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THE JOINT PLANNING AND DEVELOPMENT OFFICE AND THE NEXT GENERATION AIR TRANSPORTATION SYSTEM: STATUS AND ISSUES

HEARING

BEFORE THE

SUBCOMMITTEE ON SPACE AND AERONAUTICS

COMMITTEE ON SCIENCE AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

ONE HUNDRED TENTH CONGRESS

FIRST SESSION

MARCH 29, 2007

Serial No. 110–18

Printed for the use of the Committee on Science and Technology

Available via the World Wide Web: http://www.house.gov/science

U.S. GOVERNMENT PRINTING OFFICE

34–184PS WASHINGTON : 2007

For sale by the Superintendent of Documents, U.S. Government Printing Office
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THE JOINT PLANNING AND DEVELOPMENT OFFICE AND THE NEXT GENERATION AIR TRANSPORTATION SYSTEM: STATUS AND ISSUES

THURSDAY, MARCH 29, 2007

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON SPACE AND AERONAUTICS,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
Washington, DC.

The Subcommittee met, pursuant to call, at 10:00 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Mark Udall [Chairman of the Subcommittee] presiding.

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON SPACE AND AERONAUTICS

Hearing on

The Joint Planning and Development Office and the Next Generation Air Transportation System: Status and Issues

March 29, 2007
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

WITNESS LIST

Mr. Charles Leader
Director
Joint Planning and Development Office
Federal Aviation Administration (FAA)

Dr. Gerald L. Dillingham
Director
Physical Infrastructure Issues
Government Accountability Office

Hon. John Douglass
President and CEO
Aerospace Industries Association

Dr. Bruce Carmichael
Director
Aviation Applications Program
Research Applications Laboratory
National Center for Atmospheric Research

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HEARING CHARTER

SUBCOMMITTEE ON SPACE AND AERONAUTICS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

The Joint Planning and Development Office and the Next Generation Air Transportation System: Status and Issues

THURSDAY, MARCH 29, 2007
10:00 A.M.—12:00 P.M.
2318 RAYBURN HOUSE OFFICE BUILDING

Purpose

On Thursday, March 29, 2007 at 10:00 am, the Subcommittee on Space and Aeronautics will hold a hearing to examine the status of the Next Generation Air Transportation System initiative [also known as NGATS or NextGen—both terms will be used interchangeably in this hearing charter] and explore key issues related to the initiative and the interagency Joint Planning and Development Office (JPDO).

Witnesses:

The witnesses scheduled to testify at the hearing include the following:

Mr. Charles Leader, Director, Joint Planning and Development Office, Federal Aviation Administration (FAA)

Dr. Gerald L. Dillingham, Director, Physical Infrastructure Issues, Government Accountability Office

Hon. John Douglass, President and CEO, Aerospace Industries Association

Dr. Bruce Carmichael, Director, Aviation Applications Program, Research Applications Laboratory, National Center for Atmospheric Research

BACKGROUND

Potential Issues

The following are some of the issues that could be raised at the hearing:

- Is the JPDO effectively organized and adequately funded to plan and develop the Next Generation Air Transportation System? Does it have the necessary authority and independence? If not, what changes are needed?
- Is the JPDO's placement within FAA properly balanced? As JPDO becomes more tightly integrated into the FAA, will it continue to be viewed as an "honest broker" by the other participating agencies? Will FAA's new Operational Evolution Partnership (OEP) implement the JPDO's plans and development products or will FAA wind up subsuming JPDO's activities within the FAA's OEP?
- What are the biggest near-term and mid-term technical and programmatic challenges facing the JPDO as it attempts to plan and develop the NextGen? What steps can be taken to address those challenges?
- How well are the resource commitments and R&D activities of the agencies participating in the JPDO aligned with the needs of the NextGen initiative?
- How can we ensure that the technologies and concepts developed for the NextGen initiative will be implemented in the national airspace system in a timely manner? How important are equipage and financing policies to ensuring an effective transition of the NextGen R&D into national airspace systems and procedures?
- What role should the private sector play in the planning and development of the NextGen? How well are the views and concerns of the industry and the air traffic controllers being incorporated in the JPDO planning process?

- What needs to be done to ensure that aviation weather information is integrated effectively into the Nation's future air traffic management system and weather impacts are reduced?
- Given the importance of aviation to U.S. global commerce, how will the U.S. NextGen initiative be harmonized with the European air traffic modernization initiative, SESAR, as well as with modernization activities elsewhere in the world?

Overview

While the health of the National Airspace System (NAS) is critical to the economy, the current approach to managing air transportation is becoming increasingly inefficient and operationally obsolete. Today's NAS is near capacity, with delays growing to record levels, yet a threefold increase in air traffic is expected by 2025. Current processes and procedures do not provide the flexibility nor the scalability needed to meet the growing demand.

In 2003, Congress created the Joint Planning and Development Office (JPDO) as part of P.L. 108–176, *Vision 100: Century of Flight Reauthorization Act* [the specific legislative provisions are included as Attachment 1 to this hearing charter]. The JPDO is to plan for and coordinate, with federal and non-federal stakeholders, a transformation from the current air traffic control system to the NextGen by 2025. NextGen (formerly called NGATS) is envisioned as a major redesign of the air transportation system that will entail precision satellite navigation; digital, networked communications; an integrated aviation weather system; layered, adaptive security; and more.

Seven agencies are participating in the JPDO: the Departments of Transportation, Commerce, Defense, and Homeland Security; FAA; the National Aeronautics and Space Administration (NASA); and the White House Office of Science and Technology Policy. JPDO is housed within FAA, and the FAA FY 2008 budget request includes $18 million to support JPDO. NASA is still negotiating the amount that it will provide to the JPDO in FY 2008. However, while JPDO has the planning and development responsibility and can define R&D requirements, etc., that it would like the participating agencies to carry out, it has no budgetary or management authority over the agencies' activities in support of NextGen. Although JPDO is responsible for planning the transformation to NextGen and coordinating the related efforts of its partner agencies, FAA will be largely responsible for implementing the policies and systems necessary for NextGen, while safely operating the current air traffic control system 24 hours a day, seven days a week.

To date, the JPDO has not established practices to institutionalize the multi-agency collaborative process. For example, JPDO does not have formal, long-term agreements among the partner agencies on their roles and responsibilities in creating NextGen. The JPDO has been working to establish a memorandum of understanding (MOU) between its participating agencies since at least August 2005, but the MOU had not been signed as of the date of this hearing, even though in a hearing a year ago this Subcommittee was told that it "should occur in the next few weeks."

JPDO also currently lacks explicit policies and procedures for decision making and dispute resolution and has not yet completed mechanisms for leveraging partner agency resources. JPDO has been working with the Office of Management and Budget (OMB) to develop a means to consider NextGen-related funding, dispersed across JPDO's partner agency budget requests, as a unified federal program. Nonetheless, given JPDO's limited authority, the office could face continuing challenges in sustaining the lengthy and elaborate federal collaborative effort set forth in the *Vision 100* legislation.

FAA has created a NextGen Review Board, co-chaired by JPDO's Director and Air Traffic Organization's (ATO) Vice President of Operations Planning. Initiatives, such as concept demonstrations or research, proposed for inclusion in the OEP, will now need to go through the Review Board for approval based upon NextGen requirements, concept maturity, and risk. Additionally, as a further step towards integrating ATO and JPDO, the Administration's FAA Reauthorization proposal calls for the JPDO Director to be a voting member of FAA's Joint Resources Council and ATO's Executive Council. While some see those steps as important means of ensuring ATO can effectively implement JPDO's plans, others fear that the steps will adversely impact JPDO's independence.

The *Vision 100* legislation also directed the Secretary of Transportation to establish a Senior Policy Committee (SPC) to work with the JPDO. The SPC is to be chaired by the Secretary and is also to include the FAA and NASA Administrators (or their designees), as well as the Secretaries of Defense, Homeland Security, Com-

merce, OSTP Director (or their designees) and other federal agency representatives as appropriate. However, the SPC has met infrequently since its inception. According to JPDO officials, the SPC makes decisions through consensus of the members. If there are any issues that the committee cannot resolve among themselves, JPDO officials said that they would expect that the Secretary of Transportation would elevate those issues to the appropriate White House-level policy council, such as the Domestic Policy Council.

The JPDO established eight multi-agency Integrated Product Teams (IPTs) to facilitate the planning and development of the JPDO. They included the following [with the lead agency indicated in parentheses]:

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 (DOC/NOAA)
8. Harmonize Equipage and Operations Globally (FAA)

However, the JPDO has been restructuring the IPTs, and JPDO Director Leader should describe the changes at the hearing.

The NextGen Institute (the Institute) was created by an agreement between the National Center for Advanced Technologies and the FAA to incorporate the expertise and views of stakeholders from private industry, state and local governments, and academia into the NextGen planning process. The NextGen Institute Management Council, composed of top officials and representatives from the aviation community, oversees the policy, recommendations, and products of the Institute and provides a means for advancing consensus positions on critical NextGen issues. To meet *Vision 100*'s requirement that JPDO coordinate and consult with the public, the Institute held its first public meeting in March 2006.

In general, transforming the National Airspace System by 2025 to accommodate a projected demand of three times the current demand for air transportation services, providing appropriate security and environmental safeguards, and doing these things seamlessly while the current system continues to operate will be a complex undertaking. As noted by the Government Accountability Office (GAO), *". . .given the staggering complexity of this ambitious effort to modernize and transform the air traffic control system over the next two decades, it will not be easy to move from planning to implementation."* Nonetheless, implementing the JPDO's plans and products in the national airspace system in a timely manner will be critical to the success of the NextGen initiative.

JPDO has recently released a draft JPDO Concept of Operations for public comment, and JPDO indicates that in the next few months it will publish the NextGen Enterprise Architecture (originally intended to be ready for release last summer) and the Integrated Work Plan.

External Reviews of JPDO Progress

There have been several recent independent reviews of the status of the JPDO and its progress in developing NextGen. Some of the key findings and recommendations of those reviews are as follows:

Government Accountability Office

In November 2006, the GAO issued a status report [GAO–07–25] on the NextGen initiative [Dr. Gerald Dillingham, one of the hearing witnesses, participated in the study and will be able to provide an update]. Some of the main findings and recommendations of the GAO study were as follows:

Findings

- "JPDO's partner agencies have agreed on a vision for NGATS [NextGen] and on eight strategies that broadly support the goals and objectives of NGATS."
- "JPDO faces challenges in institutionalizing its collaborative effort, addressing planning and expertise gaps, establishing credibility with stakeholders, and harmonizing its work with other countries' efforts to modernize their own air traffic management systems."
- "To date, JPDO has not established some practices significant to institutionalizing its collaborative process, such as formalizing roles and responsibilities.

Such practices are important because JPDO is fundamentally a planning and coordinating body that lacks authority over the key human and financial resources needed to continue developing plans and system requirements for NGATS."

- "FAA, as the key implementer of the transition to NGATS, faces challenges. . .in obtaining the financial and technical resources needed to implement NGATS. FAA also faces challenges in finding ways to reduce costs or realize savings to help fund the costs of transitioning to NGATS while continuing to operate and maintain the current system. Finally, FAA faces challenges in obtaining the technical and contract management expertise needed to define, implement, and integrate the numerous complex programs and systems inherent in the transition to NGATS."

Recommendations

- "JPDO should finalize and present to the Senior Policy Committee for its consideration and action the MOU among the partner agencies to define their roles and responsibilities related to NGATS planning and development."
- "[JPDO should] clarify the roles and responsibilities between JPDO and [the FAA's] Air Traffic Organization in the planning, development, and transition from JPDO to FAA for implementation of NGATS."
- "[JPDO should] develop written procedures for dispute resolution at all levels of the JPDO organization."
- "[JPDO] should determine whether key stakeholders and expertise are not represented on JPDO's integrated product teams, divisions, or elsewhere within its organization."
- "FAA should work to determine whether it will need to contract with a Lead System Integrator, federally-funded not-for-profit corporation, or other technical or managerial entity to assist in the implementation of NGATS."

Department of Transportation Inspector General

On February 12, 2007, the DOT Office of the Inspector General (OIG) released an audit report [AV–2007–031] on the JPDO. In that report, the OIG listed a number of actions that it considered to be critical for the JPDO to be able to make progress and to make the transition from planning to implementation. Those actions included such things as having JPDO:

- "Finalize cost estimates, quantify expected benefits, and develop a roadmap for industry;
- Have FAA and NASA come to a clear understanding of the level of technical maturity NASA projects will have [so that any technology gaps will be identified]. FAA has historically relied on NASA for long-term air traffic management research;
- Establish linkage between the plans developed by JPDO and the implementation priorities of the Air Traffic Organization by delineating lines of responsibility and accountability for both;
- Develop and implement mechanisms for aligning resources between agencies; and
- Develop approaches for risk management and systems integration."

The OIG also recommended that the FAA Administrator:

- "Report NGATS cost data along three vectors—developmental efforts, adjustments to existing programs, and NGATS implementation—when reporting NGATS financial requirements to Congress and stakeholders;
- Determine the level of technical maturity of NASA's research projects developed for NGATS initiatives;
- Review existing ongoing modernization programs to determine if they are still needed and, if so, what adjustments in cost, schedule, and performance parameters will be needed;
- Include information in the annual JPDO progress report on specific research projects with budget data for FAA developmental efforts as well as budget data of other agencies that are being leveraged and specify how the ongoing research is supporting the JPDO;
- Determine what skill sets and expertise, with respect to software development and system integration, will be required by the ATO and JPDO—and how they will be obtained—to manage and execute NGATS initiatives;

- In planned NGATS demonstration projects, develop sufficient data to establish a path for certifying new systems and identify the full range of adjustments to policies and procedures needed to get benefits;
- Continue to develop and refine procedures that address conflict of interest issues with JPDO initiatives and conduct annual reviews of the matter as the role of the JPDO evolves from planning to implementation;
- Use technology readiness levels in assessing the maturity of research conducted at other agencies to help speed technology transfer and the introduction of new capabilities into the National Airspace System; and
- Fund targeted human factors research to ensure that the changing roles of controllers and pilots envisioned by the JPDO can safely be accommodated. This will require a re-prioritization of ongoing efforts at FAA and close cooperation with NASA, which also conducts human factors research."

The OIG report also identified a number of *"key research efforts needed for NGATS,"* including: Automation Improvements, Separation Standards for an Automated Environment, Cockpit Displays, and Weather Integration into Automation. The OIG indicated that over seventy research or policy areas have been identified as needing further investigation and stated that the research areas would be needed *"regardless of the technology ultimately selected."* In addition, the OIG report stated that: *"To see benefits in the 2012 timeframe, as projected by the JPDO, FAA officials have told us that work must begin now, given the lag time between development and actual deployment. It is not yet clear who or what agency will do this research. To be effective, the research must also focus on policies, procedures, and methods for certifying systems as safe for use."*

Other Concerns

Uncertainty Over NextGen Costs

In testimony before the Committee on Transportation and Infrastructure, Subcommittee on Aviation, February 14, 2007, Dr. Dillingham reported *"A JPDO official told us they have submitted a limited NextGen cost estimate to OMB with the 2008 budget request."* In his written opening statement for a March 22, 2007 Senate Commerce, Science and Transportation Committee hearing, Charles Leader wrote, *"Requirements for the first ten years range from $8 billion to $10 billion. Preliminary estimates suggest that the investments necessary to achieve the end state NextGen system range from $15 billion to $22 billion in FAA funding."*

As noted in the November GAO study, *"There are a number of drivers in the current uncertainty over the cost of NGATS. One of these drivers is the decision about which technologies to include. . .. A second driver is the sequence for replacing current technologies with NGATS technologies. A third driver is the length of time required for the transformation to NGATS, since, according to JPDO, a longer period would impose higher costs. JPDO's first draft of its enterprise architecture should constrain some of these variables."*

The November GAO study reported: *"The FAA's Research, Engineering and Development Advisory Committee (REDAC)—developed a limited, preliminary cost estimate, which officials have emphasized is not yet endorsed by any agency. The REDAC estimated that FAA's budget under a NGATS scenario would average about $15 billion per year through 2025, or about $1 billion more annually (in today's dollars) than FAA's fiscal year 2006 appropriation."*

In Charles Leader's opening statements last week, he reported *"MITRE, working with FAA, has developed a preliminary estimate of the NextGen avionics costs to users. It concludes that a wide range of costs are possible, depending on the bundling of avionics and the alignment of equipage schedules. The most probable range of total avionics costs to system users is $14 billion to $20 billion."*

The November GAO study reported that *"JPDO has also begun working with its stakeholders to develop initial cost information through a series of investment analysis workshops. Representatives from commercial and business aviation, equipment manufacturers, and ATC systems developers attended the first workshop, held in April 2006. The second workshop, held in August 2006, was for those involved with general aviation and public safety operations. JPDO plans to invite representatives from airports and regional, State, and local planning bodies to the third workshop. According to the JPDO, participants in these workshops are asked to discuss and comment on the appropriateness of JPDO's current assumptions about factors that drive private sector costs."*

NASA's Role

Both the above-mentioned GAO and DOT OIG reports expressed concern over the potential impact of NASA's restructuring of its aeronautics program [as has FAA's RE&D Advisory Committee], noting the FAA has traditionally relied on NASA for key air traffic management research taken to a relatively mature level of technology readiness. They cite the potential "technology gap" and resulting delays to NextGen if NASA reduces its involvement in those research areas. Those concerns are echoed by a number of the hearing witnesses.

FAA's Management and Acquisition Performance

In 1995, the Government Accountability Office (GAO) designated FAA's air traffic control modernization program as high risk because of systemic management and acquisition problems. In its November 2006 report, the GAO noted that the FAA has taken a number of actions aimed at improving its management practices and institutionalizing these improvements by attempting to ensure that the reforms are fully integrated into the agency's structure and processes. However, GAO also noted that transforming organizational cultures requires substantial management attention, as it can take several years for such initiatives to be fully implemented and cultures transformed in a sustainable manner.

However, follow-through on these changes must survive the loss of some of the leaders during the change: The agency's COO left in February 2007, after serving three years, and the FAA Administrator's term ends in September 2007. Moreover the current director of the JPDO is relatively new, having assumed that position in August 2006. He is the third director of the JPDO in the little more than three years that the JPDO has been in existence.

Human Factors

To quote the GAO report, the NextGen Concept of Operations *"envisions an increased reliance on automation, which raises questions about the role of the air traffic controller. Similarly, the Concept of Operations envisions that pilots will take on a greater share of the responsibility for maintaining safe separation and other tasks currently performed by controllers. This raises human factors questions about whether pilots can safely perform these additional duties. Although the JPDO has begun to model how shifts in air traffic controllers' workloads would affect their performance, it has not yet begun to model the effect of how this shift in workload to pilots would affect pilot performance. According to the JPDO, the change in the roles of pilots and controllers is the most important human factors issue involved in creating NextGen, but one that will be difficult to research. . ."*

Aviation Weather

It is estimated that about seventy percent of the delays in the national airspace system are weather-related. It is anticipated that increases in the volume of air traffic in the coming decades will make the impact of weather on the operation of the system even more pronounced than it is today. The JPDO established an Integrated Product Team (IPT) to address aviation weather issues, and the JPDO has recently announced its intention to establish an aviation weather program office. Dr. Carmichael—who is Co-Lead of the Weather IPT's Forecasting Group and a hearing witness—will discuss progress and problems in addressing aviation weather in the NextGen planning. One issue Dr. Carmichael raises in his testimony is the growing uncertainty over NASA's funding and programmatic commitment to research in the integration of weather into automated decision support tools, wake turbulence research, and integration of unmanned aircraft observing systems into the national airspace system.

International "Harmonization"

Compatibility of the U.S. NextGen system with the air traffic modernization efforts being planned elsewhere in the world is very important to U.S. and international air carriers. Failure to ensure compatibility could lead to air carriers having to equip their fleets with two sets of communications, navigation, and surveillance systems—something that could be very expensive. The Europeans currently have an initiative underway, the Single European Sky Air Traffic Management Research Programme (SESAR). It differs in a number of respects from the U.S. NextGen initiative. FAA and the European Commission are attempting to ensure that appropriate coordination takes place, and they signed a Memorandum of Understanding to the effect in July 2006.

Establishing Credibility with Stakeholders That the Government Is Fully Committed to NextGen

As noted by external experts on a GAO-sponsored panel, JPDO also faces challenges in establishing credibility among stakeholders. For example, some members of the panel told GAO that [to quote GAO], *"although JPDO has produced much activity, they did not feel the effort had demonstrated sufficient progress; some stakeholders said that both the 2004 Integrated Plan and the 2005 Progress Report lacked sufficient detail, such as definition of research needs."*

ATTACHMENT 1

Excerpts from Title VII of H.R. 2115 (Public Law 108–176)

SEC. 709. AIR TRANSPORTATION SYSTEM JOINT PLANNING AND DEVELOPMENT OFFICE.

(a) ESTABLISHMENT—(1) The Secretary of Transportation shall establish in the Federal Aviation Administration a joint planning and development office to manage work related to the Next Generation Air Transportation System. The office shall be known as the Next Generation Air Transportation System Joint Planning and Development Office (in this section referred to as the 'Office').

(2) The responsibilities of the Office shall include—

(A) creating and carrying out an integrated plan for a Next Generation Air Transportation System pursuant to subsection (b);

(B) overseeing research and development on that system;

(C) creating a transition plan for the implementation of that system;

(D) coordinating aviation and aeronautics research programs to achieve the goal of more effective and directed programs that will result in applicable research;

(E) coordinating goals and priorities and coordinating research activities within the Federal Government with United States aviation and aeronautical firms;

(F) coordinating the development and utilization of new technologies to ensure that when available, they may be used to their fullest potential in aircraft and in the air traffic control system;

(G) facilitating the transfer of technology from research programs such as the National Aeronautics and Space Administration program and the Department of Defense Advanced Research Projects Agency program to federal agencies with operational responsibilities and to the private sector; and

(H) reviewing activities relating to noise, emissions, fuel consumption, and safety conducted by federal agencies, including the Federal Aviation Administration, the National Aeronautics and Space Administration, the Department of Commerce, and the Department of Defense.

(3) The Office shall operate in conjunction with relevant programs in the Department of Defense, the National Aeronautics and Space Administration, the Department of Commerce and the Department of Homeland Security. The Secretary of Transportation may request assistance from staff from those Departments and other federal agencies.

(4) In developing and carrying out its plans, the Office shall consult with the public and ensure the participation of experts from the private sector including representatives of commercial aviation, general aviation, aviation labor groups, aviation research and development entities, aircraft and air traffic control suppliers, and the space industry.

(b) INTEGRATED PLAN—The integrated plan shall be designed to ensure that the Next Generation Air Transportation System meets air transportation safety, security, mobility, efficiency, and capacity needs beyond those currently included in the Federal Aviation Administration's operational evolution plan and accomplishes the goals under subsection (c). The integrated plan shall include—

(1) a national vision statement for an air transportation system capable of meeting potential air traffic demand by 2025;

(2) a description of the demand and the performance characteristics that will be required of the Nation's future air transportation system, and an explanation of how those characteristics were derived, including the national goals, objectives, and policies the system is designed to further, and the underlying socioeconomic determinants, and associated models and analyses;

(3) a multi-agency research and development roadmap for creating the Next Generation Air Transportation System with the characteristics outlined under clause (ii), including—

(A) the most significant technical obstacles and the research and development activities necessary to overcome them, including for each project, the role of each federal agency, corporations, and universities;

(B) the annual anticipated cost of carrying out the research and development activities; and

(C) the technical milestones that will be used to evaluate the activities.

(4) a description of the operational concepts to meet the system performance requirements for all system users and a timeline and anticipated expenditures needed to develop and deploy the system to meet the vision for 2025.

(c) GOALS—The Next Generation Air Transportation System shall—

(1) improve the level of safety, security, efficiency, quality, and affordability of the National Airspace System and aviation services;

(2) take advantage of data from emerging ground-based and space-based communications, navigation, and surveillance technologies;

(3) integrate data streams from multiple agencies and sources to enable situational awareness and seamless global operations for all appropriate users of the system, including users responsible for civil aviation, homeland security, and national security;

(4) leverage investments in civil aviation, homeland security, and national security and build upon current air traffic management and infrastructure initiatives to meet system performance requirements for all system users;

(5) be scalable to accommodate and encourage substantial growth in domestic and international transportation and anticipate and accommodate continuing technology upgrades and advances;

(6) accommodate a wide range of aircraft operations, including airlines, air taxis, helicopters, general aviation, and unmanned aerial vehicles; and

(7) take into consideration, to the greatest extent practicable, design of airport approach and departure flight paths to reduce exposure of noise and emissions pollution on affected residents.

(d) REPORTS—The Administrator of the Federal Aviation Administration shall transmit to the Committee on Commerce, Science, and Transportation in the Senate and the Committee on Transportation and Infrastructure and the Committee on Science in the House of Representatives—

(1) not later than one year after the date of enactment of this Act, the integrated plan required in subsection (b); and

(2) annually at the time of the President's budget request, a report describing the progress in carrying out the plan required under subsection (b) and any changes to that plan.

(e) AUTHORIZATION OF APPROPRIATIONS—There are authorized to be appropriated to the Office $50,000,000 for each of the fiscal years 2004 through 2010.

SEC. 710. NEXT GENERATION AIR TRANSPORTATION SENIOR POLICY COMMITTEE.

(a) IN GENERAL—The Secretary of Transportation shall establish a senior policy committee to work with the Next Generation Air Transportation System Joint Planning and Development Office. The senior policy committee shall be chaired by the Secretary.

(b) MEMBERSHIP—In addition to the Secretary, the senior policy committee shall be composed of—

(1) the Administrator of the Federal Aviation Administration (or the Administrator's designee);

(2) the Administrator of the National Aeronautics and Space Administration (or the Administrator's designee);

(3) the Secretary of Defense (or the Secretary's designee);

(4) the Secretary of Homeland Security (or the Secretary's designee);

(5) the Secretary of Commerce (or the Secretary's designee);

(6) the Director of the Office of Science and Technology Policy (or the Director's designee); and

(7) designees from other federal agencies determined by the Secretary of Transportation to have an important interest in, or responsibility for, other aspects of the system.

(c) FUNCTION—The senior policy committee shall—

(1) advise the Secretary of Transportation regarding the national goals and strategic objectives for the transformation of the Nation's air transportation system to meet its future needs;

(2) provide policy guidance for the integrated plan for the air transportation system to be developed by the Next Generation Air Transportation System Joint Planning and Development Office;

(3) provide ongoing policy review for the transformation of the air transportation system;

(4) identify resource needs and make recommendations to their respective agencies for necessary funding for planning, research, and development activities; and

(5) make legislative recommendations, as appropriate, for the future air transportation system.

