NGATS

Next Generation Air Transportation System

2005 Progress Report
To The Next Generation Air Transportation System
Integrated Plan

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I. Background

"The changes that are coming are too big, too fundamental for incremental adaptations of the infrastructure ... we need to modernize and transform our air transportation system – starting right now."

Department of Transportation Secretary Norman Y. Mineta
Aero Club of Washington Speech
January 27, 2004

In 2003, President Bush and Congress took the first critical step towards transformation with the enactment of VISION 100 – Century of Aviation Reauthorization Act (P.L.108-176) – which laid out the mandate for the multi-government agency Next Generation Air Transportation System (NGATS or Next Generation System) and formally created the Joint Planning and Development Office (JPDO) to manage the work associated with it. The overarching vision was for a system that addresses critical safety and economic needs in civil aviation, such as increased capacity, while fully integrating environmental impact, national defense and homeland security improvements – and in a cost effective manner. This vision involves the Departments of Transportation (DOT), Homeland Security (DHS), Defense (DoD), Commerce (DOC), Federal Aviation Administration (FAA) National Aeronautics and Space Administration (NASA), and the White House Office of Science and Technology Policy. The vision would encompass all areas of the aviation community, including all of General Aviation, commercial and public safety helicopter operators as well as traditional commercial and business flight operations.

"This plan isn't something that's nice to have. If we don't move forward, we won't be able to catch up. Transformation is a must."

Federal Aviation Administration (FAA)
Administrator Marion C. Blakey
U.S. Chamber of Commerce Speech
April 21, 2005

The first product of this groundbreaking effort came in December 2004 when Transportation Secretary Norman Y. Mineta and FAA Administrator Marion C. Blakey delivered the NGATS Integrated Plan to Congress. This strategic business plan lays out a common vision for the Next Generation System and establishes benchmarks for our success and a structure by which we can design and implement the changes we must make. VISION 100 also directed that an annual progress report, including any changes to the Integrated Plan, be submitted at the time of the President's budget request. This document is the first such report and we are pleased to report on our progress.

Indeed, we achieved important milestones in 2005 towards building the Next Generation System. The JPDO completed its internal organization and created eight government/industry integrated product teams (IPTs) to break this large and complex project into manageable pieces. **(Discussion of the program management infrastructure can be found in Appendix 1.)** The IPTs have already begun the important process of moving from general to specific, and from objectives to capabilities. As of December 2005, over 140 industry and private sector participants representing 66 organizations and companies are now actively involved in the IPT planning and development work. This participation has been a major initial focus of the NGATS Institute contributions to the JPDO success in 2005. The office also established critical baselines upon which to build.

In addition, the JPDO examined the many complementary and competing ideas and suggestions to develop the 2025 NGATS Vision which brings into far greater focus the future system's capabilities. Guiding our way throughout this process was the core objective that government must ensure that we have an aviation infrastructure capable of supporting future growth in demand, including a mix of new aircraft such as very light jets and unmanned aerial vehicles. To this end, we analyzed and were then able to validate the concept's ability to deliver two to three times today's capacity. The JPDO next established a roadmap to transition from today's system to the 2025 NGATS concept and developed an initial portfolio of needed policy, research and modernization efforts based on it. And in recognition of aviation's international nature, we began to develop strategies to accomplish global implementation of key capabilities. Finally, and under the direction of our Senior Policy Committee, the JPDO analyzed ongoing departmental and agency programs centered on the portfolio and established an agenda for leveraging and aligning them to achieve the Next Generation System capabilities.

Just as the JPDO process represents a bold departure in the way that federal agencies work together to achieve common objectives, President Bush and Congress envisioned a new and revolutionary way for government and the private sector to interact and collaborate to achieve the Integrated Plan's objectives. This approach would have industry participate in the very earliest phases of the critical design and throughout the subsequent activities planned by the JPDO.

In 2005, the JPDO established the NGATS Institute. The Institute functions as the primary mechanism by which industry participates in the pursuit of the NGATS vision. Reporting directly to the Director, the Executive Director of the Institute ensures that there is an open and effective two-way communication process between government and the private sector. Guided by a board comprised of 15 major aerospace industry and aviation organizations, the Institute represents the major aviation stakeholder communities on a daily basis on the JPDO team. Its first task is to help populate the eight IPTs. We want to make sure the IPTs have the best and brightest experts industry can offer. We will also benefit from the extensive experience industry stakeholders have gained through other agencies' transformational initiatives.

In addition to recruiting, selecting and assigning private sector experts and technical resources to the IPTs, the Institute will be called upon to perform specific research in areas identified by the JPDO, and usually on a quick turnaround basis. So, rather than observing and commenting, the private sector will join with the government as a full partner in the NGATS development process.

In another milestone, National Aeronautics and Space Administration (NASA) has already begun moving from the drawing board to the field and started conducting demonstration projects. For example, in June 2005, we carried out the highly successful Small Aircraft Transportation System, or SATS, demonstration project. A whole new generation of safe and affordable small aircraft will be able to take advantage of the SATS enabling technology and start delivering service where there was little or none before, thereby taking the pressure off busy airports while conveying other economic and quality-of- life benefits to literally thousands of smaller communities. Later in the year, the first Network Enabled Operation demonstration project was also successfully executed. The next wave of demonstration projects will occur in 2006; these and other planned activities are described later in the report.

Make no mistake about it; the road to NGATS is long and hard, technically, politically, and culturally. We acknowledge these challenges and commit to address those issues head on as they occur. Secretary Mineta recently observed that the Next Generation System initiative may have a more far-reaching impact than anything he has been involved with in his 30 years of public service. Given the Secretary's long and distinguished career, this speaks volumes about what is taking place today. The JPDO is honored to be making progress towards achieving that bold vision he first articulated almost two years ago, and, although much hard work and risk remains, we will work, shoulder-to-shoulder, through those challenges, regardless of their type, source, or scope. We are confident that we are on the right path and will reach our ultimate goal on behalf of our great nation and the American people.

> *"We're preparing for transformational changes in the air transportation system through the Next Generation Air Transportation System initiative… aircraft will be able to take advantage of ... technology in places where these aircraft have not had reliable access."*
>
> Department of Transportation
> Secretary Norman Y. Mineta
> 2005 AOPA Expo

II. The Road to the NGATS – Technical Planning Elements

"Remember the best day you ever flew. That's what we want to achieve for every passenger every day in the Next Generation System – from airport curb to airport curb."

DOT Undersecretary for Policy Jeffrey N. Shane
Testimony before the House Aviation Subcommittee
April 14, 2005

A 2005 Product

A. The 2025 NGATS Operational Vision

During the past year, the JPDO brought the 2025 NGATS Operational Vision into much greater definition. In contrast to today's rigid, highly manual and aging system, the Next Generation System will be flexible, resilient, scalable, adaptive and highly automated. Recognizing that in the NGATS operational vision, air travel is all encompassing, the transformation is not just related to the air traffic management system alone. The vision also includes the preservation and growth of airports, heliports and other future landing and departure facilities to fully incorporate the emerging NGATS benefits. It will take passengers from the airport curb to their airplane in 30 minutes or less with fewer of today's hassles, but with a lot more non-intrusive, layered security.

The vision also emphasizes end-to-end strategic flow management with minimal individual flight interventions. The Next Generation System will be highly automated and network centric so we get the right information to the right person at the right time while keeping the nation safe and the flow of traffic running smoothly. And we will increasingly cut the cord between ground and air as we put more data directly into the cockpit of intelligent aircraft through sensors and satellites linked together through networked communication.

Ultimately, air traffic management services will be tailored and flights will be managed based on individual aircraft and flight crew performance capabilities. We can reward aircraft that have advanced capabilities and efficiencies, such as precision navigation and the ability to land automatically, by allowing them greater operating flexibilities. We can increase capacity by 300 percent while still improving safety.

The 2005 NGATS Operational Vision: Five Principals and Eight Key Capabilities

Principles

It's About the User

The Next Generation System represents a dramatic departure from the current system and its enormous physical, technological and regulatory limitations. The NGATS is not about the government; "it's all about the user."

Users will have access to data designed for their specific needs, thereby enabling better and faster decisions and enhanced safety. By distributing this data seamlessly to those who can make best use of it, and through an appropriate mix of policy and market mechanisms, the Next Generation System will minimize the degree to which government directly controls real-time operations. Although there will be a continued need to handle flights (during emergencies, for example), the role of dispatchers, flight planners, controllers, and flow managers will emphasize end-to-end strategic flow management with minimal individual flight interventions. Greater situational awareness and access to data among all the system's participants will enable users to operate in a freer market of services and choices. The results are greater efficiencies and cost savings for both the government and system users.

