Thank you for inviting me to speak today. I think it's wonderful that the field is coming together to hold this forum in anticipation of a larger conference in the years ahead.

I know there's a Centennial of Naval Aviation forum going on along with this gathering, and that's certainly a very significant milestone. It's been my honor to have some small role in that storied history as a Naval Aviator myself. The things we're talking about here are going to make that second century now unfolding even more amazing than the first and I want to give a shoutout to my Navy, Coast Guard, and Marine Corps colleagues for their ongoing bravery and service.

NASA's space missions may sometimes be more high profile, but our aeronautics work is possibly the place where our work is most seen and felt by the general public on a daily basis.
Even if you didn't fly on an airplane today as I did, something you need in your life probably did – from overnight packages to favorite foods and more.

In this time of continuing economic challenges, the aeronautics industry provides the kinds of jobs that Americans are proud to have -- a report from 2009 identified nearly one million air transportation and domestic manufacturing jobs. In 2010, aerospace manufacturing provided a U.S. trade surplus of $43.6 billion.

So while aviation and the air traffic system is a routine part of our daily lives, the bedrock nature of its contribution to our lives does not mean it is not also a field full of innovation that is creating change and future-looking technologies.
A mature industry does not mean a stagnant one. In fact, perhaps because we have such an enviably fast, safe, and efficient system that has been performing so well for so many years, that stable base is precisely why the aeronautics field is able to generate so many innovations and will continue to do so in the future.

Like all things we do, NASA's future-centric approach is all about creating new capabilities for future generations, pushing the envelope of technology and making life better here on Earth.

Historically, we've done pretty well in aeronautics. There's NASA-derived technology in some part of virtually every aircraft flying today. Our leaps in space and in the sky have complemented each other, and we look forward to more synergy in the future.
It's very important that we help bring about the next generation of aircraft and air traffic control systems. As I mentioned, and you all know, aviation is a huge sector of the economy, not only in terms of jobs, but also in transportation of goods and people.

So your work here and in the future will have a huge impact. I'm often explaining to people the benefits of space exploration down here on Earth. In aeronautics, it's plain in everyday terms to every single person who has ever walked through an airport and struggled with our system that we must make it better.

That's why at NASA we're so excited about the opportunities we have in the coming years to help develop solutions to some of our most pressing problems and create the next generation of air travel systems – something that I think will last for generations and make us all safer while making the planet a better place. That's a huge charge. But when I see the energy and enthusiasm of the innovators in this field, I'm confident we'll get there.
In part that innovation will be driven by pressing needs, such as the need for less fuel consumption and mitigation of other environmental factors such as noise. As the system becomes more complex and increasingly automated, we need to continuously improve its safety.

Developing new ways to reduce delays or diversions caused by atmospheric hazards without compromising safety can save money and time while ensuring our high standards of safety remain a key priority.

You'll find NASA DNA in nearly every civilian and military aircraft flying today addressing many of these challenges. Just a few examples: Winglets – vertical extensions on wingtips of civilian and military aircraft that decrease drag and help conserve fuel.
Then there are composite structures, digital fly-by-wire and intelligent flight control systems, and glass cockpits. For military aircraft, NASA DNA can be found in variable sweep wings, thrust vectoring, short takeoff and landing (STOL), and vertical short takeoff and landing technologies (VSTOL).

NASA DNA is also on board new aircraft entering service very soon. Our work in advanced composites, engine chevrons to reduce noise, laminar flow improvements, and new simulation tools have contributed to fuel, emissions, and noise reductions projected by Boeing for its 787 and 747-8 aircraft.

Our work in engine combustion, engine acoustic measuring tools, engine design, and new turbine blade materials and thermal coatings are contributing to fuel, emissions, and noise reductions projected by Pratt & Whitney for its Purepower 1000G Geared Turbofan engine, and by CFM for its LEAP-X turbine engine.
Now we're working on having as big an impact on the challenges facing our entire air transportation system -- improving capacity and mobility in our airspace; again, reducing fuel consumption, noise, and emissions in really significant ways while maintaining and improving safety. I know I have a roomful of experts here, but you may not be aware of all of these great things we've already achieved and what's next from NASA aeronautics.

At San Francisco International Airport, fog conditions cause big delays, especially in the summer. NASA just developed a decision support tool that helps air traffic managers achieve more efficient and accurate release of ground holds. Expectations are that this tool will result in significant near-term reductions in ground delays and a savings of $10 million per year.
We're starting an air traffic management technology demonstration campaign that will integrate NASA tools with the FAA and aircraft using automatic dependent surveillance-broadcast (ADS-B) technology to improve aircraft arrivals at congested airports. As with the ground hold decision support tool, fuel savings are expected to be a big benefit of this work.

We've completed a series of studies with industry and academia into advanced vehicle concepts – subsonic through supersonic. These studies help us identify revolutionary technologies and sometimes revolutionary new aircraft shapes. They show us how we might achieve our ultimate goal of *simultaneously* reducing fuel use, noise, and emissions.
Finally, we're tackling problems at the system-level – the "big picture." An example of this approach is the work we're doing to reduce the technical barriers that prevent Unmanned Aircraft Systems (UAS) from getting routine access to the National Airspace System – barriers like separation assurance, communications, and certification.