(d) CONSULTATION—In carrying out its functions under this section, the senior policy committee shall consult with, and ensure participation by, the private sector (including representatives of general aviation, commercial aviation, aviation labor, and the space industry), members of the public, and other interested parties and may do so through a special advisory committee composed of such representatives.

Chairman UDALL. This hearing will come to order.

Before we begin, I would like to explain to the panel members that are here and of course the audience that Ranking Member Calvert is not here because the President of the United States, George Bush, called a special meeting of the Republican Caucus this morning. Evidently, they are all down at the White House. The meeting was scheduled to be finished at 9:30, from what I understand, so we hope Ranking Member Calvert will join us as soon as he possibly can, but in the meantime, we have his approval to go ahead and proceed, and since time is money, time is valuable, we appreciate the panel's presence. I thought I would kick the hearing off and we look forward to hearing from you after I share my opening statement with you.

As I have said, we have a distinguished panel and I look forward to your testimony. The topic of today's hearing, the status of the Nation's NextGen initiative and the multi-agency Joint Planning and Development Office, tasked with overseeing the initiative, is one of the most important topics that we will address this year. It is important because it concerns the future of America's air transportation system and the question as to whether we will have a system that will be able to meet the needs of our 21st century economy.

I think we can all agree that we need to be able to answer that question in the affirmative for the health of our economy, the quality of life of our citizens, the safety of our flying public, and our international competitiveness. In short, we all want the NextGen initiative to succeed.

Yet, hope and good intentions by themselves are not going to be sufficient to ensure success. We are going to need commitment, accountability, and ultimately effective performance by all involved.

I am troubled by indications that all may be not going as well as hoped with the NextGen effort and I hope that our witnesses will be able to shed some light on the true status of the initiative.

For example, we held a hearing before this subcommittee exactly a year ago. The Department of Transportation and Joint Planning and Development Office told us that that a Memorandum of Understanding defining the NextGen partner agency's roles and responsibilities would be finalized "within the next few weeks." One year later, it is clear that did not happen and still hasn't happened.

At that same hearing, we were told that the JPDO planned to release an Enterprise Architecture for NextGen in the summer of 2006. That did not happen and still hasn't happened.

The *NASA Authorization Act of 2005* directed NASA to align its Airspace Systems Research Program projects "so that they directly support the objectives of the JPDO's Next Generation Air Transportation System Integrated Plan" and to do that by the end of 2006. Based on at least some of the witness testimony, that alignment doesn't appear to have happened either, and a similar situation exists with respect to the FAA's R&D programs.

In addition, today's witnesses are echoing concerns we have heard in previous hearings about the negative impact that NASA's uncertain commitment to its aeronautics program is having on a host of important R&D initiatives.

Equally troubling from the standpoint of the management—excuse me—of management continuity, there have been three JPDO Directors in the past three years and two NGATS Institute Executive Directors in the past two years with the Institute position currently vacant.

Moreover, the head of the FAA's Air Traffic Organization has recently left the agency, the FAA Administrator is scheduled to depart later this year, and the Department of Transportation has a new Secretary.

In addition, the multi-agency Senior Policy Council, which was established to provide high-level advice and policy guidance for the JPDO on the NextGen, initiative has met just three times in the past three years and not once in the past year.

Finally, we haven't yet seen a clear plan from FAA and the JPDO for implementing agreed-upon NextGen technologies and procedures into the national airspace expeditiously. That is worrisome because it is clear that that there are very real costs associated with undue delay.

Now, I want to be clear that my comments are not criticisms on the dedication or commitment of the JPDO team. I recognize that developing and implementing the NextGen system are enormous challenges. However, we need to take a look both at where progress is being made and equally important, where improvement is needed. That is what today's hearing is intended to accomplish, and again I want to appreciate my appreciation to our witnesses for helping the Subcommittee in that task.

[The prepared statement of Chairman Udall follows:]

PREPARED STATEMENT OF CHAIRMAN MARK UDALL

Good morning. I want to welcome our witnesses to today's hearing. We have a distinguished panel, and I look forward to your testimony.

The topic of today's hearing—the status of the Nation's NextGen initiative and the multi-agency Joint Planning and Development Office tasked with overseeing the initiative—is one of the most important topics that we will address this year. It's important because it concerns the future of America's air transportation system, and the question is whether we will have a system that will be able to meet the needs of our 21st century economy.

I think we can all agree that we need to be able to answer that question in the affirmative—for the health of our economy, the quality of life of our citizens, the safety of the flying public, and our international competitiveness. In short, we all want the NextGen initiative to succeed.

Yet, hope and good intentions by themselves are not going to be sufficient to ensure success. We are going to need commitment, accountability, and ultimately, effective performance by all involved.

I am troubled by indications that all may not be going as well as hoped with the NextGen effort, and I hope that our witnesses will be able to shed some light on the true status of the initiative.

For example, when DOT and JPDO testified before this subcommittee exactly a year ago, we were told that a Memorandum of Understanding defining the NextGen partner agencies roles and responsibilities would be finalized *"within the next few weeks."* One year later, it is clear that that did not happen and still hasn't happened.

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Chairman UDALL. Now, at this point I would normally recognize Chairman Calvert—former Chairman Calvert and now Ranking Member Calvert for his opening remarks and I also want it to be known that if there are Members who wish to submit additional opening statements, that those statements would be added to the record. But given that Chairman Calvert is not here at this point, let me introduce our panel of witnesses, and I will start—move across from my left to right and then we will come back to you, Mr. Leader, after I have introduced everybody.

Mr. Charles Leader is the Director for the Joint Planning and Development Office of the Federal Aviation Administration. He is in charge of the planning and the development of the NextGen initiative. Next to him, we have Dr. Gerald Dillingham, who is the Director of the Physical Infrastructure Issues in the Government Accountability Office and has been actively involved in GAO's oversight of aviation-related issues. Next to him we have the Honorable John Douglass, who is former Assistant Secretary of the Navy, and he currently is the President and CEO of the Aerospace Industries Association. He also served on the Aerospace Commission, and Mr. Douglass is a frequent visitor to this committee. It is always good to see you, Mr. Douglass. And I am pleased to introduce, finally, Dr. Bruce Carmichael. He is Director of the Aviation Applications Program at the National Center for Atmospheric Research, or NCAR, which is located in my district in Boulder, Colorado. Dr. Carmichael holds an M.S. from Northwestern University in applied mathematics and a Ph.D. from the University of Maryland in computer science. His more recent work has been involved with the aviation industry and automation of maintenance processes, air traffic control and weather information. He has also been involved in system engineering of approved FAA automation and weather systems. He is currently the co-lead of the Forecasting Group, the JPDO Weather Integrated Product Team. I again want to welcome all of you.

As you all know, spoken testimony is limited to five minutes each, after which the Members of the Subcommittee will each have five minutes to ask questions in each round of questioning. The lights there are helpful to you, I am sure.

Mr. Leader, we will start with you. The floor is yours.

STATEMENT OF MR. CHARLES A. LEADER, DIRECTOR, JOINT PLANNING AND DEVELOPMENT OFFICE, FEDERAL AVIATION ADMINISTRATION (FAA)

Mr. LEADER. My name is Charles Leader and I am the Director of the multi-agency Joint Planning and Development Office. With your permission, I would like to submit my formal statement for the record and take this opportunity to make a few opening remarks.

Chairman UDALL. Without objection, so ordered.

Mr. LEADER. Thank you, sir.

I think you will agree that the United States has the safest and most efficient air traffic control system in the world. It handles a staggering amount of traffic every day. This includes passenger flights, air cargo, military operations, unmanned aerial vehicles, space launches, but as capable as it is, we are already seeing the limits of the current system. Delays and cancellations are growing, and unless we begin to transform the system now, the problems are only going to get worse.

The issues concerning the future capacity and flexibility of the National Air Transportation System are matters that the House and this Committee understand very well. In 2003, Vision 100, the FAA reauthorization, chartered the Next Generation Air Transportation System Initiative and established the Joint Planning and Development Office.

The scope of this undertaking as well as the length of the commitment is almost unprecedented in government. It involves the joint efforts of the Departments of Homeland Security, Commerce, Defense and Transportation as well as NAS and the FAA. But it is far more than just a large government program. It also represents a unique collaboration with industry. NextGen is a long-term transformation of our nation's air transportation system. We are leveraging existing technologies such as satellite-based navigation and networking while at the same time developing new capabilities and new technologies that will change our entire approach to managing the air transportation system. Often, one of the challenges in explaining the NextGen system is putting what we are doing in context.

With that in mind, an approach I would like to take in explaining NextGen is to relate the technology and procedural improvements we are making to the air transportation system to applying the technologies in ways that we are familiar with. One good example of a day-to-day application of the kind of technology, one that relates to NextGen, is the General Motors product that comes with many of their new cars called OnStar. Although applied to automobiles and operating in a two-dimensional environment of roads and vehicles, it uses GPS technology as well as voice and data links to help drivers find out where they are and at the same time uses the same type of voice and data links that we will be using in the

NextGen system. The OnStar data link can receive messages from the GM command center, sent directly to the automobile's computer to do such things as unlock the doors, report problems with the vehicle or report an automobile accident.

We will be using the same sort of existing technology in NextGen to allow flight crews to communicate, navigate and report their positions while operating within the National Airspace System.

Implementation of NextGen has already begun. Two programs, both fundamental foundational technologies, are the Automatic Dependence Surveillance Broadcast, ADS–B, and System Wide Information Management, SWIM. Both of these programs are funded and already underway. ADS–B relies on GPS and is critical in developing NextGen satellite-based navigation and control capabilities. SWIM is developing our key networking capabilities and will establish the critical networking infrastructure.

Indeed, I want to make a point about SWIM and network-enabled operations, namely that DOD, DHS and the FAA are each contributing $5 million to a real demonstration of this capability later this year. Each of these programs and the capabilities they represent are essential in beginning the transformation of our current air traffic control system from one that relies on voice communications and ground-based navigation to one that is satellite-based, network-enabled, and uses advanced digital communication.

By its very nature, this kind of initiative needs to use a portfolio-based approach. In other words, the approach has to be one that allows the Joint Planning and Development Office to integrate a wide range of research initiatives and investments. That is why some of the most important products for the JPDO have been its three planning tools: the Concept of Operations, which went out for final review last month; the Enterprise Architecture, which will be released for stakeholder review in late May; and the Integrated Work Plan, which will be released for comment in July. These will be the guides for the future research, investment and implementation of the NextGen System.

I also want to make a point that Dr. Carmichael will talk about in further depth in a few moments to express the importance of weather, weather research, and weather forecasting in meeting the objectives of the NextGen system. The success of NextGen relies heavily on improvements in gathering better weather data and implementing a common probabilistic forecasting capability. That is why we are working with each agency that has a weather responsibility to establish a common approach to developing this technology and the research strategy that is required to be pursued. NextGen is a long-term initiative and in its early stages. If given the authority and resources, I believe that JPDO can be catalytic in transforming the National Airspace System.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Leader follows:]

PREPARED STATEMENT OF CHARLES A. LEADER

Good morning, Chairman Udall, Congressman Calvert, and Members of the Subcommittee. I am Charles Leader, Director of the multi-agency Joint Planning and Development Office (JPDO). I am honored to be here this morning to testify about the JPDO, and the work we are doing to develop and deploy the Next Generation

Air Transportation System (NextGen) while providing operational and safety enhancements that deliver benefits to our customers today.

Moving to NextGen is inextricably linked to changes in the FAA's financing system. We need to establish the financing of current and future operations based on actual costs and investment requirements that will realize tangible benefits and increasing efficiency. The *NextGen Financing Act of 2007,* as proposed by the Administration, provides the necessary reforms to our financing, and puts us on the path towards fully implementing the NextGen system.

And implementing that system is imperative. Our nation's air transportation system has become a victim of its own success. We have created the most effective, efficient and safest system in the world. But we now face a serious and impending problem: today's system is at capacity. While the industry downturn following the attacks of September 11 temporarily slowed the growth in the aviation industry that began in the late 1990's, demand is growing rapidly. And we have to change if we a going to be ready to meet it.

The warning signs are everywhere. Flight delays and cancellations have reached unacceptable levels. Other issues, ranging from environmental concerns to the complexities of homeland security are placing additional stresses on the system. If we fail to address these issues, we will suffocate the great engine of economic growth that is civil aviation. A MITRE study done for FAA concludes that the current system cannot handle the projected traffic demands expected by 2015—absent modernization, the consequences will be serious.

NextGen is about a long-term transformation of our air transportation system. It focuses on leveraging new technologies, such as satellite-based navigation, surveillance and network-centric systems. Enabling any far-reaching, systematic and long-term transformation requires a vision of what you want and need to achieve, and plans for how to get there from here. That's where the work of the Joint Planning Development Office has come in to develop, the Concept of Operations, the Enterprise Architecture, and the Integrated Work Plan. These documents provide us with that picture of where we want to go and the plans for how to achieve it.

The Concept of Operations is a description of the transformed state of NextGen, much like what an architect's blueprints offers a builder. Then, to adequately lay the groundwork and basic plans for the NextGen system requires another step in the process, developed concurrently with the Concept of Operations, and that's the Enterprise Architecture. The Enterprise Architecture provides the next level of technical details of the transformed NextGen system, much like a builder's plumbing and wiring diagrams, specifying how the house will get its power, water, sewage, cable, and internet connections to the rest of the community. Finally, the Integrated Work Plan is the equivalent of the general contractor's work plan. It specifies the timing and interdependencies of the multi-agency research, demonstrations, and development required to achieve the NexGen system vision.

This set of documents will define the NextGen system and guide the future investment and capabilities, both in terms of research and systems development. The JPDO released the NextGen Concept of Operations for public comment on February 28th. It is now available on the JPDO website for review and comment by our stakeholders, and we are anxious to receive their feedback. The NextGen Enterprise Architecture and the Integrated Work Plan should be released within the next few months.

Let me emphasize, however, that we are not waiting for 2025 to implement technologies to promote safer, more efficient operations, and increase capacity in an environmentally sound manner. FAA and JPDO are beginning to move from planning to implementation. In fact, the FAA's FY 2008–2012 Capital Investment Plan (CIP) includes $4.6 billion in projects and activities that directly support NextGen. The CIP is a five-year plan that describes the National Airspace System modernization costs aligned with the projects and activities that the Agency intends to accomplish during that time. Several key NextGen technologies and programs have already been identified and are funded in the FAA's FY08 budget request. These technologies and programs are: Automatic Dependent Surveillance-Broadcast (ADS–B); System Wide Information Management (SWIM); NextGen Data Communications; NextGen Network Enabled Weather; NAS Voice Switch; and, NextGen Demonstrations and Infrastructure Development. FAA proposes to spend $173 million on these programs in FY08.

These technologies are essential to begin the transition from today's air traffic management system to the NextGen system of 2025. Perhaps the most significant of these transformational technologies is Automatic Dependent Surveillance-Broadcast or ADS–B. ADS–B is, quite simply, the future of air traffic control. A key element of the NextGen system, it uses GPS satellite signals to provide air traffic controllers and pilots with much more accurate information on aircraft position that

will help keep aircraft safely separated in the sky and on runways. Aircraft transponders receive GPS signals and use them to determine the aircraft's precise position in the sky, which is combined with other data and broadcast out to other aircraft and controllers. When properly equipped with ADS–B, both pilots and controllers will, for the very first time, see the same real-time displays of air traffic; thereby substantially improving safety.

ADS–B has been successfully demonstrated through the FAA's Capstone program in Alaska, and it has contributed to the recent reduction of GA accidents in Alaska by more than 40 percent for ADS–B equipped aircraft. One of the first uses of ADS–B technology outside of Alaska will be in the Gulf of Mexico. The FAA has signed a Memorandum of Agreement (MOA) with the Helicopter Association International (HAI), helicopter operators and oil and gas platform owners in the Gulf of Mexico to improve service in the Gulf. Using ADS–B technology, helicopter operators will transmit critical position information to the Houston Center, enabling enhanced Air Traffic Control services in the Gulf.

The FAA is looking at a rule-making that would mandate the avionics necessary for implementing ADS–B in the national airspace system, and is working closely with stakeholders to determine an appropriate proposed timeline for a future NPRM.

In today's NAS there are a myriad of systems with custom-designed, developed, and managed connections. The future, however, demands an infrastructure that is capable of flexible growth, and the cost of expanding today's point-to-point system is simply prohibitive. System Wide Information Management (SWIM) responds to that need. SWIM will provide high quality, timely data to many users and applications. By reducing the number and types of interfaces and systems, SWIM will reduce unnecessary redundancy of information and better facilitate multi-agency information-sharing. When implemented, SWIM will contribute to expanded system capacity, improved predictability and operational decision-making, and reduced cost of service. In addition, SWIM will improve coordination to allow transition from tactical conflict management to strategic trajectory-based operations. It will also allow for better use of existing capacity enroute.

The heart of the NextGen advanced airspace management concepts lies—like much of our society—in the ability to communicate large amounts of complex information in a fast, efficient, and robust manner. In the current system, all air traffic communications with airborne aircraft is by voice communications—in other words you pick up the "phone" to talk to someone else on another "phone." NextGen transformation cannot be realized through today's voice-only communications, especially if you want to manage tens of thousands of aircraft flights on optimal trajectory-based routes. Data communications enabled services, such as 4–D trajectories and conformance management, will shift air traffic operations from short-term, minute-by-minute tactical control to more predictable and planned strategic traffic management. Eventually, the majority of communications will be handled by data communications for appropriately-equipped users. It is estimated that with 70 percent of aircraft data-link equipped, exchanging routine controller-pilot messages and clearances via data can enable controllers to safely handle approximately 30 percent more traffic. [FAA ATO–P Future Enroute Work Station Study, Preliminary Results, 2006]

The NextGen Network Enabled Weather will serve as the backbone of the NextGen weather support services, and provide a common weather picture to all NAS users. Approximately 70 percent of annual national airspace system delays are attributed to weather. The goal of this investment is to cut weather-related delays by at least 50 percent. The weather problem is about total weather information management, and not just the state of the scientific art in weather forecasting. The weather dissemination system today is inefficient to operate and maintain, and information gathered by one system is not easily shared with other systems. We must integrate predictive weather information with decision support tools and provide uniform real-time access to key common weather parameters, and common situational awareness. The benefits will be improved utilization of air space across all flight domains, and reduced flight delays.

The NAS Voice Switch will provide the foundation for all air-to-ground and ground-to-ground voice communications in the air traffic control environment. The switches today are very static, and our ability to adjust the airspace for contingencies is limited. Under the current system it is very difficult and time consuming to coordinate and redesign the airspace. In the future, the impacts of bad weather could be responded to in real-time, thereby minimizing its disruptions to air traffic. The new voice switch allows us to replace today's rigid, sector-based airspace design and support a dynamic flow of traffic. Voice communications capabilities and network flexibility provided by the NAS Voice Switch are essential to the FAA's ability

to implement new NextGen services that are necessary to increase efficiency and improve performance.

At this early stage of NextGen, it is critical to better define operational concepts and the technologies that will support them. A crucial part of this activity is demonstrations of new technologies and capabilities. In late April, we will demonstrate the use of continuous descent approaches with time metering. We are requesting funding for additional activities related to defining operational concepts and technologies in the FY08 budget. This funding will support two demonstrations and a series of infrastructure development activities. The primary purposes of these demonstrations are to refine aspects of the trajectory-based operations concept, while lowering risk by phasing in new technologies. One demonstration will test trajectory-based concepts in the oceanic environment. The ultimate goal is to increase predictability on long-duration international flights and improve fuel efficiency. The other demonstration will accelerate the first integrated test of super-density operations using procedures for increasing capacity at busy airports. This demonstration should achieve near-term benefits at the test airport, and give us the tools to implement the same procedures at other locations.

It is important to understand that NextGen is a portfolio program. The technologies described above, and those that will be defined over the next several years, are interdependent, creating a series of transformations that will truly modernize today's system. Let me provide a few examples of this.

In the future, trajectory-based operations will enable many pilots and dispatchers to select their own flight paths, rather than follow the existing system of flight paths, that are like a grid of interstate highways in the sky. In the high performance airspace of the future, each airplane will transmit and receive precise information about the time at which it and others will cross key points along their paths. Pilots and air traffic managers on the ground will have the same precise information, transmitted via data communications. Investments in ADS–B, SWIM and Data Communications are critical to trajectory-based operations.

The NextGen system will enable collaborative air traffic management. The increased scope, volume, and widespread distribution of information that SWIM provides will improve the quality of the decisions by air traffic managers and flight operators to address major demand and capacity imbalances. SWIM and NAS Voice Switch are instrumental in achieving this collaborative air traffic management.

With NextGen, the impact of weather is reduced through the use of improved information sharing, new technology to sense and mitigate the impacts of weather, improved weather forecasts, and the integration of weather into automation to improve decision-making. New capabilities in the aircraft and on the ground, coupled with better forecasts and new automation, will minimize airspace limitations and traffic restrictions. Network Enabled Weather and SWIM are vital investments for these improvements.

Another vital consideration in the development of the NexGen system is successfully managing aviation's environmental impacts. We have set out an aggressive vision that grew out of a report to Congress that was requested under *Vision 100*. Two years ago we delivered "Aviation and the Environment—A National Vision." Developed through the Partnership for Air Transportation Noise and Emissions Reduction (PARTNER) Center of Excellence, it brought near 40 stakeholders together: airlines, manufacturers, community groups, airports, universities, research establishments, and other government agencies to develop a common vision. The participants agreed that the U.S. aviation system should ensure significant impacts from noise and local emissions continue to decline, identify appropriate metrics to deal with greenhouse gas emissions, improve the relationship between airports and communities that surround them, and ensure the U.S. remains a global leader in aviation environmental matters—even as we grow the system two to three fold.

A preliminary JPDO analysis has shown that long before we run into limits from technology, we run into constraints to capacity from noise and emissions impacts. In fact, we potentially lose tens of billions of dollars in foregone aviation activity. That's why the NexGen reauthorization is so important. It offers a number of programs that are essential if we are to meet the environmental objectives—and so foster capacity expansion and benefits it brings to the American public. These include: demonstrating the use of new environmentally-friendly procedures; underwriting the implementation of such procedures at airports; targeting research of environmental issues at the airport level; accelerating the maturing of new noise and emission reduction technologies for use in aircraft; and exploring the use of alternative fuels to enhance supply security and environmental performance.

We recognize that there are many challenges in converting the JPDO's vision of the NextGen system into reality. Because the JPDO is not an implementing or executing agency, the FAA and the other JPDO partner agencies must work closely

with the JPDO to develop an implementation schedule for the operational changes required as new technologies are deployed to realize the NextGen vision. The FAA is using the Operational Evolution Partnership, the new OEP, to guide their transformation to NextGen. In the past the Operational Evolution Plan successfully provided a mid-term strategic roadmap for the FAA that extended ten years into the future. The new OEP will include strategic milestones through 2025. JPDO representatives will participate along with the FAA in OEP development and execution.

The NAS and NextGen Enterprise Architectures will provide the backbone of this new OEP by specifying roadmaps for system and certification requirements, operational procedures, program phasing, and prototype demonstrations. This Operational Evolution Partnership will be the mechanism by which we hold ourselves accountable to our owners, customers, and the aviation community for the FAA's progress towards the JPDO vision, while assuring that the JPDO and the FAA are jointly on-track to deliver the NextGen system.

Cost will be a vital factor: we cannot create a NextGen system that is not affordable. Out-year funding estimates over the first ten years range from $8 billion to $10 billion. Preliminary estimates suggest that the investments necessary to achieve the end state NextGen system range from $15 billion to $22 billion in funding. We are working to continuously refine these estimates, particularly with our users as we implement new cost-based financing mechanisms, as proposed in the *Next Generation Air Transportation System Financing Reform Act of 2007,* the FAA's reauthorization proposal.

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

The importance of developing this system of the future is also quite clear to policymakers in Europe, where a comparable effort known as Single European Sky Air Traffic Management Research (SESAR) is well underway. This presents both a challenge and an opportunity to the United States. Creating a modernized, global system that provides interoperability could serve as a tremendous boost to the aerospace industry, fueling new efficiencies while creating jobs and delivering substantial consumer benefits. The further opening of U.S. and European markets in the recently-agreed "Open Skies" agreement reinforces this need. Alternatively, we could also see a patchwork of duplicative systems and technologies develop, which would place additional cost burdens on an industry already struggling to make ends meet.

Last year, Administrator Blakey signed a Memorandum of Understanding with her European counterpart that formalizes cooperation between the NextGen initiative and the SESAR program. The FAA and the EC are identifying opportunities and establishing timelines to implement, where appropriate, common, interoperable, performance-based air traffic management systems and technologies. This coordination will address policy issues and facilitate global agreement within international standards organizations such as ICAO, RTCA, and Eurocontrol, and contribute greatly to the success of this critical initiative. We hope to take the first steps under this agreement later this summer to lay out a roadmap of flight trials to test a number of procedures and technology that will reduce noise and emissions.

Our European counterparts have released a preliminary cost estimate for SESAR. SESAR is conceived as a system that, while smaller in scope and size, has similar air traffic management goals as NextGen. They consider different system scenarios and a range of total costs of $25 billion to $37 billion in U.S. dollars through the year 2020. SESAR, like NextGen, has a lot of work remaining to refine assumptions and better define the system. However, there is an important difference in scope between SESAR and NextGen. While SESAR focuses almost exclusively on air traffic management, NextGen takes what's called a "curb-to-curb" approach, and includes not only air traffic control, but also airports, airport operations, security and passenger management, and DOD and DHS NAS requirements.

Our overarching goal in the NextGen initiative is to develop a system that will be flexible enough to accommodate a wide range of users—very light jets and large commercial aircraft, manned and unmanned aircraft, small airports and large, business and vacation travelers alike, while handling a significantly increased number of operations with a commensurate improvement in safety, security, environment and efficiency. Research will continue to help us find the right balance between a centralized satellite and ground system and a totally distributed system, where aircraft "self-manage" their flight with full knowledge of their environment.

Mr. Chairman, this concludes my testimony. I would be happy to answer any questions the Committee may have.

BIOGRAPHY FOR CHARLES A. LEADER

Mr. Leader is the Director of the Joint Planning and Development Office (JPDO), appointed on August 7, 2006, by the FAA Administrator Marion C. Blakey.