System-Wide Transformation

System transformation not only involves technological innovation, but also changes in organizational structure, processes, strategies, and business practices that are seriously out of date and not aligned with customer needs. Grafting new technology onto obsolete statutes, policies, and business practices will not succeed. Describing the Internal Revenue Service (IRS) massive reorganization and business systems modernization program, former Commissioner Charles O. Rossotti recently wrote: "A critical decision in any change program is assessing how these basic structural elements need to change to reflect current best business objectives, best practices in other organizations and especially the current needs and characteristics of its customers…I concluded that any attempt to change technology in isolation would be bound to fail, as would a program only of quick fixes."[1]

Organizational leaders must also convince their technical/professional personnel – very experienced and accomplished in how the current system works – to set aside their "expert" status to embrace new policies, standards, processes and technologies that will drive transformation. Encouraging public acceptance of new and emerging technologies in key roles, such as air traffic management and aircraft operations, will become a major government and industry responsibility. State and local governments, the private sector, and academic organizations must also join the transformation process. And because air transportation is a global enterprise, transformation must be embraced too by the international aviation community. Indeed, if we are to be successful in achieving our goals in safety, efficiency and environmental stewardship, we must expand our global partnerships far beyond what exists today. Our interdependencies are too great to achieve our full potential on our own.

Proactive Approach to Safety Risk Management

Nothing is more important than safety to ensuring the continued vitality of our air transportation system and its ability to meet growing demands. Although we have an enviable safety record today with the lowest accident rate in history, we must constantly raise the bar even higher. As Secretary Mineta told an FAA-sponsored international safety forum in 2004, "We cannot think in terms of 'safety versus growth.' We must continue to innovate, continue to collaborate and continue to improve the way we do business so that we achieve both."

How do we do this? In the Next Generation System we will proactively address risk and anticipate potential safety problems so we can prevent accidents before they happen. The key is information sharing which has quickly become the next safety frontier. The data we gather will be shared and integrated, and from it, we will be able to detect national, fleet and geographic safety trends.

Most importantly, we will create a new culture that encourages the sharing of critical safety information without fear of retribution. A common vision for safety, safety goals, and ways to measure safety will drive all aviation safety improvement activities, including the prioritization of research and development (R&D) efforts. Safety design assurances and decision-making can then be built into all facets of NGATS design, operations and products and will help us manage the transition to the future system.

Global Harmonization

Creating a modernized system that provides for global interoperability could serve as a tremendous boost to the industry, fueling new efficiencies and consumer benefits. We are working to avoid a patchwork of duplicative systems and technologies, which would place additional cost burdens on an industry already struggling to make ends meet.

We are working with all regions of the world as well as International Civil Aviation Organization (ICAO) to ensure global harmonization through memorandums of understanding and joint working groups. We will establish frameworks for cooperation and global interoperability. We intend to explore opportunities for working toward commonality of Air Traffic Management Systems and developing common synchronized timelines for the implementation of the new technology. Performance-based services and risk-based safety approaches will be key to ensuring a harmonized system that allows for differences in the aircraft fleet mix and state services. And while we must pursue interoperability, we must at the same time encourage adoption of U.S. technologies and standards. Harmonization also goes well beyond the core concept of Air Traffic Management – it applies equally to environmental, safety and security concerns.

Integrated Environmental Performance

Environmental concerns regarding aircraft and airports are a major contributing factor to the current and projected lack of system capacity. A new major hub airport has not been built in the United States since Denver International opened in 1995. Even adding or expanding runways and flights can incite strong local not-in-my-backyard opposition. In spite of significant improvements in the past 15 years, airports and their attendant aircraft are still viewed by communities as sources of pollution – from large noise "footprints" to local air quality to run-off from toxic de-icing substances.

Critical environmental issues must be addressed so as not to hinder growth, nor impede our ability to meet demand and increasing capacity goals. And environmental stewardship should not be viewed in isolation but within the overall context of the Next Generation System's objectives. We must integrate sound environmental policy and awareness into how we conduct business in the NGATS. Moreover, the future system must be able to benefit from emergent technologies and approaches built in partnership with the government and private sector that will enable it to thrive. For example, NASA is already designing and developing critical engine and airframe technologies that provide a significant cut in emissions, such as low-drag, environmentally sound aircraft configurations that burn less fuel and generate less noise. And the Environment IPT is already working to implement Continuous Descent Approaches (CDAs) in the National Airspace System. This offers the ability to operate aircraft on approach in a manner that burns less fuel and produces less noise.

1 - Charles O. Rossotti, Many Unhappy Returns: One Man's Quest to Turn Around the Most Unpopular Organization in America, Harvard Business School Press, 2005, p. 295.

The NGATS effort is itself a critical environmental instrument. Elimination of air traffic system-induced congestion and delay reduces unnecessary fuel use, and therefore aviation emissions. Further, NGATS will allow greater use of precision noise abatement procedures, such as continuous descent approach, to reduce aircraft noise exposure. Equally important, using environmental management systems, government, industry, and academia must work collaboratively to develop the analytical tools required to accurately address environmental concerns, interrelationships and cost-effectiveness. State and local governments also have a role to play. Long-term land-use policies and plans are essential to enable future growth and the protection of noise-sensitive areas.

Key Capabilities

In 2005, the JPDO identified eight "key capabilities" currently missing from today's system but that individually and collectively will play a major role in the Next Generation System. They are discussed below.

Network-Enabled Information Access

Today, an enormous amount of information is generated – from aircraft position to weather to potential security threats. However, there is no "big picture" where it is all pulled together, giving multiple decision-makers quick access to the critical information they need. That is where Network-Enabled Information Access comes in: giving the right information to the right person at the right time.

The Next Generation System will be network-centric. We will make information available in a secure and useable form and in real time and distribute it for decision-making in all conditions – from normal operations, to system-wide crisis. And just as importantly, we will be able to improve the speed, efficiency and quality of those decisions.

Aircraft will become mobile "nodes" integral to this information network, not only using and providing information, but also capable of routing messages or information sent from another aircraft or a ground source. The types of data generated and used will include: flight plan information; pilot, passenger and cargo data; aircraft telemetry; surveillance information; environmental information; and weather data. Information might also be in the form of records, databases (pilot licenses, or aircraft maintenance records), voice communications, or images. Information will be "pushed" to known users and "pulled" by others.

Providers will make certain that data are appropriately protected for national defense, security and privacy concerns. Authorized users and software applications will employ "metadata" tagging (data about data) to facilitate rapid correlation and discovery of data, thus identifying and isolating what is needed for a particular application. Data sharing will be transformed from "private" control/dissemination to "enterprise data".

Additionally, various users will develop groups to enhance data-sharing capabilities necessary for their common interests. This capability will be guided by information-sharing standards addressing data ownership issues, such as access, liability and decision-making authority. International standards must also be jointly developed and shared.

Performance-Based Services

The NGATS vision is focused on transforming the air transportation system in such a way that all categories of aircraft will benefit as determined by their inherent capabilities and performance without regard to the type, mission or purpose for that aircraft operating in the NGATS environment. Further, the Next Generation System will give high-performance aircraft greater operating flexibility, enhancing their ability to get travelers where they want to go on time.

The current system is built around so-called "binary access" (you meet all of the requirements for access, or you are denied admission); one level of service (first-come, first-served), and a rigid regulatory structure built around specific equipment types. By contrast, performance-based services will establish service "tiers." We can then make the leap from equipment-based regulations to performance-based regulations, rewarding intelligent aircraft for their high-tech capabilities. Once again, it is all about the user. Multiple service levels will permit a wider range of tailored services to better meet individual user needs. In the Next Generation System, one size does not fit all.

The goal is to best accommodate the integrated set of user needs as defined through a rigorous public policy process. The development begins with "specific level of service" policies that spell out what guarantees are available and what services are offered.

Performance-based services convey other benefits. They save the government money and encourage private sector innovation. Clearly defined service tiers will also allow the service provider to create service guarantees for given performance levels. That way, users can make the appropriate investments to meet their needs.

Consistent performance levels defined worldwide will also help harmonize global operations and create free-market opportunities for users and suppliers on a multinational and/or global scale. Moreover, global implementation of spaced-based navigation systems will be necessary for seamless operations worldwide; our international strategy will focus on this goal.

Weather Assimilated Into Decision Making

Perhaps nothing is more frustrating to passengers and providers than weather delays that can wreak havoc with airline schedules and personal plans. Fast moving thunderstorms, which are difficult to predict with the required precision to support aviation operations, can needlessly ground aircraft thousands of miles away resulting in flight delays and cancellations. Business travelers who must often take flights in the late afternoon and evening – prime severe weather time – are at particularly high risk of weather delays. But 60 percent of the weather delays, which cost the nation's airlines, cargo carriers and other users in excess of $4 billion annually, are now being attributed to potentially avoidable weather situations. Although we cannot change the weather in the Next Generation System, we can certainly minimize its adverse impact on air transportation and air travelers.

In today's system, inconsistent weather data and forecasts are often provided to various decision makers. They then make their own local judgments about how to use them, often resulting in low-quality, conflicting decisions. However, in the network-centric Next Generation System we will have a common weather picture to support decision making. More accurate forecasts and tens of thousands of real-time global weather observations – including those from the ground, aircraft and satellites – will be integrated into a distributed virtual national weather information source and automatically updated. The future system can look into the future and plan around the weather. Pilots can then pick the smoothest ride possible and will be able to fly in all but the worst of weather based on aircraft capabilities.

In further contrast to today's system, weather data dissemination will not emphasize as much text and graphic products, but will stress reliance on raw weather information that will be placed into Next Generation System decision algorithms and processes, bypassing the need for human interpretation. And from a capacity point of view, computer-based decision-making will take advantage of improved probabilistic weather information, making more airspace available to system users.

