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Observations on the Progress and Actions Needed to Address the Next Generation Air Transportation System

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Mr. Chairman and members of the Subcommittee:

We appreciate the opportunity to testify on the Federal Aviation Administration's (FAA) *Joint Planning and Development Office* (JPDO) and the plans for the next generation air transportation system. Secretary Mineta has made these efforts a top priority.

The JPDO was mandated by Congress to develop a vision for the next generation air transportation system (NGATS) in the 2025 timeframe and coordinate diverse agency research efforts. This office was established within FAA, and the National Aeronautics and Space Administration (NASA), the Department of Commerce, the Department of Defense (DOD), and the Department of Homeland Security are participating in the JPDO. Thus far, we have focused primarily on the JPDO's air traffic management efforts that involve NASA, DOD, and Commerce.

There are a number of compelling reasons for moving toward the next generation air transportation system. The current air transportation system has served the nation well but FAA reports that the current system (or business as usual) will not be sufficient to meet the anticipated demand for air travel or changes in the industry. Last year, over 700 million passengers used the system, and this number is forecasted to grow to over 1 billion by 2015. It is also important because much of FAA's current capital investment focuses on keeping things running—not new initiatives.

In addition, there is an issue on the horizon that could have tremendous implications for air traffic control—micro-jets (relatively inexpensive aircraft that seat four to five people). FAA expects that over 100 micro jets will enter service next year, growing by 400 to 500 per year through 2017.

Because of the forecasted growth in air travel, the JPDO needs to continue to work on what can be done much sooner than the 2025 timeframe. We made this point last year, and the JPDO is working on what new systems and procedures can be fast tracked. It will be important for the JPDO to show tangible benefits to airspace users from its efforts.

Overall, we found that progress has been made with the JPDO since the office was established 2 years ago. The JPDO has established eight integrated product teams, set up an NGATS institute to interface with industry, and provided Congress with two progress reports. However, the cost and schedule of the next system remains unknown, and considerable work remains to align Agency budgets and plans.

Today, I would like to focus on three points:

- The JPDO's critical role in leveraging resources for the next generation air transportation system.

- Progress and challenges to date in aligning Agency budgets and plans.

- Actions that will help the JPDO keep moving forward in both the short-and long-term.

The Important Role the JPDO Has in Leveraging Resources for the Next Generation Air Transportation System

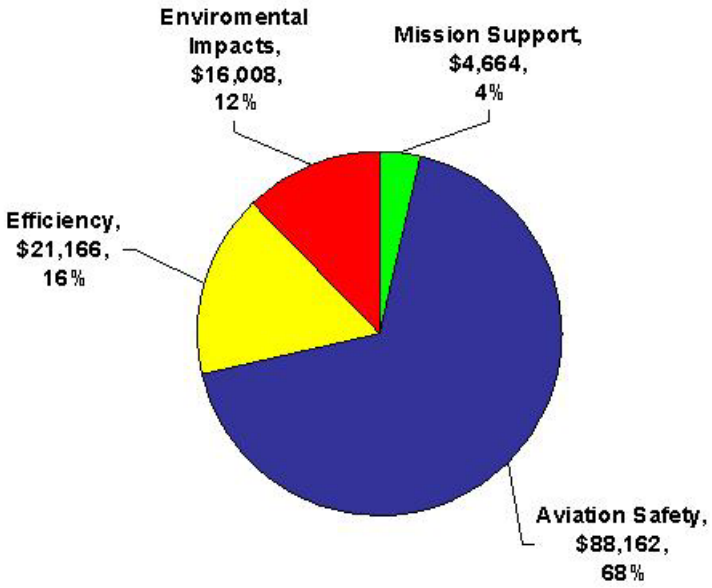
The JPDO is expected to develop a vision for the next generation system and has established ambitious, much needed goals to accommodate three times more air traffic and reduce FAA operating costs. The JPDO also expects a shift from today's ground-based system to an aircraft-based system and to obtain significant controller productivity enhancements through automation. To do so, a multi-agency approach—as outlined in Vision 100—is critical given the current deficit environment, competition for Federal funds, and FAA's tight budget. Moreover, leveraging of scare resources is essential to get the most from each Federal research dollar and prevent duplication.

