

**REMARKS FOR DEPUTY ADMINISTRATOR LORI GARVER
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Thanks, Ray (Williamson) and thank you to IISL and IAA for inviting me to speak with you today. I promise you that I pay attention better now than I did back when I had you as a professor in graduate school... Seriously, it's a great honor to be here and to share with you a few thoughts about the transformative new space initiative that President Obama has given NASA.

I know you have heard a lot about the President's plan, but in a nutshell, it will enable NASA to explore new worlds, develop more innovative technologies, foster new industries, increase our understanding of the Earth, expand our presence in the solar system, and at the same time inspire the next generation of explorers.

And it all unfolds from that grand and well thought out seed, the National Aeronautics and Space Act of 1958. This is really NASA's "Constitution." The Space Act has been amended frequently, but always in the spirit of the original and to take into account new possibilities and challenges. The President's proposed FY 2011 Budget for NASA is aimed squarely at fulfilling key principles of Congress' design for our nation's civil aeronautical and space activities—and the Administration it created to conduct them—that were laid out in that founding document.

Right up front in its Declaration of Policy and Purpose, Congress directed NASA to make concrete and genuine contributions to nine fundamental objectives. Over the course of its nearly 52-year history, NASA's success in advancing those goals has been impressive—and in many cases spectacular. The course that President Obama has now charted for NASA is designed to raise that bar. The first five objectives are specifically addressed in the President's plan:

- Expand human knowledge of the Earth and of phenomena in the atmosphere and space;
- Improve aeronautical and space vehicles;
- Develop and operate space vehicles to carry equipment and living organisms through space;

- Conduct long range studies on aerospace opportunities, benefits and challenges; and
- Preserve the role of the U.S. as a space leader.

I'll get into specifics on how the President's new directives – and especially his 2011 Budget proposal – advance these and other goals in a minute. But first let me mention another key point.

While we recognize it is not specifically stated as a goal in the Space Act, I do believe a central purpose of the Act enables exploration as one of the keystones of NASA's mission. Indeed, Congress even defined the term “aeronautical and space activities” to include “. . . such other activities as may be required for the exploration of space.”

We have to remember that in 1958, our satellite capabilities alone were quite primitive compared to what we can envision today, and no humans had yet been to space, so the concept of exploration was still taking shape. Still, it seems clear that the framers of the Space Act were trying to cast far ahead, to give a robust start to an initiative that they, rightly so, saw as the nation putting its oar into a new and untested but necessary sea. An initiative that would carry us far and develop our technological capabilities tremendously.

Our purpose in taking NASA forward on a bold new path is to uphold and advance these and other fundamental principles of the Space Act.

For instance, Congress declared, in sections 102 and 203 of the Space Act, that “the general welfare of the United States requires that [NASA] seek and encourage, to the maximum extent possible, the fullest commercial use of space,” today we are doing just that.

Congress also observed that NASA's activities should materially contribute to “[t]he preservation of the United States' preeminent position in aeronautics and space through research and technology development related to associated manufacturing processes.” These are bold challenges, and the President's FY2011 budget proposal directly implements these goals by building off of progress in the development of commercial cargo capabilities and investing \$6 billion over five years to spur the development of American commercial human spaceflight vehicles.

This is not a particularly new idea. We just think that now is a time when NASA and industry are well positioned to finally make this next step a reality. I think most of you here know that the funded partners in our Commercial Orbital Space Transportation Systems program have been steadily making progress.

This focus on commercial procurement is new in the sense that, yes, we are pushing the envelope, we're encouraging industry to try new things, to test their own boundaries. That is fully in line with the letter and the spirit of the law. We need these capabilities and there's an existing resource pool that could be brought to the next level to give them to us. We're going to do it, thus freeing up NASA to do bigger picture things and at the same time help create a whole new segment of the economy that is certain to create thousands of good, new jobs and continue to spin off high tech businesses.

With the new money the President wants to provide to add new or accelerated COTS milestones, and then to seed the entire sector with competitive solicitations to get us what we need for safe and reliable, redundant and sustainable access to low Earth orbit. The \$6 billion increase over the coming five years will cover a wide range of activities we'll need to establish an enduring access to space that is non-government.