Layered, Adaptive Security

The challenge: moving people and goods quickly and efficiently while continuously improving security. The NGATS solution: embedded and interwoven security layers that operate seamlessly and adapt to changing situations. Airport security screening will be far less intrusive so you can keep safe while keeping on your shoes.

Speaking at the Airport 2025 Conference in June 2005, Secretary Mineta observed, "The layered and adaptive security concept is far different from the add-on dimension of the current security system. It will integrate security functions into NGATS in a way that increases security, while facilitating the movement of more people and requiring proportionally fewer resources to do it." Based on this observation, one of the goals will be to implement security such that in an NGATS, the requirements are transparent and no single user will be excluded from access to airports, heliports or other portals.

Building on Network-Enabled Information Access and Performance-based Services, risk assessments of passengers and cargo in the Next Generation System will begin well before each flight. People will be quickly and appropriately screened at the airport, or as they work to support airport and aircraft operations, greatly reducing the need for severe reactive measures such as terminal lockdowns and in-flight intercepts.

As our technology matures, screening will become unobtrusive and increasingly transparent to the individual. People and cargo that "touch" an aircraft will be positively identified and assessed in terms of risk or threat, and our responses will reflect those findings.

Security will exist in "layers of defense" designed to detect threats early and provide appropriate intervention. Security changes will be assessed in terms of impact to, and effects from other aspects of the system. Airports and aircraft will be designed to be more resilient to attacks and/or incidents.

Broad-Area Precision Navigation

Precision satellite navigation and Internet-like access to critical information will allow pilots to make precision landings at airports that do not have control towers, radar, or Instrument Landing System (ILS). This new capability opens up thousands of small, underutilized airports to a new generation of very light jets, easing pressure at congested airports and bringing air service where there was none before, increasing the capacity of the NAS. The NGATS vision will encompass all flight operations, including the future equivalent of "Visual Flight Rules" such that users will have the freedom to choose how they want to access the NGATS airspace and take advantage of these expanded landing facilities.

Broad-Area Precision Navigation will provide navigation services where and when they are needed, enabling safe and reliable aircraft operations in all but the worst weather conditions. Today's domestic navigation infrastructure includes over 5,000 ground-based navigation aids operated by the FAA to support both navigation and approaches to airports. However, by taking the next evolutionary step and replacing this localized-service model with a broad-area service no longer tied to the ground, "instrument" landings will be possible at any "air portal" or location within the coverage area.

The JPDO and its industry partners are looking at a variety of ways to provide Broad-Area Precision Navigation for different required levels of performance. This capability will likely include a next generation of Global Positioning System (GPS) satellites with non-terrestrial navigation augmentation for operations in weather conditions equivalent to today's Category I approaches, as well as hybrid global navigation satellite system (GNSS)/inertial avionics for operations in weather conditions equivalent to today's Category II/III approaches.

There are tangible resource benefits too. Elimination of multiple legacy systems will reduce the air transportation system costs as well as user costs associated with maintaining proficiency over multiple navigation systems.

Aircraft Trajectory-Based Operations

To accommodate the projected doubling or tripling of system demand by 2025, today's flight planning and air traffic control must be transformed into a system that: (1) manages operations based on aircraft trajectories; (2) regularly adjusts the airspace structure to best meet user and security/defense needs, and (3) relies on automation for trajectory analysis and separation assurance. The Next Generation System will use 4-dimensional (4D) trajectories (time-based paths from beginning-to-end including ground segments) as the basis for planning and executing system operations. The design must both improve system efficiency and meet security, safety and environmental compatibility goals. This ability builds on the aforementioned Network-Enabled Information Access, Performance-Based Services, Weather Assimilated into Decision Making, and Broad-Area Precision Navigation capabilities.

The planned trajectories will be exchanged among system participants, and automation will continuously analyze trajectories, taking into account weather information and forecast uncertainties, to support a constantly updated plan that keeps aircraft safely separated. The airspace structure will be matched dynamically allocating/configuring airspace to meet operational demand, while meeting safety and environmental requirements. Additionally, we will be able to consolidate today's disparate mechanisms for segregating and managing airspace into a single one for implementing Temporary Flight Restrictions, Special Use Airspace, etc., thereby providing the maximum available airspace to all users while satisfying national security (DoD/DHS) needs for airspace restrictions.

One of the key concepts associated with this capability is the integration of trajectory planning/execution across the time horizon from "strategic planning" to "separation management." Building upon air traffic management research by NASA's Airspace Systems Program, we came up with a notional concept to support the expected distributed decision-making environment; we call this concept the "Evaluator." The Evaluator will take 4D trajectory proposals from all airspace system users and assess them for mutual compatibility with airspace/system capacity.

Users will be able to immediately see situations where over demand or contention over resources are projected to occur, and will be encouraged to play an active role in their resolution. The air traffic management system service provider will use the Evaluator to plan airspace configurations and allocate service provider resources to support changing user needs. Based on a set of published rules (jointly determined by the users and the service provider), the service provider will provide just-in-time "final arbitration" decisions when users are unable to resolve contentious resource situations. The Evaluator will provide a degree of transparency into these decisions and actions for air traffic users and service provider, airport operators, and other communities of interest.

Equivalent-Visual Operations

Through sensors and satellites, the system will allow for precise navigation and other critical information to be sent directly into the cockpit. For the first time, pilots and controllers will see the same picture, and controllers can start delegating tasks. One big benefit comes from the ability to provide aircraft with the critical information needed to navigate without visual references and maintain safe distances from other aircraft during non-visual conditions, such as low clouds or fog, thereby increasing capacity without compromising safety. This capability will provide an enhancement over current flight operating concepts, such as VFR, so that pilots of all types of aircraft will be able to take full advantage of the emerging NGATS technology, such as Automatic Dependant Surveillance – Broadcast (ADS-B) surveillance and shared situational awareness information, to gain greater access and freedom to fly point to point more safely and efficiently.

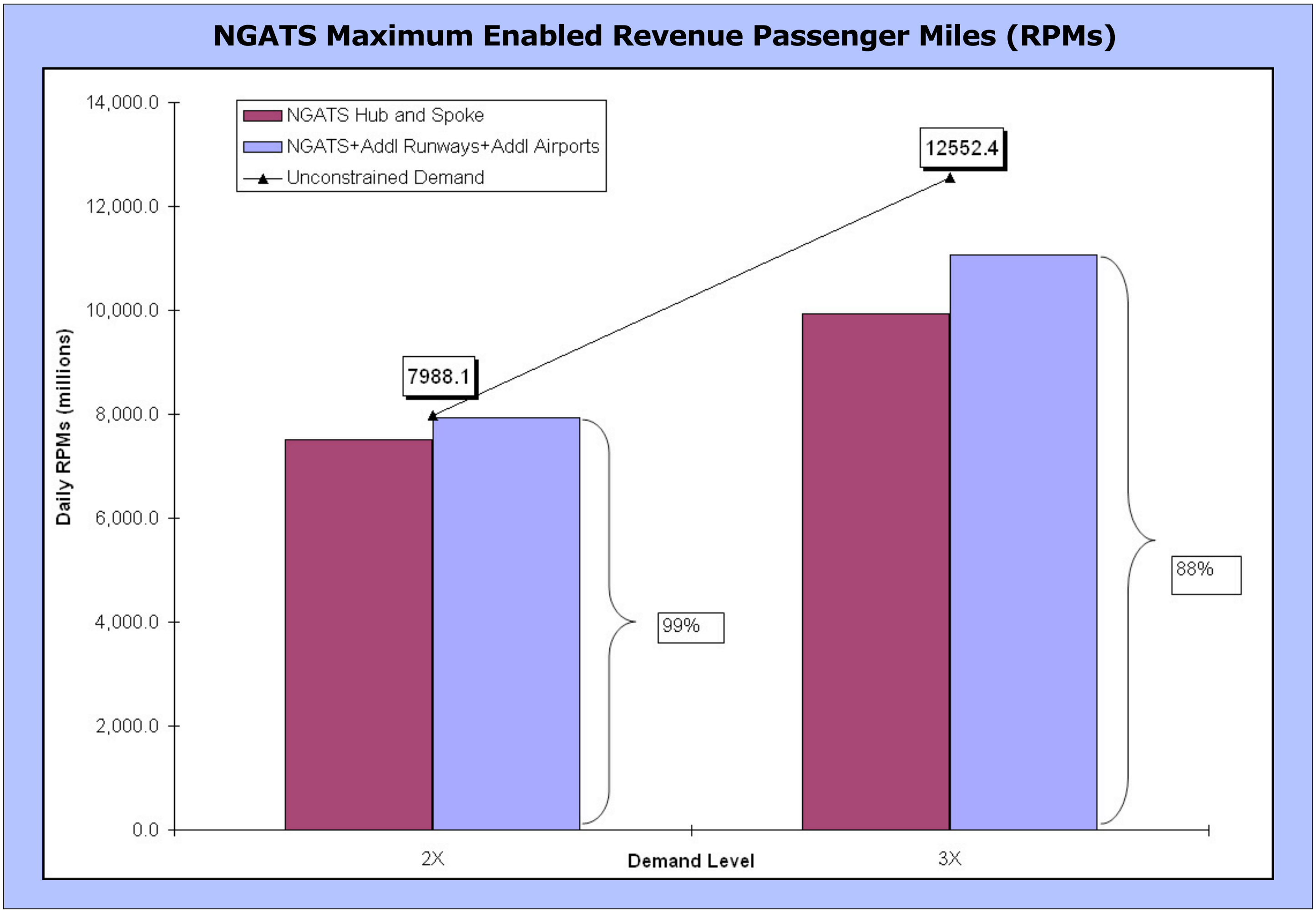
This capability builds on Network-Enabled Information Access, certain aspects of Performance-Based Services, and some elements of Broad-Area Precision Navigation and Adaptive, Layered Security. We expect this capability will become operational in about 10 years, with controllers delegating responsibility to aircraft to "maintain separation" when an aircraft is in the airport area.

