the JPDO Director is also responsible for determining the issues that must be further worked by agencies and those that must be elevated to the SPC. Specific roles of these two governance bodies are as follows:

#### Senior Policy Committee (SPC)

- Advises the Secretary of Transportation regarding the national goals, objectives, and strategies for the transformation of the nation's air transportation system to meet its future needs
- Provides policy guidance for the NGATS, which is to be developed by the JPDO, and ongoing policy review for the transformation
- Identifies resource needs and makes recommendations to respective agencies for the funding of planning, research, and development activities
- Makes legislative recommendations, as appropriate, for the future air transportation system

The SPC shall consult with, and ensure participation by, the private sector to guarantee the progress of the initiative.

#### Joint Planning and Development Office (JPDO)

- Creates and carries out the Integrated Plan for the NGATS
- Oversees research and development of the NGATS
- Coordinates aviation and aeronautics research programs to achieve the goal of more effective and directed programs that will result in applicable research
- Coordinates goals, priorities, and governmental research activities with U.S. aviation and aeronautical firms
- Coordinates the development and utilization of new technologies and operations to ensure that, when available, they are used to the fullest potential
- Creates a transition plan for the implementation of the NGATS

- Facilitates the transfer of technology from research programs such as the National Aeronautics and Space Administration (NASA) program and the Department of Defense (DOD) Advanced Research Projects Agency program to the federal agencies with operational responsibilities and to the private sector
- Reviews activities relating to noise, emissions, fuel consumption, and safety conducted by federal agencies
- Monitors and reports progress of the activities outlined within the Integrated Plan

#### JPDO Board

Each JPDO partner agency will assign a minimum of one executive to be a member of the JPDO Board, chaired by the JPDO Director. The Board members will not be part of the JPDO staff, but are senior representatives from each agency, empowered to speak and act on behalf of their agency to the JPDO and on behalf of the JPDO to their agency.

JPDO Board responsibilities include:

- Ensuring full cooperation and engagement of all relevant offices from their agency
- Ensuring liaison, coordination, collaboration, and clear communications among partner agencies, other stakeholders, and the JPDO
- Providing ongoing sponsorship and advocacy for the JPDO mission within and among partner agencies and the JPDO
- Representing consolidated agency interests to the JPDO on operational and policy issues
- Providing advice and support to the JPDO Director on all initiatives and activities
- Aiding and evaluating JPDO joint program alignment and integration
- Coordinating budget and staffing matters related to the JPDO mission among partner agencies and the JPDO
- Supporting Congressional and industry interactions related to the JPDO
- Supporting integrated product team lead agencies in achieving their objectives and facilitating interaction between IPT lead agencies with the JPDO and other partner agencies

## Integrated Product Teams

For each strategy, an IPT will be responsible for applying best practices from industry and the DOD to achieve the mission of that strategy. Primary responsibility for assembling and leading each IPT belongs to one agency. The IPT serves as the focal point for programs related to the mission and will coordinate and assemble expertise from across the federal government, pooling the efforts of related programs and private industry to empower and leverage participation by all affected partners in the transformation including manufacturers, suppliers, and customers from the private sector.

The IPTs will establish detailed plans for execution around the top-level descriptions and within the master schedule contained in this plan. Specific IPT activities include:

- Managing the planning and orchestrating the execution of all relevant work to complete the assigned strategy
- Conducting analyses and trade studies to select and validate implementation alternatives
- Analyzing changes currently underway, identifying gaps, and establishing the required government and/or industry research and development activities to close necessary gaps
- Coordinating with government and private industry on research and development resources
- Collaborating with industry on research and implementation for the initiatives
- Identifying non-technical approaches such as policy, regulation, and operational procedures
- Establishing detailed requirements for individual mission areas
- Conducting advanced concept and technology demonstrations
- Creating a transition plan for implementation of products
- Creating public/private partnerships that include multi-agency, industry, academic, civic, and government participation

## Cross Integrated Product Team Coordination

The IPT's will assemble plans that indicate the course of exploration and development and the role of individual agency and industry contributions. Within their mission area, IPTs will examine the economics of their area, refine the understanding of problems and options for future solutions, assess existing programs and plans, leverage what is available, and identify gaps and key questions for further research and development. With significant engagement with industry, JPDO and other agencies will firm up the architecture of IPT planning.