As Director of the JPDO, Mr. Leader is charged with the goal of transforming the air transportation system of the United States. His interagency office is tasked with developing and implementing a National Integrated Plan to improve the level of safety, security, capacity, efficiency, quality, and affordability of the National Airspace System. The National Plan, known as the Next Generation Air Transportation System (NGATS), is being developed with the support and resources of the Administrator of the FAA, the Administrator of NASA, the Secretary of Defense, the Secretary of Homeland Security, the Secretary of Commerce, and the Director of the Office of Science and Technology Policy (OSTP). These government agencies are partnered with more than 200 industry stakeholders to produce this transformational plan. Beginning with the safest transportation system today, NGATS will lay out a technology and policy roadmap to deliver space-based, precision navigation, "Super Density" operations to a world-wide audience. To insure global interoperability and economic growth, NGATS will promote international harmonization of these transformational plans and programs among International stakeholders.

Mr. Leader is a veteran of the U.S. Marine Corps and a graduate of the University of Notre Dame and of Harvard Business School. During the past fifteen years, Mr. Leader has held CEO and general management positions in several corporations, including Hughes Aircraft. He was a partner at McKinsey & Co. and co-leader of their Aerospace/Defense practice. Mr. Leader's experience includes working in technology development, systems integration, and the realignment of large and complex organizations.

Chairman UDALL. Thank you, Mr. Leader.

Dr. Dillingham, the floor is yours.

STATEMENT OF DR. GERALD L. DILLINGHAM, DIRECTOR, PHYSICAL INFRASTRUCTURE ISSUES, GOVERNMENT ACCOUNTABILITY OFFICE

Dr. DILLINGHAM. Thank you, Chairman Udall. My testimony today on the status of JPDO's efforts to plan and coordinate the development of the NextGen focuses on questions. First, what has been the outcome of JPDO's efforts to establish its organizational and operational structure; second, what is the status of JPDO's technical planning; and third, to what extent has funding been identified for near-term research and development?

Regarding JPDO's structure and operations, our research shows that the JPDO partner agencies have worked together to develop key strategies for implementing NextGen. JPDO has also leveraged its partner agencies' resources by staffing various levels of its organization with partner agency employees. Additionally, the establishment of the Institute provides a method for involving non-federal stakeholders in planning NextGen.

Our work has identified some organization issues that, if not addressed, could seriously jeopardize the JPDO's chances of success. For example, the frequency of leadership turnover at JPDO and the Institute has raised concerns about the stability of the office and the future of the initiative. During its three years of existence, JPDO has had three directors, and there have been two directors of the Institute. Additionally, some stakeholders have expressed concerns about the productivity and the pace of JPDO's efforts. Concerns have also been raised by some private sector stakeholders

as to whether potential conflict-of-interest issues are adequately addressed by current Institute policy.

To its credit, JPDO officials are currently proposing several changes to JPDO's structure and operations to improve the effectiveness of the organization. We believe that these changes could help address stakeholder concerns but their effectiveness will need to be monitored, evaluated and linked to a policy of continuous improvement. Furthermore, we believe that FAA and JPDO must also identify and address the factors that have contributed to the frequent turnover of its senior management.

JPDO also has a continuing challenge in ensuring the involvement of all key stakeholders. For example, active traffic controllers and technicians are not currently involved in NextGen planning. Our analysis of FAA's current air traffic control modernization program has shown that involving stakeholders is a very critical requirement for successful implementation of efforts such as NextGen.

With our regard to our second question about JPDO's technical planning, as you heard Mr. Leader testify, JPDO has made significant progress towards completing several key technical planning documents including a Concept of Operations, an Enterprise Architecture and an Integrated work Plan. We think that JPDO is focusing on the right types of planning tools for the NextGen initiative.

In our earlier testimony before this committee, we noted that JPDO is, fundamentally, a planning and coordinating body that lacks authority over the key human and technological resources of its partner agencies. To its credit, the JPDO has begun to explore ways to help ensure that it has the needed resources and authority. For example, JPDO is working on aligning Enterprise Architectures of its partner agencies. It is also working with OMB to establish a cross-agency mechanism for NextGen funding decisions and it is working with FAA to revamp its key planning tool, the Operation Evolutionary Partnership, to focus on the NextGen effort. Institutionalizing these types of collaborative processes will be critical for JPDO to maintain its achievement and ensure further progress despite personnel changes and the competing priorities of the partner agencies.

Now, I would like to turn to our final question: to what extent has funding been identified for near-term research and development? FAA and JPDO recently estimated total federal costs for NextGen will range between $15 and $22 billion. However, questions remain as to which organizations will fund and conduct some of the necessary R&D and demonstration projects. This R&D will be key to making decisions about NextGen technology, developing regulations, and addressing human factor issues. In the past, a significant part of this research was conducted by NASA. FAA's R&D advisory committee has estimated that it would cost nearly a half a billion dollars in additional funding and delay NextGen by five years for FAA to develop the necessary infrastructure and assume the previous NASA R&D. According to JPDO, the organization is exploring ways to address the R&D funding challenge and they expect to issue a report in August of this year.

Mr. Chairman, in closing, I want to emphasize that JPDO has achieved much in its short existence but much remains to be done.

This is one of the Federal Government's most complicated undertakings. There are many challenges on the horizon that will have to be overcome and will require the joint efforts of the Congress, the partner agencies and the private sector aviation community. Failing is not an option.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Dillingham follows:]

PREPARED STATEMENT OF GERALD L. DILLINGHAM

Mr. Chairman and Members of the Subcommittee:

I appreciate the opportunity to testify before you today to discuss the progress of the Joint Planning and Development Office (JPDO) in conceptualizing, planning, and facilitating a transformation of the current national airspace system to the Next Generation Air Transportation System (NextGen). Our nation's current airspace system is under growing strain as the demand for air travel is steadily increasing, from over 740 million passengers flying in fiscal year 2006 to an estimated one billion passengers by 2015, according to Federal Aviation Administration (FAA) estimates. The system is also expected to absorb a growing variety of aircraft, from the jumbo A380 which can hold more than 500 passengers to very light jets which will transport six or fewer passengers per flight. The consensus is that the current system cannot be expanded to meet this projected growth. Without a timely transition to NextGen capabilities, JPDO officials estimate a future gap between the demand for air transportation and available capacity that could cost the U.S. economy billions of dollars annually.

In 2003, recognizing the need for system transformation, Congress authorized the creation of JPDO,[1] housed within FAA, to lead a collaborative effort of federal and non-federal aviation stakeholders to conceptualize and plan the NextGen system. NextGen is envisioned as a major redesign of the air transportation system that will move from largely ground-based radars to precision satellite-based navigation and includes digital, networked communications; an integrated weather system; layered, adaptive security; and more. In addition to FAA, JPDO operates in conjunction with multiple federal partner agencies, including the Departments of Transportation, Commerce, Defense, and Homeland Security; the National Aeronautics and Space Administration (NASA); and the White House Office of Science and Technology Policy.

My testimony today focuses on the following question: What is the status of JPDO's planning and facilitation of NextGen with respect to its organizational structure, technical planning, and initial research and development? My statement is based on our November 2006 report to this subcommittee[2] as well as on-going work. We conducted this work in accordance with generally accepted government auditing standards.

In summary:

JPDO has made progress in several areas in its planning of the NextGen initiative, but continues to face a number of challenges. JPDO's organizational structure incorporates some of the practices that we have found to be effective for federal interagency collaborations, and includes an institute that facilitates the participation of non-federal stakeholders. JPDO has faced some organizational challenges, however. Leadership turnover at JPDO and the Institute have raised concerns about the stability of JPDO and the NextGen initiative. Additionally, we and JPDO officials have heard concerns from stakeholders about the productivity of some integrated product teams (IPTs) and the pace of the planning effort at JPDO. In response, JPDO officials are currently proposing several changes to JPDO's organizational structure aimed at improving the effectiveness of the organization. We believe that these changes could help address stakeholder concerns, but the effectiveness of these changes will have to be evaluated.

JPDO has also made progress toward releasing several key planning documents, including a Concept of Operations, an Enterprise Architecture, and an Integrated Work Plan, although in some cases on a revised and extended timeline. JPDO is focusing on the right types of key documents for the foundation of NextGen plan-

[1] JPDO was authorized by the *Vision 100-Century of Aviation Reauthorization Act* (Pub. L. No. 108–176). The office began operating in early 2004.

[2] GAO, *Next Generation Air Transportation System: Progress and Challenges Associated with the Transformation of the National Airspace System,* GAO–07–25 (Washington, D.C.: Nov. 13, 2006).

ning, although the current draft Concept of Operations still lacks important details. In our November 2006 report, we noted that JPDO is fundamentally a planning and coordinating body that lacks authority over the key human and technological resources of its partner agencies. Consequently, institutionalizing the collaborative process with its partner agencies will be critical to JPDO's ability to facilitate the implementation of NextGen. JPDO has identified several tasks that will help institutionalize collaboration, including aligning the enterprise architectures of its partner agencies, working with OMB to establish a cross-agency mechanism for NextGen funding decisions, and working with FAA to revamp a key planning document to focus on the NextGen effort.

JPDO has made progress in developing cost estimates for NextGen, recently reporting that it estimates the total federal cost for NextGen infrastructure through 2025 will range between $15 billion and $22 billion. Questions remain, however, over which organizations will fund and conduct some of the necessary research, development, and demonstration projects that in the past were often conducted by NASA, and which will be key to achieving certain NextGen capabilities. For example, JPDO's investment simulation capability relies heavily on a NASA modeling platform that NASA does not plan to upgrade for two years. As a result, JPDO's investment simulation capability might be constrained. JPDO also faces a challenge in addressing questions concerning how human factors issues, such as the changing roles of air traffic controllers in a more automated NextGen environment, will be researched and addressed. Finally, JPDO has a continuing challenge in ensuring the involvement of all key stakeholders. For example, active air traffic controllers and technicians are not currently involved in NextGen planning. Similarly, issues have arisen over whether conflict of interest issues could chill the participation of industry stakeholders.

In November 2006, we recommended that the Secretary of Transportation direct JPDO to take actions to institutionalize the partner agencies' collaboration in supporting NextGen, including action on a Memorandum of Understanding among the partner agencies, actions to finalize procedures to leverage partner agency resources, and actions to develop procedures for dispute resolution. We also recommended that the Secretary direct JPDO to determine whether key stakeholders and expertise are not currently represented in JPDO planning efforts. JPDO officials neither agreed nor disagree with our recommendations, but said they would consider them.

JPDO Has Made Progress in Planning NextGen, but Continues to Face a Number of Challenges

JPDO has continued to make progress in facilitating the collaboration that is central to its mission and in furthering its key planning documents. However, JPDO faces a number of challenges involving its organizational structure, institutionalization of its efforts, research and development activities, and stakeholder participation.

JPDO's Organizational Structure Facilitates Collaboration, But Continues to Evolve

Vision 100 includes requirements for JPDO to coordinate and consult with its partner agencies, private sector experts, and the public. JPDO's approach has been to establish an organizational structure that involves federal and non-federal stakeholders throughout the organization. This structure includes a federal interagency senior policy committee, a board of directors, and an institute to facilitate the participation of non-federal stakeholders. JPDO's structure also includes eight integrated product teams (IPT), which is where the federal and non-federal experts come together to plan for and coordinate the development of technologies for NextGen. The eight IPTs are linked to eight key strategies that JPDO developed early on for guiding its NextGen planning work (see Table 1).

Table 1: JPDO's Strategies and Related IPT Lead Agencies

Strategy	Related IPT Lead Agency
Develop airport infrastructure to meet future demand	Federal Aviation Administration
Establish an effective security system without limiting mobility or civil liberties	Department of Homeland Security
Establish an agile air traffic system that quickly responds to shifts in demand	National Aeronautics and Space Administration[a]
Establish shared situational awareness—where all users share the same information	Department of Defense
Establish a comprehensive and proactive approach to safety	Federal Aviation Administration
Develop environmental protection that allows sustained aviation growth	Federal Aviation Administration
Develop a systemwide capability to reduce weather impacts	Department of Commerce
Harmonize equipage and operations globally	Federal Aviation Administration

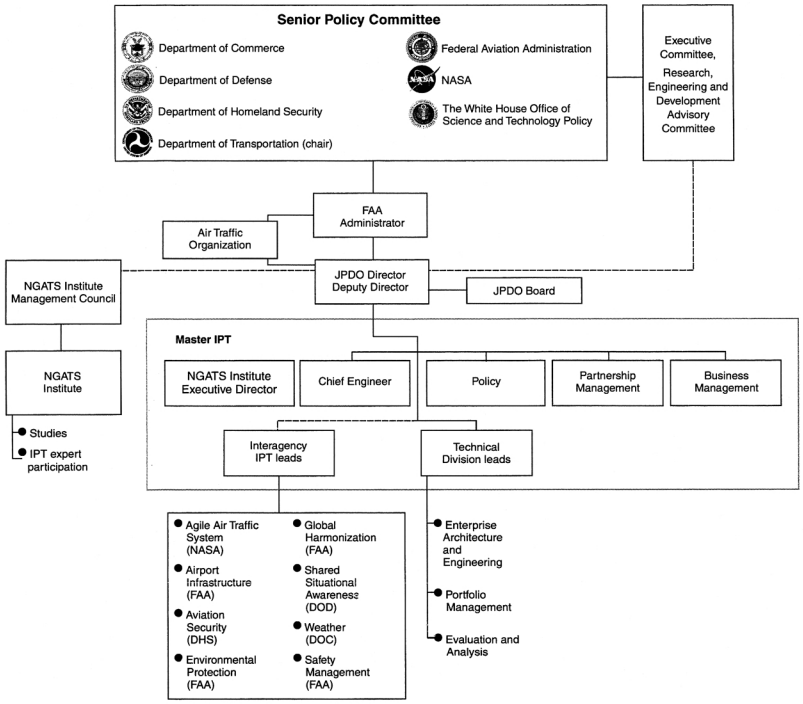
Sources: GAO and JPDO.

[a]NASA leads this IPT because it has primary responsibility for conducting the necessary research; implementation of the agile air traffic system is the responsibility of FAA.

JPDO's senior policy committee is headed by the Secretary of Transportation (as required in *Vision 100*) and includes senior-level officials from JPDO's partner agencies. The Next Generation Air Transportation System Institute (the Institute) was created by an agreement between the National Center for Advanced Technologies[3] and FAA to incorporate the expertise and views of stakeholders from private industry, state and local governments, and academia. The Institute Management Council (IMC), composed of top officials and representatives from the aviation community, oversees the policy, recommendations, and products of the Institute and provides a means for advancing consensus positions on critical NextGen issues. The IPTs are headed by representatives of JPDO's partner agencies and include more than 200 non-federal stakeholders from over 100 organizations, whose participation was arranged through the Institute. Figure 1 illustrates JPDO's position within FAA and the JPDO structures that bring together federal and non-federal stakeholders, including the Institute and the IPTs. To meet *Vision 100*'s requirement that JPDO coordinate and consult with the public, the Institute held its first public meeting in March 2006 and plans to hold another public meeting in May 2007.

[3]The National Center for Advanced Technologies is a nonprofit unit within the Aerospace Industries Association.

Figure 1: Organization of JPDO



Source: JPDO.

In November 2006, we reported that JPDO's organizational structure incorporated some of the practices that we have found to be effective for federal interagency collaborations—an important point given how critical such collaboration is to the success of JPDO's mission. For example, the JPDO partner agencies have worked together to develop key strategies for NextGen and JPDO has leveraged its partner agency resources by staffing various levels of its organization with partner agency employees. Also, our work has shown that involving stakeholders can, among other things, increase their support for a collaborative effort, and the Institute provides a method for involving non-federal stakeholders in planning NextGen.

Recently, JPDO officials told us they have proposed to FAA management and the IMC executive board a change in the IPT structure and operation to improve the efficiency of the organization. JPDO has proposed converting each IPT into a "work group" with the same participants as the current IPT, but with each work group led by a joint government and industry steering committee. The steering committee would oversee the creation of small, ad hoc subgroups that would be tasked with short-term projects exploring specific issues and delivering discrete work products. Under this arrangement, work group members would be free of obligations to the group when not engaged in a specific project. According to JPDO officials, if these changes are approved, the work groups would be more efficient and output- or product-focused than the current IPTs. JPDO officials also noted that they are proposing to create a ninth work group to address avionics issues.

We believe that these changes could help address concerns that we have heard from some stakeholders about the productivity of some IPTs and the pace of the planning effort at JPDO. Nonetheless, the effectiveness of these changes will have to be evaluated over time. Also, JPDO's director has pointed out the need for the office to begin transitioning from planning NextGen to facilitating the implementation of NextGen. We believe that these changes are potentially useful in supporting such a transition. However, it will be important to monitor these changes to ensure

that the participation of stakeholders is neither decreased nor adversely affected. Maintaining communications within and among work groups could increase in importance if, as work group members focus on specific projects, they become less involved in the overall collaborative planning effort.

Finally, while the organizational structure of JPDO and the Institute have been in place and largely unchanged for several years now, both of these entities have suffered from a lack of stable leadership. As JPDO begins its fourth year in operation, it is on its third director and operated during most of 2006 under the stewardship of an acting director. The Institute pointed out in its recent annual report that JPDO's leadership turnover had made it a challenge for JPDO to move out more aggressively on many goals and objectives, as the office waited on a full-time director. The Institute also stated that JPDO's leadership turnover had limited the ability of the IMC executive committee to forge a stronger relationship with JPDO leadership and work jointly on strategic issues and challenges. However, the Institute has also had issues with turnover and is currently functioning under an acting director due to the recent departure of its second director, who had been in the position less than two years. The leadership turnovers at both JPDO and the Institute raise concerns about the stability of JPDO and about the impact of these turnovers on the progress of the NextGen initiative.

JPDO Has Made Progress Toward Releasing Key Planning Documents, Although Further Work Remains

JPDO's authorizing legislation requires the office to create a multi-agency research and development plan for the transition to NextGen. To comply, JPDO is developing several key documents that together form the foundation of NextGen planning. These documents include a NextGen Concept of Operations, a NextGen Enterprise Architecture, and an Integrated Work Plan.

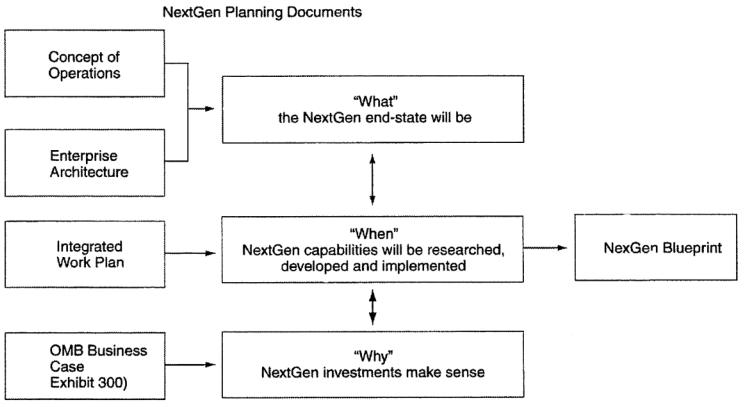
The Concept of Operations is the most fundamental of JPDO's key planning documents, as the other key documents flow from it. Although an earlier version was delayed so that stakeholder comments could be addressed, Version 1.2 of the Concept of Operations is currently posted on JPDO's website for review and comment by the aviation community. This 226-page document provides written descriptions of how the NextGen system is envisioned to operate in 2025 and beyond, including highlighting key research and policy issues that will need to be addressed.[4] For example, some key policy issues are associated with automating the air traffic control system, including the need for a backup plan in case automation fails, the responsibilities and liabilities of different stakeholders during an automation failure, and the level of monitoring needed by pilots when automation is ensuring safe separation between aircraft. Over the next few months, JPDO plans to address the public comments it receives and issue a revised version of the Concept of Operations.

In addition to the Concept of Operations, JPDO is working on an Enterprise Architecture for NextGen—that is, a technical description of the NextGen system, akin to blueprints for a building. The Enterprise Architecture is meant to provide a common tool for planning and understanding the complex, interrelated systems that will make up NextGen. According to JPDO officials, the Enterprise Architecture will provide the means for coordinating among the partner agencies and private sector manufacturers, aligning relevant research and development activities, and integrating equipment. JPDO plans to issue an early version of its Enterprise Architecture next month, although it was originally scheduled for release in September 2006.

Finally, JPDO is developing an Integrated Work Plan that will describe the capabilities needed to transition to NextGen from the current system and provide the research, policy and regulation, and schedules necessary to achieve NextGen by 2025. The Integrated Work Plan is akin to a project plan and will be critical for fiscal year 2009 partner agency budget and program planning. According to a JPDO official, the office intends to issue its initial draft of the Integrated Work Plan in July 2007.

[4] Following an introductory section, the Concept of Operations has eight sections covering air traffic management operations, airport operations and infrastructure services, net-centric infrastructure services, shared situational awareness services, security services, environmental management framework, safety management services, and performance management services.

Figure 2: Key NextGen Planning Documents



Source: JPDO.

We have discussed JPDO's planning documents with JPDO officials and examined both an earlier version of JPDO's Concept of Operations[5] and the current version that is out for public comment.[6] Based on our analysis, JPDO is focusing on the right types of key documents for the foundation of NextGen planning. As for the Concept of Operations, the current version is much improved from the prior version, with additional details added. Nonetheless, we believe that it still does not include key elements such as scenarios illustrating NextGen operations, a summary of NextGen's operational impact on users and other stakeholders, and an analysis of the benefits, alternatives, and trade-offs that were considered for NextGen. In addition, it lacks an overall description that ties together the eight key areas that the document covers. As noted, JPDO does plan to release another version of the Concept of Operations later this year.

In fact, JPDO plans further versions of all of its key planning documents. We see the development of all three of JPDO's key documents as part of an iterative and evolutionary process. Thus, it is unlikely that any of these documents will ever be truly "finalized," but rather will continue to evolve throughout the implementation of NextGen to reflect, for example, the development of new technologies or problems uncovered during research and development of planned technologies.

Finally, while each of the three key documents has a specific purpose, the scope and technical sophistication of these documents makes it difficult for some stakeholders to understand the basics of the NextGen planning effort. To address this issue, JPDO is currently drafting what the office refers to as a "blueprint" for NextGen, meant to be a short, high-level, non-technical presentation of NextGen goals and capabilities. We believe that such a document could help some stakeholders develop a better understanding of NextGen and the planning effort to date.

Institutionalizing the Collaborative Process Poses a Continuing Challenge for JPDO

In our November 2006 report, we noted that JPDO is fundamentally a planning and coordinating body that lacks authority over the key human and technological resources of its partner agencies. Consequently, institutionalizing the collaborative process with its partner agencies will be critical to JPDO's ability to facilitate the implementation of NextGen. As we reported in November, JPDO has not established some practices significant to institutionalizing its collaborative process. For example, one method for establishing collaboration at a fundamental level would be for JPDO to have formal, long-term agreements among its partner agencies on their

[5] Concept of Operations for the Next Generation Air Transportation System, Version 0.2, July 24, 2006.

[6] Our senior level technologist reviewed JPDO's current Concept of Operations for the Next Generation Air Transportation System, Version 1.2, dated February 28, 2007, by comparing it with the IEEE Standard 1362–1998 for concept of operations documents.

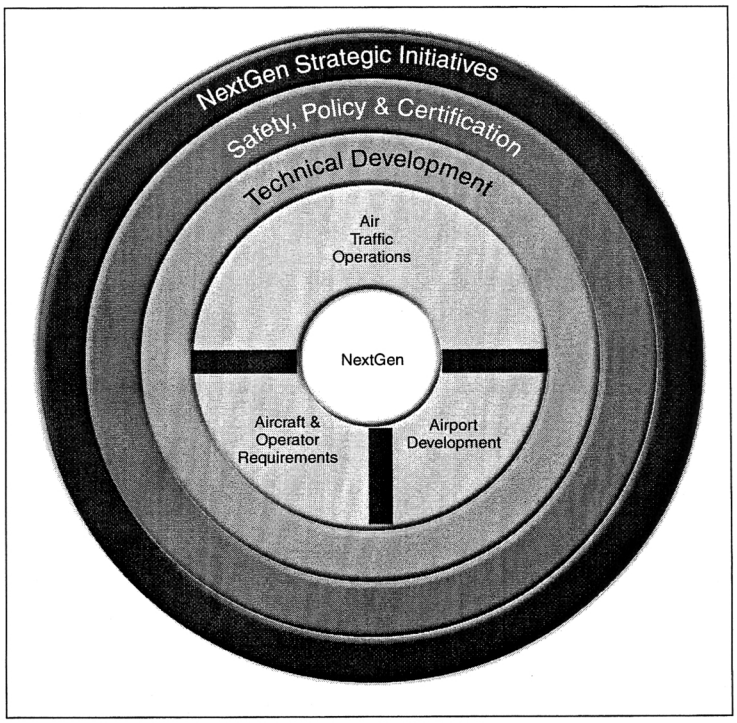
roles and responsibilities in creating NextGen. Currently, there is no mechanism that assures the partner agencies' commitment continuing over the 20-year timeframe of NextGen or their accountability to JPDO. According to JPDO officials, they are working to establish a memorandum of understanding (MOU), signed by the Secretary or other high-ranking official from each partner agency, which will broadly define the partner agencies' roles and responsibilities. JPDO first informed us of the development of this MOU in August 2005; in November 2006 we recommended that JPDO finalize the MOU and present it to the senior policy committee for its consideration and action. However, as of March 28, 2007, the MOU remained unsigned by some of the partner agencies.

Another key method for institutionalizing the collaborative effort is incorporating NextGen goals and activities into the partner agencies' key planning documents. For example, we noted in November 2006 that NASA and FAA had incorporated NextGen goals into their strategic plans. These types of efforts will be critical to JPDO's ability to leverage its partner agency resources for continued JPDO planning efforts. Even more importantly, these efforts will be critical to helping ensure that partner agencies—given competing missions and resource demands—dedicate the resources necessary to support the implementation of NextGen research efforts or system acquisitions.

Recognizing that JPDO does not have authority over partner agency resources, FAA and JPDO have initiated several efforts to institutionalize NextGen. For example, JPDO is working with FAA to refocus one of FAA's key planning documents on the implementation of NextGen—an effort that also appears to be improving the collaboration and coordination between JPDO and FAA's Air Traffic Organization (ATO), which has primary responsibility for modernization of the air traffic control system. FAA has expanded and revamped its Operational Evolution Plan (OEP)—renamed the Operational Evolution Partnership—to become FAA's implementation plan for NextGen.[7] The OEP is being expanded to apply to all of FAA and is intended to become a comprehensive description of how the agency will implement NextGen, including the required technologies, procedures, and resources. (Figure 3 shows the OEP framework.) An ATO official told us that the new OEP is to be consistent with JPDO's key planning documents and its budget guidance to the partner agencies. According to FAA, the new OEP will allow it to demonstrate appropriate budget control and linkage to NextGen plans and will force FAA's research and development to be relevant to NextGen's requirements. According to FAA documents, the agency plans to publish a new OEP in June 2007.

