STATEMENT OF VICTORIA COX, SENIOR VICE PRESIDENT FOR NEXTGEN AND OPERATIONS PLANNING SERVICES, AIR TRAFFIC ORGANIZATION, FEDERAL AVIATION ADMINISTRATION, BEFORE THE HOUSE COMMITTEE ON SCIENCE, SUBCOMMITTEE ON SPACE AND AERONAUTICS, ON A REVIEW OF THE FEDERAL AVIATION ADMINISTRATION'S RESEARCH, ENGINEERING, AND DEVELOPMENT PROGRAM, FEBRUARY 16, 2011.

Good morning, Chairman Palazzo, Congressman Costello, and Members of the Subcommittee. I am Victoria Cox, Senior Vice President for NextGen and Operations Planning Services in the Air Traffic Organization of the Federal Aviation Administration (FAA). It is a pleasure to meet the new Members of the Subcommittee today and I look forward to working with all of you. It saddens me to miss Congresswoman Giffords here, having appeared before her last year, and we at the FAA join the rest of the nation in keeping her recovery in our thoughts.

Research and development has been essential and necessary to aviation since the beginning. Where would we be without the Wright Brothers' studies and experiments on the dynamics of flight? The FAA's research, engineering and development (RE&D) program carry this legacy forward as aviation continues to thrive and change.

Aviation is a vital national resource for the United States. The aviation industry alone directly employs 1.1 million people and supports more than 11 million jobs in related industries and through spending by direct aviation employees. Altogether, this represents 6% of the Gross Domestic Product (GDP). In addition to the support it provides for commerce, jobs, and economic development, we cannot forget aviation's integral role in law enforcement, emergency response, and in the national defense and security of the

homeland. These benefits of the aviation industry require that America's air transportation system remains the best in the world.

But being the best has a price. To maintain leadership requires constant introduction of new technologies and procedures, innovative policies, and advanced management practices into the aviation system. In order to do that, we need to make sustained investments in advanced research and technology development. A robust RE&D program allows for cost-effective implementation of viable new technologies and capabilities through concept development, testing, early risk identification and mitigation.

There's an incomplete understanding of what the Next Generation Air Transportation System (NextGen) is and what it can do. The concept is simple: NextGen is a set of technologies, processes, procedures and policy that together will revolutionize how people fly. It is a radical departure from the ground-based radar of years gone by, a shift toward satellite control and navigation. It is a game changer for the controller, the pilot, and the passenger. With the technology and procedures of NextGen, we can help turn that around. But we are well aware that is not the whole story. If we want to get maximum return on the investment, if we want to support unconstrained market growth in aviation, we must take an aggressive approach to upgrading our infrastructure to maximize the benefits of NextGen. At some point, keeping the legacy systems going becomes more costly than replacing them with new technologies.

To that end, we have developed a research portfolio that will address today's needs while laying the foundation to address the needs of the future for NextGen. The FAA's research and development is geared to practical applicability. While we are developing

NextGen with an eye towards the long-term transformation of the air traffic control system, we are evolving the system in the near-to mid-term as well, as my testimony will highlight later. FAA efforts focus on the period between now and 2018.

FAA's research portfolio is divided into related fields. Our core and NextGen RE&D funding includes research that supports aviation safety and regulatory processes. Other research and development activities are aimed at introducing innovative new technologies into the air transportation system that will deliver future operational improvements envisioned for NextGen.

Our Advanced Technology Development and Prototyping (ATD&P) work is funded in the Facilities and Equipment (F&E) appropriation. It further develops products resulting from FAA RE&D investments as well as research transitioned from the National Aeronautics and Space Administration (NASA) and other sources of basic and fundamental research. ATD&P activities include development of detailed mid-term operational concepts, concept validation studies, human factors analyses and requirements for individual systems based on those concepts, and validation prototypes and demonstrations.

NextGen System Development is funded in the F&E appropriation and supports the transition from RE&D to advanced technology development through activities such as concept modeling, system level requirements development, assessments of human performance and integration with technologies, and development of environmental management methodologies.

Research and development performed by MITRE's Center for Advanced Aviation System Development (CAASD) directly supports needs of FAA research and development programs that can uniquely be provided by this Federally Funded Research and Development Center (FFRDC).

Finally, research and development is also funded by the Airport Improvement Program (AIP). There are two components: first the Airport Technology Research Program addresses the research and development needs of the Office of Airports in the areas of airport pavement, rescue and firefighting, wildlife hazard mitigation, runway surface technology, and visual guidance. The results of this research are used to update guidance material, manuals, and technical specifications that airports rely on when expending AIP funds. Second, the Airport Cooperative Research Program (ACRP) is funded by the Airport Improvement Program (AIP). ACRP is an industry-driven, applied research program that develops near-term, practical solutions to problems faced by airport operators. The FAA sponsors ACRP, and the Transportation Research Board (TRB) of the National Academies manages the program. Contractors who are selected on the basis of competitive proposals conduct the research.