The JPDO orchestrates the efforts of the IPTs and keeps the focus on fulfilling the vision. The JPDO will establish a master IPT that encompasses expertise from the executing IPTs. A chief architect will be designated to chair the council, guide the development, and coordinate a system-of-systems view of the NGATS. The JPDO will manage the enterprise architecture and integration effort while working with the IPT leads to establish a balanced portfolio to fit the roadmap for the transformation efforts. To ensure coordination throughout the effort, the JPDO is responsible for:

- Approving broad strategies of the executing IPTs as part of the Integrated Plan
- Ensuring IPT plans and schedules are consistent with the roadmap and architecture
- Providing a forum for issue resolution
- Managing technology transfer opportunities between IPTs or agencies
- Scanning for external influences and developments affecting the NGATS initiative
- Evaluating trade-offs that cross-cut IPT objectives, and coordinating necessary decisions with the JPDO Director
- Developing the means and providing performance monitoring for the IPT efforts
- Implementing a strategic planning activity
- Providing on-going maintenance of the Integrated Plan
- Establishing and implementing schedule and budget tracking capabilities

During the process, the SPC and JPDO must make a difference. A difference felt by the passenger — confident that government is working for them and they are safe and secure. To accomplish this daunting task, we must create a new model of collaboration throughout government and industry. The engine of this transformation is the partnerships among key stakeholders. Success of these partnerships will require organizational governance that empowers all stakeholders. The results will be a spirit of confidence the American people will hold in their government, assured their government is working for them, that they are safe and secure, and that the NGATS is an efficient and effective investment of their hard-earned taxpayer dollars.

## Chapter 7: Transformation Strategies

As previously described, the roadmap is sub-divided into eight large transformation strategies that collectively are intended to create the Next Generation Air Transportation System (NGATS). Integrated Product Teams (IPTs) will work to establish the detailed plans and execute these strategies. The following outlines how each IPT ties to objectives, its mission, transformation direction, and cross-strategy linkage to other IPTs. These outlines will become more detailed in the second edition of this plan. This will include refining the materials presented in outline form here, identifying the most significant technical obstacles, and pinpointing the research and development (R&D) activities necessary to overcome them.



### 7.1 Develop Airport Infrastructure to Meet Future Demand

**Airport infrastructure must address the need to expand in a way that meets future capacity and provide a system that meets or exceeds user demand by integrating airport, airspace and air traffic management design, development, and deployment.**

#### Tie into Objectives

- To provide sufficient capacity to satisfy demand
- To provide sufficient resources to ensure that the development of new technology remains on track
- To ensure the efficient flow of passengers through airport terminal facilities
- To provide air traffic control and airport authorities with greater flexibility to match demand with capacity and, when necessary, to reduce congestion and travel delays
- To provide infrastructure needed to protect the environment while sustaining growth

#### IPT Mission

To examine requirements and work for infrastructure and capacity development, through the expansion of existing airports and, in limited circumstances, the establishment of new airports to accommodate different levels and types of markets.

#### Transformation Direction

The predominant trend over the next two decades will be the expansion of existing airports to meet the forecasted increase in capacity demand. At the same time, new metropolitan areas will emerge that will prompt additional air capacity issues. National and regional airport planning will be facilitated with detailed analysis of needs to ensure the planning of sufficient capacity across the country.

If airport infrastructure expansion cannot be accomplished using existing resources due either to physical or political constraints, alternate means will be employed to match demand with capacity to reduce or avoid congestion and travel delays. Such methods may include congestion pricing and other market-based approaches to demand management, administratively established limits on the frequency of operations, or hybrid measures incorporating the advantages of both.

Planning efforts will be directed toward determining appropriate locations for infrastructure to accommodate alternative landing facilities such as unmanned aerial vehicles (UAVs), or support runway-independent flight operations that may include rotorcraft and tilt rotor that might have mobility or economic growth benefits. Federal and local roles in the deployment and maintenance of infrastructure will be reviewed.

Develop creative means to accelerate the deployment of capacity enhancing systems.

#### Cross-strategy Linkage

This IPT will coordinate its work with the following IPTs to fulfill its mission:

- Establish an Agile Air Traffic System
- Establish an Effective Security System without Limiting Mobility or Civil Liberties
- Harmonize Equipage and Operations Globally
- Develop Environmental Protection that Allows Sustained Economic Growth
- Establish a Comprehensive Proactive Safety Management Approach
- Develop System-wide Capability to Reduce Weather Impacts



### 7.2 Establish an Effective Security System without Limiting Mobility or Civil Liberties

**Establish a global security system to ensure reservation-to-destination security for travelers and the stream of commerce. Travelers and shippers will be confident that no undue security or health risks exist in the transportation system and movements and civil liberties are not unduly impeded by security measures.**