[7] Prior to expansion of the OEP, the document centered around plans for increasing capacity and efficiency at 35 major airports.

Figure 3: New OEP Framework



Source: JPDO.

Note: The concentric rings indicate the nature of initiative development from the outer ring (NextGen strategic initiatives), in which new programs and concepts are analyzed and demonstrated; to the second ring, where decisions are made regarding safety, operating policy, performance standards, and certification requirements; to the third ring (technical development), where concepts are prototyped and investment analysis decisions are made. The progression through the rings is not necessarily linear, and a program may be in more than one ring at a time. Data communications, for example, is in the technical development ring and also in the middle ring as policy and rulemaking is considered. The core is divided into three sections, which indicate the FAA offices that implement the final NextGen program.

In addition, to further align FAA's efforts with JPDO's plans for NextGen, FAA is creating a NextGen Review Board to oversee the OEP. This Review Board will be co-chaired by JPDO's Director and ATO's Vice President of Operations Planning Services. Initiatives, such as concept demonstrations or research, proposed for inclusion in the OEP will now need to go through the Review Board for approval. Initiatives are to be assessed for their relation to NextGen requirements, concept maturity, and risk. An ATO official told us that the new OEP process should also help identify some smaller programs that might be inconsistent with NextGen and which could be discontinued. Additionally, as a further step towards integrating ATO and JPDO, the administration's reauthorization proposal calls for the JPDO director to be a voting member of FAA's Joint Resources Council and ATO's Executive Council.

While progress is being made in incorporating NextGen initiatives into FAA's strategic and planning documents, more remains to be done with FAA and the other JPDO partner agencies. For example, one critical activity that remains in this area will be synchronizing the NextGen enterprise architecture, once JPDO releases and

further refines it, with the partner agencies' enterprise architectures. Doing so should help align agencies' current work with NextGen while simultaneously identifying gaps between agency plans and NextGen plans. Also, while FAA is making significant progress toward creating an implementation plan for NextGen, the other partner agencies are less far along or have not begun such efforts. JPDO's lack of authority over partner agency resources will be minimized as a challenge if the partner agencies commit to NextGen goals and initiatives at a structural level. By further incorporation of NextGen efforts into strategic planning documents, the partner agencies will better institutionalize their commitments to JPDO and the NextGen initiative.

Finally, another important method for institutionalizing the collaborative effort will be for JPDO to establish mechanisms for leveraging partner agency resources. JPDO has made progress in this area, although further work remains. As we noted in our November report, JPDO is working with OMB to develop a process that would allow OMB to identify NextGen-related projects across the partner agencies and consider NextGen as a unified, cross-agency program. We recently met with OMB officials who said that they felt there has been significant progress with JPDO over the last year. JPDO is now working on an OMB Exhibit 300 form for NextGen.[8] This will allow JPDO to present OMB a joint business case for the NextGen-related efforts within the partner agencies and will be used as input to funding decisions for NextGen research and acquisitions across the agencies. This Exhibit 300 will be due to OMB in September 2007 to inform decisions about the partner agencies' 2009 budget submissions.

Ultimately, the success of JPDO will have to be measured in the efforts of its partner agencies to implement policies and procedures and acquire systems that support NextGen. To date, JPDO can point to its success in collaborating with FAA to fund and speed its roll-out of two systems considered cornerstone technologies for NextGen: Automatic Dependent Surveillance-Broadcast (ADS–B) and System Wide Information Management (SWIM). ADS–B is a new air traffic surveillance system that will replace many existing radars with less costly ground-based transceivers. SWIM will provide an initial network centric capability to all the users of the air transportation system. This means that the FAA and the Departments of Homeland Security and Defense will eventually share a common, real-time, secure picture of aviation operations across the airspace system. Identifying such NextGen programs across the partner agencies and establishing implementation plans for them in JPDO's Integrated Work Plan will be critical going forward to creating performance metrics for JPDO.

Although we recommended in our November report that JPDO develop written procedures that formalize agreements with OMB regarding the leveraging of partner agency resources, this is still a work in progress. For example, OMB officials said they had not reviewed JPDO's 2008 partner agency budget guidance prior to its release to the partner agencies, which highlights the need for JPDO to further develop its procedures for working with OMB. Going forward, it will be important for Congress and other stakeholders to evaluate the success of the 2009 budgets in supporting NextGen initiatives, especially as 2009 is expected to be a critical year in the transition from planning NextGen to implementing NextGen.

FAA and JPDO Have Begun to Release Early Cost Estimates for NextGen, but Questions Remain Over Who Will Conduct Necessary Research and Development

In our November report, we noted that JPDO had not yet developed a comprehensive estimate of the costs of NextGen. Since then, in its recently released 2006 Progress Report,[9] JPDO reported some estimated costs for NextGen, including specifics on some early NextGen programs. JPDO believes the total federal cost for NextGen infrastructure through 2025 will range between $15 billion and $22 billion. JPDO also reported that a preliminary estimate of the corresponding cost to system users, who will have to equip with the advanced avionics that are necessary to realize the full benefits of some NextGen technologies, produced a range of $14 billion to $20 billion. JPDO noted that this range for avionics costs reflects uncertainty about equipage costs for individual aircraft, the number of very light jets that will

[8] Section 300 of OMB Circular No. A–11, Preparation, Submission, and Execution of the Budget (Nov. 2, 2005), sets forth requirements for federal agencies for planning, budgeting, acquiring, and managing information technology capital assets.

[9] JPDO, *Making the NextGen Vision a Reality: 2006 Progress Report to the Next Generation Air Transportation System Integrated Plan* (Washington, D.C.: Mar. 14, 2007).

operate in high-performance airspace, and the amount of out-of-service time required for installation.

FAA, in its capital investment plan for fiscal years 2008–2012, includes estimated expenditures for 11 line items that are considered NextGen capital programs.[10] The total five-year estimated expenditures for these programs is $4.3 billion. In fiscal year 2008, only six of the line items are funded for a total of roughly $174 million; funding for the remaining five programs would begin with the fiscal year 2009 budget. According to FAA, in addition to capital spending for NextGen, the agency will spend an estimated $300 million on NextGen-related research and development from fiscal years 2008 through 2012. The administration's budget for fiscal year 2008 for FAA includes a total of $17.8 million to support the activities of JPDO.

While FAA and JPDO have begun to release estimates for FAA's NextGen investment portfolio, questions remain over which entities will fund and conduct some of the necessary research, development, and demonstration projects that will be key to achieving certain NextGen capabilities. In the past, a significant portion of aeronautics research and development, including intermediate technology development, has been performed by NASA. However, NASA's aeronautics research budget and proposed funding shows a 30 percent decline, in constant 2005 dollars, from fiscal year 2005 to fiscal year 2011. To its credit, NASA plans to focus its research on the needs of NextGen. However, NASA is also moving toward a focus on fundamental research and away from developmental work and demonstration projects, which could negatively impact NextGen if these efforts are not assumed by others. According to its 2006 Progress Report, JPDO is building a research and development plan that will document NextGen's research needs and the organizations that will perform the work.

For example, JPDO's investment simulation capability relies heavily on NASA's NAS-wide modeling platform, the Airspace Concepts Evaluation System (ACES).[11] This investment simulation capability permits JPDO to, among other things, evaluate alternative research ideas and assess the performance of competing vendors. According to a JPDO official, this capability, which is critical to NextGen research, is eroding as JPDO's investment simulation requirements are expanding. As part of its fundamental research mission, NASA intends to upgrade to ACES–X (a more sophisticated representation of the national airspace system), but not for another two years. Until then, JPDO investment modeling capability will be constrained unless the office or another partner agency can assume the modeling work. While one option would be to contract with private sector vendors to do this type of modeling on a per simulation basis, this solution could be expensive for the government. Moreover, JPDO might not be able to continue facilitating participation by both small and large companies, thus giving both an equal opportunity to demonstrate their ideas, because small companies would have to pay for access to this proprietary modeling capability. This is an issue that needs to be addressed in the short-term.

JPDO faces the challenge of determining the nature and scope of the research and technology development necessary to begin the transition to NextGen, as well as identifying the entities that can conduct that research and development. According to officials at FAA and JPDO, they are currently studying these issues and trying to assess how much research and development FAA can assume. An FAA official recently testified that the agency proposes to increase its research and development funding by $280 million over the next five years. However, a draft report by an advisory committee to FAA stated that FAA would need at least $100 million annually in increased funding to assume NASA's research and development work, and establishing the necessary infrastructure within FAA could delay the implementation of NextGen by five years.[12] More work remains to completely assess the research and development needs of NextGen and the ability of FAA and the other JPDO partner

[10] FAA has six capital investment programs that it considers transformational NextGen programs slated to receive funding in fiscal year 2008: ADS–B nationwide implementation, System Wide Information Management (SWIM), NextGen Data Communications, NextGen Network Enabled Weather, National Airspace System Voice Switch, and NextGen Technology Demonstration. In addition, five other programs are slated to begin funding in 2009: NextGen System Development, NextGen High Altitude Trajectory Based Operations, NextGen High Density Airports, NextGen Networked Facilities, and NextGen Cross-Cutting Infrastructure.

[11] ACES provides a detailed flight simulation environment and an open framework to integrate the results of other simulations. This allows JPDO to test concepts well before they have to be demonstrated with real hardware and people. This platform provides a basis for evaluating the timing of many agencies' current budget requests and is a method for comparing competitive ideas.

[12] Research, Engineering and Development Advisory Committee, *Draft Report on Financing the Next Generation Air Transportation System* (Washington, D.C.: April 2006).

agencies to budget for and conduct the necessary initiatives. This information is critical as the timely completion of research and testing of proposed NextGen systems is necessary to keeping the NextGen initiative on schedule.

Some Fundamental NextGen Capabilities Will Require Human Factors Research

Addressing questions about how human factors issues will affect the move to some key NextGen capabilities is another challenge for JPDO. For example, the NextGen Concept of Operations envisions an increased reliance on automation, which raises questions about the role of the air traffic controllers in such an automated environment. Similarly, the Concept of Operations envisions that pilots will take on a greater share of the responsibility for maintaining safe separation and other tasks currently performed by controllers. This raises human factors questions about whether pilots can safely perform these additional duties.

Although JPDO has begun to model how shifts in air traffic controllers' workloads would affect their performance, it has not yet begun to model the effect of how this shift in workload to pilots would affect pilot performance. According to a JPDO official, modeling the effect of changes in pilot workload has not yet begun because JPDO has not yet identified a suitable model for incorporation into its suite of modeling tools. According to a JPDO official, the evolving roles of pilots and controllers is the NextGen initiative's most important human factors issue, but will be difficult to research because data on pilot behavior are not readily available for use in creating models. In addition to the study of changing roles, JPDO has not yet studied the training implications of various systems or solutions proposed for NextGen. For example, JPDO officials said they will need to study the extent to which new air traffic controllers will have to be trained to operate both the old and the new equipment as the Concept of Operations and enterprise architecture mature.

JPDO Faces A Continuing Challenge in Ensuring the Involvement of All Key Stakeholders

Some stakeholders, such as current air traffic controllers and technicians, will play critical roles in NextGen, and their involvement in planning for and deploying the new technology will be important to the success of NextGen. In November 2006, we reported that active air traffic controllers were not involved in the NextGen planning effort and recommended that JPDO determine whether any key stakeholders and expertise were not represented on its IPTs, divisions, or elsewhere within the office. Since then, the head of the controllers' union has taken a seat on the Institute Management Council. However, no active controllers are yet participating at the IPT planning level. Also, aviation technicians do not participate in NextGen efforts. Input from current air traffic controllers who have recent experience controlling aircraft and current technicians who will maintain NextGen equipment is important when considering human factors and safety issues. Our work on past air traffic control modernization projects has shown that a lack of stakeholder or expert involvement early and throughout a project can lead to costly increases and delays.

In addition, we found that some private sector stakeholders have expressed concerns that participation in the Institute might either preclude bidding on future NextGen acquisitions or pose organizational conflicts of interest. FAA's acquisition process, generally, precludes bids from organizations that have participated in, materially influenced, or had prior knowledge of the requirements for an acquisition. The Institute was aware of this concern and attempted to address it through an amendment to its governing document that strengthened the language protecting participants from organizational conflicts of interest for participation in the NextGen initiative. However, while the amendment language currently operates to protect stakeholders, the language has never been tested or challenged. Thus, it is unclear at this time whether any stakeholder participation is being chilled by conflict of interest concerns.

Mr. Chairman, this concludes my statement. I would be pleased to respond to any questions from you or other Members of the Subcommittee.

Chairman UDALL. Thank you, Dr. Dillingham.

Secretary Douglass, the floor is yours.

STATEMENT OF HON. JOHN W. DOUGLASS, PRESIDENT AND CEO, AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA

Mr. DOUGLASS. Thank you, Mr. Chairman.

First of all, I would like to ask your permission, sir, to submit my written statement for the record.

Chairman UDALL. Without objection, so ordered.

Mr. DOUGLASS. I will cover this briefly with a summary. Sir, my first involvement and deep immersion in this issue came back in 2002 when I was a commissioner on the bipartisan commission on the future of the aerospace industry and one of the extraordinary things that the commissioners discovered was that if you looked at the capacity of our air traffic control system and all of the estimates for growth in the air traffic in the United States, the two didn't match. There was a very big disconnect there and we could see fairly clearly that we were not going to be able to stay ahead of the demand unless we did something radically different, and one of the ideas that came from the commission was the creation of the JPDO, or Joint Office, to develop this new system and the vision of this Joint Office was that the technology that we need to do this task largely exists in other parts of the government. It exists in the Department of Defense. It exists in NASA and other parts of the government and we all knew that this was going to be an episodic thing that we do about every 40 or 50 years as a nation, a very complex task, and so we didn't want to reinvent the wheel, and from that was born the concept of the Joint Planning and Development Office. In the five years since this report was issued, we have seen the Department of Transportation, the FAA, and to its enormous credit, Congress, largely led by this and several other subcommittees support this concept and I would associate myself with much of what you said in your opening statement, Mr. Chairman.

So now, after five years, we find that much of the planning has been implemented but it is time for us to begin to actually implement the development of the new system and as we begin this task, it is really important to remember as both of my predecessors have said this morning, this is an enormously complex task. There is probably not another one that I can think of that is as broad an interagency effort, but the payoff if we do it right is huge in savings for the American people, both in the development process and in the important results of the project once it is implemented.

It is also important, though, Mr. Chairman to note that time is short. Five years have gone by since this commission report and there are people who are believing that we may see a meltdown this summer of the system because of thunderstorms and things of that nature and traffic is back ahead of where it was before 9/11. So we in industry share your concern about the need to get on with this and we are very concerned that the research and development funding shortfall, particularly in NASA and the Department of Homeland Security, need to be taken care of now and not pushed off into the out years. I have been told that there are some alignments coming into play as far as 2009 and 2010 down at OMB and we think that is too late.

So we believe that there is some additional accountability needed here to pull all of this together. We think JPDO needs to be accountable to the Congress. We need—we believe that the agencies that support the JPDO also need to be accountable to Congress. We are particularly concerned about the lack of regular meetings of the Senior Policy Oversight Committee that you mentioned in your opening statement. I can tell you, sir, I was a part of most of the big joint programs in the Department of Defense when I was at

General Law, sir, when I was Assistant Secretary of the Navy, and I have learned from hard experience that you have to meet very regularly to oversee these very complex projects.

Finally, my last point that I would like to make, sir, is that industry is very much a partner in this effort, not only in the development in the system but in the financing in the system. We expect that our side of the cost will probably be somewhere between $15 and $30 billion over the development cycle and it is enormously important for industry to have the confidence that the government part of the program will stay on track, and when the industry loses confidence that it will stay on track, then the funding dries up. Obviously, the airlines don't want to quit if they don't believe that a new system will actually be put into implementation.

So in summary, Mr. Chairman, I think this committee and the Congress has an important role to play in focusing the authority properly on the JPDO, making sure the resources are available. If those things happen, I think what you will see if that industry will do its part and the other parts of the government will fall in line if there is some strong oversight, especially from the Congress.

That concludes my statement, Mr. Chairman.

[The prepared statement of Mr. John Douglass follows:]

PREPARED STATEMENT OF JOHN W. DOUGLASS

Chairman Udall, Representative Calvert, and Members of the Subcommittee: I appreciate this opportunity to testify on the critical need to overhaul of our nation's air transportation system as mandated by *Vision 100, the FAA Reauthorization Act of 2003.*

A safe, secure and efficient air transportation system is essential to the economic vitality of the United States. Approximately 10 percent of the U.S. economy is directly tied to aerospace and aviation. Aviation continues to drive our nation's economic growth, and it will do so increasingly as air traffic triples over the next 20 years. Transformational improvements to our nation's air transportation infrastructure are essential to address the known capacity constraints in our current system. Since that system is operating close to the point of grid lock, it is crucial that our country develop and implement the Next Generation Air Transportation System (NGATS or NextGen) under the guidelines of *Vision 100.*

Members of the Aerospace Industries Association strongly support the mission of the JPDO, first conceived and recommended by the bipartisan *Commission on the Future of the United States Aerospace Industry* in November 2002, and we remain constructively engaged to make NextGen a reality. AIA represents almost 300 manufacturing companies with over 635,000 high-wage, highly skilled production employees. We operate as the largest aerospace trade association in the United States across three sectors: civil aviation, space systems, and national defense. Our member companies export 40 percent of their total output, and we routinely post the Nation's largest manufacturing trade surplus, a level that approached $55 billion last year. Aerospace companies also continue to invest heavily in R&D, spending more than $50 billion over the last 15 years.

The JPDO has steadily built a consensus around its vision for NextGen. This vision was initially expressed in its first two reports to Congress in 2004 and 2005. By spring, JPDO should complete the vision building stage when it releases more its detailed Concepts of Operations (ConOps) and Enterprise Architecture documents. Timely development and execution of an effective integrated NextGen plan is critical, especially since the current draft of the ConOps identifies 167 research issues and 77 policy issues that must be resolved to implement NextGen. These issues cross the disciplines and resources of all of the JPDO partner agencies.

The Administration and Congress must ensure that the appropriate levels of responsibility, accountability and urgency exist across the agencies to ensure that they properly manage and conduct the full range of integrated NextGen activities. From our evaluation of JPDO's process, products, and progress to date, we find that action is needed in the following areas for JPDO to achieve its aviation safety, security, environmental and transformation missions. AIA urges the Subcommittee and Congress to explore options to rectify these persistent problems.

Lack of Urgency: Preliminary estimates provided by the JPDO indicate that in lost passenger revenue alone, the cost of *not implementing* NextGen will exceed $50 billion per year by 2025. This loss, however, does not account for the associated economic harm from not transforming into NextGen that will be felt by general aviation, cargo transportation, and other air services components. Nor does it include the adverse impacts, such as lost productivity, that will occur in other areas such as the overall manufacturing sector.

The situation is even more urgent, however. Although flight disruptions temporarily subsided during the decrease in air travel following 9/11, news stories now remind us of the disruptions that can occur as a result of weather or other factors in a system that has reached its capacity. The FAA has publicly stated that by 2015 the system will be unable to handle the projected volume of traffic. Given the length of time required to conduct research, validate or prototype concepts, create new rules and procedures, certify systems, and incorporate the necessary upgrades into our nation's infrastructure and operational fleet, we—and many others—question whether our country can meet this looming crisis.

So far, the JPDO partner agencies' actions do not seem to match the urgency of the situation. It is estimated that NextGen development and implementation will require at least $1 billion more per year, including an additional $200–$300 million annually for federal research. Unfortunately, the Administration's FY08 budget request fails to make these investments. The FAA's FY08 proposal for NextGen, for example, is only three percent higher than the FY07 requested levels.[1] Of this amount, the FAA dedicates only an additional $4.8 million for their research efforts. Similarly, the proposed funding level for NASA aeronautics research remains inadequate. Last year, NASA proposed reducing its aeronautics funding by $188 million. Congress soundly rejected this approach and instead provided $166 million over the FY07 request. Nevertheless, the Administration has once again proposed NASA aeronautics research funding comparable to the FY07 proposal.[2]

Under current timelines, the NextGen R&D of the JPDO partner agencies will not achieve full alignment until FY09 at the earliest. We cannot accept this protracted timeline. For each delay, the cost of NextGen development will increase and more disruptions will occur, posing greater risks to the Nation's mobility and economic competitiveness.

Authority & Accountability: The *Vision 100* legislation tasks the JPDO with "creating and carrying out an integrated plan for a Next Generation Air Transportation System." The recently released National Aeronautics R&D Policy also recognizes the importance of the JPDO. On December 20, 2006, President Bush signed the Executive Order that requires the policy's implementation. According to the explicit language of the policy, the JPDO "should be responsible for planning, coordination, and oversight of both research and implementation for the NGATS to meet the Nation's civil, military, and homeland security needs." The policy also highlights the critical importance of interagency alignment with JPDO goals, and instructs the JPDO partner agencies to ". . .integrate their operational mission-specific requirements into the NGATS plan," and to align their air transportation system-related R&D efforts "with NGATS objectives to the maximum extent practicable."

Creating and implementing a national plan that depends on systematic interagency cooperation is a challenging task, especially since the JPDO cannot provide or direct agency resources. While many debate whether the JPDO has sufficient authority to complete its objective, it is clear that there is a lack of agency accountability. Accountability must be increased to ensure that agencies fully engage JPDO and execute as necessary to meet the *Vision 100* objective. With the onset of the implementation phase, it is even more crucial that the agencies are held accountable for all of their respective roles in NextGen: conducting the research; defining and implementing the policies, requirements, and systems acquisitions that are needed. Clear, measurable, and visible performance metrics must be defined. Both the Administration and Congress must hold the agencies accountable to these performance metrics if NextGen is to become a reality.

On a more immediate level, insufficient accountability and authority is inherent in the current JPDO operational structure. None of the agency employees assigned to the JPDO (with a few exceptions) report to the JPDO Director, nor does he have

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[1] FAA's Budget in Brief provides figures for NextGen-related funding levels: Total NextGen Transformational and Contributor Programs request: FY07 $1,152 billion, FY08 $1,188 billion; RE&D Contributor Programs: FY07 $57.9 million, FY08 $62.7 million.

[2] NASA proposed $724.8 million for aeronautics for FY07. Their FY08 proposal is $554 million. However, NASA's accounting system has changed due to a new scheme to handle facilities charges. In NASA's FY08 budget submission they note that the $554 million request equates to $731.8 million under the old accounting system.

direct input into their performance reviews. This lack of accountability to the JPDO Director and his inability to directly incentivize personnel makes a tough job even harder. Both the JPDO and other appropriate agency personnel should have all performance-based compensation that they receive linked to the achievement of NextGen milestones.

From our perspective, a partial solution to the lack of agency accountability could be the broader application of an anticipated DOD plan to designate a senior-level officer as the responsible individual for all military-related NextGen programs and the Pentagon's engagement with the JPDO. This is so simple, yet so efficient and effective, that we believe it should be required of all JPDO participating agencies. Then it will be clear, both within the Administration and to Congress, who is responsible for each agency's NextGen-related performance.

Program Alignment/Integration/Management: A lack of sufficient NextGen program integration across the various JPDO agencies poses a significant risk. For this reason, the relevant agencies must make every effort to complete the alignment of their activities and resources with the JPDO planning process now. Schedules and resource requirements must be realistic and reflect the input and capabilities of both government and industry stakeholders. Robust systems integration tools must be consistently used. Clearly visible and traceable alignment of federal funding must be established for this multi-agency effort. JPDO's coordination with the Office of Management and Budget (OMB) is a significant step in this direction: identifying existing partner-agency programs and funding that align with NextGen requirements. But the current timelines fail to address immediate needs.

Dependence on OMB for program integration, however, is not a long-term solution. The JPDO's system engineering and program management capabilities must continue to be strengthened. JPDO's pending reorganization of the office, which AIA applauds, will place an increased emphasis on systems engineering. At the same time, the JPDO requires additional resources to bring its system engineering, planning, and program management capabilities up to the level required to meet the *Vision 100* objectives. While Congress authorized up to $50 million per year for the JPDO in its authorizing legislation, JPDO's budget has never approached that level. The FAA's FY08 budget proposal would contribute only $14.3 million for JPDO operations.

Enhanced Engagement With Industry: Testifying before the House Transportation & Infrastructure Subcommittee on Aviation last week, the DOT Inspector General characterized the overall NextGen program as "extremely high risk" and the Government Accountability Office (GAO) echoed this view. According to their assessment, some of the chief issues that have derailed programs in the past—such as underestimating complexity, requirements creep, and inadequate stakeholder input—will likely reoccur with NextGen. Continuing to strengthen engagement with industry will help minimize these risks and promote more effective and timely implementation. Manufacturers in particular have significant expertise to offer in complex program development, risk management, system engineering, and integration. Not only can industry bring valuable insights and expertise to the JPDO, but it will likely pay a substantial portion (approximately half) of NextGen implementation costs. By current estimates, industry's share of NextGen development and implementation expenditures will approach the $15–$20 billion range. Therefore, it is critical that industry stakeholders have a strong voice in setting the detailed system requirements and implementation timelines.

While industry has been involved with the JPDO's Integrated Product Teams for some time, the engagement must become more robust and effective. The JPDO's evolving reorganization should strengthen industry engagement on the critical elements of JPDO planning. With this planned reorganization that is patterned after the recommendations of the DOT Inspector General and the National Research Council for greater industry coordination, JPDO should have a sharpened product-driven focus and greater clarity regarding the tasks and deliverables of its working groups. This deeper private sector partnership will allow JPDO to enhance its productivity and focus on delivering realistic system requirements and plans. Yet engagement cannot end with the initial planning phases. As implementation activities begin throughout the agencies, the need for them to continue to engage both JPDO and industry remains crucial if critical planning and execution details are to remain aligned.

