

**REMARKS FOR ADMINISTRATOR BOLDEN**  
**NATIONAL SPACE SYMPOSIUM**  
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**A National Commitment to a Vibrant Space Exploration Enterprise**

Thank you, Elliot, for that kind introduction, and for the opportunity to speak today. It is a pleasure to be with you, during a week that the entire nation will be thinking about space. It is an important week for space and an important week for NASA. Before I begin my remarks, I'd like to thank the staff and board of the Space Foundation, who have done so much over the years to raise awareness of space activities and the benefits of space. I'd also like to thank all of you who are here today for the professional contributions you make every day to the space industry.

I am honored to be here today representing the men and women of NASA. I want to say at the start that each and every one of us is absolutely committed to a vibrant future for this agency, and to the future of Human Spaceflight. Thirteen of our colleagues are in orbit aboard the ISS right now, two of whom just completed the third and final EVA of this mission about two hours ago. I am told that if you can manage to be up at 4:30 a.m. tomorrow morning, you'll be able to see their home in space fly overhead.

At NASA, we are committed to this new era of space exploration, a 21<sup>st</sup> Century Space Enterprise, because it is a transformative path that offers a real future for space exploration and development. I think all of us who love the space program, and especially those of us committed to it professionally, can agree that we need to start developing transformative technologies now if we are to plant human boots on Mars or even if we are to land robotic scouts on destinations where we have never been before.

We are committed, because sending human explorers into the Solar System, not only in person, but also through our robotic precursors and our observatories, will blaze a trail for others who will one day live and work in space. This is a lofty goal, perhaps, but one

that merits our total commitment. The benefits are numerous. It's an enterprise that can open new markets and create new, high-tech jobs. It's an enterprise that will lead to extraordinary scientific discoveries. And it's an enterprise that advances the human condition by creating new capabilities that can solve problems here on Earth even as it helps us all to open our imaginations to what's possible.

It's not just our NASA team that's committed to this Enterprise. President Barack Obama is also strongly committed to our future in space. We are so committed that we have made the hard choice to undertake a challenging new direction. We are so passionate about space that we made the hard choice to step back from our current program and find a more affordable and sustainable path forward. We had to look beyond the present to make hard choices about our future in space. We had to ask ourselves, what will the next generation need? How can we get to places we've only imagined? What funds will our future leaders be willing to allocate? What capabilities will these missions require, and how can we most effectively mature these capabilities?

Because it is sometimes hard to be impartial when you are in the thick of something, we asked independent experts with impeccable reputations - Norman Augustine and his *Review of Human Space Flight Plans Committee* - to help us examine our program. It was their finding that "the current U.S. human spaceflight program appears to be on an unsustainable trajectory". We're 40 years beyond the first landing of humans on the moon and yet we are still far from the capability to conduct long-duration missions outside of low Earth orbit, let alone to being able to consider sending humans to Mars. This is not only because we don't fully understand how humans can cope with the health risks of missions into deep space, but also because we don't completely know what hazards and resources we'll find at these destinations.

In response to the questions - "What will it take to create the vibrant space exploration enterprise that we'd like to see unfold in the future?" And "how can we increase America's capabilities in space, open new markets, mature new capabilities, and once again inspire the nation about space?" - The President, with my full agreement, did

something very bold. He made a change -- a big change. He made the change that we believe is needed to set NASA on a sustainable course into the Solar System.

The increased funding proposed in NASA's FY 2011 budget will build a steady cadence of success, a crescendo that will leverage the multi-national investment we and our partners have made in the International Space Station, demonstrate vast new capabilities required for human exploration in the future, and increase our knowledge of the solar system exponentially as we send numerous new probes to future human exploration targets. So, at a time of extreme budget pressure, the President has chosen to invest in exploration of the space frontier, with NASA firmly at the helm.

Although the President's plan involves a new philosophy and approach to human spaceflight, the fundamental goal has not changed – to boldly advance human presence beyond the cradle of Earth. We will be, as we have always been, mission driven - developing the capabilities we need and overcoming obstacles with specific solutions. Safely sending humans into deep space for years at a time and exploring destinations across the solar system is not something to be done overnight or to be taken lightly. Yes, we want to go back to the moon. We want to visit asteroids, too, the moons of Mars, and Mars itself.

Mars is an especially compelling target for future human exploration. It presents us with scientific mysteries to solve as few other destinations do. It challenges us to invent the most innovative capabilities for our journey, and it has long occupied our collective consciousness as a place that humans must one day explore.