#### Tie into Objectives

- Adapt to changing market forces
- Ensure security efficiently serves demand and time constraints

- Prepare for new and varied security threats
- Increase the speed and predictability of air travel
- Reduce aviation system security costs
- Instill high public confidence in the aviation security system

### **IPT Mission**

- Serve as the central activity to ensure alignment — operational effectiveness and suitability — of appropriate processes, policies, and technologies in the transformation to the NGATS
- Ensure program coordination with stakeholders in the aviation industry, airports, operators, service industries, academia, and related associations
- Align resources necessary for timely development of candidate security systems
- Align resources necessary to ensure timely acquisition, deployment, and life cycle support of transformational security systems

### **Transformation Direction**

#### **Develop reliable means to identify and mitigate security risks.**

- Ensure real-time aviation security situational and domain awareness for all security stakeholders to eliminate security breaches or mitigate impact to lessen the need for blanket flight restrictions
- Develop and deploy appropriate NGATS communication systems across the security spectrum
- Provide the user community and operators with accurate



vulnerability assessments and a comprehensive security incident reporting system

- Develop and integrate technologies into aircraft/airborne vehicles to prevent the use of aircraft/airborne vehicles or other missiles as effective weapons
- Collaborate with industry and other government agencies to develop and apply appropriate procedures and higher accuracy and sensor technology to identify aviation threats including chemical, biological, radiological, nuclear, and explosives
- Implement techniques to positively identify and rapidly screen air travelers and air cargo for threats to, or conveyed by, the air transportation system
- Reduce cycle time for security system certification and deployment
- Integrate monitoring and response functions for anomalous flight behaviors to reduce threats while also lessening the need for blanket flight restrictions and reducing the need for air intercepts

#### **Integrate cost-effective, scalable to variable passenger and cargo demand, security procedures and technologies fully into the aviation transportation system, resulting in improved airport landside flow and elimination of the hassle factor of air travel.**

- Passengers and baggage screening will not add significant time to the curb to gate transit
- Terminals will have an effective physical security design that minimizes vulnerabilities while facilitating passenger and baggage flow
- Parking facilities will be consistent with physical security and will not impede passenger transport
- Cargo will be pre-screened and assessed for risk with all higher risk cargo subject to physical screening or exclusion from the system
- Unmanned aerial vehicles (UAVs) will provide maximum benefit for security surveillance and threat identification. Develop appropriate sensor capabilities for UAVs to expand their use for security application and integration into the NGATS
- Facilities and sites for inter-modal connections will maximize transfer efficiency with standardized and non-redundant security processes
- Security policies and procedures requiring review or change will be identified and corrected

### **Ensure worldwide integrity of transportation security safeguards by actively promoting international cooperation.**

- Identify and standardize requirements for security, public health, and identification of passengers and cargo
- Minimize health and security risks within the global transportation sector
- Conduct on-going comprehensive vulnerability assessments
- Assist other countries in achieving a minimum aviation security standard for flights arriving in or departing from U.S. airspace

### **Cross-strategy Linkage**

This IPT will coordinate its work with the following IPTs to fulfill its mission:

- Establish an Agile Air Traffic System
- Establish User-specific Situational Awareness
- Harmonize Equipage and Operations Globally
- Develop Environmental Protection that Allows Sustained Economic Growth
- Establish a Comprehensive Proactive Safety Management Approach



## **7.3 Establish an Agile Air Traffic System**

**Establish an agile air traffic system that accommodates future requirements and readily responds to shifts in demand from all users. The system will be responsive to market elasticity, have the flexibility to deliver capacity and efficiency improvements, and ensure that equipment and personnel are able to support a wide range and number of operations tailored to customer needs.**

### **Tie into Objectives**

- Accommodate future growth in demand
- Increase the speed and predictability of air travel
- Enable transparent military and space vehicle operation
- Improve resilience to system perturbations, including those caused by weather conditions
- Accommodate new types of vehicles

### **IPT Mission**

- Develop a system capable of maximizing airspace and landing/departure capacities to efficiently and effectively satisfy market-driven demands

- Develop and deploy new technologies and establish policies and procedures that promote capacity growth and increased efficiency
- Enable deployments to occur throughout the transformational process
- Employ a right-sized approach, redefining roles and responsibilities to ensure a system that is affordable and scalable to varying levels of demand
- Establish basis for seamless airspace allocation
- Align resources for research, development, and deployment of transformational technologies, policies and procedures