Closing the R&D Gap: We must ensure that sufficient transitional R&D is conducted so that technologies are sufficiently mature when implementation decisions are made or NextGen is likely to stray off course. Perhaps the most crucial challenge facing timely and effective NextGen development and implementation is the

transitional R&D gap that exists between FAA and NASA. This gap has emerged from NASA's new focus on foundational aeronautics research. Foundational technologies must be properly assessed and validated before they can be implemented in either new standards or products. However, the FAA lacks the ability and resources to conduct the transitional research needed to mature NASA's foundational technologies. As a result, no agency claims responsibility for this critical research segment. AIA raised this issue last summer in testimony before this subcommittee and the DOT Inspector General's office amplified the same concern in its February report. The importance of transitional research also emerged as a significant discussion topic at the Subcommittee's hearing on FAA R&D programs last week.

The transitional research gap need not exist and it must be closed as soon as possible. Congress and this subcommittee in particular have shown outstanding leadership in addressing aeronautics research issues by mandating the development of the National Aeronautics R&D Policy and its associated integrated research roadmap. At the same time, three provisions of the *NASA Reauthorization Act of 2005* set the stage for addressing the transitional research gap. Section 422 of the Act set targets for NASA to develop and demonstrate critical aviation critical technologies related to environmental performance and other areas that are directly related to achieving NextGen goals. Sections 423 and 424 require NASA to align its airspace systems and safety research to the JPDO's Next Generation Air Transportation System Integrated Plan within one year of enactment. Furthermore, the National Aeronautics R&D Policy highlights NASA's role in transitional research for public interest research (e.g., safety, environment), high-risk technology gaps, and government internal R&D, including support of the FAA and JPDO. It also calls for NASA to align its programs to NextGen objectives "to the maximum extent practicable." However, the full, integrated aeronautics roadmap still needs to be developed and NASA has yet to meet its obligations under sections 422–424.

In addition to providing critical direction on aeronautics, the FY07 Continuing Resolution allocated an additional $166 million for NASA's Aeronautics Research Mission Directorate. In AIA's July 2006 testimony, we recommended that any additional aeronautics research funds NASA receives above the requested amount go towards NextGen-related transitional R&D. Congress has provided the necessary funds. Now it is up to NASA, working with JPDO and FAA, to jumpstart its research execution this year and close the research gap now. Our country cannot afford to wait. One point is certain: our entire nation will reap the benefits of NextGen success. Just as certainly, our entire nation will suffer the negative consequences if it is allowed to fail.

Thank you once again, Mr. Chairman, for this opportunity to testify.

BIOGRAPHY FOR JOHN W. DOUGLASS

John W. Douglass is President and Chief Executive Officer of the Aerospace Industries Association (AIA), which represents the Nation's leading manufacturers and suppliers of civil, military, and business aircraft, helicopters, UAVs, space systems, aircraft engines, material, and related components a, equipment services, and information technology.

Mr. Douglass became the seventh full-time Chief Executive of the Association in 1998. Before that he served for nearly three years as Assistant Secretary of the Navy for research, development and acquisition of defense systems for the U.S. Navy and U.S. Marine Corps.

A nationally recognized expert in systems acquisition, Mr. Douglass has extensive acquisition experience in Congress, the Defense Department, and the executive branch as a policy authority, contracting officer, engineering officer, test and evaluation officer, program control officer, and research director.

Before being named Assistant Secretary of the Navy, Mr. Douglass was with the Senate Armed Services Committee where he was foreign policy and science and technology advisor to Senator Sam Nunn and served as lead minority staff member for defense conversion and technology reinvestment programs.

Earlier Mr. Douglass completed 28 years of U.S. Air Force service and retired as a brigadier general in 1992. His numerous Air Force assignments included service as the deputy U.S. military representative to NATO as well as Director of Plans and Policy and Director of Science and Technology in the Office of the Secretary of the Air Force. He also served as special assistant to the Under Secretary of Defense for Acquisition.

Within the Office of the President, Mr. Douglass was Director of National Security Programs for the White House, responsible for formulating policy on a broad range of national security issues. He served as President Reagan's personal representative to the Blue Ribbon Commission on Defense Management chaired by David Packard.

A native of Miami, Florida, he earned a Bachelor of Science degree in industrial engineering from the University of Florida, a Master of Science degree in industrial engineering from Texas Tech University and a Master of Science degree in management science from Fairleigh Dickinson University. Mr. Douglass has done postgraduate work at the Cornell University Center for International Studies where he was an Air Force Research Fellow with the Peace Studies Program.

Mr. Douglass is a member of the Board of Governors of the Aerospace Industries Association and Chairman of the Board of Trustees of the National Center for Advanced Technologies. He served on the Commission on the Future of the United States Aerospace Industry, which issued its final report in November 2002. Mr. Douglass is Chairman of the International Coordinating Council of Aerospace Industries Associations.

AIA Positions

Member, AIA Board of Governors

Chairman, Board of Trustees, National Center for Advanced Technologies

Chairman, National Institute for Aerospace Studies and Standards

Member:

American Astronautical Society Board of Directors

Council of Manufacturing Associations Board of Directors, National Association of Manufacturers

International Coordinating Council of Aerospace Industries Associations

FAA Research, Engineering and Development Advisory Committee

Industry Management Council, Next Generation Air Transportation System Institute

National Contract Management Association

University of Tennessee Aerospace Advisory Council

Chairman UDALL. Thank you very much, Secretary Douglass.

Dr. Carmichael, the floor is yours.

STATEMENT OF DR. BRUCE CARMICHAEL, DIRECTOR, AVIATION APPLICATIONS PROGRAM, RESEARCH APPLICATIONS LABORATORY, NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

Dr. CARMICHAEL. Thank you, Chairman Udall. I would request submission of my testimony—written testimony for the record.

Chairman UDALL. I am sorry. Yes, unanimous consent, so ordered. Let the record show that Dr. Carmichael's full remarks are included in the record.

Dr. CARMICHAEL. As you heard from Mr. Leader, aviation weather research is critical to the successful development and implementation of NextGen. Seventy percent of delays in today's system are attributed to weather. That is the bad news. The good news is that as much as 60 percent of today's delays and cancellations for weather stem from potentially avoidable weather situations. Enhanced weather forecasts as well as improved use of forecasts can contribute to a reduction in these avoidable weather impacts. Improved weather information supports an agile decision-making process to manage air traffic expected in the future system. It allows the system to smoothly mitigate the potential impacts of summer and winter storms, turbulence, en route icing, and reduce ceiling visibility conditions. This can be achieved only through the introduction of new technologies related to the observation, forecasting, dissemination and integration of improved weather information into our traffic management decision support tools and processes.

The investment in aviation weather safety research must continue in order to ensure that an increase in accidents does not accompany an increase in traffic. Such investments have yielded and will continue to yield critical improvement for the flying public.

A promising program initiative of the JPDO is to develop a NextGen network-enabled weather system to be executed by the FAA, DOD and NOAA to integrate the forecasting and dissemination capabilities of the different weather forecasting agencies. The JPDO weather team has compiled a list of 130 research tasks needed for NextGen. These tasks address a number of issues that are critical if the Nation is to successfully integrate aviation weather into NextGen. Many of the issues are known, and research is already underway. Research in improved forecasting and integration of forecasts into decision support tools is absolutely critical to NextGen. It must be recognized that sustained and predictable aviation weather research funding at a significantly increased level is required in each of the JPDO stakeholder agencies. This funding stability is needed to allow the laboratories to hire, develop and maintain the highly specialized researchers needed to address the complex issues at hand.

The community of weather and automation researchers has been hard at work for three years supporting the JPDO planning process almost totally on a collateral basis. To maintain this very talented experience base, it is critical that funding be appropriated to begin to directly support this expert team.

Changes to NASA's aeronautics program are having a serious impact on the effectiveness of the Aviation Weather Initiative. The NASA aeronautics program has experience in ATM decision support and is a logical partner for the JPDO and FAA in this endeavor. However, in my view, the current NASA funding direction in aeronautics provides little hope for a strong effort by NASA in the area of integration of weather into automation tools. This is unfortunate.

In conclusion, aviation research—aviation weather research is vital to the successful development and implementation of NextGen. Most of the technology needed to build NextGen has already been invented. Weather remains an area with significant inventions still to be done if we are going to successfully integrate it into NextGen. All agencies and laboratories with relevant skills must be brought to bear on these difficult problems if we are to be successful, but current changes to NASA's aeronautics program are having a significant negative impact on the effectiveness of the Aviation Weather Integration Initiative.

This concludes my testimony, and I thank you for the opportunity to be here today.

[The prepared statement of Dr. Carmichael follows:]

PREPARED STATEMENT OF BRUCE CARMICHAEL

Good morning, Chairman Udall, Congressman Calvert and Members of the Subcommittee. I am honored to be here this morning to testify on the Joint Planning and Development Office (JPDO) and the Next Generation Air Transportation System. I am Bruce Carmichael, Director of the Aviation Applications Program at the National Center for Atmospheric Research (NCAR). For the past 16 years I have worked at NCAR to improve weather information for pilots, dispatchers, and controllers with special focus given to the hazards of thunderstorms, turbulence, icing, winter weather, and ceiling/visibility. For almost three decades, I have been in-

volved with the aviation industry in the automation of maintenance processes, air traffic control, and weather information. I serve the JPDO Weather Integrated Product Team as the Co-Lead of the Forecasting Group, and the National Business Aviation Association, Inc., as Weather Chairman of the Access Committee.

The importance of aviation weather research to the successful development and implementation of the Next Generation Air Transportation System (NextGen).

Advances in aviation weather research will be critical to the success of the Next Generation Air Transportation System (NextGen). Seventy percent of delays in today's system are attributed to weather. Moreover, as traffic grows, weather-related delays will worsen. The Federal Aviation Administration (FAA) estimates that unless we can make progress on better weather forecasts, by 2014 there could be 29 days of delay worse than the worst delay day of 2006. That is the bad news. The good news is that as much as 60 percent of today's delays and cancellations for weather stem from potentially avoidable weather situations. Enhanced weather forecasts as well as improved use of forecasts can contribute to a reduction in these avoidable weather impacts. Research guidance given to the JPDO departments and agencies including FAA, the National Oceanic and Atmospheric Administration (NOAA), the Department of Defense (DOD), and the National Aeronautics and Space Administration (NASA), includes many recommendations. A high priority is the development of a consolidated summer and winter storm forecast system. All of the agencies involved agree with that strategy. A goal is to gradually merge 16 different forecasting systems so that by early in the next decade we will have a single system that utilizes the best-of-the-best elements of today's technologies.

Better weather forecasting skill is a vital building block for NextGen, facilitating performance targets for the years 2015 and 2025 that will reduce congestion by providing far greater capacity than our current system with higher efficiency levels than we have today, while maintaining or enhancing safety. Improved weather information provides support for an agile decision-making process to manage the large volume of air traffic expected in the future. It allows the system to smoothly mitigate the potential impacts of summer and winter storms, turbulence, enroute icing, and reduced ceiling/visibility conditions. As a result, the system will be able to respond quickly to changing air traffic needs in the face of changing weather. This can only be achieved through the introduction of new technologies and procedures, innovative policies, and advanced management practices related to the observation, forecasting, dissemination, and integration of improved weather information into air transportation decision support tools and processes.

NextGen Network Enabled Weather (NNEW).

One of the program initiatives coming out of the JPDO to synthesize the weather research activities and to move the research toward operational capabilities is the concept of network enabled weather. The DOD already has a number of aspects of network enabled weather that it uses to collect, process, and disseminate weather to operational units around the world. DOD, FAA and NOAA are collaborating on a joint program office concept that would begin to integrate the forecasting and dissemination capabilities of the different agency weather programs. A number of the research concepts that I've already mentioned would be incorporated into this joint program office. The FAA has requested initial funding in FY 2008 and an interim goal is to move toward early working prototypes by the 2011–2012 timeframe. I would defer to others more directly involved to discuss the details.

Research on aviation weather safety issues, although not highlighted as a part of the NextGen activity, is actually assumed to underlie all other weather activity. Aviation weather safety research is essential to meeting safety objectives and NextGen performance targets. The potential of the NextGen system to handle tremendous growth in air traffic compels us to maintain our vigilance in weather safety research. We must continue to invest in weather safety to reduce accident rates to insure that an increase in accidents does not accompany the increase in traffic. Unmanned aerial systems will also require more precise weather forecasts. Investments in weather safety R&D over the last 25 years have yielded, and will continue to yield, critical safety improvements. Our scientists and engineers, for example, developed the solution to the microburst and wind shear problems; developed the state-of-the-art Aviation Digital Data Service (ADDS); improved forecasts of summer and winter storms; developed far more precise forecasts of airborne icing and turbulence; improved ceiling and visibility forecasts; and improved aviation radar products.

Weather research to transform airport operations in NextGen is also critical. Key elements of this research are to increase the capacity and improve the safety of air-

craft operating from airports in winter weather and reduced visibility conditions. As the number of operations at our airports continues to rise, weather research projects must include integration with decision support tools that insure safe transit of aircraft on taxiways and runways, improving our understanding of the effects of winter weather on the safety of aircraft operating in ice and snow conditions, and the development of state-of-the-art technology that uses improved weather skill to minimize the disruption during deicing and plowing operations.

In NextGen, weather is also important if we are going to meet the increasing demand for flying in an environmentally sound manner. The weather focus of the environment goal is making aviation quieter, reducing pollution in communities around airports, and reducing climate impact. New investments in weather research are required to help us better understand how to couple weather information to an agile air traffic management (ATM) system to dynamically reduce noise, pollution, and climate impacts.

Given expected demand growth, it is important to improve operations well in advance of 2025 so we can avoid grid lock. With that in mind, weather research is critical now to support mid-term capabilities that must be put in place. The JPDO weather team is helping to define Initial Operating Capabilities that can deliver mid-term results and also provide needed stepping stones to NextGen.

Significant issues that need to be addressed if the Nation is to successfully integrate aviation weather into the Next Generation Air Transportation System.

The JPDO weather team has compiled and prioritized a list of over 130 weather research-related tasks needed in the NextGen environment. A preliminary allocation of those tasks among FAA, DOD, NASA and NOAA has been discussed and FY 2009 guidance has been given to those agencies. Assimilating weather into decision-making is a critical enabler of the NextGen system. Common situational awareness, system capacity, system efficiency, and safety will be increased due to the availability of authoritative, net-centric 4–D weather information to all systems users. Current thinking is that the NextGen weather environment will address four nested spatial scales (airport and metro area, regional, continental, and global), and will allow users to safely plan and conduct 4–D, gate-to-gate, trajectory-based operations that avoid hazardous weather and provide safe and comfortable flight conditions. All users will have access to real-time critical hazardous weather information (diagnostics and forecast) to facilitate weather avoidance and efficient flight operation. Aircraft will become nodes on the network. The information will support all phases of the flight include pre-flight planning, in-flight updates, and post flight review. The Air Traffic Management (ATM) system is expected to be able to maximize safely navigable airspace due to the seamless, automatic assimilation of adaptive nowcast/forecast information into the software logic of ATM decision support tools. I'm sure that the JPDO would be happy to brief you and your staff on the concepts, initiatives and timetables in the weather research plan.

Fortunately, in collaboration with the FAA, the aviation weather research community has been steadily and carefully refining R&D goals and portfolios to meet the needs of the aviation community for more than twenty years. We continually assess our research programs in conjunction with our stakeholders and users to ensure we keep our R&D resources focused on the most critical tasks. Thus many of the 130 tasks noted by the JPDO are already known and research is already underway.

Integrating Weather into Decision Support Systems

The weather R&D program has received expert advice and guidance from the FAA's Research, Engineering and Development Advisory Committee (REDAC). The REDAC, under its National Airspace System (NAS) Operations Subcommittee, recently established a Weather ATM Integration Working Group (WAIWG) to do a focused study on the difficult problem of automatically integrating real-time and forecast weather information directly into the software logic of ground-based and cockpit-based decision-support tools and processes. The working group includes weather and operations experts from national laboratories, MITRE Corporation, NASA, DOD and the airline industry. The weather research program will benefit significantly from the recommendations provided by this group regarding how to deal with weather ATM integration. This working group is interacting closely with the weather and automation R&D communities to develop recommendations that will be effective.

As a member of this group I can tell you that one of our greatest challenges is our ability to understand what the future system will look like. What new weather forecasting and decision-support technologies will be available? The JPDO weather team has developed a comprehensive Weather Concept of Operations to raise the

questions needed to focus research and systems development. This is all significant work, essential to understanding the transformed operational environment and helping us to develop a plan for achieving it. It also makes clear many of the difficult questions that the weather research community must answer if NextGen is to succeed.

Better Processing of Huge Amounts of Information

To some extent our nation's aviation weather system has become a victim of its own success. We have created the most effective, efficient and safest system in the world dealing with weather issues. But we now face a serious and impending problem: today's weather system produces a large volume of information with such frequent update that human users are overloaded when trying to effectively make use of the valuable detail available to systematically fine tune flight plans and their execution. We must continue to improve our forecast skill, and this implies increasing our time and space resolution. Automated decision-support tools will have to achieve several breakthroughs in order to effectively and automatically apply enhanced weather information to route planning, and route re-planning for FAA and airline traffic flow management specialists.

Weather research will help achieve NextGen by identifying challenges, understanding scientific barriers, and developing solutions that jointly address weather safety, weather mitigation of environmental impacts, weather for improved air traffic management, human factors associated with highly automated weather systems, systematic integration of weather into decision support tools, and effective system separation of aircraft from weather. NextGen must address the challenges of operating the safest, most efficient, high-capacity air transportation system in the world. We are a long way from knowing how to do the weather portion of this, but the job of research is to discover the solution. We must identify the scientific constraints and barriers imposed by weather to separate solutions that are effective from those that are not.

To address such issues, research in improved forecasting and integration of those forecasts into decision-support tools is absolutely critical to NextGen. It must be recognized that sustained and predictable aviation weather research funding at a significantly increased level is required in each of the JPDO stakeholder agencies. This funding stability is needed to allow the laboratories to hire and develop the highly specialized researchers needed to address the complex issues at hand.

Human Factors research and demonstration projects will be needed to develop the best approaches for integration of improved weather information into decision support systems to help mitigate potential errors and exploit the problem-solving capacity of humans. Performance metrics should be developed that measure the value added by people as elements of the weather decision system versus the impact of new technologies.

Historically, aviation weather R&D has had a focus on near-term operational goals and objectives. A large share of the R&D was focused on specific near-term safety and capacity issues. The weather research program must be adapted to be more flexible, balanced, and dynamic so that we can respond simultaneously to the critical near-term needs of the system while providing for the cutting-edge NextGen requirements. The JPDO weather team is the mechanism by which the multi-agency stakeholders and the community will assess weather R&D requirements for NextGen, and new initiatives will be reviewed and prioritized, before being recommended to one or more agencies for execution.

The aviation weather research community, with guidance from the JPDO, is incorporating NextGen into its planning activities, including a strong requirement for systematic integration of weather forecasts directly into decision-support tools and processes used by FAA traffic flow managers, airline dispatchers and pilots. In addition, the weather community is using the NextGen planning process to guide our transformation of weather capabilities in a way that is tightly coupled with the transformation of decision-support tools. In the past, the weather research community's plans and execution successfully provided benefits in safety, capacity, and efficiency to the community. But the new approach of developing plans that are tightly coupled with the decision-support tool research community promises to significantly enhance our success. This includes the R&D work in decision support tools at the MITRE Center for Advanced Aviation System Development (CAASD). I believe that a timely and efficient transition to NextGen requires the weather research community to participate in concept development, validation, prototyping, and field demonstrations. Such involvement will give us in-depth understanding of required NextGen weather improvements and hasten our ability to implement NextGen weather systems. Of particular importance are demonstration projects that show the feasibility and utility of seamless integration of weather into new decision support

tools that use System Wide Information Management (SWIM) as the source for weather. Such demonstrations can lower our risk and provide rapid implementation opportunities.

The weather research community is also using the JPDO process as a way to plan, execute and implement partnerships with private industry. Through the JPDO weather team we are seeking stakeholder input, evaluating available technologies, defining and prioritizing research and development requirements, establishing milestones and commitments, and providing status, context and guidance for weather initiatives related to NextGen.

The JPDO weather team also provides a single point for initiatives to be coordinated among all stakeholder agencies and institutions. It ties initiatives directly to each organization's budget process, and in this way moves us toward a coordinated development of JPDO's vision of the future aviation weather system. It provides an integrated view of the programs, systems and procedures that are critical to transforming the Nation's aviation weather system; and it will let us plan our activities within the framework of the steps that must be taken by all JPDO agency weather partners in order to achieve timely implementation. It also allows us to understand the near-term steps and mid-term goals that we must accomplish to transform the aviation weather system on our way to the NextGen system of 2025.

The community of weather and automation researchers has been hard at work for three years supporting the JPDO planning process, almost entirely on a collateral basis. However, now that the planning stage has matured and we are on the verge of stepping up the tempo in research and applications dealing with weather and NextGen, it is critical that funding be appropriated to begin to directly support these expert teams and the program advances that the JPDO has identified.

Impacts that the changes to NASA's aeronautics program are having on the effectiveness of the aviation weather initiative.

NextGen is committed to reducing congestion in our nation's air transportation system. Future congestion can only be alleviated by transforming the system we have today through bold moves that include systematic integration of more skillful weather information into the heart of innovative new automated decision-support tools. The NASA aeronautics program has a wealth of experience in the development of decision-support tools for air transportation, and is a logical partner for the JPDO and FAA in this endeavor. The Center-TRACON (Terminal Radar Approach Control) Automation System (CTAS) is a good example of NASA's prior work in this area. However, in my view, the current NASA funding direction in aeronautics provides little hope for a strong effort by NASA in the area of integration of weather into automated tools. This is very unfortunate.

The FAA is requesting substantial funding to support wake turbulence research to help increase capacity while maintaining safety. This will help us to safely reduce separation distances between aircraft, support the efficient use of closely spaced parallel runways, and allow airports to operate closer to their design capacity. NASA has a long track record of partnership with the FAA in this research area. Wake turbulence is viewed by the JPDO as a weather issue, and is part of the planning process for the weather team. In large part, this is because of the critical importance of the weather connection when predicting wake turbulence behavior. Wake turbulence is a research activity that is in need of significant JPDO attention to rationalize the activities of the various agencies. Uncertainty of NASA's funding and lack of integration with the rest of the weather community in this area is creating difficulty in coordinated weather research planning.

Research in use of unmanned aircraft systems as platforms for targeted observations of the atmosphere offers considerable promise to improve forecasts in high value areas with sparse observations. NextGen needs to explore the integration of unmanned aircraft observing systems into the National Airspace System. This research is a natural fit for NASA, but programs in this area have disappeared.

In conclusion, aviation weather research is vital to the successful development and implementation of the Next Generation Air Transportation System (NextGen). Most of the technology needed to implement NextGen is already relatively mature. Weather remains an area with significant issues that need to be addressed if the Nation is to successfully integrate aviation weather into the Next Generation Air Transportation System. All relevant agencies and laboratories must be brought to bear on these difficult problems if we are to achieve success. Current changes to NASA's aeronautics program are having a significant negative impact on the effectiveness of the aviation weather integration initiative.

This concludes my testimony, and I thank you for the opportunity to appear before the committee. I would be happy to answer any questions the committee may have.

BIOGRAPHY FOR BRUCE CARMICHAEL

Dr. Carmichael holds a M.S. from Northwestern University in Applied Mathematics and a Ph.D. from the University of Maryland in Computer Science. He has 38 years of experience spanning a number of activities including university teaching, commercial research, government service, consulting, and academic research. His past 27 years have been involved with the aviation industry in automation of maintenance processes, air traffic control, and weather information. He has been involved in system engineering of improved FAA automation and weather systems. For the past 16 years he has been at the National Center for Atmospheric Research, where he serves as Director of the Aviation Applications Program. This program is working to improve weather information for pilots, dispatchers, and controllers, particularly related to the hazards of thunderstorms, turbulence, icing, winter weather, and ceiling/visibility. He is currently serving the Joint Planning and Development Office (JPDO) Weather Integrated Product Team as the Co-Lead of the Forecasting Group, and the National Business Aviation Association, Inc., as Weather Chairman of the Access Committee. For the past nine years he has coordinated the Friends/Partners in Aviation Weather activity, a grass roots group which brings together the weather provider community and user community to discuss topics of common interest. Dr. Carmichael is also an active commercial instrument-rated pilot.

DISCUSSION

Chairman UDALL. Dr. Carmichael, thank you for your testimony.

STATUS AND IMPORTANCE OF MOU DEFINING AGENCIES' ROLES IN NEXTGEN

At this point we will open the first round of questions. The Chair recognizes himself for five minutes.

Mr. Leader, I would like to start with you, if I might. As you know, the JPDO, as it is currently organized, has no direct budgetary or programmatic authority over its participating agencies. Again, as we have heard, and certainly in my remarks, I also mentioned if those agencies don't work together and make the necessary resource and R&D commitments, the NextGen initiative is unlikely to succeed, and that is why I am troubled by the fact that a year after this subcommittee was told that an MOU would be signed that clearly defined each participating Agency's roles and responsibilities, it still hasn't happened. Given that it has already slipped by a year, it is clear that one or more significant issues are holding up the signing of the MOU. Could you outline what those issues are and how you intend to address them? And to give a heads-up to the other witnesses, if they would like to comment after your comments, I would be eager to hear what they have to say, and in particular, how important is it that an MOU be agreed upon by the participating agencies.

Mr. Leader.

Mr. LEADER. Yes, Mr. Chairman. We currently—it is correct that we currently do not have a signed Memorandum of Agreement. We have a signature on the draft by the Secretary of Transportation and by the Administrator of NASA. The Department of Defense, it is my belief, has reviewed the draft MOU and is prepared to sign it but is waiting for the Department of Air Force to be recognized as the executive agent for Next Generation issues. Secretary Wynn has, I believe, already seen it and has been through the DOD General Council's Office so it is a question now of getting the authority for the Air Force to be the signatory on the Memorandum of Agreement.

It is probably more important symbolically to have the Memorandum of Agreement signed. More important would be the active commitment of the various departments and agencies to the success of the initiative.

Chairman UDALL. Do the other panelists care to comment? Dr. Dillingham.

Dr. DILLINGHAM. Yes, Mr. Chairman Udall. I agree that the Memorandum of Understanding is important because I think you need something in place that is going to span this change in senior executives in the various places, be it, you know, the secretaries of the various Cabinet departments, the Administrator of FAA. All of those are sort of changing positions, changing people, personalities, and this is a long-term undertaking and I think there needs to be some document, some formal document that is there. On the other hand, I think some of the things that are also taking place now are very useful in that vein. For example, I think, you know, working through OMB to have an Exhibit 300 where the NextGen projects across the government are tagged as such and it makes a portfolio. It is very important because that sort of, you know, where the money is. It is also important as well as having that sort of agreement. Similarly, I think if JPDO can go through, again working through OMB to coordinate the various Enterprise Architectures across the various participating partner agencies, that again is sort of—you know, in a strategic way, it is the kind of thing that will give some institutionalization to JPDO. So the Memorandum of Understanding is important but these other kinds of activities are also useful and important, I think.

