KEYNOTE SPEECH

By

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Let me begin by thanking everyone for participating in this conference. These events are very important to NASA not only because they allow us to share our plans and accomplishments, but also, just as importantly, because they allow us to receive feedback on what we're doing.

I am sure that many of you have heard me talk about the three core principles that guide everything we do in ARMD. I know that my deputy, Dr. Shin, reviewed these principles with you yesterday. As you know, the first principle speaks of our dedication to the mastery and intellectual stewardship of the core competencies of aeronautics for the Nation in all flight regimes. And of course, implicit in our dedication to mastery is an unwavering commitment to the pursuit of technical excellence and technical truth. And this in turn implies a commitment to peer-review. And peer-review is something that is very easy to commit to until one's own research is under scrutiny -- but I think everyone in this room understands we must all hold ourselves and each other to this standard.

So, I invite everyone here to raise their hands during the technical sessions and ask questions, provide constructive feedback, recommend alternative approaches, etc. We will all get smarter from these kinds of exchanges, and that is really the point.

Now, what I really would like to talk to you about is NextGen. As I am sure most of you know, our third core principle states that NASA will directly address the fundamental research needs of NextGen in partnership with the other member

agencies of the JPDO. And while the fundamental research that we need to conduct obviously includes Air Traffic Management research, it is by no means limited to that. We must also conduct research that will enable the air vehicles that fly within the system to overcome environmental and fuel constraints. We must consider the potential of new air vehicles that may offer opportunities to fly faster, or to fly with significantly reduced field lengths, or to fly with dramatically lower noise signatures.

And of course, we must conduct the fundamental research that will enable all of these vehicles to operate safely within the system. And that is a daunting challenge. Today's system has its problems, to be sure, but it is safe. We all know that. We all trust that. And to move to a brand new system, no matter how appealing its attributes, requires that whatever we do will not compromise the standards of safety that we have come to expect and rely upon.

Yesterday, you heard Nick Sabatini talk about a safer, aircraft-centric future system. You heard Bob Pearce describe the NextGen vision. And you heard Dr. Shin quote what I consider to be the most important paragraph of the National Aeronautics R&D Policy:

"As the science and application of aeronautics progressed, an interdependence developed among the aircraft, the air transportation system, and the people who use these systems, resulting in a multi-dimensional, highly integrated aeronautics

enterprise….Treating the entire system as a whole is complex but necessary, and requires close coordination among multiple government departments and agencies as well as industry, academia, and other non-Federal stakeholders to ensure that the needs of all enterprise users are addressed."

And I am guessing, as you listened to those talks yesterday, that you wondered to yourselves, "Do these people in Washington have any idea how hard this is going to be?"

Let me assure you, the answer to that question is YES.

But I am hoping, as engineers, that you were also inspired by what you heard. NextGen is an incredible challenge. We are talking about designing a whole new system. Think about that for a moment. Today's system was not designed with forethought – it evolved, largely as a series of responses to accidents. Now we are going to design a system based on the attributes that we want it to have – a system that is so different from today's system that it truly represents a paradigm shift. As engineers, these are the challenges that we have trained for – these are the challenges that we live for.

I would be remiss not to observe, given the 50th anniversary of NASA, that as a country, we know how to pull together to face these kinds of challenges, to take on what at first appears impossible. These kinds of challenges are what bring out the

best in us, and raise us to a level of capability that has benefits beyond what we can even imagine today.

So, what will be required of us to achieve success?

First, we must recognize the importance of long-term, fundamental research in this endeavor. It is worth noting that NASA defines fundamental aeronautical research as research that ranges from advancing our understanding of the foundational principles that underpin the aeronautical disciplines to research that advances our understanding of the interactions that occur at the system level. In other words, for those of you who are familiar with our research pyramid, fundamental research advances our knowledge at all levels of that pyramid.

As Nick Sabatini explained yesterday, NASA's role is to conduct the innovative research that will allow us to achieve the long-term vision of NextGen. NASA's research portfolio has been structured to ensure that the research we conduct today will enable the NextGen capabilities that we all envision in 2025 and beyond.

It is probably worth noting that, in the development of a major system like NextGen, there are tremendous pressures to show quick results in order to "sustain political advocacy". This pressure often drives the research to focus on the near term at the expense of the long term. This pressure must be resisted, because there are critical trades and research areas that must be investigated that require sufficient time to explore and resolve. NASA will be addressing many of these

issues, in partnership with the other JPDO agencies and the broader aeronautics community. Examples include:

- Identification of actions best-suited to be moved from the ground-based air navigation service provider to the aircraft, particularly for separation assurance
- The roles and responsibilities of humans and automation in different operational concepts
- Uncertainty impacts on traffic flow management (weather being a prime example)
- The development of prognostic analysis capabilities to identify potential inadvertent safety impacts of NextGen concepts, approaches, and technologies
- Improving aircraft efficiency and performance within the constraints of environmental compliance, and
- Understanding how to deploy advanced vehicles into NextGen safely by exploring the trades among procedures, vehicle characteristics, and overall NextGen performance. Such vehicles include things like VLJs, blended wing bodies, supersonic jets, and advanced rotorcraft.

The second key to success will be the establishment of real intellectual partnerships among industry, academia, and Government researchers. As I think most of you are aware, NASA is working hard to foster such partnerships with industry and academia by means of cooperative Space Act Agreements and fully

and openly competed awards, which we call NASA Research Announcements, or NRAs, that emphasize true collaborations among all partners. These partnerships will be critical to raise the knowledge level of the entire community, which will be essential if we are going to be successful in carrying out the NextGen vision. No one company or university or Government agency can do this alone. It is therefore our intent to provide for the widest practical and appropriate dissemination of our research results, in accordance with the NASA Space Act and the National Aeronautics R&D Policy.

Finally, and perhaps most importantly, success will require an unwavering commitment to technical truth. Every one of you in this room, regardless of where you work, must never forget that as engineers and scientists, you can never ever compromise your loyalty to technical truth. That loyalty must trump everything else. As individuals whose research is intended to ensure that the system of the future is safe, you must have the courage to raise your hands when you discover that a concept or technology will not work. And it is inevitable that despite our best efforts today, based upon subject matter expertise and years of analysis, that we are wrong about some things that we are assuming about this system we are going to build. We have never designed and built an air transportation system like this. So we cannot fool ourselves into thinking that we know everything we need to know to build it. We are going to learn things that we cannot even anticipate, and we

must all – every one of us – be unafraid to speak up when the things we learn result in the need to change course, redefine expectations, abandon a concept or technology, slip schedules, etc. Indeed, we must not treat such events as “failures” – the discovery of truth is never a failure.

The political pressure to “advocate” for programs is enormous – and because NextGen is a multi-decade endeavor, these pressures are even greater. There are constant worries about sustaining momentum, ensuring political support in both the executive and legislative branches, etc. However, none of these pressures, no matter how intense, can justify a compromise of truth.

My first – indeed my only – shuttle launch experience was Challenger. I was there when it blew up. I was a freshman at MIT at the time, and to this day, I cannot forget the chill that I felt when I realized what had happened. What I took away from that experience was the sobering realization that engineers have an awesome responsibility – to advance what humans can accomplish without ever losing sight of the fact that those humans rely upon us to build safe systems. Please do not forget this when the pressures to “advocate” weigh upon you.

Let me conclude with a quote from President John F. Kennedy that I really like, and that I think is very appropriate:

The American, by nature, is optimistic. He is experimental, an inventor and a builder who builds best when called upon to build greatly.

Thank you, once again, for participating in this conference, and for sharing your lunch with me today. I would be happy to take questions.

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