There are a number of other reasons why the JPDO is looking to other agencies, including the fact that FAA does not conduct much long-term air traffic management research. Further, most of its current $2.5 billion capital account goes for keeping things running (sustainment), not new initiatives.

FAA's FY 2007 Budget Request for Research, Engineering, and Development

FAA is requesting $130 million for FY 2007, a decrease of $6.6 million from last year's appropriated level of $136.6 million. This includes $18 million specifically for the JPDO. Figure 1 illustrates the makeup of the FY 2007 request by major lines of effort.

Figure 1. FAA FY 2007 Budget Submission for R,E & D (in Millions)
$130 Million



As shown above, almost 70 percent of FAA's research budget, or $88 million, focuses on improving safety—not new air traffic management initiatives. This includes projects on fire safety and aging aircraft systems, which focus on preventing accidents and making them more survivable. The remaining funds are requested for efficiency, environmental research, and mission support efforts.

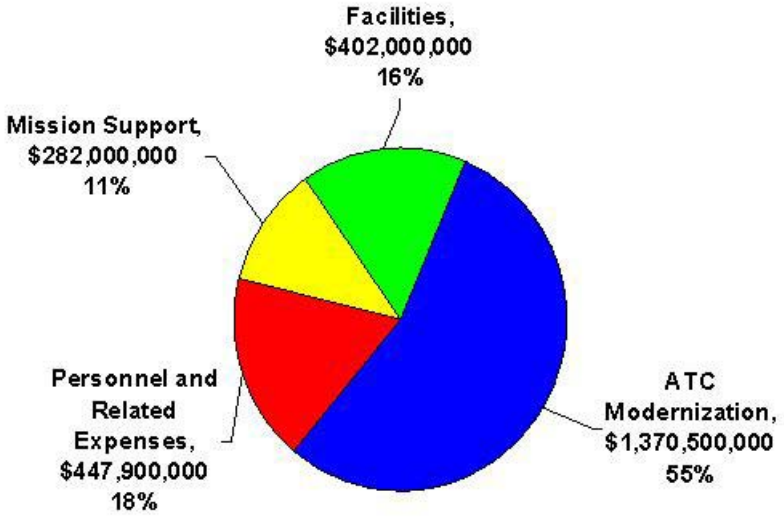
FAA is also requesting research funds from its airport account for safety and efficiency issues. FAA is requesting $17.8 million in FY 2007 for research in the areas of, among other things, airport pavement and airport markings. In addition, FAA is requesting $10 million in FY 2007 for airport cooperative research projects with airports, including efforts to enhance safety and improve airport lighting.

Perspectives on FAA's Capital Account

FAA's capital account—or the Facilities and Equipment (F&E) account—is the principal vehicle for modernizing the National Airspace System. It represents about 18 percent of the Agency's FY 2007 budget request of $13.7 billion. For FY 2007, FAA is requesting $2.5 billion for the F&E account, which is $50 million less than last year's appropriation. FAA has a long history of cost growth, schedule slips, and performance shortfalls with its air traffic control modernization efforts.

As illustrated in Figure 2, only about 55 percent of FAA's FY 2007 request for F&E (or $1.4 billion) will actually go for acquiring air traffic control systems. The remaining funds will be spent on personnel, mission support, and facilities.

Figure 2. FAA's FY 2007 Facilities and Equipment



As we have noted in the past, the majority of FAA's capital account now goes for keeping things running (i.e., sustainment), not new initiatives. A review of the top 10 projects by dollar amount in the FY 2007 request shows some projects will form important platforms for JPDO initiatives. For example, the $2.1 billion *En Route Automation Replacement* Program is replacing the current software and hardware for facilities that manage high-altitude traffic. Attachment A provides details on key, ongoing modernization programs that will likely play a role in JPDO efforts.