Chairman UDALL. Secretary Douglass.

Mr. DOUGLASS. Yes, sir. These things are vital. I was just thinking back in my memory, when I was a young officer I was the business manager on the Joint Cruise Missile Project Office. You may recall, Jimmy Carter cancelled the B–1 bomber and he said we are going to put cruise missiles on the B–52s and so we had a Memorandum of Agreement which was imposed down on the Navy and the Air Force to go have the Navy develop these missiles, and even with the agreement, sir, you know, there were daily arguments about who was going to do what and so on. The agreements just begin the—are the first step in a lengthy discussion of agencies working together. My experience on Joint Strike Fighter later when I was Assistant Secretary of the Navy, also there are Memorandums of Agreement between the services for things like air-to-air missiles so that if we develop new air-to-air missiles that can work on the F–15, the F–16, the F–18, the Joint Strike Fighter, so on. These things are fundamental. If you don't have them, the dialog that comes later when you try to actually implement things together is almost impossible to put into any rational context. So I can't emphasize as an old joint program guy myself how important these things are, sir.

Chairman UDALL. Function follows form, I hear you saying, Mr. Douglass.

Dr. Carmichael, would you like to comment?

At this juncture, the Chair would like to recognize an important and contributing Member of this committee, Mr. Rothman from New Jersey.

Mr. Rothman, you have five minutes.

Mr. ROTHMAN. Thank you, Mr. Chairman. Thank for the very kind introduction.

PROJECTIONS FOR AND NEGATIVE IMPACTS OF INCREASED AIR TRAFFIC

Thank you, gentlemen, for your testimony and your appearance today. I have another hearing with the Defense Subcommittee with Secretary Gates and the head of the Joint Chiefs of Staff next door so I am going to be bowing out after my questions, but please don't take that departure and my late arrival—I was there first—as a lack of interest. I am passionate and completely and totally focused on what you are doing and in particular the work of the FAA, frankly for lots of reasons.

Number one, there is an airport in my district, Teterboro Airport, and we also have air traffic overhead from Newark and from LaGuardia, and JFK is in the immediate, or nearly immediate vicinity as well, so hundreds of thousands of people in the New York metropolitan area are suffering today with the present levels of activity from aircraft noise, emissions from aircraft that are not healthful, they are unhealthy, and with living every day with the masses of aircraft coming over our houses at various altitudes, one after another after another after another, and you folks want more aircraft in the sky over our heads?

Let me ask you this question I asked the previous panel, which I would respectfully ask you to consider. Let us assume that you could get your wish on technology, you could make it silent—planes silent. You could make them without any harmful emissions and you could make it safe for them and you could make it safe for them to operate wing to wing to wing to wing and it could cover the sky, the horizon so much so that it blotted out the sun. Is that what you are shooting for? Is that the kind of world you want me to live in or you want your children to live in? Is that progress? Is that necessary? Commerce is supposed to serve and benefit the quality of life of the people. That is why we have commerce. But when the level of commerce becomes harmful to your physical well-being or your emotional well-being and becomes destructive, then commerce had got to find a different avenue of pursuing its goals.

And so, I read with some interest, discouragement—I saw that you have as one of the strategies and related agencies, develop environmental protection that allows sustained economic growth, aviation growth, and I am assuming by environmental protection you mean noise and emissions. And that is fine, that is great, but I tell you, there are millions of people around the country, millions, who are fed up and they don't care if you can achieve these, you know, more efficiency in the sky and pack more planes into the sky. That is not what they want. And when a two-lane road becomes crowded, people have to find another avenue, another way to get where they want to go. And so, I tell you, I for one—and I understand the importance of aviation to our economy and to our security, et cetera, completely. But it is not going to be at the expense of the quality of life of the people, which is already too great—of the people who are paying too great a price. And so, I respectfully, but forcefully, plead with you to take these matters into

consideration. Otherwise, I will be a uniform—a bigger thorn in everybody's side and I know that I represent millions and millions of people across this country.

But about my question about the wing to wing to wing to wing hypothetical, has any—have we thought about that? And if you say that is fine, then that says something about your view of the quality of life of the people of this nation. If you say wing to wing to wing and it blots out the sun, it is just too much. Then tell me where you draw the line of what is a reasonable limit on blotting out the sun or constant, massive plane line overhead, if there is time for an answer.

Chairman UDALL. Mr. Douglass.

Mr. DOUGLASS. Congressman, we—I think most people recognize that there is a natural tension in a democracy among constituents of different value streams. If you live around an airport, you see the negative side of air congestion. Probably, it is a part of your life much more than if you are a person who wants to go visit your granddaughter in California and you are a working person and you only have a day or so that you can take off and you can't spend the whole time to go in your car or go on a train or some other factor. But the fact of it is, sir, the sky is a big place and I would ask you—I am sure you fly home to New Jersey occasionally, look around when you fly and how—think of how seldom it is when you are in the air that you can actually see another airplane. It is a rare thing. I am an aviator. I have been in the Air Force and served in the Navy and, you know, I tend to look out the window, look for other airplanes because that is what I did when I was on active duty. But you seldom see them. It is a very big place. The truth of it is, there is a great margin of accommodation here between the millions and millions of Americans who have an interest in flying for business reasons or recreational reasons or whatever and the countervailing interest of people that live around airports. And I will tell you, sir, that the industry, both the manufacturers and the airlines themselves are absolutely dedicated to doing everything they can to relieve the burden on the people around them.

Mr. ROTHMAN. I know my time is up, Mr. Secretary, but we don't live within—you know, Teterboro Airport is a little generation aviation airport which causes a lot of problems when they fly low and Newark flies high, and that can be fixed and I hope that that will. But the people who are affected are living further and further away from airports who report—and I am there at their homes and see these planes coming overhead, so it may not seem like it when you look out a window, but when you look up on your kid's soccer field and you see the planes every day—I know I have taken too much time but it is not just people who live within—who moved into a house within sight of an airport. They are living farther and farther away and never thought they would be affected by an airport or the region's airports who are now being affected. So those are—it is getting worse, in my view.

Chairman UDALL. The gentleman's time has expired.

We have been joined by former Chairman Calvert, Ranking Member Calvert now, and I know he has an opening statement and then I would also like to extend to him five minutes for questions if he would like to use those five minutes.

Mr. Calvert.

Mr. CALVERT. Well, I appreciate it, Mr. Chairman. I had a—we had a meeting with the President of the United States so he trumped you, I am afraid, Mr. Chairman. So—but I am glad I got back to give this statement and to thank you. I do have to fly back to California later this afternoon. I do it every week and I am glad that there are airports that take me and I can get back here to Washington early Monday morning.

But anyway, I want to thank you for scheduling this hearing to assess the progress of the Joint Planning and Development Office and thanks to our witnesses for taking time out of your busy schedule to appear before us this morning. Even though this Subcommittee held our last hearing on JPDO just last year, in my mind, Congress can't exercise enough oversight in such a critically important and fast-paced program, much to the dismay, I suppose of the JPDO's leadership but I think it speaks volumes about Congress's interest in assuring the successful development of the Next Generation Air Traffic Management System. Failure to keep pace with growth in air travel would be disastrous to this economy.

I look forward to hearing from you. I will have a couple of questions, hopefully, before we have votes on the Floor, and get your candid assessment about the progress that has been made or not made and challenges remaining in meeting the goals of the Vision 100 legislation. I know teams of federal and non-federal experts have been working hard to put in place the processes and management structures required for such a massive undertaking, but in the few minutes I have remaining I will limit my comments to NASA's evolving role in air traffic management research.

NASA R&D REORGANIZATION EFFORTS ON FAA TECHNOLOGY

When Vision 100 legislation was enacted, Congress anticipated the Federal Aviation Administration, as the operator of our nation's ATM system, and the National Aeronautics and Space Administration as our nation's leading aeronautics and R&D organization, would continue to work collaboratively as they have for more than 40 years, NASA's research into developing long-lead, high-risk technologies, FAA adapting their research products to incorporate them into a national airspace system. It has been a productive relationship, and over the years each agency has collaborated their R&D programs and budgets to reflect that. The JPDO recognized NASA's expertise early on by selecting them to lead the Agile Airspace Integrated Product Team.

In the last 18 months, however, the subsequent—and subsequent to the creation of the JPDO, NASA's aeronautics R&D program has undergone, as you know, a major reorganization. I don't dispute the rationale for making the reforms but NASA also made a fundamental change in its R&D relationship with FAA by limiting future research to a level of technical maturity far lower than they have in years past. This has left the FAA with no recourse other than to cover the technology shortfall by increasing its own R&D budgets. Money, as you know, especially around here, is fungible, but talent and expertise doesn't easily transfer and, simply stated, my

concern is that it will take FAA several years to adapt to this change.

I remain concerned that this early grand endeavor now known as NextGen has happened at a time when R&D roadmaps are being finalized and spending for developing integrated new technologies is about to ramp up. I would strongly prefer that NASA's Airspace Management Program continue to advance promising technologies to a high level, thus freeing the FAA to focus on integrating them into NextGen. It is my sincere hope that NASA's actions don't hinder JPDO's efforts to develop technologies upon which NextGen will be reliant upon.

[The prepared statement of Mr. Calvert follows:]

PREPARED STATEMENT OF REPRESENTATIVE KEN CALVERT

Thank you, Mr. Chairman, for scheduling today's hearing to assess the progress of the Joint Planning and Development Office, and my thanks to our witnesses for taking time from their busy schedules to appear before us this morning.

Even though this subcommittee held our last hearing on JPDO just a year ago, in my mind Congress can't exercise enough oversight on such a critically important and fast-paced program, much to the dismay, I suppose, of the JPDO's leadership. But I think it speaks volumes about Congress' interest in ensuring the successful development of the next generation air traffic management system. Failure to keep pace with growth in air travel would be disastrous to our economy.

I look forward to hearing from our witnesses to gain their candid assessment about progress made, and challenges remaining, in meeting the goals of the *Vision 100* legislation.

I know teams of federal and non-federal experts have been working hard to put in place the processes and management structure required for such a massive undertaking, but in the few minutes I have remaining, I'll limit my comments to NASA's evolving role in air traffic management research.

When the *Vision 100* legislation was enacted, Congress anticipated that the Federal Aviation Administration, as the operator of our nation's ATM system, and the National Aeronautics and Space Administration, as our nation's leading aeronautics R&D organization, would continue to work collaboratively as they have for more than forty years: NASA researching and developing long-lead, high risk technologies; FAA adapting their research products to incorporate them into the national airspace system. It has been a productive relationship, and over the years each agency has calibrated their R&D programs and budgets to reflect this collaboration. The JPDO recognized NASA's expertise early on by selecting them to lead the 'Agile Airspace' integrated product team.

In the last eighteen months, however, and subsequent to the creation of the JPDO, NASA's aeronautics R&D program has undergone a major reorganization. I don't dispute the rationale for making the reforms, but NASA also made a fundamental change in its R&D relationship with FAA by limiting future research to a level of technical maturity far lower than they have in years past. This has left the FAA with no recourse other than to cover the technology shortfall by increasing its own R&D budgets.

Money is fungible, but talent and expertise doesn't easily transfer, and simply stated my concern is that it will take FAA several years to adapt to this change. I remain concerned that so early in this grand endeavor now known as NextGen, one of the two key partners is changing the rules of the game, and it's happening at a time when R&D roadmaps are being finalized, and spending for developing and integrating new technologies is about to ramp up. I would strongly prefer that NASA's Airspace Management program continue to advance promising technologies to a high level, thus freeing FAA to focus on integrating them into NextGen.

It is my sincere hope that NASA's actions don't hinder JPDO's efforts to develop technologies upon which NextGen is reliant.

Thank you, Mr. Chairman.

Mr. CALVERT. So with that, I want to thank you for that statement, Mr. Chairman, and allowing me to do that, and I have a question for everyone.

When JPDO was first created, it was established as an adjunct to the Federal Aviation Administration but over the last year the JPDO has become more tightly integrated within the FAA. Are there any concerns that JPDO's assimilation with the Federal Aviation Administration is viewed by other federal partners as being a proxy for FAA and not an honest broker working with other federal agencies?

CONCERNS REGARDING JPDO'S ASSIMILATION WITH THE FAA

And I guess we will start with you, Leader—Mr. Leader.

Mr. LEADER. Thank you, sir. I have heard the same concern expressed but I do not share that view. In fact, I think even during the course of my relatively short tenure here the links to the other partner agencies have been strengthened and they have become more engaged.

Dr. DILLINGHAM. I think over the last year or so the integration of JPDO and FAA, particularly through the OEP plan, has on one hand it might have been seen by some as sort of being too entwined, but I think the other way to look at this is that the JPDO is the vision part of the air traffic control modernization program, and the current FAA is handling what is in place now, and it is very important that they work together and that there is sort of an exchange of information and ideas and approach with FAA.

I think that what we just got through talking about, this Memorandum of Understanding, as well as the other initiatives that are underway to bring all of the agencies closer together are things that need to be completed. Our research shows that there is sort of a mixed bag in terms of the relationship between the various partner agencies. In some cases, like NASA and Commerce, the relationship seems to be pretty strong in the kind of way we want it to be. In some other cases, Homeland Security, DOD to some extent, it is still a work in progress. So I think at this point there is pluses and minus associated with the arrangements.

Mr. DOUGLASS. Sir, to really answer your question you have to go back to 2002 when I was a commissioner on this commission on the future of the industry. And we found ourselves in the extraordinary position of the FAA's OEP having an improvement program that did match the growth in the industry, and you don't see that too often in government. You do see it occasionally, but you wouldn't see the Department of Defense, for example, sending troops—having a plan to build a tank, for example, that they knew would be defeated by the enemy tank in a one on one battle or they would actually plan to build a fighter airplane they knew was inferior to one that would come up against in combat. We try to stay ahead of what we know the demand or the threat or whatever is.

And so, the commissioners detected a feeling that there was something wrong here. We have a national need and we have a plan to meet that need which doesn't meet the need, and so we looked at it and we said, look, you know, we know these technologies exist. For example, when I was Assistant Secretary of the Navy, just before I was on that commission, we had various kinds of technologies that knitted all the radars and the fleet. We were very much in the network centric warfare. We could tell where a

sea skimming cruise missile was within a few fractions of a centimeter at any portion of a second in time.

And so, we wanted to take those technologies and move them over to the FAA and get the FAA energized to do something different than it had been doing before, and that is there the JPDO was born out of that concept. And so now, five years have gone by, and we find ourselves with a department with the FAA doing, I think, about the best they can under the circumstances. We have seen the Department of Transportation pretty much dedicated to this approach, and we have seen Congress dedicated to it. But at the same time we see other parts of the government who don't seem to get the message. Despite the fact what this committee says, NASA goes again and continues to under fund its aeronautics as you pointed out in your statement.

So there is concern that the government in its entirety has not recognized the seriousness of the problem and really engaged to solve it, but I wouldn't place that blame on the FAA. I think they are doing the best they can under the circumstances.

Dr. CARMICHAEL. It has taken us three years of thoroughly concerted effort to finally get to the point with the FAA where the FAA is actually buying in to the JPDO program, and I think this is refreshing. And I can only hope that we can bring the other agencies to this same point where they have an equivalent level of buy-in into their own programs and infrastructure to the JPDO.

Mr. CALVERT. You probably heard the sirens go off. We have a vote coming up, but I just want to make a comment and then I am going to submit some questions for the record that you can answer, hopefully, in the next couple of days back to the Committee. But, as you know, I think we are spending approximately $185 million in R&D money which was extremely low I think relative to the agency, what we are trying to do to create a safe environment for the future to fly increasing air traffic. In spite of our own parochial interest about airports nearby, the fact of the matter is air traffic will continue to increase and will continue to be an important and integral part of our economy as it should be.

And it is incumbent upon all of you, the experts, and those you work with to make sure that we have a safe, and continue to have a safe and effective way to travel, and that the traveling public can look forward to that in the future. So you have a big job ahead of you and in a relatively short time frame because I think the system that we have has been hobbled together and has been effective over the last number of years, but I don't think anyone here would disagree has pretty much met its limitations.

So anyway, as we move forward, there has been a lot of delays in this so I don't think we can delay any longer, and I look forward to working with you and working with the Chairman to making sure that we have a safe and effective air traffic system for this country and continue to be leaders in the world. With that, Mr. Chairman, I yield back the balance of my time.

Chairman UDALL. I thank the Ranking Member for his comments and his questions, and clearly the ranking member has a significant encompassing grasp of not only the challenges here but the opportunities that present themselves to us if we—I shouldn't say if but when we implement the next system. As Ranking Mem-

ber Calvert mentioned, we have a vote. I think for the best use of our time, I am going to temporarily recess the Committee. I will go over and vote as quickly as I can, come back, and if the panel can stay we will hope to resume in 10 to 15 minutes because you have traveled a long way, and I want to take advantage of your expertise and insight. So we will temporarily recess, and I will be back as soon as I can.

[Recess.]

BENEFITS OF AND SUGGESTED AREAS FOR INCREASED NASA FUNDING

Chairman UDALL. Thank you for your forbearance. We will get right back to questions. Mr. Leader, if I could direct a question at you and then the panel in turn can respond. You stated a NextGen initiative has a number of important research areas that need to be addressed if it is to succeed. In the joint resolution for fiscal year 2007, Congress wound up giving NASA's aeronautics program an additional $187 million above the President's fiscal '07 request. Mr. Douglass, in his testimony recommended that the additional NASA aeronautics funding go towards NextGen related transitional R&D. How much would the NextGen initiative benefit from increased NASA funding of NextGen research needs? Could you tell us what projects and activities NASA should apply additional aeronautics funding to in order to best address the research needs of the NextGen initiative? If I could get your thoughts now, I would also like to have you respond for the record.

Mr. LEADER. Yes, sir, I will provide a response for the record. I have not thought of the issue in terms of the question as you framed it and quantify it in financial terms. I can speak briefly to what our top R&D priorities are though. Obviously, safety-related issues because the National Airspace System is a safety system it is our highest factor and relative to that human factors were to support how flight crews and controllers would operate in the NextGen system remains critically important to us, as does support of our safety management system that would be predictive rather than forensic. We believe that there can be a significant contribution there as well.

In addition, there are automation issues and conflict resolution that are going to be very important to maintaining separation required to increase capacity, and also relative to capacity would be wake vortex work that would drive separation procedures.

Chairman UDALL. Thank you. Dr. Dillingham.

Dr. DILLINGHAM. Chairman Udall, I think we haven't looked at that real thoroughly but we do have a couple of thoughts. One is again we want to commend JPDO for taking a wide ranging look to try to determine what their research needs were and various ways in which they might be able to fund that R&D. But one thing that does come to mind for us, particularly at this stage of trying to move towards implementation, and that is our understanding is that NASA has a capabilities test bed where companies can come in and put their concept to the test in terms of what will work well in the mass.

It is also a situation where if you are a small company, you can come in and use it free of charge whereas a large company like

Boeing or Lockheed, they probably have their own. Our understanding is that NASA is not going to be upgrading that capability and is something that can be very useful, we think, to the JPDO in the near-term.

Chairman UDALL. Thank you, Dr. Dillingham. Mr. Douglass, do you have a comment?

Mr. DOUGLASS. Just to add that we think that the area that needs a lot of emphasis is the systems engineering work and the phenomenology examination like looking at wake vortex, some of the weather issues Dr. Carmichael has mentioned are excellent candidates for additional research by NASA. Dr. Dillingham mentioned the modeling and the test beds that NASA has. Those things need to be funded and updated. One of the really interesting things that is going to happen as we get further into this, there are going to be periods of time when we are bringing the new system on but we still have the old system, and how do you run two things in parallel so that you have the confidence? Do you take the old one down now and depend on the new one? That requires a lot of modeling.

We have done those kind of things before in the Department of Defense and they are not easy. So I think there is a pretty good shopping list. Now let me just add one caveat to it that I think helps put it in context. You know, NASA is struggling to create a new system beyond the Shuttle, and the NASA administrator is keenly aware of the fact that there is a ten-year gap from 2010 to—now it is almost up to a five-year gap, where we have no access to space essentially. And so the NASA administrator is under a lot of pressure, of course, to close that gap. It is going to take more money to do that and so I think you have to look at NASA's decision making in the context of the other problems that they have. But, clearly, for the benefit of the Nation, we need to fund these aeronautic shortfalls.

Chairman UDALL. Dr. Carmichael, do you have any additional comments?

Dr. CARMICHAEL. I do. The NextGen is predicated on the notion of a trajectory based air traffic management system, and by that we mean that the aircraft in the system have a contract that at a particular point of time an aircraft is supposed to be at a certain place in its four dimensional space. To do that absolutely requires accurate weather information. Where the weather is in space to a large extent is determined by where the weather is. Now as you are designing an air traffic system, and NASA has done this for years, they are very good at building a system for the nominal case. In other words, on a clear day the automatic systems work really well. Bring the weather in and everything becomes non-linear.

So a lot of the things that we have been pressing NASA to do is essentially a new start. We are saying you do great work on building air traffic decisions or tools but now we are asking you to start building those tools with weather integrated into those tools from day one. This is a new start, and to get a new start kind of activity within NASA right now is exceptionally difficult so that is our issue.

Mr. DOUGLASS. If I might add one after thought to that, and that is this work on weather phenomenology has lot of benefit to our Department of Defense as well. You can imagine the effect that

weather can have on combat operations so when you think about us as a nation investing in this work there are multiple payoffs beyond just the air traffic control system, sir.

Chairman UDALL. That is a very good point. Just so the panel is aware, we have another vote scheduled in 40 or so minutes, I believe. If you all could stay till lunch time till noon or so, I would really appreciate it. We got—it looks like I have, I should say, a series of additional questions I would like to extend to you. But I think we can cover most, if not all of them, over the next 30 minutes or so. And, Mr. Leader, I am not intending to pick on you first with every question but I would like to start with you again.

CONCERNS REGARDING THE IMPLEMENTATION OF NECESSARY TECHNOLOGY

And I wanted to mention last week we had an FAA R&D hearing and several of the witnesses there indicated that one of the key challenges facing the NextGen initiative is how to transition to agreed-upon NextGen technologies and procedures into the National Airspace System expeditiously. I think Mr. Douglass was speaking to that earlier. They and other observers are concerned that the FAA and the JPDO don't appear to have a clear plan for implementing those technologies and procedures in a timely fashion, and my set of questions to you includes is that a valid concern? If not, what are your specific plans for getting such technologies and procedures into the National Airspace System as soon as possible? Do you have clear and well-defined agreements on certification and operational procedures approval for such things as ADS–B or the operation of military UAVs in the National Airspace System, and to make your job even easier, if not, why not, and when will you? And then I will put the other witnesses on notice that I also would appreciate your comments if you would like to do so after Mr. Leader.

Mr. LEADER. Yes, sir. We do believe we have an ever clearer and evolving approach to implementation and it is a challenge to explain it because it is not a blanket approach. The relationship between JPDO and the partner departments and agencies is for fairly obvious reasons fundamentally different. With FAA with whom we have the largest relationship in the sense that FAA will fund and implement the largest part and subsequently operate the Next Generation system, we are working with them through the evolved operational evolution partnership, which is the process by which concepts and requirements from JPDO will be installed into the planning and execution systems within the FAA, but that is a FAA-specific process.

Within the Department of Commerce, our primary interest is obviously weather, and we are moving forward in an effort involving FAA, Department of Commerce, and Department of Defense to bring forward to the senior policy committee early this summer a specific recommendation for the creation of a joint office that would pursue weather research development and the creation, ultimately, of tools to be used by the three agencies involved. Within the Department of Defense there is a recommendation awaiting approval to create a program office that would be specifically dedicated to the Next Generation system and whose charter would be to man-

age the exchange between JPDO and Defense as well as to implement—oversee implementing programs, joint programs, with them.

With NASA, our primary interaction, as we have discussed earlier in the area of research and development, and we have recently provided our desired research guidance to them and are working very closely with NASA to clarify that, so I think you can see that in each case we are evolving how we will transition from the theory of the case within JPDO into the actual implementation into the NextGen system.

Chairman UDALL. Other witnesses care to comment?

Dr. DILLINGHAM. Yes, Mr. Chairman, I think what we mentioned earlier in our testimony about the operational evolution partnership between FAA and JPDO is very important, it sort of is the process by which they are going to move these new technologies into the NAS. However, the question that you ask is very important because it brings up a couple of integrated points. One is the need to have these key planning documents, concept of operations, enterprise architecture, and the like, because that in fact sort of is the blue print that describes how things are going to be integrated together. You need that in order to go to the next step which is to decide about the necessary regulations and human factors research that needs to be undertaken.

Tied to that is the need for R&D monies, which we just got through talking about, in terms of the concern about enough not being available and organizations not being identified to do it. So there are positive things on some side but the need to get these documents finally completed so that they serve as the base to move forward is also very critical.

Chairman UDALL. Mr. Douglass.

Mr. DOUGLASS. Yes, sir. I have a couple of comments. I think it was you in your opening statement noted that this September we will lose our FAA administrator. We have already lost the head of the air traffic office. The institute recently lost its staff director for a variety of reasons. Some of these problems have to do with the complexity of the task and some are just inevitable. I mean the administrator is moving because it's the end of her five-year term. When Congress plays its role in bringing a new administrator in, I would strongly urge Congress to be mindful of the skill sets that this next administrator is going to need which is someone who understands how big systems like this are pulled together and managed.

Another thought that I think needs to be put into the mix here is I think the senior policy committee has probably suffered a little bit because we have changed from one Secretary of Transportation to another, and I don't mean that as a criticism of the current Secretary. I just mean when you change people it takes a while for everybody to get up and so on. But, clearly, this project is going to need someone at the very top of the FAA who understands systems acquisition. It is going to need some kind of enforcing function to keep everybody working together, and if it is not the SPC, I am not sure what it would be unless it is somebody up here on the Hill who really rides very close herd on this in a way that is difficult for an oversight committee to do. So I am concerned. I think industry is watching to make sure that we do have some way of pulling

this all together because it is a very difficult task and it is an episodic task.

It is important to remember that we only do this about every 40 or 50 years so it isn't like over in the Pentagon when you go from one fighter program to the next, you have a whole group of people who just finished the last one. You can kind of move them over to the new one and so on. This is something that we do rarely, and there aren't a lot of people here today who invented the last system, and so we have to relearn certain things as we go along. And that is going to require central control of some magnitude in my opinion, sir.