In this same vein, the Space Act states that NASA's activities should advance "the improvement of . . . aeronautical and space vehicles; the development and operation of vehicles capable of carrying instruments, equipment, supplies, and living organisms through space; [and] the preservation of the role of the United States as a leader in aeronautical and space science and technology"

The President's budget provides for transformative technology development and innovative technology demonstrations to pursue more advanced approaches to space exploration. It fosters research and development on heavy-lift and propulsion technologies, and seeks to modernize our nation's critical launch infrastructure. The goal is to improve US competitiveness in many commercial space arenas, including the launch sector, to improve the space industrial base and increase the nation's economic growth.

The President has committed to a decision by 2015 about the heavy lift vehicle we're going to build to take us beyond low Earth orbit. We will invest in the necessary technologies over the next several years that will enable us to choose a heavy lift vehicle that will be able to incorporate the most promising technologies, and will thus be sized for our most critical needs and missions.

This capabilities-drive effort will enable exploration of multiple potential destinations, in the most cost effective and safe manner. We plan to increase investment in chemical propulsion technologies that could be important to heavy lift, as a way to support a more affordable and robust space transportation industry that serves multiple users -- military, commercial and civil.

As always, the challenge will be the wise early investment of money in technology, looking for the payoff of lower operations cost in the long run. But the bottom line is that we need to invest in systems that can be affordably sustained and operated.

A formal Request for Information about heavy lift is on the street right now, with inputs due May 21. Our preliminary efforts on first-stage launch propulsion will focus on development of a U.S. liquid oxygen/kerosene rocket engine. We'll be looking to incorporate features that, through this liquid engine technology, will reduce manufacturing, production, and operating costs for the engine and total launch system costs.

We also want to get information on initiating development and flight testing of in-space engines, including low-cost liquid oxygen/methane and liquid oxygen/liquid hydrogen engines. These liquid engines will be applicable to multiple users for different in-space applications. Our goal will be to incorporate features that will reduce manufacturing, production, and operating costs as well as total launch and space transfer system costs.

And we're interested in foundational propulsion research. We want to look at areas such as new or largely untested propellants, advanced propulsion materials and manufacturing techniques, combustion processes, and engine health monitoring and safety. NASA will engage industry and academia with the goal of encouraging a broad range of innovative approaches focusing on cost and reliability. And we think this effort will

develop the next generation of scientists and engineers in the space launch propulsion arena.

Our Chief Technologist is ready to set the ball in motion on a number of important technologies as soon as we are able, including solar sails, optical communication, advanced in-space propulsion systems and the next generation of in situ resource utilization technologies, just to name a few. Inflatable habitats, orbiting fuel depots, and autonomous rendezvous and docking are also in the queue. These are all technologies for which we're making real plans and to which we will commit development dollars. There is little disagreement that these are capabilities we must have if we are to explore beyond low Earth orbit for any extended period of time.

While our initial phase of planning the new programs is done, there is still much work ahead. NASA will be holding a workshop in Galveston May 25-26 that will explore the multi-faceted path forward. Representatives from industry, academia, and the federal government have been invited to discuss strategy, development, and implementation of the President's proposed new direction.

We'll provide a status update on planning for the new programs, discuss proposed program assignments, solicit feedback, ideas and suggestions, and prepare for next steps after the new programs are initiated.

We've already issued the RFI for heavy lift that I mentioned, and one for the new Exploration Technology Development Program. Additional RFI's for our Flagship Technology Demonstration program, commercial capabilities and robotic precursor missions will be posted in the coming days.

We're inviting industry, academia, International participants and other non-government research organizations to provide inputs. It's a very exciting time with a rush of information and ideas anticipated in the very near term.

But, the Space Act makes clear that the U.S. is not to explore alone. Indeed, Congress directed NASA to pursue "cooperation . . . with other nations and groups of nations in work done pursuant to [the] Act and in the peaceful application of the results thereof." Accordingly, the President's proposed FY 2011 Budget for NASA continues and increases history's most impressive multilateral space program, the International Space

Station, and provides for increased utilization of the ISS by governmental and non-governmental participants alike. The station, in other words, will be allowed to reach its full potential as an unprecedented orbiting laboratory, and the discoveries we make there will boost our exploration goals.