Availability of the Equivalent Visual Operations capability at all "air portals", combined with appropriate landside services, including security, means more airports can reliably serve their communities or region – be it for commercial service, business aviation, air taxi, air cargo or general aviation. It can help link them together through point-to-point, on-demand air service and that is great news for the economic lifeblood of these smaller and rural communities.

Super Density Operations

Key to the complete success of the Next Generation System is our ability to match airport land and airside throughputs (traffic coming in and out) to meet future demand. The implementation of previously described capabilities will enable peak performance in even the busiest metropolitan areas.

Airport taxiway and runway configuration requirements will enable high-capacity traffic operations on the airport surface. Airborne separation standards will be reduced, as a result of "intelligent" aircraft capabilities, enhanced surveillance and navigation performance. This reduction will result in the ability to perform closely-spaced and converging approaches at distances closer than currently allowed and with no reduction in safety. Tools to detect and avoid hazardous wake vortices will be developed and integrated. The airport "landside" (including security systems) will be sized to match the passenger and cargo flow to the airside throughput.



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B. Evaluating the Operational Vision: The Goals Set Forth in the Integrated Plan Can Be Met

The NGATS is designed to address many of the most significant limitations to growth in the current air transportation system. These include runway capabilities and the inherent limitations of ground-based control of en route and terminal area airspace and the vulnerability of the system to weather. During 2005, the JPDO analyzed and defined current system performance in enough detail to identify when and where performance limitations restrict desired demand. From this work we were also able to produce an initial assessment that validated the Concept's ability to deliver two to three times today's capacity as illustrated above. (**A complete and detailed discussion of the methodologies, scenarios and models used to evaluate the Operational Vision can be found in Appendix 2.)**

While many of the previously described NGATS capabilities will enable dramatic increases in system capacity, and thus keep pace with increasing demand, the evaluation also determined that the Next Generation System will be able to cope much better with the effects of bad weather. As previously noted, travelers are all too familiar with how bad weather affects airlines' operations: massive delays and flight cancellations that ripple throughout the system. However, in the NGATS, ground-based and airborne technologies will be deployed to allow airports to maintain the same rates of arrival and departure operations that are experienced during visual flight conditions even during those requiring instrument-based operations. Thus, the only conditions in which airport throughput would still be affected would be extreme weather events.

The potential for reducing weather-induced delays is dramatic. An analysis of a future with three times today's demand reveals that, without NGATS, the average flight delay more than doubles on a typical day in which bad weather strikes many parts of the country as compared to a good weather day throughout the system. But with NGATS, significant reductions (over an order of magnitude) in weather delays are envisioned.

In summary, the Next Generation System is designed to increase system performance in the near term by improving the efficient use of the existing runway system; making better use of en route airspace and enabling more system resilience under adverse weather conditions. As the NGATS is implemented, it is likely that other ground-level improvements at airports will result.

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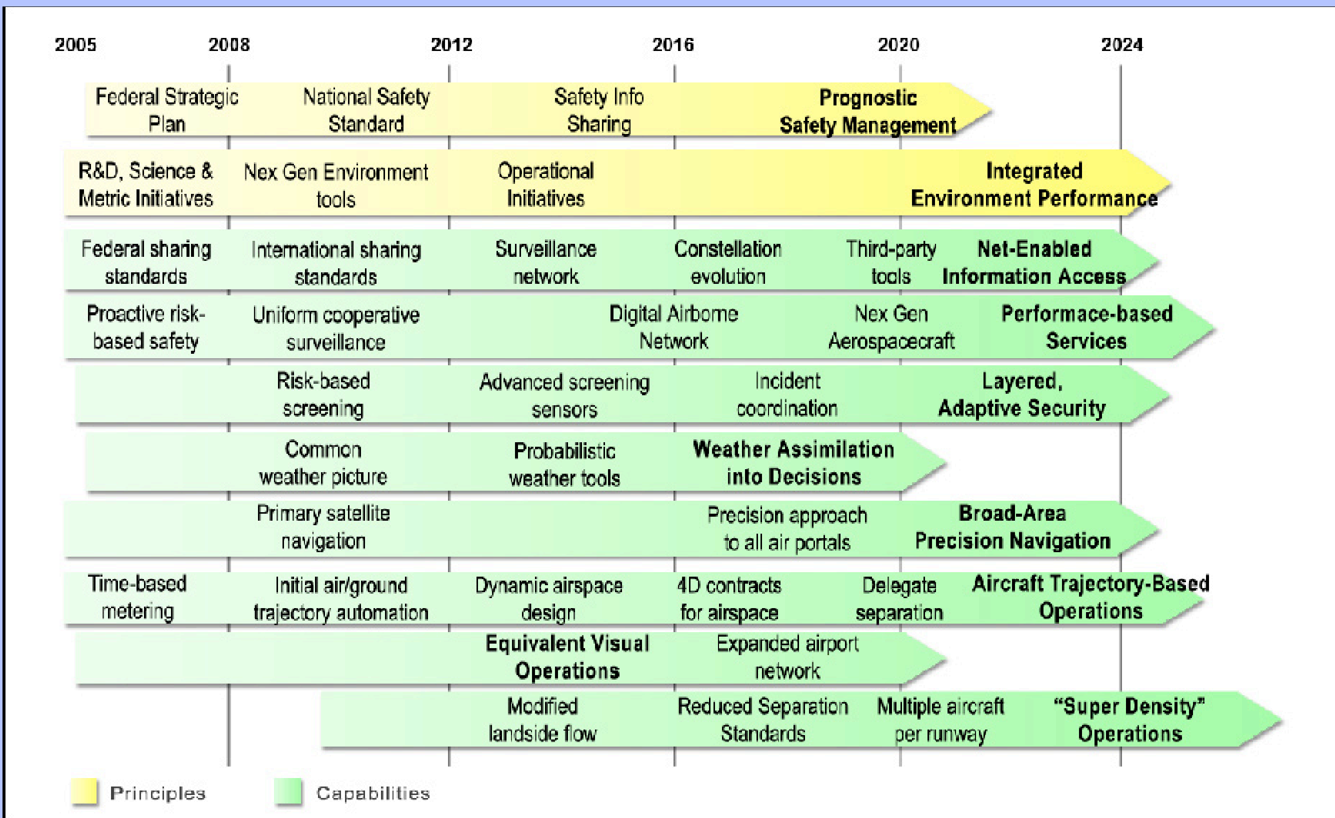
NGATS Capability Roadmap



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C. The NGATS Roadmap – A Pathway to the Future

The operational vision is great, but how do we get there? A map always helps, and that is what the JPDO created in 2005: the NGATS Capability Roadmap, which lays out a high-level path, timelines and key transition states and sequences for each of the eight NGATS capabilities leading to the 2025 system. The 2005 NGATS roadmap illustrated above builds on the initial NGATS Roadmap published last year in the NGATS Integrated Plan. As the operational vision matures, so does the Roadmap to achieve it.

For example, an initial step toward globally secure information access is to create Information Data Sharing Standards, which is identified on the roadmap as one of the first major steps along the path to full Network-Enabled Information Access in 2025. There are other milestones on the road to the future system.

By the end of 2008, Time-based Metering is expected to be in use nationwide, enabling more efficient control of air traffic flows. Air/Ground Trajectory Automation will increase flexibility for user needs through a more-efficient, environmentally compatible, and safe air traffic management system. Ultimately, the system will evolve to Aircraft Trajectory-based Operations in 2025.

Uniform Cooperative Surveillance will be in place under the ADS-B program during the 2007-2012 timeframe, followed between 2012 and 2016 by a more robust Surveillance Network implementation in the Network-enabled Information Access capability. Not only air traffic service providers, but also those agencies responsible for airport, passenger, cargo security and homeland defense will reap the benefits of Network-enabled Information: more efficient and safe air traffic management and flight operations, as well as greatly enhanced shared situational awareness both on the ground and in the air. And with such a system in place, the U.S. government can begin to retire its resource-intensive and costly ground-based navigation infrastructure.

It should be noted that other roadmaps, such as ICAO's Global Air Navigation Plan for CNS/ATM Systems and its Operational Concept, were scrutinized during this analytical process. This was necessary to identify any gaps or divergences that must be overcome if true global harmonization is to be achieved.

A 2005 Product

D. The NGATS Portfolio

Whereas the NGATS roadmap describes the evolution of the air transportation system toward the 2025 Operational Vision, the NGATS portfolio is comprised of specific operational improvements and the research, analysis, and demonstrations that lead to them. These portfolios also provide much needed near-term detail for all required investments found in the roadmap. Implementation of these systems and procedures must also be selected, scheduled, and optimized along the path to 2025.