Chairman UDALL. Dr. Dillingham, did you have an additional comment?

Dr. DILLINGHAM. Yes, Mr. Chairman. I just wanted to sort of give a footnote to what Mr. Douglass said. I think the statute that created the position for chief operating officer for the air traffic organization in FAA, which is sort of the match for JPDO, created a five-year term, the potential of a five-year term, for that position. Mr. Chew was able to fill that position for three years. I think as FAA goes out to find a new chief operating officer that to the extent that someone can commit themselves to the five-year term might be important.

We are at a point now that as we move from planning to implementation if you got somebody that is going to be there for five years it is a better shot than if you got them there for less time than that.

Chairman UDALL. Dr. Carmichael, did you have any thoughts on the various questions that have been posed?

JOINT WEATHER ACTIVITY

Dr. CARMICHAEL. I just wanted to put a footnote on Mr. Leader's comment about the joint weather activity. You know, in today's world there are three weather forecasting services in this nation. There are two in DOD, one in the Air Force, one in the Navy. And then there is the National Weather Service. And if a pilot asks the same question about the weather over central Kansas at 10,000 feet at 5:00 this afternoon, they may very well get three different answers. DOD is under extreme pressure, budgetary pressure. Even though the defense budgets are high that money is not going to the people who do aviation weather forecasting. And so they are under pressure to streamline to be more efficient and effective in aviation weather.

And so they have a strong desire to collaborate with the Weather Service and with JPDO in this joint weather activity. It is to the benefit of the FAA, NOAA and DOD to have a single entity that is providing aviation weather service for all. And so I am very hopeful that this new joint activity is going to be successful.

Chairman UDALL. Mr. Douglass, did you have a follow-up thought as well?

Mr. DOUGLASS. I did. I just was going to say I agree with Dr. Dillingham. I think those five-year terms that came about both for the administrator and for the ATO officer are well served and I would hope that when we replace Mr. Chew we can find somebody who would give us a five-year commitment.

SUGGESTIONS FOR SPECIFIC LEGISLATIVE PROVISIONS

Chairman UDALL. Let me move to my next question, if I might. We in the Congress will be reauthorizing the FAA this year, and this committee will play an important role in that reauthorization process. I thought since I had you all here, I would ask if you have any thoughts on specific legislative provisions that we ought to include as a part of this reauthorization process. Mr. Leader, I am going to assume that you would suggest we adopt the Administration's FAA proposal. I am going to let you off the hook and——

Mr. LEADER. Yes, sir, that is a very safe assumption.

Chairman UDALL. And start with Dr. Dillingham. We will let you catch your breath this time.

Dr. DILLINGHAM. Mr. Chairman, overall what we understand about the programs that are being changed or modified for reauthorization, we don't find any serious problems with that. However, we have raised some concerns about the funding mechanism that is being proposed for the FAA. Specifically, we are concerned about the basis of the cost allocation system that they have set up to charge user fees, and we testified before that this is a pretty complicated proposal that hasn't had that much time for people to look at and evaluate, so we would caution going forward with something so dramatic as what is being proposed in terms of funding.

Chairman UDALL. Mr. Douglass.

Mr. DOUGLASS. Yes, sir, Mr. Chairman. When I think about this, I am mindful of that scene in the movie, Oh, Brother, Where Art Thou, where the three convicts are chained together and the two guys on the outside are arguing who is going to be the lead on the team, and the guy in the middle says, well, I am for you fellers. Our business, we sell to both the general aviation community and to the airlines. Our products go across the industry. And we are reluctant to be caught between those two communities in their dispute about who should pay more for the use of the system.

The one part of the current proposal though that we really, really don't like is there are user fees in there for the certification of new products, and if you read the language, Mr. Chairman, it is very open ended. It is lots of the administrator may and then there is a long list of things that you could put user fees on, and no bounding of that. And we believe that the certification process in the civil aviation part of our industry is an inherently government function and it should be funded through the FAA. Just like when we produce our military products, the Department of Defense has a part of its organization that inspects them and makes sure they are billed correctly and so on, and we like the way the FAA is currently doing it today and would like to see the current system maintained rather than go to use some sort of user fee system for certification of new products. That is our principal concern with the new proposal.

Chairman UDALL. Dr. Carmichael, do you have any thoughts on the reauthorization of the FAA.

Dr. CARMICHAEL. I want to address the method of funding, but I would like to say that if we are going to accomplish what we are planning to accomplish with the NextGen it is absolutely critical that we have stable funding, predictable funding, that we can build

a multi-year research program to accomplish, and so the stability of that funding is critical.

Chairman UDALL. Thank you. Mr. Douglass, I can't help but relate a quick story that Judge Hall, I think, told me, Congressman Hall, a ranking member on this committee, when a public official was faced with a particularly dirty issue and asked what his position was. He said some of my friends are for it, and some of my friends are against it. I am for my friends. It sounds like that is the position that you think is most appropriate here.

Mr. DOUGLASS. That is exactly our position, Mr. Chairman.

CONCERN REGARDING NASA'S RETRENCHMENT IN WEATHER-RELATED RESEARCH

Chairman UDALL. Let me turn to Dr. Carmichael, and take advantage of his deep expertise when it comes to weather and weather analysis, weather forecasting. In your testimony you raised concerns about the impact on NASA's restructured aeronautics program on important aviation weather research initiatives, and we have heard from a wide variety of expert witnesses, and I hope Congress and the White House will heed those warnings and take corrective action. So that we can better understand what is at stake, could you please elaborate a bit on the nature of your concerns and what the consequences of a NASA retrenchment in these aviation weather-related research area would likely be?

Dr. CARMICHAEL. Well, let me first of all be clear that it is not our position that we expect NASA in their aeronautics program to be performing weather research. What we are asking NASA to do because they are the experts in automation system research is we are asking NASA to team with the folks who do aviation weather research to build automation decision support tools that have weather tightly coupled into the algorithms inside those systems. So that is what we think is critical. Now, if NASA doesn't do that work then I think the fall back position is that the FAA has to have funding to find other ways to do that work. MITRE Corporation, MITRE, CAASD, probably is the beneficiary of building a work force on FAA funding to do that work if NASA is not able to do it.

And I would like to put a footnote also on the question of funding. Currently the R&D is divided up into buckets. There is a safety bucket and there is a capacity bucket. And weather sometimes falls victim to this notion of where does it fit, is it safety or is it capacity. And sometimes these artificial labels cause problems in allocating and managing funds so I would ask that, if possible, with the funding that somehow weather be recognized as funding that is not easily put into either a safety or a capacity bucket. Thank you.

Chairman UDALL. Thank you. We look forward to calling on you further given your expertise and insights into really important areas, as we discussed before the hearing began. Let me turn back to Mr. Leader. In your testimony you refer to a number of agreed upon NextGen technologies including the ADS–B, SWIM, NextGen, Enabled Weather, and the NAS Voice Switch. And obviously, a timely transition in the National Airspace System will be key to the success of the NextGen initiative. When will each of those sys-

tems be fully implemented into the NAS, and please provide for the record if necessary, I know these are fairly complicated dynamics here, and what prevents them from being fully implemented earlier?

Mr. LEADER. That is a question, sir, that I will have to answer for you for the record later.

SCHEDULE OF UAS INTEGRATION

Chairman UDALL. Thank you, and we look forward to those answers. Dr. Dillingham, in your testimony at last week's T&I Aviation Subcommittee hearing, you reported that the "FAA has begun reviewing its existing safety regulations developed for manned aircraft to determine how or whether they need to be modified to enable UAS to be safely integrated into the National Airspace System. FAA expects this to be a five to ten-year effort." That was the end of the quotes of the statement I have here. Given the growing expectations for UAS applications, do you regard this as a timely response, and, if not, what would you recommend be done?

Dr. DILLINGHAM. Chairman Udall, we currently have a study underway that is addressing that question. It has been raised by several members of Congress whether this is actually too long a lead time in that state governments, local governments, are increasingly wanting to use UAS so if you would allow us to get a little further along with our research we certainly would report back to you on that point.

Chairman UDALL. Do you have a time sense of when that might happen, not so much the reporting back but the actual initiative itself or would you like that to be part of——

Dr. DILLINGHAM. I would like that to be a part of what we report back to the record.

Chairman UDALL. Should other government entities be involved, other government agencies?

Dr. DILLINGHAM. Beyond FAA?

Chairman UDALL. Yes.

Dr. DILLINGHAM. Yes, sir. I think that—and they are involved in it at this point. DOD is involved in it for sure. And I am not sure—and Homeland Security is also involved in it. So what we are doing is we are trying to see to what extent they are coordinating their work, and we are also trying to see if there are some lessons learned that we can get from international UAS activities.

STATUS OF UNMANNED AIRCRAFT IN NAS

Chairman UDALL. Excellent. Dr. Carmichael, you have testified to the great potential of unmanned aircraft for targeted observations of the atmosphere to improve forecasts. Do you think that JPDO is moving fast enough to include unmanned aircraft in the NAS?

Dr. CARMICHAEL. I think this is another area where NASA could play an extremely beneficial role. We focus a lot on how do we integrate the unmanned aircraft into the system but from a weather standpoint it provides a tremendously valuable opportunity for us to seek our observations in areas where we need observations to improve the forecast. And those areas may differ from day to day

so the ability to actually move an observing platform where you need it together with observations can make a significant improvement in the weather forecast. So I think this is another area where NASA could be extremely helpful. As far as I understand now, they have no program in this area.

Chairman UDALL. Let me follow on. You testified that "Unmanned aerial systems will also require more precise weather forecasts." That was the end of the quote. Does that comment imply that you believe in some ways unmanned aircraft control won't be as robust as piloted aircraft control?

Dr. CARMICHAEL. No. What I mean by that is that the unmanned aircraft systems span a broad range of capabilities, and some of those aircraft are going to be very, very weather sensitive, so it is important to have weather that is going to be suitable for all classes of unmanned aerial operations all the way from things that may be the size of your thumb or your hand all the way up to huge aircraft. And as you might guess, the small aircraft may be very weather sensitive.

Chairman UDALL. I could continue asking questions but I have other appointments over the noon hour, and I am sure all of you do as well. Before I bring the hearing to a close, I want to thank all of you for appearing here today before the Committee. Your testimony has been very thought provoking and helpful. If there is no objection, the record will remain open for additional statements from the Members for answers to any follow-up questions the Committee may ask of the witnesses. Without objection, so ordered. This hearing is now adjourned.

[Whereupon, at 11:55 a.m., the Subcommittee was adjourned.]

Appendix:

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

Responses by Charles A. Leader, Director, Joint Planning and Development Office, Federal Aviation Administration (FAA)

Questions submitted by Chairman Mark Udall

Q1. The development and transition to the NextGen is one of the most complex efforts that FAA has ever undertaken.

Q1a. What do you consider to be the biggest near-term and mid-term technical and programmatic challenges facing the JPDO as it attempts to plan and develop the NextGen?

A1a. One of the greatest challenges is to ensure that the research in civil aeronautics by the partner agencies is consistent with the needs and plans being identified and developed by the JPDO. Further we need to assure that agency resources can be leveraged, technically and programmatically, in such a way to enable the effective implementation of NextGen operational concepts and capabilities. Over time, the transition from the near-term to the mid-term will bring greater challenges in the area of integrating multiple capabilities into wide-ranging operational contexts.

Q1b. What steps do you intend to take to address those challenges?

A1b. With respect to R&D, the JPDO is working with its partner agencies to develop the NextGen R&D Plan. This product will be delivered to the Office of Management and Budget (OMB) at the end of August. The plan will identify the R&D needed to enable the mid-term transition to the NextGen end-state as well as the funding requirements and agency responsibilities.

Systematic technical and programmatic coordination across the agencies will play a vital role in ensuring success as NextGen moves from the near-term to delivering mid-term capabilities. The recent JPDO realignment is aimed at ensuring that success and results in the refocusing of JPDO's efforts from long-term planning to implementation facilitation. Among the principles changes to support this include: (1) evolution of the Master Integrated Product Team (MIPT) into an Integration Council (IC); (2) creation of a Regulatory Council (RC); (3) reformation of the Integrated Product Teams (IPTs) into Working Groups (WGs); and (4) creation of a Joint Architecture & Engineering Board (JAEB). These entities are further described on the JPDO website at *www.jpdo.aero.*

Q2. In your testimony you refer to a number of agreed upon NextGen technologies, including ADS–B, SWIM, NextGen Enabled Weather, and the NAS Voice Switch. Obviously, a timely transition of these technologies into the national airspace system will be a key determinant of the success of the NextGen system. Please provide the dates by which each of these systems will be fully implemented into the NAS. What prevents them from being implemented earlier.

A2. The FAA plans to award the contract for the ADS–B ground infrastructure in August 2007. By December 2009, the agency expects to make the "in-service decision" that essentially commissions ADS–B for the National Airspace System (NAS) and certifies its use for air traffic control separation services. The deployment across the NAS is planned to be completed by 2013.

Since the ADS–B implementation requires both ground infrastructure and avionics equipage, the FAA is also preparing a proposed rule that will require operators to install ADS–B avionics in order to fly in certain classes of airspace. This rule will be consistent with the way we currently operate the Nation's airspace, and structured much like the rule that today requires transponders for operations in controlled airspace and the areas surrounding busy airports. The FAA will issue the proposed rule in September 2007, and expects it to become final in November 2009. It is projected that there will be 100 percent compliance to the rule by fiscal year 2020.

The first segment of SWIM will be complete in 2013 and will include the SWIM architecture, initial core services, and information services between selected NAS systems. SWIM cannot be implemented earlier because the first segment will connect other NAS systems which are not fully in place, and are dependent on other modernization efforts. For example, SWIM segment 1 will be developed in conjunction with ERAM Release 3, Traffic Flow Management Modernization, Terminal Data Distribution Service, and the development of the Corridor Information Weather System. SWIM cannot be accelerated without accelerating those programs, which would introduce considerable risk.

Beyond the first segment of SWIM, future segments of the SWIM program will implement services that are available from NextGen systems as they come online. Therefore, the final SWIM solution will unfold as other NextGen systems are developed and fielded. The full scope of SWIM cannot be accelerated without accelerating the rest of the NextGen program.

Regarding the NextGen Enabled Weather, the plan calls for a phased implementation of improvements through full implementation in FY 2020. There will be two major phases which build on each other sequentially. The first major phase provides ready access by most users via a network-enabled capability to a limited set of advanced convective and wind shear products to be operational in FY13. The second phase, building upon the network-enabled capability from the first phase, will migrate and upgrade additional products for direct user access and will enable integration into decision support tools on the ground and on the flight deck.

Earlier implementation is limited by several factors, including the time frame for implementation of the first segment of the SWIM Program and the need to maintain current aviation weather capabilities while transitioning a to network based solution from a hard-wired legacy system approach. In addition, extensive coordination among the multiple agencies of the Joint Planning and Development Office, especially the Department of Defense and Department of Commerce, will be required to produce a government-wide solution rather than a solution which meets the needs of only the Federal Aviation Administration. Finally, the development of large scale data networking and assimilation techniques will require several spirals to assure reliability in use by the aviation community.

The NAS Voice Switch program is just beginning the initial investment analysis phase. NVS will have two operational systems in the NAS by FY 2015 as part of its initial operational capability (IOC). The En-route Air Traffic Control Centers and large TRACONS are scheduled to be complete by FY 2022 in line with current mid-term and full capability NextGen goals. Other smaller facility voice switch modernization schedules will be dictated by a combination of end-of-useful life predictions for the legacy systems, and the need to operationally cutover specific airspace in synch with the NextGen transition. The NVS IOC date is contingent on the ongoing investment analysis. This analysis is addressing the total system life cycle cost based upon the projected facility installation waterfall plan. This plan can be accelerated to keep pace with other facility plans by increasing the budget line item accordingly.

The Data Communications Program is in the initial investment analysis phase. The program anticipates deploying capability in three segments beginning in 2014 with upper en-route airspace and select large airports, and concluding with all airspace coverage by 2025. The pacing item for the Data Communications Program will be the airborne user equipage profile. These plans are being developed and synchronized with direct input from the aviation community. Current planning calls for initial equipage starting as early 2013 to support departure clearance and other airport operations, and covering all upper en-route airspace users by the 2017 timeframe. The program will then evolve into terminal airspace in large metropolitan areas. In concert with the investment analysis, the FAA is addressing the rule-making strategy for the program. Acceleration of these dates is unlikely given the user equipage required.

Q3. How much would the NextGen initiative benefit from increased NASA funding of NextGen research needs? What projects and activities should NASA apply any additional aeronautics funding to in order to best address the research needs of the NextGen initiative?

A3. The NextGen R&D plan is due to the Office of Management and Budget (OMB) at the end of August. The R&D plan intends to answer the question of what R&D is needed and which agency is responsible.

Q4. With respect to R&D needed for the NextGen initiative,

Q4a. How well are the resource commitments and R&D activities of the JPDO participating agencies aligned with the needs of the NextGen initiative?

A4a. The JPDO partner agencies are working together to specify NextGen R&D needs and perform a gap analysis against agency plans. The R&D plan due to the OMB at the end of August will answer the question of what R&D is needed and which agency is responsible.

Q4b. Has the JPDO developed a clear set of research requirements for the NextGen initiative along with the agency's research responsibilities? If not, why not, and when will these requirements be developed?

A4b. See answer to question 4a. The R&D plan is due to the OMB at the end of August.

Q4c. Do you consider JPDO research requirements "guidelines" for each NextGen participating agency to consider, or do you consider them to be mandatory requirements that will have to be addressed completely?

A4c. See answer to question 4A. The plan will identify the R&D requirements as well as agency responsibilities. The plan results from the participation and decisions of the partner agencies; the plan in total represents both the requirements and the commitments of the partner agencies.

Q4d. Has the JPDO established agency resource and research contributions to the degree of specificity that it can determine if an agency is failing to meet its commitments? If not, why not?

A4d. See answer to question 4A. The NextGen R&D plan results from a series of needs and gap analysis activities. The gap analysis activities will determine the difference between what is and what should be for the period of FY 2009 through FY 2013.

Q4e. Is there a process for remedying a situation in which one or more agencies is not follow through on commitments to NextGen?

A4e. The JPDO NextGen Senior Policy Committee (SPC) is responsible for oversight, decision-making, and providing assurances in support of partner agency commitments to NextGen. This responsibility is summarized below, as referenced in *VISION 100—Century of Aviation Reauthorization Act* (Public Law 108–176).

(1) advise the Secretary of Transportation regarding the national goals and strategic objectives for the transformation of the Nation's air transportation system to meet its future needs;

(2) provide policy guidance for the integrated plan for the air transportation system to be developed by the Next Generation Air Transportation System Joint Planning and Development Office;

(3) provide ongoing policy review for the transformation of the air transportation system;

(4) identify resource needs and make recommendations to their respective agencies for necessary funding for planning, research, and development activities; and

(5) make legislative recommendations, as appropriate, for the future air transportation system.

Q5. Do NASA and FAA have an agreement on how far NASA will go in maturing NextGen technologies before transitioning them to FAA? If so, where is the dividing line? If there is not such an agreement, how are you able to plan? If there is no agreement yet, has NASA told you how far (in terms of technological maturing) it will take the research that it is planning to do?

A5. We are depending on NASA for the longer-term, transformational elements of the transition to NextGen that we expect to begin implementing after 2015. Up to that point, the research, much of which was originally pioneered by NASA, has largely been completed or is at a more advanced stage of development.

Therefore, for the next several years, we do not expect that there will be any significant technology gaps. The FAA's reauthorization that is currently with Congress reflects our expanded requirements for R&D to meet the mid-term needs of the transition to NextGen (up to 2015).

In the long-term, we are looking to NASA to answer challenging transformational questions, such as the relative roles of humans and automation in NextGen, how to implement automated, fault-tolerant gate-to-gate 4D trajectory management within the NAS. We are actively working with NASA and JPDO to understand the details of the research that is required and to ensure we have a technology transition pathway.

Q6. NASA is moving toward a focus on fundamental research and away from demonstration projects. Industry experts have expressed the concern that this will leave a gap in technology development. This leads to the question of what entity will do the development work that will be important to NextGen? According to JPDO officials, JPDO has conducted gap analysis on the impact of NASA's actions on NextGen planning.

Q6a. When will that analysis be completed? Please provide the results to this committee.

A6a. The R&D gap analysis begins in May and will be completed with submission of the R&D Plan to OMB in August.

Q6b. Does the FAA budget for FY08 with its five-year run out assume that FAA will fund all of the technology maturation tasks for the NextGen initiative that you had been counting on NASA to do? If not, how much additional funding will be required for FAA to do all of the technology maturation, and what will be the extent of the resulting delays, if any, in implementing the technologies?

A6b. The Director of the Joint Planning and Development Office was unable to provide an answer for the record.

Q7. You have stated that preliminary cost estimates for NextGen include $15–22 billion in FAA funding and $14–20 billion in avionics costs to users, for a total of $29–42 billion. At the same time, you state that the total costs of the European SESAR system are estimated at $25 to $37 billion. Given that you describe the European system as "smaller in scope and size" and focused "almost exclusively on air traffic management" while NextGen "includes not only air traffic control, but also airports, airport operations, security and passenger management, and DOD and DHS requirements," why isn't the cost of the U.S. system much higher than the European system, rather being only about 15 percent higher?

A7. The preliminary cost estimates of $15–22 billion apply to the FAA's capital funding requirements. The avionics cost estimates are preliminary and recognize that the range reflects uncertainties concerning the individual aircraft, operational requirements, and equipage schedules. Through the development of the NextGen business case, the JPDO is actively working to comprehensively identify the future NextGen resource requirements as it spans the partner agencies, user community, and other stakeholders. The SESAR cost estimates reflect a preliminary but broad estimate across all its stakeholders, while the NextGen estimates, to date, largely reflect those of the public sector and preliminary user equipage costs.

Questions submitted by Representative Jim Matheson

Q1. What is the time frame for implementation of the FAA's Automatic Dependent Surveillance Broadcast (ADS–B) system and when will it be required for civilian aircraft to be equipped?

A1. The FAA plans to award the contract for the ADS–B ground infrastructure in August 2007. By December 2009, the agency expects to make the "in-service decision" that essentially commissions ADS–B for the National Airspace System (NAS) and certifies its use for air traffic control separation services. The deployment across the NAS is planned to be completed by 2013.

Since the ADS–B implementation requires both ground infrastructure and avionics equipage, the FAA is also preparing a proposed rule that will require operators to install ADS–B avionics in order to fly in certain classes of airspace. This rule will be consistent with the way we currently operate the Nation's airspace, and structured much like the rule that today requires transponders for operations in controlled airspace and the areas surrounding busy airports. The FAA will issue the proposed rule in September 2007, and expects it to become final in November 2009. It is projected that there will be 100 percent compliance to the rule by fiscal year 2020.

Q2. Does FAA anticipate the elimination of ground-based radar installations, such as Automatic Surveillance Radar (ASR–11) after the implementation of the ADS–B system?

A2. The FAA does not have any plans in the near-term to eliminate ground-based radars. An important part of the plan for ADS–B is to maintain 50 percent of the current system of secondary radars at high-density locations to serve as a back-up in case of an outage of the Global Navigation Satellite System (known in this country as GPS, or Global Positioning Satellites). Some older legacy surveillance systems are planned for removal starting in 2016, well after the commissioning of ADS–B for the national airspace system in 2013. Removal will occur slowly over the years, with the last of the targeted legacy systems eliminated by 2023.

Q3. If ASR–11 will not be eliminated, does FAA plan to extend radar coverage to new locations? If so, how will this be accomplished? If not, why not?

A3. There are currently no plans to expand radar coverage to new locations beyond current program baselines. In addition to the set of en route and terminal secondary radars that will remain in place as part of the ADS–B backup strategy, primary radars such as ASR–9 and ASR–11 will also be used to support backup surveillance where they are currently located. In areas outside of these locations, backup surveillance capabilities will not be required, and so the long-term expansion of surveillance services to these areas, if required, will be accomplished using ADS–B alone. As with any capability in the NAS, the need for these surveillance services will continue to be periodically assessed as the NAS evolves to the next generation system.

Q4. Does FAA anticipate the elimination of other ground-based navigational systems such as ILS equipment or VOR? How does FAA plan to accommodate the elimination of these systems?

A4. The FAA anticipates reducing, but not eliminating, both VOR and ILS equipment. Reductions will be designed to minimize the operational impact on aircraft while maintaining sufficient numbers of these systems to provide a safe and efficient backup to satellite navigation. Analysis is underway to establish the criteria for identifying which specific systems will be retained and which will be candidates for elimination.

Questions submitted by Representative Ken Calvert

FAA Financing Proposal

Q1. What would be the effect, if any, on the NextGen budget if Congress does not enact the Administration's proposed aviation financing reform package (ticket prices, aviation fuel taxes) as part of a new authorization, but instead leaves the current ticket and fuel taxes in place?

A1. The FAA, like the Congressional Budget Office, projects Trust Fund revenues to continue to grow over the long run under the current system. However, this does not necessarily mean the current system can efficiently accommodate the requirements of NextGen. Under the existing financing system, our revenue is inflexible and is vulnerable to factors—such as ticket prices—that are unrelated to the cost of providing service. This year-to-year volatility makes long-term planning difficult, and will severely hamper the efficient implementation of NextGen in time to avoid gridlock in the 2014–2015 timeframe.

Our financing proposal will create the flexibility to provide the resources we need for NextGen when we need them, through adjustable cost-based user fees and taxes, a well-defined general fund contribution, and borrowing authority. In addition, under the current system, FAA's discretionary spending must compete within the budget caps for all government discretionary programs. In other words, even if the Trust Fund does have enough money, the FAA may or may not get access to it when we need it.

Under the proposal, user fees would be offsetting collections, not subject to the overall discretionary spending caps. This is a key reason this year's President's Budget is able to accommodate the significant capital spending increases that will be required for NextGen, and proposes a capital spending increase of $1 billion a year by 2012.

NextGen Cost Estimates

Q2. You stated that the full-up cost of NextGen is on the order of $15 billion to $22 billion, and I understand that JPDO is working to refine these estimates. Please break down this estimate on an agency by agency basis?

A2. The estimates cited above apply to the FAA. The estimates by agency are currently in development and will be reflected in the NextGen business case.

NASA's Role in JPDO

Q3. Traditionally NASA has developed promising technologies to a high maturity level enabling FAA to incorporate them into its air traffic control system without too much additional development. Now that NASA is confining its development work to a basic level of technical maturity, does FAA and the other federal partners have the resources and capability to fill this void?