### **Transformation Direction**

- Transition to an end-to-end traffic flow management schema:
  - Control by exception
  - Distribute decision-making processes thus decreasing transaction burdens
- Create a more optimal allocation of functions between automation and humans and between ground and air vehicles, to cost-effectively and safely deliver reliable and robust air traffic services
- Transition to a system with less dependence on ground infrastructure and facilities that are more scalable to varying levels of user demand
- Improve use of existing capacity and airspace:
  - Provide more routine operations in adverse weather conditions, achieving visual meteorological conditions operational performance in instrument meteorological conditions
  - Provide routine, reliable access to the airspace system by new vehicle types such as UAVs, microjets, and single-pilot aircraft
  - Provide strategic negotiation for priority uses that balance transportation benefits, equity of access, and national security requirements
- Create global interoperable communications, navigation, and surveillance infrastructure that can function reliably within available spectrum
- Achieve better context-relevant information formats and distribution methods for aircraft operators, air traffic service providers, airports, and transportation service users:
  - Provide 4-D flight path prediction



- Provide weather information
- Provide wake vortex location/strength prediction
- Provide current and projected system status
- Move to performance-based air traffic services and extend the definition to include required weather and environmental performance
- Reduce time from technology development to air traffic service implementation at new and existing locations
- Develop cost and risk sharing for air traffic services through public-private partnerships

### Cross-strategy Linkage

This IPT will coordinate its work with the following IPTs to fulfill its mission:

- Develop Airport Infrastructure to Meet Future Demand
- Develop System-wide Capability to Reduce Weather Impacts
- Establish User-specific Situational Awareness
- Harmonize Equipage and Operations Globally
- Develop Environmental Protection that Allows Sustained Economic Growth
- Establish a Comprehensive Proactive Safety Management Approach



## 7.4 Establish User-specific Situational Awareness

**Develop and deploy globally compatible information sharing capabilities to provide on-demand, real-time knowledge for users of the air transportation system. Each stakeholder will be able to reach informed decisions through increased knowledge of current conditions, plans, and events affecting the system.**

### Tie into Objectives

- Provide all stakeholders with a comprehensive, secure, integrated awareness of relevant aspects of the air transportation system, including real-time notifications of changes and information

### IPT Mission

Develop globally compatible information sharing capabilities to provide comprehensive, secure, integrated, real-time knowledge for all air transportation stakeholders:

- Stakeholders include air transportation management service providers, military services, security and law enforcement services,

airlines and other aircraft operators, as well as shippers, travelers, and other users of the air transportation system.

- Stakeholders will have access to relevant real-time data such as current and projected airspace demand, weather information, and airport delays to meet mission needs and to improve decision-making.
- Flight operations, airspace use planning, and air traffic management will integrate data into a shared situational awareness accessible to users requiring this information.
- The integration of surveillance and intent information, including conformance monitoring and anomaly detection into a single information exchange network, will enable rapid response to defense, security, and other threats.
- Assemble the decision-making business architecture.

### Transformation Direction

- Accommodate future growth in demand by enabling an agile air transportation management system through timely information exchange
- Enable security efficiency by providing a method for timely and accurate security-related information exchange
- Enable preparedness for new and varied security threats by allowing ready access to information that could be harvested for intelligence cues
- Increase the speed and predictability of air travel by sharing information such as flight path data, aircraft characteristics, projected demand, airspace constraints, and weather information for effective planning and recovery from disruption



- Improve aviation safety record by ensuring users are constantly informed of changes in system conditions so they can take safer, better informed actions
- Develop complementary policies between and among government stakeholders:
  - Develop a shared situational awareness requirements process
- Support containment of government costs by:
  - Eliminating development and maintenance of duplicative and conflicting data
  - Reducing workload in some operational areas
  - Reducing unnecessary security actions
- Provide for common defense and air security by distributing relevant intelligence and system status information in a timely manner
- Define shared situational awareness security approach and architecture for 2025:
  - Baseline current systems
  - Define incremental growth

### Cross-strategy Linkage

This IPT will coordinate its work with the following IPTs to fulfill its mission:

- Harmonize Equipage and Operations Globally
- Establish an Effective Security System without Limiting mobility or Civil Liberties
- Establish an Agile Air Traffic System
- Establish a Comprehensive Proactive Safety Management Approach
- Develop System-wide Capability To Reduce Weather Impacts

## 7.5 Establish a Comprehensive Proactive Safety Management Approach

**Develop and implement a common and comprehensive risk management doctrine at the national level that is applied to aviation and space travel. Encourage and participate in global safety practices to ensure the safety of the traveling public and cargo. Develop and implement a cutting-edge operational data analysis capability that identifies safety issues. Promote expansion of the U.S. capability to meet national and international safety goals and objectives.**

