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The Future of Air Transportation: Opportunities and Challenges

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Good morning, and thank you for the opportunity to speak about some of the challenges that we face in aviation today.

This morning you have already heard the Congressional address and views from the Hill. You've also heard an update from the FAA. As Vicki Cox just discussed with you, new infrastructure and key technology demonstrations are planned for the mid-term. Progress is well underway with stakeholders engaging.

I want to share with you a different perspective on our NextGen investment—the future. To meet our Nation's needs for air transportation, we must continually test our implementation path against a clear long-term vision. We must carefully coordinate the sometimes competing requirements for national and homeland defense and civil aviation. Our world is incredibly dynamic, with ever-changing needs for safety, efficiency, and security. Along the way, we must be flexible in our plans to reach the vision for 2025 and beyond.

At top level, a full transformation of the Nation's aviation system is desired. We want to achieve the next level of safety, moving closer to a world without aviation or commercial space accidents. We want to move aircraft efficiently around the world with the right equipment, procedures, and facilities, and with little environmental impact. And we want to move seamlessly through the airport.

It is imperative to move toward the broad vision in steps, rolling out new capabilities when and where they are most needed. Given our difficult economic times, it is now more critical than ever to set strategic priorities for modernizing air traffic control.

I think everyone here knows why we must modernize. Simply put: aviation is vital to the American economy. Aviation contributes about 5.6 percent of the GDP. A third of all U.S. exports are shipped by air, and the number of international travelers is projected to triple by the year 2025. Aviation also provides us with national security and homeland defense.

The United States must maintain our historical leadership in aviation. We can not fail in our attempts to modernize. We must consider airports, operations, and aircraft together as we design and harmonize domestic and global capabilities.

Coordination on policy, system standards, and operational procedures across international borders will promote seamless global travel as the system evolves. And we know it is evolving with significant aviation growth in Brazil, Russia, India, and China.

I'm a researcher and technologist at heart. But, I'll tell you: technology alone won't get us to our destination. It's going to take a carefully coordinated investment in both technology and policy research.

Let me give you an illustration.

I recently read a book titled, *Microcomputers: A Technology Forecast and Assessment to the Year 2000*. I received the book in the mail and it turned out to be fascinating. It was based on research conducted in 1976, long before the iPad or Google. I was surprised to see the authors' predictions for telecommuting,

medical records, electronic voting, energy-efficient buildings—all technologies that are commonplace today. One chapter caught my attention: "Impacts of Microcomputers on the National Airspace System." One decision tree examined in the chapter outlined anticipated changes to air traffic control procedures. Computers would enable low-cost flight controls as well as more ground-based computing capacity. The ability of pilots to handle more information, together with greater air traffic control automation, would help optimize safety and efficiency. Computers would also lead to decisions on pilot responsibilities and the role of the aircraft. The authors speculated that the driving force behind change would be pilot frustration over the inability to make use of potentially powerful new avionics. Does this sound familiar?

A lot has changed since 1976. Years of fierce competition and advances in technology have brought us the advanced computing capability that enhances our daily lives. It's going to take continued and conscious cooperation across government—and, in lock step with industry—to fully use that capability onboard aircraft and in ground-based systems. It's hard, but we must get the job done.

In the early days, NextGen planning focused mostly on finding a way to increase system capacity. Essentially, we were tackling a network demand problem in which demand was outstripping the system's ability to keep up. Without a fix, the system would bog down to an unacceptable service level and we'd eventually sink the economy. It all began with industry and government coming together to build a bold vision of air transportation for 2025. The planners knew that we'd later have to define an evolutionary path leading toward that ultimate unconstrained vision.

Today, industry and government continue to work together on the planning, testing, and deployment of NextGen. Vicki Cox earlier described joint successes with wide area multi-lateration (or WAM), ADS-B, and metroplexes. Looking to the long-term, we will build from these successes. We'll work to maximize the 2025 benefits of our satellite-based surveillance system by maturing applications. And, we'll need to keep our eye on innovative technologies for the much longer term.

I talked earlier about the ever-changing demands on our air traffic system. I'd like to give you a few examples that show how we must be adaptable in our planning, and attentive to technology, procedures, and policies.

My first example is about Unmanned Aircraft Systems or UAS.

The founding charter for the Joint Planning and Development Office (JPDO) called for a system that would accommodate a wide range of aircraft operations. Past analyses considered how the system would work for very light jets and air taxis. These types of operations were growing, and we needed to know how they would impact the efficient operations. Now, the presence of UAS in the airspace system is a reality. They want in! This is particularly true for defense and border protection. Other applications already include fire fighting, pipeline inspection, and law enforcement—all dirty or dangerous missions. Couple these with commercial missions for small and large UAS that we've not begun to envision.

