REMARKS FOR DEPUTY ADMINISTRATOR LORI GARVER
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Thank you very much to AIAA and Boeing for inviting me to speak at this luncheon. I truly appreciate the opportunity to speak to so many colleagues who share my passion for space.

The topic I was asked to speak on today was Space: The Next 50 Years. Assessing where we will be in 50 years is quite a challenge. As renowned physicist Niels Bohr said, "Prediction is very difficult, especially if it is about the future." Nevertheless, it did get me out of DC and at least in theory is different than a talk about the various strengths of the House and Senate bills!

It is in my view precisely by asking what will happen in the next 50 years that drives what should happen in the next few months, and then the next couple of years, because that will lay the framework for probably decades to come.

It goes without saying that the current actions create our future, for better or for worse. The "why"—basically where we want to be in 50 years drives the investments we make now.

A quick update--since I spoke here last year, a lot has changed. The Shuttle has flown four more times, and is down to its final flights, as the construction of the International Space Station nears completion and we ramp up its full use as a global laboratory. And with the fiscal year 2011 budget request, the President gave us an expansive, visionary blueprint for what we should do next.

The Nation's leadership is working to determine the details about the specific path forward. Many of the strategic priorities proposed in the NASA budget request are included to a significant extent in the various NASA bills currently being considered by Congress: technology development to give us capabilities far beyond what we have today, increased lifespan for the International Space Station, greater commercial role in space exploration, greater support for Earth and other science, aeronautics and education, and providing the best value to the taxpayer.

Through the proposed budget, the President is encouraging us really think hard about where we want to be in a generation, which is the basic foundation of our budget request, not just the next five years. To move beyond our vehicle-driven approach to think in broader terms about the capabilities we need in order to do a wide range of things and serve a wider range of people -- from other government users of space to our international partners, industry, academia and the private citizen.

Let me be clear—we drive capabilities by doing missions…and a lot remains the same about what we want to accomplish in space. The means are the discussion now, not whether or not we should be exploring, but rather a focus on expanding our capabilities. It wasn't that long ago that we were debating whether we would have human space flight at all. Now we are discussing how we are going to do human space flight, but whether or not we will do human space flight at all is no longer a question.

Under all the scenarios currently being discussed, there is increased focus on facilitating commercial access to space and more investment in technology development. We hear a lot about the controversy over the exploration path, but there's a huge swath of the budget about which there is little debate: extending the International Space Station to at least 2020, increasing support for many science missions, especially in Earth science, ramping up funding for the next generation of aeronautics technology, increasing support for education to help us widen the pipeline for future leaders. The ways we invest in science and learning about our home planet, and develop technologies and opportunities for people who will never leave the Earth, or may not even care about space, are also a big part of how our future is going to unfold.

In 1951, Wernher von Braun and Chesley Bonestell predicted our future in space would include a reusable launch vehicle, a space telescope, and a rotating space station.

Tom Paine, former head of NASA during the first moon landings, and head of The Paine Commission, laid out a strategic framework for space exploration in 1985. In the introduction, he describes what it was like in 1935 when Pan American Airways inaugurated trans-Pacific service, when the last Pony Express rider turned over his mail pouch to a young biplane pilot, and when no one expected to fly the Atlantic except folks like Lindbergh. He compares that to the year the report was written, 50 years

later, when more than 25 million people flew over the Atlantic every year, communication satellites were flashing color television signals around the world, and a spacecraft transmitted pictures and data from Uranus across 1.8 billion miles and was flying on to Neptune. He then goes on to say what it was like to look into the future, to the year 2035. He said, "It is as challenging for us today to envision the advanced world of 2035 as it was to foresee today's world back in 1935. Even the most visionary science fiction writer then failed to foresee the scale of the resources that would be needed to initiate the Space Age, and no one imagined that these would become available within 25 years. Looking to the future, we are confident that the next century will see pioneering men and women from many nations working and living throughout the inner Solar System. Space travel will be as safe and inexpensive for our grandchildren as jet travel is for us…Through vigorous leadership on the space frontier, America can make this happen."

Our vision of the future hasn't changed very much from that of Tom Paine's (but I know most of us would agree we have not come as far as we would have liked in the 25 years since he said it.)

The time from barely being able to stay aloft for a few seconds to commercial transport across the oceans was less than 50 years. It was just under 60 years from the Wright Brothers to Yuri Gagarin and Alan Shepard. It is very possible that in the next 50 years, we'll have what Tom Paine envisioned for space travel on an even faster timeline than these great achievements.

But let's look at what we have now. First, we have the ISS, an incredible platform for understanding physics, chemistry and biology in low Earth orbit. The Station will be used for research on human health as we progress further into the solar system. This is the type of platform that von Braun and others predicted, and said we required.