D1. Implementation

To best achieve the Next Generation System, we must develop several intermediary states of transformation, or "segments" of the final 2025 portfolio. The set of operational improvements selected for implementation and the research required to support future implementation decisions constitutes a "segment portfolio."

A 2005 Product

NGATS Initial Segment Implementation Portfolios

Essential prep for NGATS (FY06-07)	Segment 1 Portfolio (FY08 start)	Segment 2 Portfolio (FY10 start)
• *Policy:* NGATS architecture & standards for net enabled information access	**Early Opportunity** • FAA-DoD-DHS net enabled information access to strengthen national security	• FAA-DOC-User net enabled information access to reduce operator costs **2007**
	• *Policy:* NAS rule for SatNav	• SatNav is primary means of domestic area navigation • 4D-trajectory delivery via datalink to improve efficiency
Early Opportunity **2007** • *Policy:* Define levels of service for NGATS	• RNP routes to congested runways and along constrained approach paths to increase capacity	• RNP routes to all congested runways and along all constrained departure/approach paths to increase capacity
• *Policy:* Define processes for creating new RNP routes	• Environmentally favorable RNP routes	
• *Policy:* Initiate NAS rule(s) for ADS-B	**Early Opportunity** • Cooperative surveillance in major terminal areas via ADS-B to increase safety & security	• Cooperative surveillance enroute via ADS-B to improve efficiency **2007** • Self spacing in terminal area via CDTI to reduce excess in-trail spacing and improve arrival throughput
	• Explosive trace detection screening technology to improve security • Enhanced vehicle tracking to improve security	
	• Better terminal-area forecasts improve runway configuration planning and management, reducing terminal-area delays	• Integrate airborne weather sensors into NEO to increase safety and capacity • Provide national weather products to all users via NEO to reduce weather delays
	• Implement time-based metering nationwide (including point-in-space) to increase capacity	• Enroute 4D-trajectory management to increase capacity
		• Distribute volumetric SUA and TFRs via NEO and manage them dynamically to increase capacity • Collocated ATC service delivery points to reduce cost
RNP Required Navigation Performance NEO Network-Enabled Operations 4D Four-dimensional (x, y, altitude, and time)	ADS-B Automatic Dependent Surveillance–Broadcast CDTI Cockpit Display of Traffic Information SatNav Satellite Navigation	NAS National Airspace System SUA Special-Use Airspace TFR Temporary Flight Restriction

The "NGATS Initial Segment Implementation Portfolios" table presents the 1st and 2nd segment portfolios. We will leverage existing agency plans and initiatives to deploy these initial capabilities, which in turn lay the groundwork for long-term transformation, moving the nation past the FAA operational evolution plan and launch a national plan for the future air transportation system.

Segment 1 (center column) will use FY08-09 money for development and FY10-11 money for implementation. Segment 2 (right column) will use FY10-11 money for development and FY12-13 money for implementation. Before any segment portfolio can be implemented, essential preparatory work (left column) must be completed. It largely consists of policy initiatives, including national airspace system (NAS) rulemaking and certification efforts.

Given its fundamental importance to the success of the Next Generation System, establishing an initial Network-enabled Operations (NEO) capability is a high priority. Current efforts focus on identifying the network architecture and enacting standards for information and safety data sharing. In Segment 1, infrastructure and procedures will be developed and implemented to enable FAA, DoD, and DHS to share information intelligently and efficiently. As previously discussed, a network-enabled architecture will strengthen national security through shared situational awareness. Segment 2 investments will add the Department of Commerce and user groups (e.g., airline operations center) to this expanding information network, thereby including weather information.

Satellite navigation (SatNav) is also a key enabling technology to reduce separation standards and expand airspace capacity while enhancing safety. Once in place, SatNav will become the primary means of navigation in domestic airspace in segment 2. These steps will significantly increase airspace capacity and efficiency, allowing the FAA to gradually retire its inventory of ground-based navigation aids in later segments of the 2025 portfolio.

Required Navigation Performance (RNP) has a prominent place, too, in this initial segment portfolio – and for good reason. RNP routes are expected to be a more efficient alternative to today's procedures. RNP's benefits are clear: far more efficient air traffic management (ATM), improved safety in all stages of flight, reduced fuel costs for the airlines, and reduced environmental impacts from noise and emissions. Development of RNP routes is already underway at some airports.

Initial Segment Research Portfolio

Capability	Segments 1 & 2 (FY08 - 13)
Network-Enabled Information Access	• Auto-Negotiation for Air/Ground, Ground/Ground • Airborne Information Web
Performance-Based Services	**Early Opportunity** (2007) • Required Total System Performance (RTSP) • Levels of Service as a function of safety, aircraft and operational capabilities (align service levels to RTSP) • Aircraft Noise and Emissions
Layered, Adaptive Security	• Passenger and cargo screening • Adaptive Security Envelopes, positive people & cargo ID • Improved threat detection, aircraft & facility hardening
Weather Assimilated Into Decisions	**Early Opportunity** (2007) • Weather models to produce common formatted output • Development and initial implementation of a weather information system.
Broad-Area Precision Navigation	• Primary and Back-up Navigation requirements
Aircraft Trajectory-Based Operations	**Early Opportunity** (2007) • Methodology and toolsets for dynamically reconfigurable airspace • "Evaluator" functionalities such as prediction of incompatible user plans, framework for "final arbitration" decisions, 4D trajectory management (continuous vs coordination points, level of precision, etc) • Roles of humans and automation • Allocation of functions between service provider and user/operators • Machine-based trajectory analysis and separation assurance • Procedures/methods for environmental impact reduction
"Equivalent Visual" Operations	• Data and analysis for ADS-B air-to-air separation
"Super Density" Operations	• Closely spaced, optimal-use runway separation standards (parallel, converging, crossing) • Single and multiple runway research • Wake Vortex Prediction (predictable detection/integration of wake vortex hazards)

However, the first necessary step toward realizing RNP's full efficiency benefits will be getting a definition of "levels of service." With it we can govern usage of RNP routes. Once processes for developing and introducing new RNP routes are in place, Segment 1 will build and then initiate use of RNP routes on congested runways and along constrained approach paths. Segment 2 will expand this capability to include all congested runway ends and all constrained departure/approach paths.

ADS–B will also be among the first new systems to see operational use **(see next section 3 - Initiating Research and Implementation for NGATS)**. A key part of network-centric air traffic management, it provides a unique way to identify nearby aircraft, provide information to the pilot, and reduce separation between planes. As a result, safety and security are expected to benefit in the near term. There is an immediate need, however, for government rulemaking to govern minimum ADS–B equipage. Once that is in place, Segment 1 will deliver improved surveillance accuracy; Segment 2 will enable initial ADS-B airborne applications.

D2. Research Portfolio

During the Segment 1-2 time period, research that leads to improvements in Segments 3 and beyond will be conducted. The above "Initial Segment Research Portfolio" table represents a balance between them: near-term research necessary to refine well-understood capabilities and to support policy decisions; long-term research to better understand operational concepts; and basic research to further the state of the art in a particular discipline.

III. Initiating Research and Implementation for NGATS

"And we don't have to wait until 2025 to see changes. By focusing current investments on Next Generation Systems, we are making an operational difference today."

Department of Transportation Secretary Norman Y. Mineta
"Airport 2025" Remarks
June 28, 2005

A. Examples of Early Success – Leveraging the FY 2007 Agency budgets for the NGATS

In July 2005, based on the roadmap and initial segment portfolios, and under the direction and guidance of its Senior Policy Committee, the JPDO conducted its first Inter-agency Program Review (IPR). The goal was: (1) to perform a structured assessment of aviation research programs/projects across the federal government; and (2) then identify and leverage examples of how interagency collaboration could deliver NGATS capabilities in the FY 2007 budget. Based on this review we became aware of the opportunity to leverage certain ongoing activities the results of which are captured in the summaries below. The "2007" brackets in the segment portfolio table found in the previous section refer to the opportunities in the table below. This review identified opportunities or projects that would help pave the way for the broader implementation planned later on the roadmap. This work also identified areas for more effective interagency collaboration. We plan on conducting further IPR's throughout the duration of the effort to further align and prioritize investments as we mature the initiative.

Opportunity	Associated Agencies
Start ADS-B	FAA, DoD
Start net enabled information access	DoD, DHS, FAA
Synchronize weather research and accelerate development	FAA DoC, NASA, DoD
Define Required Total System Performance (RTSP) levels of service	NASA, FAA, DoD
Initiate Aircraft Trajectory-Based Operations Research	NASA, FAA, DoD, DHS

Start Cooperative Surveillance (ADS-B)

The key component of the NGATS "Net-Enabled Information Access" capability is a "cooperative surveillance" model for civil aircraft operations where aircraft constantly transmit their position, flight path intent, and other useful data. This information will then be combined with data from a sensor-based surveillance system that tracks other "non-cooperative" targets. Together, they will form an integrated federal surveillance approach to tracking airborne vehicles. The President's FY 2007 budget request for FAA asks for funding ADS-B to support the transition to the air traffic surveillance architecture which incorporates ADS-B in the near-term and relies on it in the mid-term (e.g., about 2015).