We are planning that UAS, whether remotely piloted or autonomous, will operate in NextGen just as manned aircraft operate in the National Airspace System today. Rules governing operations for UAS will reflect the capabilities of the vehicle and the class of airspace used. In fact, if you looked at our NextGen architecture, you wouldn't find improvements aimed specifically at UAS because they simply fly like aircraft.

In order to accomplish this degree of integrated operations, several key issues will have to be successfully addressed. Let's assume that for regulatory purposes it may be possible to treat UAS as another class of vehicle. But safe and efficient introduction of UAS will still require defining certification requirements and standards. This includes end-to-end performance measures and thresholds, human factors and design standards, and data-link performance requirements to name a few. We must also address safety operations in the event of a lost GPS signal, and system-safety unique to new applications of aircraft autonomy.

To advance UAS integration into NextGen, the JPDO is developing a strategic plan that will guide research, development, and demonstrations. The Departments of Defense and Homeland Security, NASA, and FAA, both regulators and researchers, are all contributing to our effort. Our first step was to bring together the technical experts to take a composite snapshot of all of the UAS research activities ongoing within these agencies. Each agency is addressing different needs whether its interdiction, civil applications, or operating invisibly. We'll take a look at all the needs and assess whether we need to rethink the NextGen airspace.

With a cross-agency research portfolio and communication, we'll stretch our collective research dollars. I want to stress that it's critically important that the research and development priorities we identify address both the user requirements and the regulatory requirements for UAS operations. Before I leave the UAS topic, I should mention that our plans later call for broader stakeholder engagement.

My second example considers data. It's 2011. Computers are here. And our society is data rich. Aviation, too, can gain increased predictability and less variability. Indeed, an early tenet of NextGen was getting the right information to the right people at the right time.

Operating in NextGen will require complex, fast-paced decision making based on timely, accurate, and comprehensive information. At the JPDO, we are proving net-centric operations by seeking solutions for "integrated surveillance" whose need is underscored by events like 9/11. In very basic terms, integrated surveillance means developing a common operating picture, based on data and sensors, to see both cooperative and non-cooperative aircraft in the National Airspace System. Civil aviation, defense, and homeland security officials must coordinate among multiple participants in a

wide variety of locations to make and execute almost every significant decision. It requires an unprecedented sharing of information among government agencies. This includes data on weather, flights, surveillance, security, airport conditions, and aircraft operators.

Moving from our legacy “need-to-know” to a “need-to-share” information exchange model will require a major culture shift among stakeholders. It means moving from a single-owner model to an enterprise-centric model in which information services, freely and securely, cross organizational boundaries.

Right now there are questions on who will be responsible for developing, funding, implementing, and maintaining this information-sharing infrastructure. Also, there is not a structure for enabling and managing secure information exchange among stakeholders, including data-exchange agreements and standards. So, there is work to do.

Information sharing goes beyond government and integrated surveillance. Instant access to a wealth of real-time data for dispatchers, pilots, and controllers will mean a minimum of delays and interruptions for passengers. With a little innovation, future

travelers will be able to travel easily on demand and rapidly adapt to changing schedules and weather situations. I think the travelers will expect this service.

As a final example, we need to be ready to revisit our plans as research and business cases prove fruitful new concepts. Being ready means investing now.

Our hypothesis is that establishing a trajectory-based operations environment—where aircraft separation will be determined based on the “known” position of the aircraft at a later point in time—is a key to system efficiencies. The expanded use of automation is still a big leap from where aviation is today. Analysis shows that while automation may lead to efficiencies, it also comes with cost and risk if not properly phased.

The trajectory-based operations concept, in the entirety of the vision, has large uncertainties and system complexities that carry unaddressed policy issues. However, the concept, like the NextGen initiative, will be implemented in a series of purposeful steps. We need to consider the roles of pilots and controllers. Safety is the critical driver in choosing the path.

The JPDO is outlining the system performance goals and metrics for trajectory-based operations. This will support agency research planning to find the best mix of automation in our human-centered system. The plan will satisfy 2025 system performance requirements while building a foundation for a stronger capability in the future. Even in tight fiscal times, we can not give up on our future.

I want to leave you with a few thoughts. Aviation fuels our economy. We must design our aircraft, operations, and airports to meet the future demand and national requirements for civil aviation, defense, and homeland security. As we build our new system, priorities will continually change and we must be prepared adapt to those evolving needs. Even when we initially envisioned NextGen 2025 less than a decade ago, no one fully understood the emergence of UAS today or the benefits of an information-rich environment and the policies of data sharing. Now there is more evidence, and we'll address these challenges. We must keep our bold vision for air transportation in plain view as we learn, adjust, and prioritize the necessary steps toward it.

Thank you.