However, the bulk of funds are requested for projects that have been delayed for years, as well as for efforts to improve or maintain FAA facilities or replace existing radars. It is important to recognize that FAA's existing investments will heavily influence NGATS requirements and schedule. FAA will have to assess how JPDO plans affect ongoing acquisition projects and determine which ones need to be accelerated or re-scoped.

There are a number of reasons why there is so much discussion about the next generation air traffic management system. For example, over the last several years, FAA has deferred or cancelled a number of projects as funding for the capital account has remained essentially flat. This includes efforts for a new air-to-ground communication system, controller-pilot data link communications, and a new satellite-based precision landing system.

Notwithstanding a tight budget, FAA is requesting funds for two projects in the F&E account that are considered "building blocks" for the next generation system and have potential for enhancing capacity and reducing delays. These are not new programs, per se, and have been under development or been funded in previous budgets.

- Automatic Dependent Surveillance-Broadcast (ADS-B) is a satellite-based technology that allows aircraft to broadcast their position to others. In FY 2007, FAA is requesting $80 million for this satellite-based technology. In prior budgets, ADS-B was funded under the *Safe Flight 21 Initiative*, which demonstrated the potential of ADS-B and cockpit displays in Alaska and the Ohio River Valley. FAA expects to make a decision about how quickly to implement ADS-B and at what cost later this year. Airspace users will have to equip with the new avionics to get benefits, and FAA may have to rely on rulemaking initiatives to help speed equipage. This illustrates why the JPDO must address complex policy issues as well as research.

- System Wide Information Management (SWIM) is a new network information architecture that will allow airspace users to access a wide range of information on the status of the National Airspace System and weather conditions securely and seamlessly. It is analogous to an internet system for all airspace users. FAA is requesting $24 million for this program in FY 2007.

FAA Has Historically Relied on NASA for Long-term Air Traffic Management Research

NASA makes a significant investment in aviation research and is requesting $724 million for aeronautics research in FY 2007, less than last year's appropriated level of $884 million. Although NASA is in the process of restructuring its aeronautics research portfolio, officials are committed to supporting JPDO efforts. Table 1 illustrates NASA investments in aeronautics research for FY 2005 and FY 2006, as well as its request for FY 2007.

Table 1. NASA Funding For Aeronautics Research (Dollars in Millions)

NASA Aeronautics Research	FY 2005 Operating Plan	FY 2006 Operating Plan	FY 2007 Budget Request
Fundamental Aeronautics	$630	$562	$447
Airspace Systems	149	174	120
Aviation Safety	183	148	102
Aeronautics Test Program	0	0	55
Total	**$962**	**$884**	**$724**

Source: NASA

FAA had close ties with NASA *before* the establishment of the JPDO, and we see this relationship continuing. FAA and NASA have different roles. While FAA focuses its research and development efforts (in both the research and capital accounts) on the near-term, NASA focuses on long-term, cutting-edge technologies. In fact, NASA has conducted the majority of long-term research for air traffic management. FAA has also looked to DOD in the past for developing aerospace concepts and technologies, including the Global Positioning System. Attachment B provides information on potential agency contributions to the JPDO and each agency's areas of expertise.

Progress Is Being Made in Coordinating Diverse Agency Efforts but Considerable Work Remains To Align Agency Budgets and Plans

The law requires the JPDO to coordinate and oversee research that could play a role in NGATS. Central to the JPDO's mission—and making it an effective multi-agency vehicle—is alignment of agency resources. This is a complex task, and the law provides no authority for the JPDO to redirect agency resources.

The Secretary of Transportation has played an important role in coordinating various efforts by chairing the *Senior Policy Committee*. This committee was established by Vision 100 and includes, among others, deputy secretary level representatives from Commerce and Homeland Security, as well as the Secretary of the Air Force. It also includes the FAA and NASA Administrators. This committee provides high-level guidance, resolves policy issues, and identifies

resource needs. Each participating agency conducts research tailored for its specific mission.