Since its inception in 1958, NASA has enjoyed significant benefits in almost all of its major programs through various levels of international cooperation. In the past 50 years, the agency's international cooperative activities have involved more than 3,000 agreements with over 100 nations or international organizations. This cooperation includes a broad range of activities such as: joint mission planning and development of human space flight systems on the ISS; flight of international astronauts on the space shuttle; flight of NASA instruments on international spacecraft (and vice-versa); suborbital campaigns and field research, including measurements from sounding rockets, balloons, aircraft and ground-based measurements; and scientist-to-scientist data exchanges with joint analysis and publication.

These activities have enabled us to develop the kind of partnerships we will need as we expand our plans for exploration beyond low earth orbit. International contributions and partnerships have contributed significantly to the success of many of our programs and missions. Our experience working on the station's robotic Canadarm 2 and the stunning success of Cassini-Huygens at Saturn, our collaboration on Japan's Hinode to study the sun, and instruments we had on Indian's Chandrayaan-1 that made worldwide news about water on the moon, show we have been successful in relying on each other for mission success. We are also taking new steps towards enhanced international cooperation with the NASA-European Space Agency Mars program.

In Earth Science, some of the exciting programs in which NASA is already engaged with non-traditional partners include the Aerosol Robotic Network (AERONET), which consists of about 400 sites in 50 countries on all seven continents. It's an optical, ground-based aerosol-monitoring network and data archive system that consists of sun and sky-scanning spectral radiometers. Among other things, by providing accurate measurements from the ground, AERONET has emerged as the best tool for validating the accuracy of new satellite instruments on orbit.

The Global Learning and Observations to Benefit the Environment (GLOBE) program is a hands-on, primary and secondary school-based science and education program uniting students, teachers, scientists and community members around the world in study and research about the dynamics of Earth's environment. There are now more than 40,000 GLOBE-trained teachers representing over 20,000 schools around the world. GLOBE students have contributed more than 18 million measurements to the GLOBE database for use in their inquiry-based science projects. Our budget proposal expands NASA's support for GLOBE.

SERVIR is a regional visualization and monitoring system that integrates Earth observations and forecast models together with in-situ knowledge for timely decision making to benefit society. SERVIR has helped forecasters predict air quality in Meso-America, for example, and improved responses to natural disasters and agricultural management in the regions where it operates. The NASA/USAID SERVIR project currently has two nodes, for East Africa (headquartered in Kenya) and Central America. The new budget allows SERVIR to expand.

Within our Exploration Systems Mission Directorate, where we are planning the human missions of the future, we are looking to enhance our international partnerships in a similar manner. The missions we are planning are ambitious, and while challenging, promise to deliver enormous benefits. But again, we can't do them alone. To establish the critical partnerships we want, we're working to establish a common vision for human space exploration. In this way, we can work together with our partners to prepare for these exciting missions and leverage the investments of all interested agencies.

Right now we're continuing this dialogue with our international partners at the working level, while establishing our preliminary needs and objectives so that we can move forward toward more senior discussions and consensus building, with both current and non-traditional partners, in the near future.

The common vision, taking the form of a Global Exploration Roadmap, will reflect a steady progression of human missions to increasingly ambitious destinations, ultimately to the surface of Mars. It will include the technology demonstrations and robotic precursor missions we envision as a key

component of the international strategy. The roadmap will enable the realization of the critical roles to be taken by all interested agencies, taking advantage of their capabilities and long term interests and building to the robust capabilities we need for these exciting missions.

We will see near term partnerships that will contribute to realization of our shared long term vision. We've learned a lot from the ISS and the missions we've shared with other countries to this point, and now we're going to forge what is likely to be one of the Space Age's most memorable collaborations, as we plan one of humanity's boldest ventures as the people of a planet, not just one nation.

While the majority of NASA's cooperation is accomplished with spacefaring nations, an increasing number of other nations are now relying on space for day-to-day activities, such as urban planning, resource management, disaster preparedness and response, communications, weather forecasting, and navigation. As a result, NASA's international partnerships have continued to grow in diversity and importance, as the agency engages developed and developing nations in a wide range of mutually beneficial activities.