And in science, we've rewritten the textbooks in just the past decade, especially the last five years. The number of confirmed extra-solar planets now number in the hundreds. We've witnessed massive supernovas in other galaxies, we're calculating the gravitational waves from black holes smashing together. Things that were pure science fiction not very long ago. The recommendations of the astrophysics decadal survey just came

in, and I think I can safely say we're just at the start of a renaissance in the space sciences.

On the Earth front, we've never had as much power in space to observe our home planet in as many ways, in as many wavelengths. This is going to be crucial in the future, and we want to be more than just a collector of data, we want to provide the tools to make it useful to decisionmakers.

NASA-developed technologies are already doing great things to improve life here on Earth. For instance, the New York company Early Warning developed a new water analyzer—employing a carbon nanotube biosensor licensed from NASA—that can evaluate a water sample and alert operators to potentially dangerous biological contaminants in about two hours, a drastic improvement over typical laboratory-based water sampling, which can take several days.

We are developing technologies for more efficient use of energy. In 2000, NASA and the University of Arizona developed the Mars Oxygen Generator, a two-pound experiment designed to generate oxygen for life support and fuel production on Mars. The device used solid oxide electrolysis cells to convert carbon dioxide and water into oxygen and fuel. When operated in reverse as a fuel cell, this device has been shown to produce clean, reliable electricity here on Earth. Development and commercialization of this technology as a NASA spin-off by Bloom Energy, which is now largely supported by the private sector, is moving beyond the early demonstration phase, with the goal of generating electricity at prices lower than traditional methods while producing half the amount of greenhouse gases.

We have a robust infrastructure, and a plan to develop a 21st Century launch complex with huge potential to support many more clients. We have cutting edge facilities to learn about thermal protection systems and test how materials survive re-entry, the world's largest wind tunnels, a new friction stir welding facility that can make seamless rocket parts, an amazing fleet of rover prototypes clambering over moon and Mars-like surfaces and teaching us more each year.

Most importantly, we have people…passionate people who have guided us repeatedly through the unforgiving descent to the surface of Mars. Who continue to come up with innovative ideas that eventually make sense, like

LCROSS, a probe to the deepest craters of the moon, using a spent Centaur in a way it had never been used before.

We have so many resources that we need to channel for the future of continued success. And you ask what's next.

First, I think we're going through some philosophical changes – better determining what government can and should do; what we as a people can do; what is possible, desirable, necessary.

There will always be a government role to buy down risk, push the technology envelope and open new markets, but then get out of the way. The government should always be at the leading edge of what's next, but it's going to be up to established and emerging companies to carry the ball forward. As we continue to push forward new technologies making space exploration more efficient and effective, we will increase opportunities for the private sector to use these technologies in unimagined ways, growing the space economy even more.

As always, we have a young generation who is passionate, who wants to make a difference and contribute to the world. Like any generation, though, they want a future as exciting, more exciting, than the past.

I think this young generation will be excited and inspired by the incredible technology that we will develop together to fly into space in new ways, and technology that also will have great and sometimes unexpected applications here on Earth. Some day people will be inspired by pictures in high def from a robot lander somewhere we've never before been. We will have human missions to an asteroid. And test flights of the new technologies we are going to develop. I don't think the public has lost interest in space. But I do think we need to better show them what's new and exciting about it.

Some technical advancements are hard to predict, although we know what some will be. The field has been telling us for years what many areas of focus should be. Study after study since the Apollo days has pointed out the developments we needed for further exploration. Advanced in-space propulsion. Closed-loop life support. In-space refueling, aerocapture, precision landing, inflatable habitats. It's a long list.

A lot of these will happen through formal programs and projects. And some will come about with a more entrepreneurial, incentivized approach.

Our Chief Technologist Bobby Braun talks about “grand challenges.” There are three broad goals, First, make space a part of humanity’s natural environment—to establish capabilities needed to make human space flight routine, economical, and safe. Send, manage space as a natural resource—assume responsibility for managing the space environment as we currently manage our environment on Earth (and maybe shoot higher)—things like portable and economical energy on demand. Third, blaze our trail to the Universe—we will extend the limits of humanity’s knowledge and abilities as far as they can go—for example, understanding the laws of the Universe, and discovering life and Earth-like worlds. You start with a big idea like "make access to space economical," or "develop routine satellite servicing," and see what kind of specifics you can generate. I think we’re going to make a lot of progress by challenging those who have the passion and the knowledge to make things happen. Someone out there, some innovator, has a solution percolating in their brain. One way we want to address them is through incentives. I think prizes and awards and competitions – things like Centennial Challenges and the X- Prize, even FIRST Robotics, will galvanize learning and bring technological solutions to the table.

Many of the science headlines the Paine commission predicted have come true: ice at lunar poles… first detection of extra-solar planets…space station celebrates first year in an enclosed environment.