The JPDO's March 2006 progress report to Congress outlined various accomplishments to date, including the establishment of multi-agency teams and the NGATS institute (a mechanism for interfacing with the private sector). However, the report did not provide details on specific ongoing research projects or funding that the JPDO expects to leverage at FAA or other agencies. Without this information, it is difficult to assess progress with alignment of budgets.

The majority of JPDO's work is done through eight *Integrated Product Teams* (IPT) that focus on eight strategies, such as how to use weather information to improve the performance of the National Airspace System. The teams are composed of FAA, other Federal agencies, and the private sector. Attachment C provides details on the JPDO's IPTs and their major areas of emphasis.

The National Research Council recently examined JPDO plans and was critical of the IPT structure. The Council's report found that even though the teams have multi-agency participation, they are functioning primarily as experts in specific disciplines rather than as cross-functional, integrated, multidisciplinary teams organized to deliver specific products. One of the report's recommendations was that the IPTs be reduced in number and made more "product driven." Although we have not reached any conclusions on how to best structure the IPTs, we do agree that a more product-driven focus would be an important step forward.

Our work on three important IPTs shows that there is considerable coordination but little alignment of agency budgets to date. Moreover, the IPT leaders have no authority to commit agency resources to JPDO efforts and often have no products other than plans. The following illustrates progress and challenges to date with the three IPTs we examined in detail.

- The Weather IPT is led by the National Oceanic Atmospheric Administration (NOAA), an agency of the Department of Commerce. FAA, NASA, DOD, and NOAA are all conducting weather research tailored for their specific missions. Thus far, this team's efforts have focused on contributions to FAA's *Traffic Flow Management Program* (which assists traffic managers to optimize air traffic by working with airlines). NOAA is also helping the JPDO refine its concept of a fully automated system. Integrating new, up-to-date weather forecast systems into planned automation efforts will be challenging.

  We note that JPDO has not yet determined if a considerable amount of applied research and development conducted by NOAA at the Office of

Atmospheric Research and the National Environmental Satellite Data and Information Service could be leveraged for next generation initiatives. We have shared our concerns about effectively leveraging weather research with the JPDO, which recognizes it can do a better job.

- The Shared Situational Awareness IPT is led by DOD. All participating agencies are adopting network-centric systems.[1] As noted earlier, FAA is developing its own network system called SWIM. While there are considerable opportunities for leveraging net-centric efforts, there is also potential for duplication of effort. Challenges here focus on taking an approach pioneered by DOD and applying it specifically to air traffic control to get benefits in terms of enhanced capacity and delay reduction.

  An active role by DOD is vital because it is both a provider and a consumer of air traffic services. Thus far, work with this IPT has focused almost exclusively on maximizing agency network capabilities in DOD, such as the *Global Information Grid*, which is a net-centric communication system DOD is developing for global use. Moreover, DOD's real-world experiences and lessons learned in sharing data (from air and ground systems) in actual operations and in real-time have not been tapped and will prove invaluable in reducing cost and technical risks in developing the next generation system.

- The Air Traffic Management IPT is led by NASA. It is expected to play a key role by helping develop the automated systems to boost controller productivity. FAA has neither planned nor budgeted for this type of research. Major challenges focus on establishing requirements and gaining a full understanding of the risks associated with developing and acquiring these new software-intensive systems before making financial commitments. This is important because future automation efforts will be a major cost driver for the next generation system.

  We see potential for the most progress with coordination and alignment between the JPDO and NASA. Even though NASA is restructuring its aeronautical research program and spending less than in the past, the JPDO and NASA are working on several complex concepts for new automation systems and the timing of research efforts. This work will be funded via NASA efforts associated with "airspace systems." However, experience shows that NASA will need a much clearer picture of FAA's requirements—and when prototypes would be needed—to better support the next generation system.