The benefits of this action are clear: (1) early implementation of key infrastructure elements that are critical to the Next Generation System; (2) alignment of technical expertise and efforts across agencies (including private sector involvement); (3) reduced FAA operating costs for air traffic surveillance services; and (4) operational benefits for users who elect to equip with minimum ADS-B equipment. In July 2006, the JPDO will conduct an ADS-B National Deployment technology demonstration project. It will also carry out a related Capstone Phase III project that will help to extend safety benefits from WAAS (Wide Area Augmentation Service) routes, weather infrastructure and air-to-air ADS-B in Alaska to additional areas in the state.

Start Network-Enabled Information Sharing

This is the situation today: The DoD has already invested considerable resources in information technology and telecommunication research focused on NEO and information access/sharing. DoD's efforts with the Global Information Grid (GIG) alone are significant in breadth and allocated resources. As previously described, FAA, DHS and Commerce are also committed to developing network-centric information architectures.

The opportunity now exists to synchronize those efforts, especially in the areas of data interoperability and compatible network-to-network interface mechanisms. Two on-going DoD initiatives – the synchronization of DoD and DHS classified networks and DoD's development of its Net-Centric Enterprise Services – will serve as templates for this effort.

Using these two templates, JPDO will then coordinate: (1) development of the FAA's transitional network-centric information architecture; 2) DHS integration of its numerous unclassified networks; and (3) integration of Weather Information Network. In July 2006, the JPDO will also conduct a demonstration project involving the FAA's SWIM (System-wide Information Management) program – the beginning of network-centric operations in the NAS.

Indeed, the FY 2007 President's budget request for FAA has asked for funding for SWIM. This opportunity is also enhanced by the on-going federal information sharing initiative outlined in Executive Order 13356 and directed by the President's Federal Information Sharing Program Manager.

As previously discussed, the Next Generation System will be network centric and the benefits extend from security to greater capacity and safety to cost savings.

Synchronize Weather Research and Accelerate Development

Current weather research efforts span four departments/agencies (FAA, NASA, DoC, and DoD); each tailored to its own mission. Synchronizing these efforts will allow us to align the four agencies toward a common weather capability which each agency can then tailor to its own mission. Of great importance, this action will accelerate the first enabling component of the NGATS weather vision to 2012 or earlier.

By updating existing weather information management standards, policies, and data access/publication privileges, the Next Generation System will provide an integrated platform for weather decision systems. These efforts will harmonize agency programs aimed at the common objective of seamless integration of weather information and aircraft weather mitigation systems into the NGATS. Moreover, it will eliminate duplication and save precious taxpayer dollars.

Define Required Total System Performance (RTSP) Levels of Service

One of the Next Generation System's eight capabilities is providing performance-based services designed to match user performance. Risk analyses (safety, security, environment, etc) will be based on performance-based versus equipment-based approaches. Crucial to this capability is the need to fully define the Required Total System Performance (RTSP) for aircraft avionics and operators.

Varying degrees of work have been accomplished in RNP, Required Communication Performance (RCP) and Required Surveillance Performance (RSP). However, it is incomplete, and little progress has been made towards comprehending RTSP as an integrated whole. Understanding and defining the performance framework, its associated levels of performance, and commensurate levels of service, are a critical early step towards reaching the Next Generation System. Therefore, FAA will accelerate and integrate efforts to develop this required definition; NASA and DoD will participate too. When fully realized, RTSP will help improve safety, increase system reliability and efficiency and will allow for the optimum usage of precious airspace and resources.

Initiate Aircraft Trajectory-Based Operations Research

Current federally-funded research is focused on automation tools that work within the "static" route structure and airspace sector model. It assumes a continued dependence on labor intensive separation assurance. To achieve the NGATS "Aircraft Trajectory-Based Operations" capability, federally-funded research competencies must be redirected to address a variety of key issues including: (1) appropriate function allocations between human and automation, providing a framework of automation-reliant separation assurance; (2) appropriate function allocation between aircraft operators and their air traffic service provider, under a wide variety of ATM system operating conditions, while providing maximum flexibility to operators; (3) develop toolsets and operational concepts for creating and altering dynamically reconfigurable airspace that enables as many user-preferred 4D trajectories as possible, and (4) define an integrated framework for ATM system-level trajectory planning/execution across the spectrum of time horizons from 'strategic planning' to 'separation management', including surface segments of the aircraft trajectory.

IV. Understanding the Preliminary NGATS Cost Analysis

"Many have suggested that creating a Next Generation System might be a budget buster and therefore a non starter in these challenging fiscal times. To the contrary, we are using the JPDO process as a way to ensure full participation across agency lines, and between the government and private sector, in ways that simply have not been done in the past. We already have a sizeable amount of resources being spent each year on air transportation research. By better coordinating our actions and tying them to a long-term integrated national plan we can maximize the benefits of those private and public investments."

DOT Undersecretary for Policy Jeffrey N. Shane
Testimony before the House Aviation Subcommittee
April 14, 2005

In 2005, JPDO efforts to define the NGATS system provided the basis for justifying specific programmatic investments during the development of the 2007 President's budget as well as a starting point for developing a long-term NGATS cost-estimate. The JPDO is working with the member agencies to ensure that the current funding is leveraged and aligned with NGATS system requirements and associated technologies to effect timely transformation results. For example, DOD has done extensive work in the area of network-centric information sharing. The FAA will take advantage of this investment as we begin to put in place the equivalent civil capability. The President's $24 million request in the FY 2007 budget for the internet-like System Wide Information Management network at FAA is an important step in this direction. Another example of how the JPDO is affecting near-term actions within the government is the Department of Transportation's FY2007 budget request of $80 million to begin implementing Automatic Dependent Surveillance-Broadcast (ADS-B) through out the National Airspace System. This technology will implement a cooperative surveillance solution that is more accurate and enables more capacity and efficiency than current surveillance systems. Additionally, NASA will implement a completely replanned Airspace System Program in FY2007 that is aligned with key NGATS research requirements.

"The key to JPDO success at this stage is not an infusion of funds but rather how well it leverages research dollars managed by the other agencies, including the National Aeronautics and Space Administration and the Department of Defense."

Kenneth M. Mead
Inspector General
U.S. Department of Transportation
Testimony before the House
Aviation Subcommittee
April 14, 2005

As well as seizing such immediate alignment and leveraging opportunities, the JPDO is also working to identify the longer-term costs. The JPDO conducted a low-fidelity financial analysis of the air traffic management portions of NGATS. It included examining the existing 2025 operational vision to understand the hardware and software components that may be required to implement NGATS. Because of the high level of uncertainty in some areas and a significant number of assumptions in others, more work is required before this analysis can be useful and credible.

For example, some key areas such as automation are in the pre-requirements research phase. Two examples of the type of assumptions that are critical to any cost analysis are the timing of FAA facility consolidations which can have a substantial impact in reducing projected costs; and the timing of any new equipage or software mandates on the aviation industry as a result of NGATS.

In order to address these matters and to better understand the costs and benefits of NGATS, we have asked the NGATS Institute to host a forum so that the critical assumptions and uncertainties underlying any cost benefit effort can receive scrutiny and be validated for further use. That forum is scheduled to occur in Spring 2006, and will involve a wide cross-section of aviation decision-makers. In addition, further detailed studies will focus on the near term costs and benefits which will be used to inform more immediate agency planning activities over the next five years. We will then expand our cost analysis to consider the expected total systems costs for NGATS.

V. Engaging the Private Sector – The NGATS Institute

"You can see that the Institute has a very difficult job – to ensure that the JPDO has absolutely the best people working on these problems and to do so in a fair and balanced way. I am confident that they can do it."

FAA Administrator Marion C. Blakey
Aerospace Industries Association Speech, "The Best and Brightest"
February 28, 2005

The NGATS Institute

Just as the JPDO process represents a bold departure in the way that federal agencies work together to achieve common objectives, VISION 100 envisioned a new and revolutionary way for government and the private sector to interact to achieve the Integrated Plan's objectives.

We recognized early on that the preliminary technical plans we will propose would need the benefit of private sector expertise. These plans must mature, and we must make sure that the solutions we derive reflect the wisdom and perspective of the broadest range of stakeholders. That is where the innovative NGATS Institute comes in.

Stood up earlier this year, the Institute is the functioning arm of fifteen organizations representing major aviation stakeholder communities. The Institute allows industry to become directly supportive of the NGATS vision as full members in the transformation process.

Seen from a high level, the Institute is intended to provide an unbiased diversity of ideas, analysis, and research during the early planning phases. These ideas will then be used to establish and define the NGATS functional capabilities, such as enterprise architecture, requirements, and operational concepts.

The Institute's first task is to help populate the eight IPTs. We want to make sure the IPTs have the best and brightest technical experts industry can offer. The IPT is assisting the JPDO by assigning private sector technical, scientific and professional talent on selected working groups, studies and R&D efforts identified by the JPDO IPTs. This will include possible technology demonstrations in support of the NGATS objectives as being defined in the concepts of use. Private sector technical, scientific, and professional talent will also serve on selected work groups, perform studies and R&D projects identified by the JPDO, and conduct technology demonstrations in support of NGATS objectives.

The Institute will oversee how private sector resources are selected and applied to the NGATS mission. We will also benefit from the extensive experience industry stakeholders have gained through other transformational initiatives.