The benefits of all of this work extend beyond environmental and energy impacts. We'll improve efficiency for today’s fleet of aircraft, while providing tools that can scale up as traffic grows and more types of vehicles enter the system. We'll help make it possible for airlines to get maximum benefit out of new aircraft technologies. We'll provide tools and information needed by the FAA to certify new equipment and improve overall safety.

All of this we believe supports US competitiveness, the economy, and jobs. This is a national priority.
In fact in the President’s American Jobs Act he proposes that one billion dollars be made available to the Federal Aviation Administration to carry out Next Generation advancements that will make air travel safer, faster, more efficient and easier. The American Jobs Act will not only spur this kind of innovation, it will accelerate hiring and promote growth throughout all sectors of the American economy.

The United States Air Force has been a key partner in many of NASA's aeronautics achievements over the decades. Right now the Air Force Research Laboratory is part of our X-48 research team. The X-48 is a blended wing body configuration – no tail and a wing that blends into the fuselage. It has the potential to achieve that ultimate goal I mentioned earlier -- dramatically reduce noise, emissions, and fuel use simultaneously.
There's a 21-foot wingspan remotely piloted X-48 test vehicle out at NASA's Dryden Flight Research Center in California that's completed a first round of test flights. It's been modified based on what we learned in those tests. Round two of testing has just begun.

At the hypersonic level, we're building a new legacy with the Air Force through development of the air-breathing scramjet propulsion technology. In 2004, flights of the X-43A uncooled scramjet – each about ten seconds – broke speed records. One flight clocked in at Mach 9.6 or about 7,000 mph. For scramjets, though, it's as much about actual operation time as speed. In 2010, the X-51A fuel-cooled scramjet achieved an operation time of nearly 150 seconds. Right now, work continues on developing a practical hypersonic vehicle, with more sophisticated technology flight experiments planned in the next few years.
NASA also has been working with the United States Navy on jet noise reduction, benefiting our long-term supersonic aeronautics research goals as well as helping with the nearer-term concerns the Navy has with the effects of jet noise on aircraft carrier personnel. We have collaborated on testing of real world concepts to reduce noise on the F-404 engine, and are currently collaborating on fundamental research at universities on diagnostic tools, measurement techniques, and active control of jet noise.

We also are exploring opportunities for collaboration with the Navy in research related to autonomous and unmanned system technologies. At this forum and in all of the various channels for dialogue we have established and participate in, NASA is seeking to understand the aeronautics community’s perspectives on the overarching issues facing the field -- down to the level of some of the specifics I've just been mentioning.
o Where do you see the risks, both from a transportation system perspective and from a competitiveness perspective?

o Where do you see the opportunities to create new value for our nation?

o What do you see as being critical to reach higher technology readiness levels?

Those are some of the things, from my perspective, on which I hope this forum and the upcoming conferences will generate dialogue, and where there will be real fruitful collaboration that can help us move the ball down the field. Partnership is critical to this process.

Our goal is to bring technologies out of the labs and into innovative products – and that means partnerships between NASA, industry, academia, and other government agencies. We can’t do it alone.
We also need to ensure the next generation of engineers and scientists are at the forefront of aeronautics. When we talk about the good-paying jobs of the future in science, technology, engineering and mathematics, a lot of those are right here in aeronautics. You don't have to be headed for space to make a big difference in a STEM career and get a good job doing that.

So we need to be bold, think big, and bring the challenge of the future to inspire and develop the greatest workforce in the world.

Recently, we began regular visits with the U.S. aerospace industry, and it's clear to us that there are many productive avenues for future innovation within the aeronautics sector. Continued communication at both the technical and management levels is going to help us bring about more vigorous public-private collaboration in pre-competitive areas of common interest.
The National Research Council's Aeronautics Research and Technology Roundtable, which just kicked off its work last month, will help NASA to explore needs and system-level research concepts with the community.

We are also fortunate that the National Science and Technology Council’s (NSTC) National Aeronautics Research and Development Policy and Plan as well as the Next Generation Air Transportation System (NextGen) Plan provide a clear articulation of the goals and objectives we need to achieve as a nation. And we're going to continue forming public-private partnerships within the constraints of the NASA Aeronautics budget.

Even now, some of those big, general goals are being transformed into real activities for NASA, and for you and your colleagues.
Whether that's our recent competition for industry to submit concepts for the aircraft of the future, or scholarships for the next generation of aeronautics leaders, or continued work on some of the technologies I've discussed.

As our colleagues at the NRC grapple with the big questions facing this field, I hope today and at future gatherings you, too, will help us get a clearer picture and dynamic ideas about the overall state of the U.S. aeronautics and aviation industry.

I hope you'll consider transportation requirements, global challenges and the major needs and risks for aeronautics when looking out over the next 10 to 20 years. This field is truly essential to our modern way of life, and the dialogue and connections and energy you are generating are critical to our future.
Again, thank you for the opportunity to speak today. These are exciting times for aeronautics. At NASA, the "first" "A" in our name is alive and well and making great strides toward a bright future, in partnership with all of you.