[1] A net-centric system uses internet protocols to transfer data.

Several Actions Are Critical for the JPDO To Make Progress in Both the Short- and Long-Term

Key questions for FAA and the JPDO focus on what the new office can deliver, when, and how much it will cost. They are central questions in the discussion about how to best finance FAA and will shape the size, requirements, and direction of the capital program for the next decade. We understand that the JPDO is planning to conduct workshops with industry to help determine the costs, requirements, and milestones associated with the next generation system.

Moving to the next generation system is important to meet the demand for air travel, change the way FAA provides services, and reduce Agency costs. However, it is also a high-risk effort, given the complexity of the task and the policy and regulatory issues that must be addressed. To make progress, several steps are needed.

- Leadership. The position of the JPDO Director is currently vacant—FAA needs to find the right person to lead this effort. The JPDO does not have authority to redirect agency resources. The former JPDO director was also the director of the Air Traffic Organization's (ATO) planning organization. We think experience has shown that one person cannot effectively do both jobs because of complex technical issues and important policy decisions facing FAA and the JPDO. Leadership will be important to bridge the gap between the ATO's near-term planning horizon and the JPDO's longer-term mission to transform the National Airspace System.

- Developing and Implementing Mechanisms for Alignment. As noted earlier, much work remains to align agency budgets. There is a need for mechanisms to help the JPDO align diverse agency efforts over the long haul.

  The JPDO recognizes that more needs to be done and is working with the Office of Management and Budget (OMB) to develop an integrated budget document that provides a single business case (a document similar to the "OMB Form 300") to make sure efforts are indeed aligned.[2] As part of this, JPDO has promised to provide OMB in the next several months with an architecture for the next generation system, as well as a specific list of programs in other agency budgets it intends to leverage. We will follow up on this step during our ongoing audit.

[2] OMB Form 300 was established as a source of information on which decisions about budgetary resources consistent with Administration priorities, planning, management and use of capital investments are consistent with OMB policy and guidance.

JPDO's ongoing efforts to develop an *enterprise architecture*,[3] or overall blueprint for the next generation system, will help in setting goals, supporting decisions, adjusting plans, and tracking agency commitments. The architecture will also show requirements from FAA and the Departments of Defense and Homeland Security and where various agency efforts fit in the next generation system. It will prove helpful in the future in resolving difficult policy decisions, including who pays for what elements of the system.

JPDO is taking an incremental approach to architecture development and plans to have an initial version this summer. However, considerable work remains to link current systems with future capabilities and develop technical requirements, particularly for new concepts for automation.

Until these actions are taken, it will be difficult for the Congress and aviation stakeholders to determine if the JPDO is leveraging the right research, if funding is adequate for specific efforts, or how projects will improve the U.S. air transportation system and at what cost. Therefore, we think the JPDO should include in its periodic reports to Congress a table of specific research projects with budget data of other agencies it is leveraging and how that ongoing research is supporting the JPDO.

- Examining Barriers to Transforming the National Airspace System That Have Impacted Past FAA Programs and How They Can Be Overcome. Our work on many major acquisitions shows the importance of clearly defined transition paths, expected costs (for both FAA and airspace users), and benefits in terms of reduced delays. This is particularly the case for initiatives that call airspace users to equip with new avionics.

  For example, FAA cancelled the controller-pilot data link communications program specifically because of uncertain benefits, concerns about user equipage, cost growth, and the impact on the Agency's operations account. The inability to synchronize data link with other modernization efforts, such as the multi-billion dollar *En Route Automation Replacement Program* was also a factor.

  Other critical barriers to be overcome include how to ensure new systems are certified as safe for pilots to use and getting the critical expertise in place at the right time. Problems with FAA's multi-billion *Wide Area*

[3] Enterprise Architecture can be viewed as a blueprint that links an enterprise's strategic plan to the programs and supporting systems in terms of interrelated business processes, rules, and information needs. This includes the transition from the "as-is" to the "to-be" environment.