So, rather than observing and commenting, the private sector will join with the government as a full partner in the NGATS development process – something rarely achieved in government before. These efforts will guarantee the establishment of a collective enterprise among key stakeholders to achieve the transformation, as well as to ensure that we fulfill our critical obligation to create a process that is transparent and fully open to public scrutiny. Additional ways of engaging the private sector will be proposed during implementation and later phases of NGATS development.

The Institute is managed on a day to day basis by the Executive Director, a senior member of the Master IPT and who reports directly to the Director of the JPDO. The Executive Director works closely with the JPDO leadership team and the IPT Directors to ensure effective and diversified industry participation. As the lead industry representative assigned to the JPDO, the Executive Director is also responsible to the Industry Management Council (IMC) which functions essentially as the Industry Board of Directors for the Institute.

V. Engaging the Private Sector – The NGATS Institute

In addition to the day to day support of the IPT and JPDO leadership, the Institute will also respond to directed requests for more specific industry contributions related to technical, economic and operational issues identified by the IPT and approved by the JPDO management. Included in this will be requests for detailed input on anticipated concepts of use and operational scenarios that the user community will require of NGATS. The JPDO will request additional support for specific technology analysis and independent assessments via the Institute to help the JPDO IPTs continue to develop the capabilities and identify issues and challenges related to NGATS users. The Institute will support these specific requests for direct IPT support by providing the process and venue for announcing the requests to industry and awarding the subsequent tasking to the industry individual, team or group with the most responsive and cost effective answer to this request for industry support.

IMC Participants
Airports Council International - North America http://www.aci-na.org
Aerospace Industries Association http://www.aia-aerospace.org
Air Line Pilots Association http://www.alpa.org
Aircraft Owners and Pilots Association http://www.aopa.org
Air Transport Association http://www.airlines.org/home/default.aspx
Air Traffic Control Association http://www.atca.org
Embry-Riddle Aeronautical University http://www.erau.edu
General Aviation Manufacturers Association http://www.gama.aero/home.php
Helicopter Association International- http://www.rotor.com
National Association of State Aviation Officials http://www.nasao.org
National Business Aviation Association http://www.nbaa.org
National Business Travel Association http://www.nbta.org
Regional Airlines Association http://www.raa.org
Radio Technical Commission for Aeronautics http://www.rtca.org

VI. Summary and the Road Ahead

"The Next Generation initiative is the real deal – one of the most important aviation programs the government has undertaken in many years, and is yet a further example of our determination to get out in front of changes before they swamp us."

DOT Undersecretary for Policy Jeffrey N. Shane
Remarks before the American Bar Association Forum on Air & Space Law Annual Meeting and Conference
Montreal, Canada
October 1, 2005

The past year was marked by significant progress and milestones. A solid foundation was set down upon which we can now start building the Next Generation System. In 2005, we brought the 2025 NGATS vision into much greater focus and after rigorous analysis determined that we can achieve our goals. We created the NGATS Capability Roadmap which lays out a high-level path, timelines and key transition states and sequences leading to the 2025 system. And based on the roadmap, we developed an initial portfolio of needed policy, research and transformational efforts. We also created and stood up the NGATS Institute which will allow for full private sector participation in the transformation process.

Of great significance, JPDO conducted its first preliminary interagency program review where it identified five examples of how interagency collaboration could deliver NGATS capabilities in the FY 2007 budget. And in a defining action, the JPDO recently examined the entire portfolio of aviation-related research across government, and the Senior Policy Committee took the critical initial steps to align departmental/agency resources. Greater gains and more benefits will be realized in the out-years.

In 2006, the JPDO will build on these successes and begin to generate tangible and cost-effective benefits to users and providers through the six jump-started projects. We have taken to heart Secretary Mineta's words: transformation starts today – and it has and will continue in 2006. We must sustain the momentum we generated in 2005.

There are five major efforts which will facilitate the continued momentum into 2006:

- Provide NGATS planning and programming guidance to each participating agency
- Expand industry participation.
- Establish enterprise engineering integration discipline
- Implement portfolio management
- Ensure a more global and international focus

First, the JPDO will move from reacting to current agency/departmental plans and programs to providing recommended guidance at the start of each agency's planning cycle. Relevant aviation research programs, plans and dollars must now be aligned to the Next Generation System and meet required deadlines.

Second, private sector participation will begin in earnest through the NGATS Institute. The IPTs will be fully populated with top-notch technical experts, and funded studies will commence by the end of the first quarter.

Third, all planning will be driven by analysis, enterprise engineering and integration discipline. Indeed, the NGATS concept of operations and roadmap will be integrated into a formal enterprise architecture, ensuring that dependencies, gaps, overlaps and costs are fully understood and resolved.

Fourth, portfolio management will be formalized with links established to the key research and implementation programs across the NGATS member agencies. We expect to develop a functional and vetted enterprise architecture and portfolio.

Lastly, we will bring an international focus today to ensure seamless global operations in the future.

VI. Summary and the Road Ahead

The past year has been about laying a firm foundation for transformation: building interagency partnerships, aligning programs, creating the NGATS baselines, and defining where we can start research that can be implemented in FY2007. The year 2006 will see a true national public/private partnership emerge, much greater definition and detail in the NGATS concept of operations and roadmap, and a thorough understanding of the total portfolio of investments and actions necessary to achieve greater benefits in FY2008 – benefits that will ultimately help take us to the system of the future.

Appendix I

Managing the Initiative – Changing the Way We Work Together

The program management infrastructure directs two critical operations:

1. The institutional structure required to bring together the complex and heterogeneous organizations.
2. The technical structure required to plan, design and build a complex system of systems.

Institutionalalizing the NGATS Initiative: Structure for Dialogue and Success

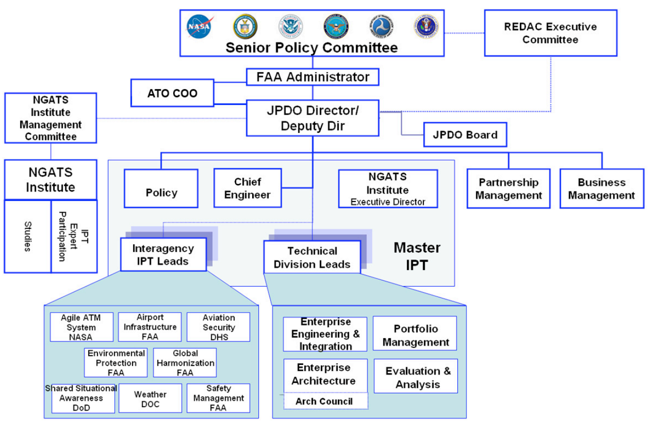


Figure 1. Organized for the NGATS to Provide Structure and Open Dialogue to All Stakeholders

Senior Policy Committee

The Senior Policy Committee (SPC) provides high-level guidance, resolves major policy issues, and identifies resource needs. Changes to the President's second-term Cabinet affected membership of the SPC. The Secretary of Transportation continues as chair of the committee, which includes the Deputy Secretaries of Commerce and Homeland Security, the Secretary of the Air Force, the NASA and FAA Administrators, and the President's Science Advisor. The SPC has met three times since its inception, the first time in October of 2004, in June 2005 and met again in November 2005.

Executive Advisory Committee

The FAA Administrator established a high-level executive advisory committee under the auspices of the Research, Engineering & Development Advisory Committee (REDAC) to advise the SPC on periodic, in-depth reviews of NGATS progress. The committee includes distinguished individuals with direct, senior experience in aviation development and operations, large system development and acquisitions, and major transformational change efforts.

JPDO Board

An adjunct to the SPC is a Board of senior executives representing the five federal agencies involved in the NGATS initiative. Each Board member reports to his or her respective SPC member and actively advises the JPDO on ways to create alignment among the member agencies.

Integrated Product Teams

Eight Integrated Product Teams (IPTs) were established in late 2004 to plan and own the execution of the corresponding NGATS strategies. These teams of government and private sector technical experts are applying best practices to achieve their assigned objectives. The IPTs are working closely with our stakeholders to ensure that they have an early window into our thinking and that we take full advantage of their expertise along the way.

The primary responsibility for assembling and leading each IPT belongs to one of the Next Generation System's participating government agencies. The JPDO is responsible for approving the IPTs' broad strategies as part of the Integrated Plan and ensuring their plans and schedules are consistent with the overall roadmap and enterprise architecture. Agency leadership and the function of each IPT are shown below:

1 NASA – Establish an Agile Air Traffic System
2 FAA – Develop Airport Infrastructure to Meet Future Demand
3 FAA – Formulate Environmental Protection that Allows Sustained Aviation Growth
4 FAA – Harmonize Equipage and Operations Globally
5 FAA – Establish a Comprehensive Proactive Safety Management Approach
6 DHS – Establish an Effective Security System without Limiting Mobility or Civil Liberties
7 DoD – Establish User-Specific Shared Situational Awareness
8 DOC/NOAA – Develop a System-wide Capability to Reduce Weather Impacts

Master Integrated Product Team

The technical work of the JPDO is handled by the Master Integrated Product Team (MIPT), established early in FY 2005. Under the chairmanship of the JPDO Deputy Director, this body is responsible for guiding JPDO technical directors and the eight IPT directors (who are members of the MIPT) in their planning processes.