### Tie into Objectives

- Maintain aviation record as the safest mode of transportation
- Improve the level of safety of the U.S. air transportation system while accommodating future growth and changes in system operations

### IPT Mission

- Create a national-level integrated safety management framework that addresses all facets of the air transportation system, building safety design assurances into operations and products
- Establish an on-going, integrated operational data analysis capability to proactively identify and resolve safety concerns before incidents occur
- Establish and track a safety improvement culture where safety and its continuous improvement are seen as the primary goals
- Lead and manage research efforts to determine national safety strategy

### Transformation Direction

- Develop a comprehensive approach to safety across the system-of-systems at the national level
- Develop a comprehensive set of safety management principles and practices to establish a common framework for the aviation community:
  - Create an integrated safety doctrine and program standards, and define national comprehensive safety management doctrine and terms of reference
  - Develop the means to forecast and manage safety risks; apply advanced safety/risk analysis methodologies, including those from other industries, to design new operations and systems to target levels of safety; identify and model accident precursors; identify and model incident investigations as they apply to the safety management system — how incident investigations are used to identify hazards
- Ensure an evolution of present certification, testing, and inspection of individual system elements to comprehensive approvals of operators' and manufacturers' safety management programs:
  - Compliance with regulations is still the basis for future system safety management
  - Promote the evolution to a comprehensive system

management approach to certification

- Once safety management systems programs are approved, the industry and government users are responsible for safety assurance for products, policies, procedures, practices, and training. The regulatory authority does not abdicate its public safety obligations but rather shifts regulator focus to proactive implementation of corrective measures based on hazard analysis, operational data analysis, and risk modeling and monitoring
- Promote safety through training, sharing of safety data, and dissemination of lessons learned:
  - Create a standardized data integration capability to be shared among the aviation community
- Establish a non-punitive reporting system, relieving concerns about corrective action processes

#### Cross-strategy Linkage

This IPT will coordinate its work with the following IPTs to fulfill its mission:

- Each IPT must follow the comprehensive safety management doctrine developed at the national level
- Furnish safety analysis data requirements to the situational awareness IPT

## 7.6 Develop Environmental Protection that Allows Sustained Aviation Growth

**Foster distributed leadership, responsibility and burdens among all stakeholders to mitigate environmental impacts related to the growth of aviation to foster public acceptance of air transportation growth –with innovations emerging as a result of investment, experimentation, feedback and learning at local, regional, national and international levels. Develop and implement new models, metrics, policy and market-based approaches, operational improvements, and technology innovation.**

#### Tie into Objectives

- Allow expansion of the NGATS while ensuring that environmental protection measures are met:
  - Noise - FAA
  - Air and Water Quality - Environmental Protection Agency
- Harmonize national and global standards
- Reduce community noise and local air quality impacts of

aviation in absolute terms, regardless of the anticipated growth in air traffic

- Reduce uncertainty in emerging issues of climate change and health and welfare effects of emissions to a level that enables appropriate actions to be undertaken to address their effects.
- Airports will be valued neighbors; the public will be well informed about aviation and environmental issues
- Airlines and airframe/engine manufacturers will be recognized as global leaders in jointly addressing mobility and environmental needs.

#### IPT Mission

Retain leadership by standard setting through International Civil Aviation Organization (ICAO) and harmonizing global standards.

- Developing an environmental approach for aviation:
  - Ensure the appropriate environmental approach is established at the national level and harmonized globally
- Developing issues and metrics for aviation:
  - Ensure the appropriate noise, air quality, and water quality metrics are established at the national level and harmonized globally
- Explore the possibility of developing a metric for global climate change effects
- Developing environmental models:
  - Create new analytical tools to understand better the relationship between noise and emissions, the different types of emissions, and the costs and benefits of different policies and actions



- Promoting solutions to resolve or address environmental issues:
  - Research and development — technology and operations
  - Research – policy and procedures
  - Center of Excellence - foster public/private research and solutions
  - Streamline environmental impact assessments
  - Promote innovative financing and market-based options