Augmentation System (a new satellite navigation system) that led to cost growth and schedule slips were directly traceable to problems in certifying the new satellite-based system.

- Developing a Strategy for Technology Transfer. Technology transfer—the movement of technology from one organization to another—is a central issue for the JPDO because the law envisions new capabilities developed by other Federal agencies (or the private sector) being transitioned into the National Airspace System. The JPDO will have to pay greater attention to this matter as it moves forward.

  Our past work shows that FAA has experienced mixed success in transitioning systems developed by others into the National Airspace System. For example, FAA ultimately abandoned work on a new controller tool developed by NASA (the Passive Final Approach and Spacing Tool) for sequencing and assigning runways to aircraft because of complex software development and cost issues. As we noted in our review of FAA's Free Flight Phase 1 Program, the use of "technology readiness levels" could be useful to help assess maturity of systems and ease issues associated with the transfer of technology. Both NASA and DOD have experience with categorizing technical maturity. This could help reduce cost, schedule, and technical risk with implementing JPDO initiatives.

- Conducting Sufficient Human Factors Research To Support Anticipated Changes. The JPDO is planning to make fundamental changes in how the system operates and how controllers manage traffic to accommodate three times more aircraft in the system. Currently, the union that represents controllers is not yet participating in JPDO efforts for a variety of reasons.

  History has shown that insufficient attention to human factors can increase the cost of acquisition and delay much needed benefits. For example, problems in the late 1990s with FAA's *Standard Terminal Automation Replacement System* were directly traceable to not involving users early enough in the process.

  The need for focused human factors research extends well beyond the traditional computer-machine interface (such as new controller displays) and has important workforce and safety implications. For example, FAA expects the controller's role to change from direct, tactical control of aircraft to one of overall traffic management. There also will be significant human factors concerns for pilots, who will be expected to rely more on data link communications. It will be important to have sufficient human

factors analysis and studies to ensure that the changes envisioned by the JPDO can be safely accommodated.

Mr. Chairman, that concludes my statement. I would be happy to answer any questions you or other members of this Subcommittee might have.

Attachment A. Key Platforms

System	Status and Key Issues
Terminal Modernization: Standard Terminal Automation Replacement System (STARS), Common Automated Radar Terminal System (Common ARTS): Controller work-stations that process surveillance data and display it on the screen to manage air traffic in the terminal environment.	FAA has struggled with how to complete terminal modernization. STARS, which so far has cost of $1.3 billion for only 47 sites, was envisioned as the centerpiece of terminal modernization. Because of technical problems and schedule delays with it, FAA decided to deploy another system, Common ARTS, as an interim solution at over 140 facilities in several configurations. FAA is rethinking its approach to terminal modernization and recently decided to field STARS to only 5 additional sites. A decision affecting the remaining 100-plus sites has been postponed for over a year. FAA needs to resolve how it will complete terminal modernization and what additional capabilities will be needed as it works with the JPDO.
En Route Automation Modernization (ERAM): Replaces the Host computer hardware and software (including the Host backup system) and associated support infrastructure at 20 En Route Centers.	With an estimated cost of $2.1 billion, ERAM is one of the largest and most complex acquisitions in FAA's modernization portfolio. Progress is being made with the first ERAM deliverable—a backup system for the Host computer. However, the bulk of the work focuses on development of the first major ERAM software release, which involves developing over 1 million lines of code. A number of new capabilities (dynamic airspace management and data link) depend on future enhancements to ERAM that have yet to be defined or priced.