So what will these capabilities allow us to do in 50 years? We envision robotic and human explorers traveling throughout the solar system and ultimately into interstellar space; the identification of life on other planets and Earth-like worlds around other stars; an Earth observation system that can accurately forecast the emergence of major storms and natural disasters; and a commercial spaceflight industry at least to LEO and contributing substantially to solving our Nation's technological needs.

Over the coming decades, NASA is determined to work with people everywhere to achieve a sustained presence for human explorers beyond Earth (we now have had such a presence for over 10 years). Continued and expanded exploration for space with humans will drive prosperity on

Earth through innovations and technologies not even imagined today. We will work to open near-Earth space to many more people, so humans can experience the adventure of visiting, living and working in space. Through our exploration endeavors we will expand our economic sphere, enabling new businesses, expand our minds through exciting scientific discoveries, and expand our imaginations by going where, dare I say, “no one has gone before.”

In the next 50 years we truly hope to witness the first boots on Mars, fulfilling the dreams of generations who have come before. We will finally answer the key scientific question about Mars – is there life on our planetary neighbor? And even if we find no indigenous Martians, as our first astronaut shakes the red soil from her boots, she will prove once and for all that humans are meant to explore.

We hope to venture to Europa with robotic missions to see if we can explore an under-ice ocean, uncovering possible past or current life, via an intelligent robotic lander / penetrator .

We hope to map and visit the surface of Saturn's moon Titan and explore its atmosphere and climate via a long-duration airship operating in Titan's atmosphere, with occasional descents to the surface.

We plan to return samples from a variety of asteroids and comets, including some of the primitive bodies of the solar system. Combined with the above visits to the planets, we would be able to construct a definitive history of the solar system.

In astrophysics, who knows, we may discover that Earth-sized planets are common in the galaxy, that some are Earth-like in that they have water and carbon cycles, and that some of those host life in some form. We may detect earliest forms of matter, galaxies, and stars in the universe with JWST. We may grow to understand the nature of dark energy and dark matter, and their role in shaping the structure and evolution of the universe, taking our next steps with JWST and WFIRST (Wide Field InfraRed Survey Telescope).

In the future we could probe the event horizon of a super-massive black hole in another galaxy with the International X-ray Observatory. We may be able to peer back to the beginning of the universe - -days/weeks/a few years after the Big Bang. We may be able to detect and measure gravity waves with LISA (Laser Interferometer Space Antenna).

In heliophysics over the next 50 years, we will more fully understand how the Sun operates and predict days/weeks/months into the future the impact of those influences on Earth, satellites, and human explorers. We'll use a constellation of spacecraft to do this which "instrument the solar system"; near the Sun, at Lagrange points, in orbit around the Earth and other planets, and traveling through the outer reaches of the heliosphere.

In Earth science, derived from NASA's pioneering Earth science missions and research, a host of international partners have already deployed and are maturing a Global Earth Observation System of Systems. In the future this system will enable routine extended weather forecasting and inter-annual to decadal climate predictions on a regional basis. This system will inform UAVs deployable on demand at any location around the world. In addition, operational systems will enable greatly improved management of natural and man-made disasters.

Twenty to twenty five years from now, we could be flying in a commercial subsonic airplane that may look like a flying wing. Or many airplanes may still look very similar to today's tube and wing configurations. But regardless of the outside shapes, future airplanes will use much lighter materials and structures, high temp materials, and potentially hybrid-electric (battery) propulsion systems. These revolutionary airplanes will be far more efficient, less pollutant, and quieter than today's airplanes.

I didn't make this up—these are all things NASA is investing in today to shape such a future. A lot of these topics will be discussed at this conference, have in fact already been discussed at previous meetings.

The approach to making all of these things happen has to be a sustained, step by step program that is part of a larger context. Challenging but feasible. Adequately funded. But we simply can't keep living on old investments in tech development and existing capabilities.

There's an open letter to students from Bobby Braun on the AIAA website. He makes a lot of good points and challenges today's students to become tomorrow's innovators. One of our immediate needs is to inspire and challenge the next generation and give them the hands on opportunity to develop hardware and flight-test it.

We want them to have the chance to excel and create the world of tomorrow and stunning possibilities for all of us like the Mercury, Gemini and Apollo generation did? Like the scientists who launched Hubble? We all do.

It's going to take all of us to help make these things happen. Not to think parochially. I don't think it's a prediction, but more a statement of fact that this industry is going to grow and prosper. It's not just going to create more jobs, it's going to create new kinds of jobs and generate enormous economic benefits. This field is innovative by its very nature. It has always attracted the best people. But it's got to keep challenging us to do new things and to do them differently. The overarching themes of this conference are: imagine, innovate, collaborate. That about sums it up, doesn't it?

It's a big, multi-faceted future taking shape. Will we be ready with the technology to go the next step and continue to lead the world? The answer to that lies with many of you in this room. The choice is ours. I, for one, believe we will make the right choice that will usher in the next great wave of innovation and discovery. Thank you.