With that eventual destination in mind, we'll develop capabilities prior to that big leap that will bring us many new benefits. Among them, as I mentioned, the propulsion systems to get us there, and faster than we possibly could today; habitats to live in deep space or other planetary surfaces; fuel depots in space; the capability to manufacture oxygen, water or fuel from the resources at hand.

These are some of the key technologies that we need. Many of you in this room today have been talking with me or with NASA for years about how we could make these technologies a reality. It's time to take these ideas from concept to flight. The President has given us the resources to achieve these goals.

Our 21<sup>st</sup> Century Space Enterprise will be enabled by the discoveries we make and the advanced technologies we create. In addition to full utilization of the International Space Station, we intend to adopt a phased approach to contract with industry to develop transportation to low Earth orbit as soon as possible. Our new strategy will enable human exploration across a wide range of destinations by developing the required technology advances upfront, establishing clear performance and success criteria, and measuring progress along the way to ensure NASA is providing the best value to the nation. The thrust of this strategy is an ambitious, stepwise exploration approach that is sustainable, achievement-oriented, and globally inspiring. Building upon our technological advances, our human explorers will perform near Earth missions, and then explore deep space before eventually performing extensive surface exploration of the Moon and Mars.

The new systems we develop will incorporate the first set of advanced capabilities, proven over the next few years, as part of our plan. As our technological capability increases, so will our reach into deep space. As we ultimately demonstrate the most challenging capabilities, we will be able to send humans on extended excursions to the surface of our Moon, Mars and its moons.

An anticipated offshoot of our Enterprise will be enhanced U.S. economic competitiveness and development of new commercial markets, capitalizing on the American ideals of competition and innovation. We will benefit from our aerospace industry's decades of experience while engaging a generation of new space entrepreneurs. Through the partnership of NASA with established and entrepreneurial corporations paving the way to Earth orbit, NASA will be the catalyst of a global space

exploration movement, as nations across the globe join together to explore beyond our home planet.

Government has blazed the path to low Earth orbit. New players are now ready to engage that field. These are companies both large and small, with many strengths to offer. They, too, are often about enabling technologies, improving our ability to live and make discoveries in space. And as we engage industry and other nations, we will also engage young minds to imagine what is possible, and to bring those dreams to fruition.

So how do we start? We've actually already begun. Central to our 21<sup>st</sup> Century Space Enterprise is full utilization of the International Space Station. Through the President's new direction, we will be using this laboratory to more productively learn about what is needed to send humans further into space. The President's support for extending the ISS to 2020 or beyond, gives the nation an enormous payback on its investment.

Through utilization of this laboratory, we have already learned more about growing plants in space, about water processing and conservation and thus closed loop life support, about the behavior of viruses, and about the heart and other muscles and bones. This is vital knowledge, and we've only begun the research with our partners, academia, and industry.

Our new Space Enterprise requires that we fundamentally transform our approach and make the required technological investments, so that we may ultimately pass on a space faring capability to our children, and to their children. This shift will also create new research products, businesses, industries, and a host of technology and space-oriented jobs across our Nation and the world.

Consider how our options for human exploration of our solar system will change when inflatable habitats, next-generation heavy-lift rockets, and advanced in-space propulsion technologies are available for our use. Consider the gains in human adaptability to the space environment when we have improved knowledge about radiation shielding and

life-support systems. Consider the revolution in space exploration possible when we can live off the land and make fuel and other consumables on other planets, rather than bringing it all with us. Now is the time to mature a strategically selected set of these systems from concept to flight.

We are fortunate to build on deep expertise and experience already existing at NASA. We've already demonstrated some important results extracting oxygen from soil at field sites in Hawaii. Already, we have sent an early robotic precursor, the Lunar Reconnaissance Orbiter to the Moon, demonstrating how a well-conceived satellite can do good science and pave the way for future human missions. We have been taking small steps along this path, but now we have a more aggressive, technology-enabled plan matched with the resources to carry it out.

We refer to the technologies we want to develop as game changing. We want to make things possible that a generation ago seemed impossible. We want to build broad and deep technical expertise that includes industry, international partners, academia and the very best and brightest young minds that want to join us in this endeavor. We want to change the playing field and make it possible once again for innovation to thrive and for new inventors and designers to get their chance to shine. Not all of them will succeed. And that's okay. We're going to be open to all possibilities and take measured risks because this increases our chances for success. By making a robust set of investments today, our nation's future human exploration opportunities will be numerous, and the technological and scientific leadership of the United States will be strong and sure.