A3. Timely and efficient transition of research products will require the FAA to engage at lower technical maturity levels. While we have been successful at

transitioning NASA technologies to the National Airspace System in the past, this process has required a considerable length of time. Far slower than we can afford if we are going to be able to develop the NextGen capabilities we need in order to meet forecasted demand.

The FAA's reauthorization request reflects our expanded requirements for R&D to meet the mid-term needs of the transition to NextGen. The requested funding will allow this transition. We will focus internal resources on NextGen research and technology development and will use attrition to hire technical and program management expertise. We will use the Operational Evolution Partnership to focus MITRE CAASD research on NextGen requirements. We are also assessing resources available at Volpe to supplement FAA capabilities, and we may look to industry for assistance.

We are in the process of seeking outside expertise in the form of a "blue ribbon panel" to explore strategies to strengthen our technical and contract management expertise.

Industry Led Development of NextGen

Q4. What is the current thinking on the role of the private sector in the development and operation of NextGen? Has the JPDO come to any firm decision on using a Large Systems Integrator approach?

A4. The role of the private sector in the development of the NextGen infrastructure and in the actual operations of NextGen is still being discussed and analyzed. However, some private sector involvement, in the provision of certain key NextGen capabilities, is likely.

With regard to the use of a large systems integrator approach this too is still being evaluated. The focus of implementation continues to rely on the partner agencies and as such, so far at least, hasn't involved a centralized systems integration approach. However, one possibility as the initiative develops, and this has yet to be evaluated, may be to rely to some degree on a lead systems integrator.

Certification

Q5. In his statement before the Subcommittee, Mr. Douglass expressed concerns about the time required to prototype, validate, and certify new technologies required for NextGen, in addition to time required for rule-makings. Do you share Mr. Douglass' concerns? How much of a risk do these processes pose to the timely development of NextGen?

A5. With so much of the NextGen initiative involving new equipment, changes in procedures and new approaches to the operation of the national airspace system, there are going to be a large number of new certification requirements. Mr. Douglass is justified in his concerns. However, the JPDO, through the development of a comprehensive planning process that accounts for these requirements, as well as the lead time involved, is working to mitigate the risks these certification needs will have on the timely development of NextGen.

Accountability

Q6. In his statement before the Subcommittee, Mr. Douglass raised concerns about the potential lack of accountability and authority in the current JPDO structure, especially with regard to partner agencies. He recommends that each partner agency designate a senior level official as the responsible individual for all NextGen related programs. Do you share Mr. Douglass' concerns? Should agencies designate a senior program official?

A6. The existing legislation already mandates that the partner agencies support NextGen and the JPDO. However, Mr. Douglass' point is well taken and the JPDO, working closely with its major partner agencies has put a considerable emphasis on developing sound working relationships with all of its partner agencies. We have had considerable success in developing processes and linkages that allow us to closely align critical programs and funding to support NextGen initiatives.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Gerald L. Dillingham, Director, Physical Infrastructure Issues, Government Accountability Office

Questions submitted by Chairman Mark Udall

Q1. How long should the Joint Planning and Development Office (JPDO) exist, and should its role evolve from its current one? If so, in what ways?

A1. JPDO was established to plan and coordinate the development of the next generation air transportation system (NextGen) and should exist for the duration of those tasks. The basic planning documents that JPDO is developing for NextGen are near completion, but further iterations of these planning documents will be needed as NextGen technologies are developed and implemented. As NextGen has progressed from the initial planning to the early implementation phase, JPDO's role has evolved to include coordination and facilitation activities, as well as planning activities. GAO believes this is a reasonable evolution and a proper role for JPDO and is consistent with the language of JPDO's authorizing legislation.

One example of this evolution is the role JPDO has begun to play in incorporating NextGen goals and activities into the Air Traffic Organization's (ATO) strategic plans. ATO has expanded and revamped its Operational Evolution Partnership (OEP) to become the Federal Aviation Administration's (FAA) implementation plan for NextGen. The Review Board that oversees the OEP is co-chaired by JPDO and ATO. If JPDO ceased to exist before NextGen was more fully developed, some alternative means of planning and coordinating NextGen's development would have to be established, which could delay NextGen's implementation. Similar developments are expected to occur with other partner agencies as JPDO completes a Memorandum of Understanding with these agencies.

JPDO's role could further evolve to include more coordination and oversight activities. For example, JPDO could establish a program oversight capacity that would enable it to perform such functions as (1) harmonizing the enterprise architectures among the partner agencies; (2) coordinating the research, development, and systems-engineering and integration activities of the cooperating agencies and industry; (3) overseeing multi-agency projects; (4) overseeing, with FAA, the selection of products or outcomes of research and development that would be moved to the next stage of a demonstration project through the Joint Resources Council (JRC);[1] (5) overseeing the fundamental research activities that support the long-term strategic investments of NextGen by managing a research portfolio among NASA, academia, federally funded research and development centers, and industry; and (6) maintaining a baseline modeling and simulation environment for testing and evaluating alternative concepts to satisfy NextGen enterprise architecture requirements.

Another example of the evolution of JPDO's role is the organizational shift from integrated product teams to working groups. This shift reflects the extension of JPDO's role beyond planning to development of work products or "outcomes" that will contribute to the early development of NextGen and facilitate its implementation. As JPDO assumes more responsibility for facilitating NextGen's implementation, greater authority and resources would allow it to do more to coordinate the efforts of the partner agencies and work with the Office of Management and Budget as the principal NextGen point of contact. With adequate funding and authority, JPDO could acquire staff with the project management and systems engineering skills needed for JPDO to be an effective oversight and coordinating office.

Q2. Should JPDO be moved out of the Federal Aviation Administration's Air Traffic Organization to be given greater visibility and authority? For example, should it report directly to the Office of the Secretary of Transportation? Why or why not?

A2. Currently, JPDO is located within FAA and reports to both the FAA Administrator and the Chief Operating Officer of ATO. In GAO's view, JPDO should not be moved out of FAA. Since JPDO provides the vision for the future air traffic control (ATC) system and ATO is to be the principal implementer of that vision, the two organizations need to continue working closely together.

However, JPDO's dual reporting status hinders its ability to interact on an equal footing with ATO and the other partner agencies. On one hand, JPDO must counter

[1] FAA's Joint Resources Council establishes and manages acquisition program baselines which define cost, schedule, performance, and benefit parameters for programs over the full life cycle of the program.

the perception that it is a proxy for the ATO and, as such, is not able to act as an "honest broker." On the other hand, JPDO must continue to work with ATO and its partner agencies in a partnership in which ATO is the lead implementer of NextGen. Therefore, it is important for JPDO to have some independence from ATO. One change that could begin to address this issue would be to have the JPDO Director report directly to the FAA Administrator. This change may also lessen what some stakeholders now perceive as unnecessary bureaucracy and red tape associated with decision making and other JPDO and NextGen processes.

As a part of any change in the dual reporting status of JPDO's Director, consideration could be given to the possibility of creating the position of Associate Administrator of NextGen and elevating the JPDO Director to that post. This would give greater credibility, authority, and visibility to this important position.

JPDO should not report to the Secretary of Transportation because placing JPDO in the Secretary's office would remove it too far from the implementation and operations of NextGen.

Q3. What are the specific roles of the Department of Homeland Security (DHS) and the Department of Defense (DOD) in JPDO?

Q3a. Do we know how much DOD plans to spend on NextGen for its development and implementation? If so, how much will it be?

Q3b. Do we know how much DHS plans to spend on NextGen for its development and implementation? If so, how much will it be?

A3a,b. The specific role of DHS in JPDO is to lead the Security Working Group and to develop an effective security system for the national airspace system (NAS) without limiting mobility or civil liberties. DHS carries out this role through its Transportation Security Administration (TSA). More specifically, DHS's task, through TSA, is to develop and implement a real-time network to share information with appropriate parties about passengers, cargo, and aircraft and to create a transparent set of security layers that will deliver security without causing undue delays, limiting access, or adding excessive costs and time.

The specific role of DOD in JPDO is to lead the Net-Centric Operations Working Group and to establish user-specific situational awareness. Situational awareness means that each user of the NAS, including DOD and the civilian sectors, has the awareness needed to reach decisions through the creation of a combined information network. All users of the system will have access to the air transportation system data they require for their operations.

The specific roles of both DHS and DOD in JPDO are related to the "curb-to-curb" approach to air traffic management that Vision 100 established for NextGen. Under this approach, JPDO envisions an expansion of the air transportation system that includes airport departures and arrivals as well as flights. The JPDO working groups, which evolved from FAA's former integrated product teams (IPT), focus on eight strategies, such as how to use weather information to improve the performance of the NAS. The working groups are composed of personnel from FAA, other federal agencies, and the private sector. Each of the working groups is headed by a steering committee under both a federal agency—in this case, DHS or DOD—and a private sector representative.

We do not know how much either DOD or DHS plans to spend on NextGen. However, we are aware that DOD, FAA, and DHS each plan to provide $5 million for net-centric (i.e., a continuously-evolving network of information sharing and situational awareness) demonstrations. Both DOD and DHS also provide a variety of "in-kind" services through personnel assigned to the JPDO working groups and through the potential leveraging of mission-specific research that could support the development and implementation of NextGen.

Q4. NextGen technologies will increase flight efficiency by means of automated flight operations and reduced separations.

Q4a. Will this render the system more brittle against disturbances such as terrorism and equipment failure and acts of nature?

Q4b. How will we ensure the continued safe operation of the system in the event of such disturbances?

A4a,b. NextGen technologies will not render the system more brittle than the current system. Although no system is 100 percent safe, GAO has not seen any data or other information indicating that the planned satellite based navigation system is more vulnerable to security threats than the current ground based radar system. JPDO's plans call for robust security system protocols and firewalls to increase protection, as well as sufficient redundancies within the system to reduce

vulnerabilities and offset any disruptions. Security will exist in "layers of defense" designed for early detection of threats from terrorism, equipment failure, and natural disasters and will provide appropriate intervention. Additionally, although the system will become more automated, there will still be opportunities for human intervention if the system fails.

Questions submitted by Representative Ken Calvert

Implementation by Other Federal Partners

Q1. In your written statement, when discussing the planning efforts of the JPDO partner agencies (exclusive of NASA and FAA), you stated that they are not as far along developing implementation plans and institutionalizing JPDO goals into their planning documents. Why is that? Does this reflect a lack of commitment?

A1. The current situation does not necessarily reflect a lack of commitment on the part of the partner agencies. JPDO partner agencies face competing mission and resource demands. In addition, NextGen is an extraordinarily complex undertaking, and some agencies are still learning to work collaboratively. By contrast, FAA and NASA have a long history of working with each other, and the core effort of JPDO is within their purview.

The partner agencies will engage more collaboratively as NextGen's processes and mechanisms mature. For example, the Department of Transportation (DOT) was recently designated as the Managing Partner responsible for ensuring collaboration among the partner agencies in implementing NextGen-related research and development. DOT is also responsible for submission of the OMB 300 for the NextGen as a portfolio project after review by JPDO.[2] JPDO's decision to develop a Memorandum of Understanding to broadly define the roles and responsibilities of the partner agencies is another positive step. Additionally, the extent to which Congress provides JPDO with the authority and resources it needs for program oversight will affect the nature and scope of the partner agencies' collaboration.

FAA Financing Proposal

Q2. What would be the effect, if any, on the NextGen budget if Congress does not enact the Administration's proposed aviation financing reform package (ticket taxes; aviation fuel taxes) as part of a new authorization, but instead leaves the current ticket and fuel taxes in place?

A2. The current FAA funding structure can provide sufficient funding for NextGen—with some caveats. Congress has used the current funding structure—excise taxes plus a General Fund contribution—to fund FAA for many years. As the number of air travelers has grown, so have excise tax revenues. Even though revenues fell during the early years of this decade as the demand for air travel fell, they began to rise again in fiscal year 2004, and FAA estimates that if the current taxes remain in effect at their current rates, revenues will continue to increase. According to projections prepared by the Congressional Budget Office (CBO),[3] revenues obtained from the existing funding structure will increase substantially. Assuming the General Fund continues to provide about 19 percent of FAA's budget, CBO estimates that through 2016 the Airport and Airway Trust Fund (Trust Fund) can support about $19 billion in additional spending over the baseline FAA spending levels CBO has calculated for FAA (the fiscal year 2006 funding level, with projected growth for inflation) provided that most of the spending occurs after fiscal year 2010. How far this money will go to fund modernization is subject to a number of uncertainties—including the future cost of NextGen investments, the volume of air traffic, the future cost of operating the NAS, and the levels of future appropriations for the Airport Improvement Program, all of which influence the amount of funding available for FAA.

However, if the desired level of funding exceeded what was likely to be available from the Trust Fund at current tax rates, Congress could make changes within the current structure to provide FAA with additional revenue. Congress could raise more revenue from airspace system users for NextGen or for other purposes by rais-

[2] Section 300 of OMB Circular No. A–11, Preparation, Submission, and Execution of the Budget (Nov. 2, 2005), sets forth requirements for federal agencies for planning, budgeting, acquiring, and managing information technology capital assets.

[3] Congressional Budget Office, *Financing Investment in the Air Traffic Control System* (Washington, D.C.: Sept. 27, 2006)

ing the rates on one or more of the current excise taxes. Congress could also provide more General Fund revenues for FAA, although the Nation's fiscal imbalance may make a larger contribution from this source difficult.

JPDO Organizational Authority

Q3. Would GAO recommend any changes to the authorities and resources now provided to JPDO to enhance its effectiveness in coordinating the partner agencies, and if so, what would they be?

A3. Yes, providing JPDO with the authority and the resources to establish a program oversight capacity would enable JPDO to perform such functions as (1) harmonizing the enterprise architectures among the partner agencies; (2) coordinating the research, development, and systems-engineering and integration activities of the cooperating agencies and industry; (3) overseeing, with FAA, the selection of products or outcomes of research and development that would be moved to the next stage of a demonstration project through the Joint Resources Council (JRC); (4) overseeing the fundamental research activities that support the long-term strategic investments of NextGen by managing a research portfolio among NASA, academia, federally funded research and development centers and industry; and (5) maintaining a baseline modeling and simulation environment for testing and evaluating alternative concepts to satisfy NextGen enterprise architecture requirements.

JPDO will need additional funding and staff to expand its role in coordinating the efforts of the partner agencies and working with the Office of Management and Budget as the principal NextGen point of contact.

However, JPDO's dual reporting status hinders its ability to interact on an equal footing with ATO and the other partner agencies. Therefore, it is important for JPDO to have some independence from ATO. One change that could begin to address this issue would be to have the JPDO Director report directly to the FAA Administrator. This change might also lessen what some stakeholders now perceive as unnecessary bureaucracy and red tape associated with decision making and other JPDO and NextGen processes. As a part of any change in the dual reporting status of JPDO's Director, consideration could be given to the possibility of creating the position of Associate Administrator of NextGen and elevating the JPDO Director to that post. This would give greater credibility, authority, and visibility to this important position.

NASA's Role in JPDO

Q4. Traditionally NASA has developed promising technologies to a high maturity level, enabling FAA to incorporate them into its air traffic control system without too much additional development. Now that NASA is confining its development work to a basic level of technical maturity, do FAA and the other federal partners have the resources and capability to fill this void?

A4. It is not clear whether FAA and the other federal partners have the resources and capability to fill this void. As your question indicates, the National Aeronautics and Space Administration (NASA) formerly conducted the type of intermediate research and development (R&D) and demonstration projects that will be needed for the NextGen program, but the funding for these efforts was discontinued when NASA's aeronautical research portfolio was restructured to focus more on fundamental research. Although FAA has not fully determined the impact of the NASA restructuring on the R&D needs for NextGen, some additional R&D funds will be needed and are critical for the timely development of NextGen. FAA recognizes that this is a critical issue and has already taken some action to address it. For example, in the President's fiscal year 2008 budget request for FAA, funds have been included for developmental and transition research in the Facilities and Equipment (F&E) Activity 1 account. In light of the NASA restructuring, FAA has also undertaken a study to assess the nature and scope of its NextGen R&D needs. According to JPDO officials, this study will be completed in August 2007. More work remains to completely assess the research and development needs of NextGen and the ability of FAA and the other JPDO partner agencies to budget for and conduct the necessary initiatives. One way to fill an identified research and development need might be to make more use of the resources available at the FAA Technical Center in Atlantic City, New Jersey, and the FAA Aeronautical Center in Oklahoma City, Oklahoma.

Certification

Q5. In his statement before the Subcommittee, the President and CEO of the Aerospace Industries Association, Mr. Douglass, expressed concerns about the time required to prototype, validate, and certify new technologies required for NextGen, in addition to the time required for rule-makings. Do you share Mr. Douglass's concerns? How much of a risk do these processes pose to the timely development of NextGen?

A5. Yes, we share Mr. Douglass's concerns. The time required to prototype, validate, and certify a technology can present a significant risk to the timely and cost effective implementation of NextGen. We have studied the lead times required to prototype, validate, and certify new technologies. JPDO or FAA do not currently have sufficient resources to prototype, validate, and certify new technologies, and cannot currently develop them internally without causing significant delays in the implementation of NextGen. In addition, stakeholders have expressed concern over the time it takes to develop rules for new equipment and the problems caused when equipment is fielded before rules are finalized. Any activities that will be required to implement new policies, demonstrate new capabilities, set parameters for the certification of new systems, and develop technologies will take time. Just as important, the time required to prototype, validate, and certify a new technology must be balanced against the need to ensure the reliability of the technology and the safety of the flying public.

Accountability

Q6. In his statement before the Subcommittee, Mr. Douglass raised concerns about the potential lack of accountability and authority in the current JPDO structure, especially with regard to partner agencies. He recommends that each partner agency designate a senior-level official as the responsible individual for all NextGen-related programs. Do you share Mr. Douglass's concerns? Should agencies designate a senior program official?

A6. Yes, we share Mr. Douglass's concerns and further note that these fundamental leadership issues are exacerbated by the apparent inactivity of JPDO's Senior Policy Committee (SPC). This committee is responsible for overseeing the work of JPDO, but has met only four times in three years and has not convened as a body since November 2005. The committee is chaired by the Secretary of Transportation and includes senior leaders from the partner agencies and the Director of the White House Office of Science and Technology Policy. SPC was established to provide policy guidance and review; make legislative recommendations; and identify and align resources. A more regular schedule of meetings and an agenda for SPC could lead to more participation and accountability on the part of the partner agencies.

Additionally, assigning sole responsibility for supporting NextGen to a senior official from each agency would be a positive step. As a point of contact and coordinator for NextGen activities, that person should, within prescribed limits, have access to, and authority from, the SPC member from their agency to make decisions and act on behalf of their agency.

Finally, to the extent that the pending Memorandum of Understanding (MOU) between the partner agencies defines the roles and responsibilities of each agency, it will, when signed, be a useful document for ensuring accountability.

ANSWERS TO POST-HEARING QUESTIONS

Responses by John W. Douglass, President and CEO, Aerospace Industries Association of America

Questions submitted by Chairman Mark Udall

Q1. The Aerospace Industries Association has stated its concern that the NGATS Institute, established to facilitate industry involvement in the JPDO, "has not attained the extensive industry partnership that was envisioned."

Q1a. Could you please elaborate on the nature of your concerns?

A1a. The initial draft of the Concept of Operations (Con Ops) was drafted without meaningful input from the Integrated Product Teams (IPT), resulting in nearly 1,500 comments when it was released for comment. Due to this overwhelming response, completion of the Con Ops was further delayed. Had the IPTs been engaged in the process from the outset, the Con Ops may have been completed in a more reasonable timeframe.

Q1b. What would you recommend be done?

A1b. With the delayed release of the Con Ops, AIA, in addition to numerous participating organizations, are calling for a closer coordination of working groups within the JPDO. Reorganization of the IPTs, with clear objectives demonstrated is a positive step which AIA applauds, will place an increased emphasis on systems engineering. At the same time, the JPDO requires additional resources to bring its system engineering, planning, and program management capabilities up to the level required to meet the Vision 100 objectives.

Q2. The costs to users for equipage have been estimated at $14 to $20 billion. NextGen can't be realized unless this investment is made.

Q2a. Will incentives or mandates be required?

A2a. AIA believes that a business case for necessary equipage is necessary to allow timely operational and equipage decisions. Additionally, a combination of operational and perhaps financial incentives should be considered. Statutory requirements will be required to encourage full equipage. However, clear and unambiguous product development and certification standards will be required to obtain the required systems in a timely way. Numerous cargo operators and airlines have begun to implement technologies such as ADS–B in order to maximize operational efficiency.

Q2b. What specifically needs to be done to ensure that a sustained commitment to NextGen exists in booth industry and government?

A2b. The JPDO and the partner agencies must achieve tangible results in the near future. Without which, Congress and industry partners will loose faith in the initiative. A clear plan must be developed, aggressively followed and we all must see satisfactory performance resulting from the plan. AIA is calling for increased accountability and adherence of all NextGen Partner Agencies to their responsibilities with the JPDO. Further, AIA requests that true performance metrics be developed, monitored, and reported to Congress by the [GAO/DOT Office of Inspector General] at least annually.

Question submitted by Representative Ken Calvert

NASA's Role in JPDO

Q1. Traditionally, NASA has developed promising technologies to a high maturity level enabling FAA to incorporate them into its air traffic control system without too much additional development. Now that NASA is confining its development work level of technical maturity, does FAA and the other federal partners have the resources and capability to fill this void?

A1. As with many portions of the NextGen Initiative, timing is of the essence. If another agency were tasked with completing this work, substantial time would be lost as they spool up. Budget would have to be amended, facilities will likely need to be created or transferred and staff would have to be hired or transferred from NASA for the work to be preformed by another agency.

Research and development (R&D) is key to the success of NextGen; however, NASA is the only agency capable to conducting the required R&D, particularly in

the required timeframe. If the R&D responsibilities were to shift to another agency, the necessary spool up time would slow the modernization effort by many years. We believe NASA has been allocated an adequate budget to step up in 2007, and firmly believe they need to do so now.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Bruce Carmichael, Director, Aviation Applications Program, Research Applications Laboratory, National Center for Atmospheric Research

Questions submitted by Chairman Mark Udall

Q1. In your testimony you state "It must be recognized that sustained and predictable aviation weather research funding at a significantly increased level is required in each of the JPDO stakeholder agencies." *Is that fact recognized in each stakeholder agency? Which agencies do you consider to be the "stakeholder" agencies?*

A1. Within each stakeholder agency their representatives and experts involved in the JPDO Weather initiative, clearly understand the need for sustained, predictable funding at a significantly increased level for aviation weather research. Senior management of these agencies has varying degrees of understanding of these needs and discussions are underway as the agencies formulate their FY 2009 budgets.. For example, Russ Chew, former COO of the FAA ATO, specifically identified convective weather as an especially critical area in need of attention as aviation traffic increases. General Johnson, Director of the National Weather Service and former head of the Air Force Weather Agency is supportive of the concept of a fully integrated forecasting system. The stakeholder agencies involved with the JPDO weather initiative are FAA, NOAA, NASA, and DOD.

Q1a. How much would you recommend funding be increased in each agency for this research?

A1a. The FAA needs an increase of $40 million in its Research, Engineering and Development appropriation to be allocated among efforts to understand how to improve observations unique to aviation, to increase forecasting skill, to capitalize on the proposed Network Enabled Architecture, and to integrate weather information into automated decision support systems. NASA needs an increase of $30 million, of which $10, million should augment the Science Directorate to support research on improving observations for aviation, and $20 million to Aeronautics to support the integration of weather information into automated decision support tools in ground-based systems and aboard aircraft. NOAA and DOD each need an increase of $20 million for aviation weather research and associated in-house staff resources to support the development of a seamless, joint modeling and forecast post-processing capability so that the United States Government can produce a single, global, authoritative 4D aviation forecast grid.

Q1b. What determines how quickly NextGen weather capabilities can be incorporated into the National Airspace System? Are we waiting for a better understanding of weather, or the development or implementation of enabling technologies, or organizational decisions?

A1b. The most significant pacing factor for incorporation of NextGen weather capabilities into the National Airspace System is the establishment and execution of a joint program between the weather research community and the ATM automation research community. A collaborative program will advance understanding the nature of forecasts suitable for incorporation into a new generation of probabilistic ATM tools based on a decision theory approach to management of air traffic. Although there are significant advantages to developing a better understanding of weather, and enabling technologies such as improved observation platforms and faster supercomputers will move system performance in a positive direction, a clear organizational decision to move rapidly toward a much more highly automated system with weather fully integrated into the automation is currently the most critical need.

Q2. Improved weather forecasting and forecast dissemination is an important part of the NextGen vision. It is estimated that 60–80 percent of air traffic delays are weather related. Is the necessary research being conducted?

A2. The necessary research has been scaled back in the last several years, a victim of budget pressures and reprogramming of funds. Joint weather and ATM community research on how to seamlessly integrate improved weather information into a new generation of automated ATM decision support tools is barely funded. This is an effort that should begin at once as a joint effort between NASA, FAA, NOAA, DOD, and research laboratories such as Mitre, NCAR and MIT/LL. In addition, research to improve the skill of aviation weather forecasts has eroded since 9/11 be-

cause of continuing cuts in the FAA's Aviation Weather Research Program (AWRP) and the reprogramming of AWRP funding to meet other FAA objectives.

Q2a. Which NextGen weather initiative do you consider to be the most challenging and why?

A2a. The correct forecasting of weather activity, whether for aviation or other purposes, will continue to be a challenge, but it is a challenge that the atmospheric research community is actively and continually engaged to meet. With continued research funding, each year the aviation weather forecasts will become more skillful. But we recognize that they will always be uncertain. The biggest challenge at the current time is to work together as weather researchers and ATM automation researchers to learn how to use weather information that is uncertain to make optimal deterministic decisions for management of the air transportation system.

Q2b. There are many weather prediction tools and data formats. Who will decide between them for NextGen? For example, in your opening remarks you state that "A high priority is the development of a consolidated summer and winter storm forecast system. . . A goal is to gradually merge 16 different forecasting systems so that by early in the next decade we will have a single system that utilizes the best-of-the-best elements of today's technologies." *Does the JPDO weather team have the clout to make that happen? After all, different groups may have made substantial investments in technologies that now they will be told to discard.*

A2b. The foundational concept of NextGen Weather is that an automated ATM system is fully integrating the very best weather information available, to produce a common operating picture of the system, including weather. The system is facilitating all management decisions based upon this common operating picture. The JPDO cannot dictate systems and technologies to be discarded, but it can, and must, dictate how forecast information will be fused to form the NextGen Common Operating Picture for weather.

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