Attachment A. Key Platforms (continued)

System	Status and Key Issues
FAA Telecommunications Infrastructure (FTI): FTI is designed to replace existing telecommunications networks with one new network through a phased process. A single provider is responsible for acquiring, operating and maintaining the new telecommunications infrastructure.	FTI is FAA's effort to transition from multiple telecommunication networks to a single new network for the purpose of reducing operating costs. FTI is expected to replace about 25,000 existing telecommunications services and circuits at more than 4,400 facilities. FAA re-baselined FTI in December 2004, increasing lifecycle costs from $1.9 billion to $2.4 billion and adding 5 years to the life of the program. However, FTI is not likely to be completed on schedule in December 2007 because FAA does not have a realistic master schedule or effective transition plan identifying when each site and service will be accepted, when services will be cut over to FTI, and when existing services will be disconnected. Through the end of FY 2005, FTI equipment was installed at about 700 sites, and only about 3 percent of the 25,000 FTI services were operational, leaving a vast amount of costly existing equipment still being sustained. As a result, expected FTI cost reduction benefits are eroding. To address the schedule risk, FAA needs to develop a realistic master schedule and incorporate it into the FTI contract to hold the prime contractor accountable. Successful FTI implementation is critical to many other programs such as System Wide Information Management (SWIM) system and ERAM.
Traffic Flow Management (TFM) is an FAA initiative to modernize the hardware and software used to manage the flow of air traffic.	TFM Infrastructure products and services are designed to support the Traffic Management Specialists (TMS) and Traffic Management Coordinators (TMC) to optimize air traffic flow across the National Air Space System. The TMS and TMC planners analyze, plan, and coordinate air traffic flow through continuous coordination with the airlines and the use of surveillance sources, weather, automation, and display subsystems.

Attachment B. Potential Agency Contributions

The following table provides perspectives on the wide range of research being conducted at agencies for their specific missions that participate in the JPDO. We note that only some of the ongoing research will be applicable to the JPDO's efforts.

Agency	Key Area of Leverage
DOD	DOD has an extensive and diverse Research and Development (R&D) base, including research in new aircraft, composites, imaging systems, and data exchange systems for all services. DOD has requested $73.1 billion overall for R&D in FY 2007. The JPDO is particularly interested in DOD's broadband communication networks, such as the *Global Information Grid*. DOD planned upgrades to the Global Positioning System Constellation will be critical to civil aviation.
Commerce / NOAA	Commerce is requesting $1.06 billion for research in FY 2007. NOAA is a part of Commerce and is responsible for the National Weather Service; the National Environmental Satellite, Data and Information Service; and Oceanic and Atmospheric Research. NOAA requested $533 million in FY 2007 for R&D. The JPDO is seeking from NOAA probability weighted forecast capabilities, a national uniform weather database of forecasts and observations, and transparent automatic adjusted traffic management for weather.
NASA	For years, NASA has conducted the majority of long-term Air Traffic Management research, including automated controller tools and human factors work. NASA has requested $724 million for FY 2007 on aeronautical R&D. The JPDO is looking to NASA to develop automated aircraft metering and sequencing, and dynamic airspace reconfiguration.
Department of Homeland Security (DHS)	DHS contributes expertise in the areas of security and net-centric initiatives. The Agency has requested $1 billion in FY 2007 for Science and Technology R&D. FAA is looking to DHS to develop automated passenger and cargo screening, hardened aircraft security, and flight control overrides.

Attachment C. Integrated Product Teams

IPTs are multi-agency teams that are defining the specific concepts, and capabilities and coordinating the actions necessary to make possible the transformation in each of the eight strategies articulated in the NGATS Integrated Plan.

1. Develop Airport Infrastructure To Meet the Future Demand – FAA
2. Establish an Effective Security System Without Limiting Mobility or Civil Liberties – DHS
3. Establish an Agile Air Traffic System – NASA
4. Establish User-Specific Situational Awareness – DOD
5. Establish a Comprehensive Proactive Safety Management Approach – FAA
6. Develop Environmental Protection That Allows Sustained Aviation Growth – FAA
7. Develop a System-Wide Capability To Reduce Weather Impacts – Commerce/NOAA
8. Harmonize Equipage and Operations Globally – FAA