Through our technology-enabling approach, NASA can also be an important catalyst for innovation and economic expansion across the Nation, re-engaging American universities, small businesses, inventors, and innovators from across this great land. This investment will not only allow NASA to return to its roots as a national driver of innovation enabling the emergence of commercial industry, but will spur contributions to broader national needs in energy, weather and climate, Earth science, health and wellness, and national security just to name a few.

I can't emphasize enough how passionately President Obama and I feel about educating and inspiring the next generation. That's one reason there's a big education component to this budget as well. Today's students will be undertaking a lot of this work, or carrying it to the next level. I have no idea if my granddaughters will love space as much as I do, but they'll have friends who will, I'm certain.

In the wake of discoveries from such great instruments as the Hubble Space Telescope and others of the Great Observatories, we've rewritten the textbooks in astrophysics and space science in just the past couple of years. And we haven't even launched the James Webb Space Telescope or come close to evaluating the results of Kepler's patient peering at extra-solar planets. Even with all we've done in the past decades, the advances of just the last generation, we have barely begun to scratch the surface, not only of what we are capable of achieving technologically, but what we can discover about our solar system and our universe.

And that's really the vision the President has for us. It's no longer about science versus exploration. It's about what we can achieve as a unified community who are dedicated to finding out more about our true capabilities. Who want to strive again for what may seem impossible or unachievable.

The plan for our future exploration is beginning to take shape. In implementing this new era of exploration, we will pursue incremental, measured progress. You're going to see a series of ground and space demonstrations that will build on our heritage and build on each successive milestone. We want to mature emerging technologies to flight readiness levels and get them there with a sense of urgency. We want to flight test these technologies. We want to send out precursor flights to the Moon, near-Earth asteroids, Mars and other destinations. These precursor flights, serving as technology demonstrators will allow us to perfect our concepts of precision landing on distant bodies or refine our systems for resource prospecting and production so we can begin reliable autonomous operations prior to human arrival.

Our early technology efforts will advance power, communications, propulsion and life support, building new capabilities to improve our ability to work in space and also to improve life on Earth. An example of one early demonstration is in the field of robotics, where NASA has been working in cooperation with General Motors on the next generation of advanced robots. In coming months onboard the International Space Station, NASA will demonstrate this technology to advance efforts in human-robotic collaboration that are required to improve productivity, reduce costs, and mitigate risks of our future spaceflight programs. Simultaneously, this development program has been of great benefit on Earth, where it has improved the nation's competitiveness in the automobile industry. We call it Robonaut – the current version, R2 - and it's not a movie or a video game. R2 is a dexterous robot, so lifelike in some ways it's almost uncanny. It has amazingly precise fingers, for example, with great strength and responsiveness.

This is just one of the capabilities that NASA will demonstrate on its pathway to sustainable human exploration beyond low-Earth orbit. Over the next few years, others, including advances in life support systems, inflatable habitats, heavy-lift and in-space propulsion, will follow this milestone. Over the next few months, we will be releasing additional details on specific missions in our new exploration enterprise portfolio.

Like the grand challenge of first crossing the ocean or building the transcontinental railroad, implementation of this grand plan must begin with technology innovation. These past challenges not only utilized our best talent, but also inspired generations to pursue challenging goals, created new industries, and ultimately improved our country and the world. Similar opportunities are in front of us now.

So where do we go from here? NASA planning teams are currently laying out the details of this grand exploration enterprise. Through a rigorous systems engineering process, the Agency will ensure that our technology development, robotic missions, human research and national infrastructure are aligned to accomplish the United States' goals in human space exploration. This activity will conduct mission analyses and



spacecraft design studies to define scenarios for reaching our exploration destinations and determining their proper sequencing. Potential future international partners, academia, and industry will be included in this process to gather their diverse viewpoints and unique capabilities. In this manner, the nation's investments in technology and systems development will be aligned with our objectives in space exploration.

Let me end where I began. The President and I, in fact everyone at NASA is committed to a vibrant future for human spaceflight. I bet everyone in this room is also committed to a healthy space program. Let's work together to insure the goals of our commitment are fully realized – to make the dreams of our children reality - to create a space exploration enterprise worthy of our great nation.

Thank you.