FAA takes seriously the need to continue to improve environmental performance in order to sustain aviation growth. The FAA and aviation industry agree that environmental impacts will constrain NextGen if they are not effectively managed and mitigated. Technological advances in engine, airframe, and fuels technologies offer the greatest improvements and will keep the U.S. globally competitive. We have partnered with industry in our Continuous Lower Energy, Emissions and Noise (CLEEN) technology

program to develop new technologies to reduce aircraft noise, emissions, and fuel burn, and to advance sustainable alternative aviation fuels.

Engine and airframe technologies will offer the greatest long term benefit but these new technologies must be coupled with efficient procedures, particularly in the near term. Thus, we are implementing new Optimized Profile Descents (OPDs) at nine locations including Los Angeles, Atlanta, Phoenix, San Diego, Honolulu and Anchorage. In addition, eight OPD projects are presently under development in the NAS including Seattle, St. Louis, Louisville, Charlotte and Memphis**.** Traditional approaches require a plane to follow a stair-step pattern of arrival – descending and leveling off several times before landing. Each time a pilot has to stop descending and resume level flight, they have to throttle up the engines. These OPDs allow planes to continually descend to the airport from high altitudes without having to level off, or step down, at interim altitudes. This process of continuous descent results in significant fuel savings and a reduction in radio communications – especially, in complex, busy airspace around major airports.

Sustainable alternative fuels development and deployment offer prospects for environmental improvements, energy security, and economic stability for aviation. We're working cooperatively with the industry through the Commercial Aviation Alternative Fuels Initiative (CAAFI) to develop "drop-in" fuels. We achieved approval of a synthetic fuel in 2009 (ASTM D7566), the first new fuel standard in decades. We are on track to achieve a fuel standard that will allow a 50% blend of a synthetic fuel with jet fuel this year.

We do want to point out that we are not alone in these efforts. We are committed to working smarter and more leanly, and to that end, we are partnering with others to leverage their knowledge and resources to augment ours. We engage with industry via advisory boards and with a multitude of international organizations. The Joint Planning and Development Office (JPDO) facilitates partnerships across the government agencies including FAA, NASA and the Departments of Defense, Commerce and Homeland Security. The JPDO supports the future vision for NextGen by developing the long-term research plan for improvements that extend beyond the 2018 planning window that is FAA's focus.

Through our coordination with our internal and external partners, we have been able to identify research gaps, reduce duplication of efforts, and leverage available resources. One of our most important research partners is, of course, NASA. That agency's contributions to our research and development are of such vital importance that, as of January 2011, we have assigned an FAA liaison to NASA's Aeronautics Research Mission Directorate (ARMD) to identify research and development collaboration opportunities and ensure stronger and timely coordination between FAA and NASA.

One of the many ways we partner with NASA under the auspices of the JPDO is on a series of Research Transition Teams (RTT). Four pilot RTTs were initiated in 2007 to ensure that research and development needed for NextGen implementation is identified, conducted, and effectively transitioned to the implementing agency. These include:

- Integrated Arrival/Departure/Surface
- Efficient Flow into Congested Airspace

- Dynamic Airspace Configuration
- Flow-Based Trajectory Management

Both NASA and FAA collaborated through these RTTs to conduct joint research, simulation, and field trials of NextGen technologies. Through this interaction selected algorithms have been transferred from NASA to the FAA, along with research results to inform the implementation process of the given technologies.

We are also partnering with NASA on our NextGen Human Factors Research Coordination Plan. Our work began in September 2010 and we anticipate that the final product will be published this month by the JPDO. This product will describe key coordination activities recommended by Government Accountability Office (GAO) and the Department of Transportation's Office of the Inspector General, namely: identification of initial focus areas for research, establishment of methods for leveraging past and current human factors research, and creation of an inventory of existing facilities for human factors research. The coordination process leverages GAO-recommended best practices to help enhance and sustain collaboration among Federal agencies. This is an aggressive renewed effort to formalize existing human factors research coordination process between FAA and NASA, and begins an annual coordination process between our two agencies to review planned research efforts, identify gaps, monitor and evaluate progress, and report results.

NASA also is a vital collaborator with the FAA in its Partnership for Air Transportation Noise and Emission Reduction (PARTNER) Center of Excellence supporting

development of aviation technologies and operational procedures to reduce fuel burn and environmental impacts due to noise and emissions.

On the Department of Defense side, we have an Air Force Research Lab (AFRL) Liaison to FAA for NextGen. In 2010, the Air Force assigned a NextGen research liaison to FAA to work closely with researchers to identify opportunities to leverage relevant research, laboratory capabilities and expertise available within AFRL. Our joint goal is to advance the air traffic management research and technology required for FAA to implement our National Airspace System (NAS) mid-term capabilities as defined in the Enterprise Architecture and the NextGen Implementation Plan (NGIP). The ARFL Liaison partnership, in particular, has helped advance Human Factors, Unmanned Aircraft Systems (UAS) and sustainable alternative fuels work.