### Transformation Direction

- Develop necessary models and update/develop metrics
- Develop technology, policy, and procedures that will cost-effectively eliminate, or significantly reduce, environmental constraints on the expansion of the NGATS:
  - Promote greater application of surface technologies at airports such as ground support equipment and ground equipment
  - Begin long-term research on alternative fuels, engine improvements and other types of technological innovations in aviation that benefit emissions or provide noise reduction
  - Develop understanding of market-based mechanisms to foster enhanced environmental objectives
  - Harmonize approaches and compatible standards for U.S. and international airports for noise and local air quality issues
  - Consider the use of market-based options and financial incentives to address environmental issues
  - Gain better understanding of aviation and climate change issues
  - Expand public and private partnerships to increase the effectiveness of environmental programs

### Cross-strategy Linkage

This IPT will coordinate its work with the following IPTs to fulfill its mission:

- Harmonize Equipage and Operations Globally
- Develop Airport Infrastructure to Meet Future Demand
- Establish an Agile Air Traffic System



## 7.7 Develop a System-wide Capability to Reduce Weather Impacts

**Achieve increased safety and efficiency in the national aviation system by deploying and integrating scientific and operational advances in weather technology to enable aviation system users to mitigate the negative impact of adverse weather.**

### Tie into Objectives

- Maintain and improve aviation safety record
- Accommodate future growth in demand and increase the efficiency and predictability of air travel
- Enable lower private-sector unit costs
- Ensure aviation remains a good neighbor
- Prepare for new and varied security threats
- Retain U.S. role as the world leader in aviation

### IPT Mission

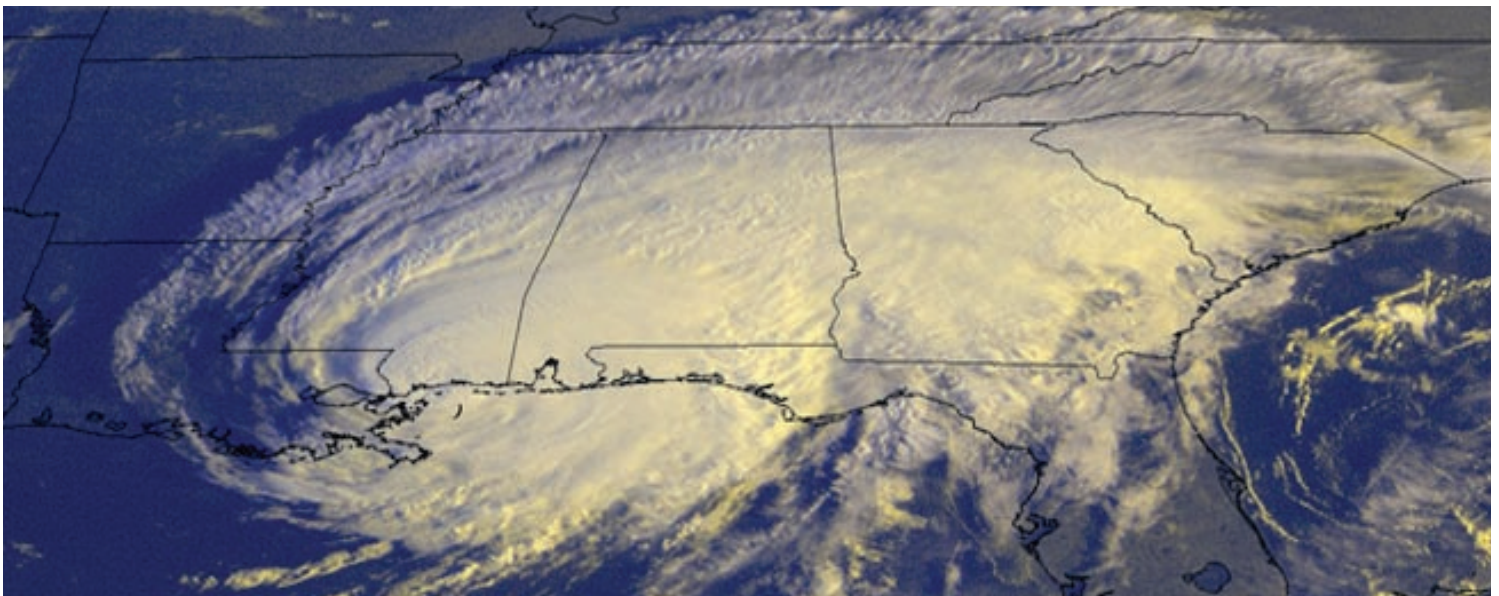
- Establish and document NGATS aviation weather requirements
- Develop partnerships and collaborative relationships in the United States to coordinate and implement long-term plans for aviation weather
- Conduct needs analyses, alternative analyses, and trade studies to select and validate implementation alternatives
- Oversee establishment of policies, processes, and systems which efficiently and cost-effectively address the nation's weather requirements
- Determine agency/industry responsibilities in fielding next generation aviation weather system
- Continuously improve and set new standards in aviation weather deployment, processes, and accomplishments
- Partner with situational awareness strategy IPT and foster development of globally compatible weather information sharing capabilities to provide comprehensive, secure, integrated, real-time knowledge for all air transportation stakeholders
- Partner with private-sector innovators to ensure the necessary procedures, practices, training, and role changes are developed in parallel with new products
- Develop and continuously evaluate U.S. government aviation weather performance metrics