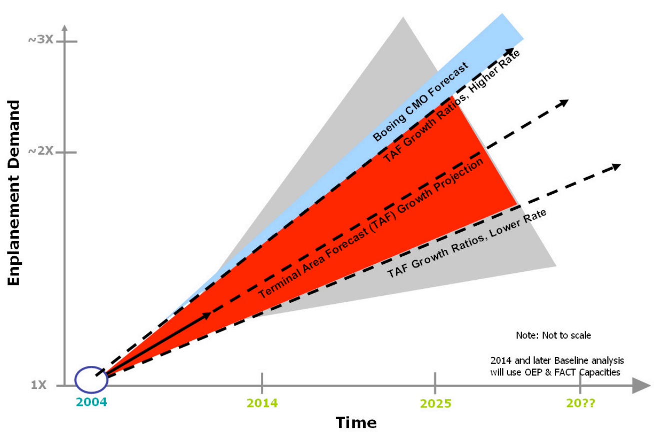
The purpose of the MIPT is to ensure that individual IPTs do not develop autonomous cultures/program objectives. An equally important objective is to formalize appropriate cooperation and collaboration across these individual constituencies. Within this cooperative environment, the MIPT is ultimately charged with formulating a single integrated transformation plan.

Having formulated the Integrated Plan, it has become the responsibility of JPDO technical directors to oversee the integration of NGATS strategies. These strategies were, in turn, translated by the JPDO into the following functional Divisions: enterprise architecture, systems engineering and integration, evaluation and analysis, and portfolio management.

Appendix 2

Evaluating the Operational Vision

The NGATS is designed to address many of the most significant limitations to growth in operations in the current air transportation system. These include runway capabilities and the limitations of ground-based control of en route and terminal area airspace as well as the resilience of the system under adverse weather conditions. During 2005, the JPDO analyzed and defined current system performance in enough detail to be able to discern when and where performance limitations restrict desired demand. It examined a number of capacity performance indicators, representing different market segments (passenger, general aviation) airport domains, etc. From this work we were also able to produce an initial assessment of the high-level capability concepts proposed by the Agile Air Traffic System, Shared Situational Awareness, and Weather IPTs. This analysis is part of an ongoing process to identify the requirements of the National Airspace System (NAS), the impact of NGATS strategies, and the most appropriate areas for investment in research, development and implementation.



Modeling such long-range futures is complicated by the fact that many of the elements of the NAS are likely to change significantly from the present, such as the aviation business model (more point-to-point or air taxi operations); the complexity of operations; the airports they access; and the flight schedules. For that reason, various "demand" assumptions were made: one reflects the FAA's baseline forecast; others include accelerated growth rates and changes in aircraft fleet mix that may result from the diversification of airline business models.

One of the reasons that these variations are crucial is that the predicted point in time at which 3x operations must be accommodated has a significant impact upon our assumptions about how the currently configured NAS will perform – most importantly, about which airports and runways are used and how much more runway capacity may be captured.

System capacity can be expressed in many different ways but fundamentally it indicates the system's ability to accommodate a number of flights over a unit of time. Alternative measures, such as revenue passenger miles, operations per flight segment (measuring the number of pilot/controller interactions) are capacity metrics of interest depending upon the performance objective being reviewed. This year's analysis focuses on the impact of NGATS on the number of flights the system can accommodate. The baseline system capacity of the NAS to accommodates a total of approximately 100,000 commercial, general aviation, and military flights on a high-demand day. This number of flights would scale up to meet demand in the 2025 timeframe in a way that would result in nearly three times as many operations in some of the most densely used airports in the system. If airlines begin to do business in a dramatically different way, or new aircraft are used in the general aviation fleet, the scaling might be even higher. The JPDO assessments of future system performance therefore allowed for variation in the business model, including a hub-and-spoke model and a shift to the use of smaller regional airports for point-to-point operations. No matter which assumed demand growth rate was used, results indicate that the baseline system will not provide enough capacity to accommodate the levels and types of demand that it will face in future years.

NGATS is the key to providing the additional system capacity that will be required to satisfy much of future demand; however, this analysis only addresses a portion of NGATS. Significant NAS performance gaps in the future may lie with en route capacity management, the impact of weather, as well as the ability of terminal security processing capacity to keep pace with passenger volume.

In the long run, even the NGATS changes assumed in the current system of managing en route capacity and improved efficiency at the most heavily utilized runways are insufficient to meet demand; to be flexible enough to accommodate the full range of possible demand levels in the future, additional airport utilization, an even more radical transformation in the en route management system, and additional runway strategies will be needed.

In the initial assessment the elements of the NGATS plan that were modeled for their capacity impacts were those that improve airport accessibility and runway throughput, en route capacity management, aircraft situational awareness and resilience of flight operations under significant weather conditions. NGATS concepts will extend well beyond these basic elements, such as the use of true 4D trajectory management and dynamic resectorization. The details of these more advanced concepts are in the research phase, and therefore their specific impacts have yet to be fully realized in the analyses conducted to date. The NGATS concept attributes were mapped to overall increases in current airspace capacity (sector capacity in today's terminology) and increases in airport capacity (runway arrival and departure rates). This basic paradigm is revealing, in that it both illustrates the long-term impact of NGATS and the potential transition impacts from today's system into the future.

Increases in capacity were assigned based upon current, well-established research regarding elements that form the basis for the planned NGATS concept of operations; however, the research fails to reflect interactions among the elements of the concepts. Therefore, the models revealed that the integrated NGATS plan's potential for increased capacity exceed the individual estimates of specific studies. For example, NASA's research in advanced air traffic management concepts feature characteristics of the NGATS operational vision for en route capacity enhancement; specifically, studies indicate that a 200% increase in sector capacity is feasible. Similarly, NASA and FAA research into wake vortex mitigation and avoidance provided a basis for modeling NGATS benefits in expanding runway arrival and departure capacity. Similar studies of the impact of 4D optimized routing in the limited area of the terminal airspace, conducted by MITRE, indicate a 14% increase in terminal area as well as additional runway capacity through no lost runway use (no slot spoilage). Results from all of these studies, as well as others, were used in combination to create a representation of the possible future under the NGATS plan. The resulting efficiency gains for the current system as well as the tremendous growth in usable capacity (within the currently underutilized regional airport system) results in significant capacity increase overall.

Modeling results based on NAS-wide simulations compare the known short-fall for 2x current (2004) demand with complete Operational Evolution Plan (OEP) implementation and the number of operations enabled with NGATS capabilities. NGATS results for the en route, weather and situational awareness components of the plan enable approximately an additional 11,000 daily flights beyond what OEP improvements alone can accommodate. For 3x current demand, NGATS enables over 17,000 additional daily flights beyond predicted OEP-enabled capacity. In terms of Revenue Passenger Miles (RPMs) per day, for 2x current demand (approximately 8,000 million daily RPMs), NGATS can accommodate a total of approximately 7,500 million daily RPMs or 94% of the forecast demand. For the 3x demand case (approximately 12,500 million daily RPMs), NGATS can accommodate a total of approximately 9,900 million RPMs per day, or 79% of forecast demand.

The current NAS includes airports of widely varying operational capacities. Analysis shows that the available capacity at the intensely-used, capacity-constrained airports becomes the significant barrier to growth between 2x and 3x demand. Additional capacity improvements are expected from strategies in NGATS that affect the number of runways that may be safely operated and the complexity of those operations at airports in the terminal area. In addition, the NGATS will enable the seamless integration of existing secondary airports into the system with the functional capacity of primary airports, further expanding the capacity of the future air transportation system. The JPDO analysis identified a number of airports that are capable of accommodating an additional runway within the existing airport boundaries. Integration of regional airports within the vicinity of the OEP airports and the addition of runways at selected airports increases the number of enabled annual operations beyond OEP capacity. The combination of OEP, NGATS, the integration of secondary airports, and additional runways increases total system throughput to approximately 7,925 million daily RPMs (99% of forecast demand) for the 2x scenario, and approximately 11,000 million daily RPMs (88% of forecast demand) for the 3x scenario. While this is not the 100% solution; the reasons for the shortfall provide informative implications for the planning of NGATS itself.

Appendix 3
Acronyms

4D	4 Dimensional
ADS-B	Automatic Dependant Surveillance – Broadcast
ATM	Air Traffic Management
CNS	Communication, Navigation and Surveillance
DHS	Department of Homeland Security
DoD	Department of Defense
F&E	Facilities and Equipment
FAA	Federal Aviation Administration
GIG	Global Information Grid
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
ICAO	International Civil Aviation Organization
ILS	Instrument Landing System
IMC	Institute Management Council
IPR	Inter-agency Program Review
IPT	Integrated Product Team
IRS	Internal Revenue Service
JPDO	Joint Planning and Development Office
MIPT	Master Integrated Product Team
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NEO	Network Enabled Operations
NGATS	Next Generation Air Transportation System
NOAA	National Oceanic and Atmospheric Administration
OEP	Operational Evolution Plan
R&D	Research and Development
RCP	Required Communication Performance
REDAC	Research, Engineering & Development Advisory Committee
RNP	Required Navigation Performance
RSP	Required Surveillance Performance
RTSP	Required Total System Performance
SatNav	Satellite Navigation
SPC	Senior Policy Committee
WAAS	Wide Area Augmentation Service

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