Finally, we work closely with the JPDO to continue to define our future needs and priorities. The JPDO works to mitigate research and development risk for 2025 by analyzing various issues, such as:

- UAS and other advanced technologies that will require careful transition and ultimately lead to NAS integration
- Trajectory Based Operations
- Potential environment constraints.

The JPDO works with FAA to coordinate development of information data sharing standards, models, and integration of advanced aviation weather forecasts into air traffic control tools. I am pleased to report that our efforts have been paying off. In Fiscal Year

2010, we have completed several research and development efforts in the safety arena. In partnership with the National Oceanic and Atmospheric Administration's National Weather Service, FAA has developed the Weather Research and Forecasting (WRF) Model, an operational next-generation numerical weather prediction system designed to serve both operational aviation forecasting and atmospheric research needs. FAA-funded researchers also developed the Graphical Turbulence Guidance (GTG) product which provides contours of weather turbulence potential out to 12 hours. The current product, GTG2, operationally implemented on Aviation Digital Data Service in FY 2010, provides forecasts for clear air turbulence from 10,000 - 45,000 feet. The Congressional Joint Economic Committee estimates that air traffic delays cost the U.S. Economy over $41 billion in 2007, of which 70% are related to adverse weather - and as the demand for air traffic grows, air traffic delays and the associated economic toll will only increase. We have determined that 2/3rds of these weather related delays are avoidable with more accurate and better integrated weather information for decision-making, potentially reducing the number of delays by 46% and saving $19 billion annually. The FAA, NOAA and other partners are working to realize these savings and accommodate the expected demand growth.

In partnership with the Air Transport Association's Human Factors Committee and Alaska Airlines, we completed beta testing of new training material and procedures to improve safety in Airline Maintenance and Ramp Operations. FAA developed *Front Line Manager Best Practices Quick Reference Guide* (FLM QRG) to assist air traffic front line managers in preventing errors through performance management. FLM QRG

provides helpful information on topics such as communications, improving performance, training, and leadership.

In the NextGen arena, we have completed a Wake Turbulence Separation Safety Risk assessment to reclassify all B757s in the same weight class and harmonize the weight boundary between the US Heavy and Large from 255,000 to 300,000 lbs, thus harmonizing with ICAO. This successful change was implemented April 8, 2010. The completion of the Wake Turbulence Safety Risk assessment for the B787 Dreamliner has been submitted to the FAA Safety Management System for adoption. and we have ongoing work with the B747-8 and A380 in response to satisfying the NTSB recommendation A-94-056. These efforts address the need to mitigate the risk for wake turbulence through the development of safe wake separation standards prior to entry into service of new aircraft and to continue this evaluation early in the service life.

We have completed Human-in-the-Loop Simulations and flight trials for the 4-Dimensional (4D) Flight Management System (FMS) Trajectory-Based Operations (TBO) and partnered with Alaska Airlines to conduct 4D FMS TBO Initial Flight Trials at Seattle. In response to the RTCA Task Force 5 recommendations, FAA has partnered with Federal Express and Delta Airlines to field test the Collaborative Departure Queue Management surface management system at Memphis and Orlando. We completed initial investigations, including Human-in-the Loop simulations, into application of Data Communications in the terminal domain, and conducted Staffed NextGen Tower proof-of-concept field demonstrations at Dallas Fort Worth Airport in August 2010. Finally, in partnership with Customs and Border Protection (CBP), we conducted flight trials with

CBP's Predator UAS system at Cape Canaveral to investigate potential solutions to help with integration into the NAS. This is the first in a series of progressive demonstrations that are planned for next year, with an expanding list of partners. Each of these accomplishments takes us step-by-step closer to realizing the full benefits of NextGen.

In the airport environment, I am pleased to report that we have developed a new FAA Wildlife Website/Database with a cell phone application for reporting wildlife strikes. Additionally, we have installed a pilot Runway Status Light (RWSL) system at Boston-Logan Airport aimed at investigating RWSL applicability for intersecting runways. We conducted Human-in-the-Loop simulations using Converging Runway Display Aid (CRDA) at Newark Airport. Finally, we have recently completed installation of prototype Low Cost Ground Surveillance systems at Spokane, WA; Manchester, NH; and San Jose, CA. These cost effective systems offer the potential to provide an added layer of safety by giving air traffic controllers basic ground surveillance for aircraft and vehicles operating on runways and adjacent taxiways, where current radar-based ground surveillance is not available.

As our recent accomplishments illustrate, our approach to research and development with an eye toward maintaining our leadership in aviation while leveraging our partnerships to maximum effect is bearing fruit. As the aviation industry continues to evolve and change, it is vitally important that our country leads the world in this sector. I look forward to working with this Congress to ensure that we do.

This concludes my prepared remarks. Thank you again for the opportunity to appear before you. I would be happy to answer any questions that you might have.