So, beyond the ISS and NASA's long and successful history of international cooperation with its "traditional" partners, we are seeking to expand and deepen our "global reach," to find mutually beneficial activities with non-traditional partners that can be implemented at a lower cost, yet have a high-impact for both the potential partners and NASA.

In pursuing these innovative programs with both traditional and non-traditional international partners, NASA is also fulfilling another important mandate of the Space Act, which directs the Agency to "(expand) human knowledge of the Earth and of phenomena in the atmosphere and space." The President's budget proposal will enhance these efforts, as it seeks to increase research and accelerate the next wave of climate change research and observations spacecraft, with an additional \$1.8 billion over the next 4 years in Earth and climate science funding. That's a 60% increase.

That increase allows us not only to accelerate priority new missions, but also "continuity" missions, or those that will help us build on previous missions and continue gathering vital data over the long term. We've

gained a great understanding of our planet's processes over the past decades, but given that it's a dynamic, living system, we have to keep watching it and build baselines to evaluate over time. The budget also allows us to get some nimble "venture" class missions into space. These are smaller scale competitive missions for which we'll be doing rotating annual solicitations in a couple of different classes.

We'll also be accelerating the priority missions of the field as identified in the latest decadal survey, and re-flying the Orbiting Carbon Observatory, which failed on launch last year.

The Space Act states that NASA shall "provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof." It is therefore our mission to advance not only technological development and scientific discovery, but to make that knowledge widely available and, I would interpret that here is where we're a key part of the nation's education effort – and beyond just formal education to science and technical literacy and to inspiration. We need to help reach and keep the next generation engaged in our exploration adventure.

In line with the President's support for education, he's drawing on NASA's resources in this area and initiates the *Summer of Innovation*, which will pilot programs over three years to engage and inspire middle schools students and their teachers to become achievers in science, technology, engineering and math. We will also implement programs in these STEM disciplines that focus on innovative ways to reach undergraduate and graduate students, improve student retention in STEM disciplines, leverage the research platform of the ISS, and better engage community colleges and minority institutions in STEM efforts.

To do all these things, NASA needs some help to ensure an environment exists that is conducive to the development of its missions (especially on an international basis). I am pleased to note that Administration is taking significant steps to ensure a robust and competitive industrial base through efforts such as the President's Export Control Reform Initiative, which Secretary of Defense Gates announced just a few weeks ago.

I am hopeful that the streamlined, consolidated, and balanced export control program objectives that Secretary Gates announced will relieve some of the barriers to competition that have unduly burdened the critical

space industrial base that supports NASA and many other agencies of the federal government.

These export control reforms will help NASA as we capitalize on the opportunity that the President has given us to correct our underinvestment in technology development and help realign us with the intent of the Space Act. The intent of the Space Act has always been for NASA to “contribute materially”, to the broader 5 objectives I outlined in the beginning of the talk, and to keep us looking forward, to keep us innovating.

In the biggest picture, the benefits for our country and the world from space exploration are derived from NASA's philosophy, its mission driven approach. We set goals and solve problems. We don't intend to scatter grants to the wind and hope something will come from them. We are focused problem solvers, and that's how we take on the big missions.

As Congress has directed, it is NASA's mission to further the general welfare of the United States through the programs and capabilities I have mentioned. And there are hundreds more, each making a vital contribution to our nation's future. The President's budget proposal takes us even further in pursuit of the goals set forth in the Space Act, and enables exciting developments in research and technology that will make future space flight more affordable and sustainable and inspire a new generation of Americans. We carry the NASA banner proudly, building on a legacy of hard work and sacrifice and finding new ways to fulfill our key mandate as laid out in the Space Act. It is an unbelievable honor for me to again work at NASA and carry out this work on behalf of the American people. I'm often asked these days how I can manage during such a difficult and stressful time. My response is that it is not at all stressful to be working toward such important goals as those of NASA and to be able to work with the unbelievably talented space community, such as that represented in this room. Thank you.