- Put in place a planning, programming, and budget oversight system responsive to requirements, and one that assures the most effective movement of research results to operational application
- Provide a seamlessly flexible and layered holistic architecture that supports NGATS weather requirements
- Provide the leadership and management, from requirements definition to development and operational implementation, to develop an integrated, cohesive, comprehensive aviation weather support system

#### Transformation Direction

- Improve accuracy and timeliness of aviation weather information, allowing NGATS to proactively, versus reactively, respond to weather
- Disseminate weather information to all users in a context relevant situation
- Develop changes in aircraft, airport, and system technology to enable operations in a wider spectrum of weather conditions
- Provide a streamlined method for infusing technology into the national airspace system, facilitated by a joint weather program office, to enable the rapid preplanned infusion of new weather capabilities into operations
- New, integrated operational products will allow greater decision-making on the ground and in the cockpit, greatly enhancing safety and capacity

- Enhance aviation safety and capacity through the use of weather support tools that increase the operational focus, relevance, and accuracy of weather predictions, and leverage technology to improve scientific understanding, efficiency, capability, and communications
- Promote advances in weather technologies from major breakthroughs in our scientific understanding of weather, major improvements in weather sensor technology, and a vast increase in the number and type of weather measurements made from ground-, satellite- and aircraft-based sensors
- Expedite the dissemination of information such as integrated enhanced weather information with ground and flight deck decision support systems. New tools will assist operators in managing their information load to provide decision-makers with clear and concise facts to enable better and timelier decisions
- Employ forecaster expertise, where it adds value over using improved automated forecasting tools
- Transition present day deterministic air traffic management/air traffic control (ATM/ATC) system into a probability based NGATS
- Document NGATS weather requirements including near, mid-, and long-term NGATS decision support systems
- Survey existing U.S. government and industry aviation weather efforts — identify gaps and establish the required government and/or industry R&D activities for closure
- Identify policies, procedures, and training objectives



requiring review and/or change

- Manage development of a national aviation weather database

### Cross-strategy Linkage

This IPT will coordinate its work with the following IPTs to fulfill its mission:

- Establish an Agile Air Traffic System
- Establish User-specific Situation Awareness
- Develop Airport Infrastructure to Meet Future Demand
- Establish an Effective Security System with out Limiting Mobility or Civil Liberties
- Establish a Comprehensive Proactive Safety Management Approach
- Harmonize Equipage and Operations Globally



## 7.8 Harmonize Equipage and Operations Globally

**Ensure the establishment of performance based global standards to improve safety, security, mobility, and economic viability of air transportation.**

### Tie into Objectives

- Make it as safe abroad as it is at home
- Promote equivalent security measures that are compatible throughout the international system
- Promote U.S. aviation industry developments for global markets
- Seamless use of equipment and operational procedures across international boundaries that satisfy U.S. needs
- Perform the U.S. military's mission worldwide
- Make aviation environmentally friendly throughout the world
- Achieve cost reduction, capacity expansion, and enhanced quality of air and space transportation services through international harmonization

### IPT Mission

- Coordinate U.S. positions on standards and policies for international negotiations/collaboration:
  - Develop government/industry partnerships and collaborative relationships in the U.S. to coordinate long-term plans for global standards and policies

- Organize unified U.S. policy positions related to all aspects of transformation, as developed by joint IPTs
- Identify and resolve any differences between U.S. national and international objectives such as security and defense

- Establish joint initiatives with international partners to develop technologies and policies:

- Expand existing or establish new collaborative relationships with multilateral, regional, national, and non-governmental, international partners to coordinate long-term transformation plans globally
- Share research, synchronize timetables for development, and adopt new technologies and concepts
- Partner with major growth countries and regions such as India, China, and Latin America, in promoting common technology and procedures
- Promote interoperability internationally and harmonize standardization of required systems

- Advocate global adoption/proliferation of U.S.-preferred transformation concepts, technologies, procedures, and standards:

- Identify and resolve potential conflicts between developments in the United States and in other countries pursuing harmonization or interoperability, as appropriate
- Promote strategic aviation investment by other countries for economic growth and aviation safety and accessibility
- Engage other countries in discussions about, and facilitate their adoption of, best practices worldwide to enhance safety and expand capacity
- Assist other nations to acquire/adopt U.S. technology and procedures
- Lead outreach campaign on global transformation
- Promote increased aviation market liberalization

### Transformation Direction

- Create unified U.S. air transportation positions in all major technology and policy areas for use in international discussions including timetables that can be used to align activities
- Create economies of scale by aligning ATM and security developments across national boundaries
- Streamline and accelerate international standardization processes using nontraditional means such as:

- Establishing collaborative relationships with other states and regions in promoting technology and procedures
- Engaging professional associations and workshops in the international standardization process
- Foster development and use of performance-based and professional organization developed standards
- Ensure global collaboration in development of standards and policies and operations to achieve safety, efficiency, security, environment, and health benefits in air and space transportation system
- Enable information centric architectures for multiple objectives such as security, safety, and operational efficiency
- Implement the ICAO Communication, Navigation, and Surveillance Air Traffic Management (CNS/ATM) global plan
- Implement ICAO/ATM operational concept

#### **Cross-strategy Linkage**

This IPT will coordinate its work with the following IPTs to fulfill its mission:

- Work toward global changes that are in concert with U.S. positions developed by the IPTs:
  - Coordinate and promote U.S. efforts to ensure worldwide integrity of transportation security safeguards
  - Coordinate global seamless CNS/ATM capabilities and achieving international operational compatibility
  - Coordinate globally compatible information sharing capabilities and protocols
  - Coordinate global understanding of and alignment with the U.S. safety management approach
  - Coordinate international harmonization of environmental policies, procedures, and standards
  - Coordinate the development and adherence to global airport standards, share best practices, and promote infrastructure development globally
  - Coordinate global efforts to enhance aviation weather forecasts, information dissemination, and weather related technologies



## Chapter 8: Next Steps

The President's budget for FY 05 funds the operations of the Joint Planning and Development Office (JPDO) at a level of approximately \$5 million each from NASA and FAA. This is sufficient to fund essential operations and allow the JPDO to proceed with the basic actions in the critical areas of this plan such as establishing the framework of architectures and the basic systems engineering process. Many of the IPT efforts that are required to support the execution of this plan are already funded at some level in the individual agencies' budgets.

The FY 05 IPT effort will focus on identifying those on-going efforts that are essential to the success of the program. Through the IPT activities we will determine how to leverage the existing resources from all activities by coordinating and restructuring the programs of record, consistent with the developed architectures and identified requirements so as to maximize the return on the investments. The need for funding augmentation will be determined as part of the Senior Policy Committee oversight of the program activities during FY05/06 and addressed as part of the administration's budget process.

The initial actions of the IPT's will be to refine the options for future solutions, assess existing programs and plans, leverage what is available, and identify gaps and key questions for further research and development. System engineering/integration work will begin in earnest to support the architecture and IPT planning. These more detailed plans will be reflected as annexes to the second edition of this plan, and will be reflected in the FY 07 budget submission. The objective of this planning will be to harness the creative spirit and coordinate the change that is coming.



The benefits of a system capable of robust response to change and sustained growth with unquestioned safety lies in its ability to deliver air transportation services for the diverse needs of U.S. businesses, travelers, and our nation's security. These remarkable possibilities are sketched from a "limited" imagination, and if the past is a guide, it underestimates the potential. Who could have predicted today's dependence on air transportation from the success of the Wright brothers' innovation? From this beginning, our nation continued to produce the pioneering milestones of flight. From Charles Lindbergh crossing the Atlantic to Chuck Yeager breaking of the sound barrier, from offering global air service created by Pan American World Airways to opening the door for commercial space travel by Burt Rutan, these pioneers illustrate the enormous potential for air travel to serve our nation. We are entering a new age of aviation with the opportunity to dramatically increase everyone's access, reaching farther and faster.

The challenges for seizing these opportunities in aviation are significant, and we must again be pioneers. The leadership for this effort is ready with a vision and a roadmap to pioneer the Next Generation Air Transportation System. Vigorous action is needed to achieve the future vision of air transportation. Each individual agency will make its FY 07 budget submission and the report will show how they build on and leverage each others programs. Both government and industry have shown their readiness to partner to deliver an air transportation system that accommodates industry shifts as it strives to serve individual customer needs.