

**REMARKS FOR DEPUTY ADMINISTRATOR LORI GARVER  
PRATT WHITNEY WOMEN'S FORUM  
May 24, 2010**

Thanks, Dave. And thanks to all of you for inviting me to join you today. It's my pleasure to offer both the big picture perspective on where NASA is headed right now and my own personal perspective from a 25 year-plus career in aerospace.

Needless to say, 25 years ago, it would have been a lot harder to convene this many women in the aerospace professions. Especially in leadership. We can credit a lot of things for this, one of which is our astronauts who happen to be women with a lot of high visibility for women doing daring things. Doing things that required backgrounds in science and engineering and math in a visible way is often a catalyst for educating and engaging young women. We do have to admit, though, that the Russians were 20 years ahead of us with the first woman in space, although there were very few Russian women who followed after Valentina Tereshkova.

As Dave mentioned, I did have the great opportunity to work for John Glenn. However, I started as a receptionist. But working for John Glenn was an amazing experience.

I always hesitate when I use the term "woman astronaut," just like I hesitate when I say, "woman doctor" or "woman Deputy Administrator." It would be really nice when the day comes when it's nothing special to be an astronaut or an aerospace professional and also happen to be a woman. But we are not there yet, and I have such incredible respect for the women who have blazed a trail into space for us. Sally Ride, the first American woman in space...the late Judith Resnick...Kathryn Sullivan, the first woman to walk in space, who has been followed by only nine others. Shannon Lucid, who spent many months on Mir and held the record for time in space by a woman for many years. Susan Helms, who still holds the record for longest spacewalk with her partner Jim Voss. Peggy Whitson, who holds the record for most time in space by any American. Mae Jemison, the first African American woman to travel in space when she went into orbit aboard the Space Shuttle Endeavor in September 1992.

These are just a few of the women who achieved major milestones and made history in space, inspiring generations of women of all ages.

We've been flying in space for more than 40 years, but women have excelled in science and mathematics for centuries. I am a bit of a history buff, and there are some distinguished scientists and mathematicians of note throughout history who are women.

For instance, Hypatia of Alexandria in 400 AD became head of the Platonist school of Alexandria. During her life, she discouraged mysticism and encouraged logical and mathematical studies. Unfortunately, she was killed by a mob who blamed her for religious turmoil.

Emilie Du Chatelet lived from 1706-1749. She was a French physicist and mathematician who translated Newton's Principia into French. She disguised herself as a man in order to study science. Her father encouraged her to seek an education because he thought she was too ugly to receive a marriage proposal, although she did marry at 19 years of age. She later became the mistress of Voltaire, who declared that Du Chatelet was, "a great man whose only fault was being a woman."

One last example—Maria Mitchell who lived from 1818 to 1889 was the first professional woman astronomer in the U.S. and the first woman to gain membership in the American Academy of Arts and Sciences in 1848. She discovered that sunspots are whirling vertical cavities and not clouds as previously thought. Mitchell was named Director of the Vassar College Observatory. She learned that many younger male professors had larger salaries, despite Mitchell's reputation and experience. She insisted on a salary increase and got it.

Mitchell said, "We especially need imagination in science. Question everything."

Scientists who happen to be women are still making waves. Black hole size waves, for instance. A woman leads a team at NASA's Goddard Space Flight Center that is doing some of the most complex calculations ever about the collisions of black holes that have required the highest resources of our supercomputers. The principal investigator of the NuStar mission that will take hard X-ray pictures of our universe for the first time is a woman. The PI for the Moon Mineralogy Mapper on India's

Chandrayaan-1 moon orbiter that confirmed water on the moon is a female scientist at Brown. A woman leads the team that is responsible for all the beautiful images you see Cassini sending back from Saturn. Women also play key roles in our heliophysics division. They're planetary geologists and astrobiologists and in virtually every discipline at NASA.

So they're out there, but we're working for there to be more of them.

Let me say it's great to be the second woman to hold the post of Deputy Administrator at NASA, but like I said, I can't wait until being a woman and being number two at a technical agency is no big deal. I have a passion for space, but my academic background might not seem destined to have led me to NASA. It was the combination of public activism and a passion for space policy that got me here. And while it worked for me, it may not be the one that others would be able to follow in the same way. Certainly my path of volunteering for candidates and working for a space legend in the Senate created a good ferment for me (along with more than a decade at the National Space Society and a previous stint at NASA). Although my background is not "technical," I know that I have a role in creating the environment, promoting the role models, and hopefully encouraging more young women to enter into scientific and technical fields by giving NASA and aerospace overall a more inspiring and exciting future.

I think we all know that the stats are not great right now for women in engineering, math and physics. They're just not fields of study that women choose in large numbers. According to the National Science Foundation's Science and Engineering Indicators Study, in 2005, men earned the majority of bachelor's degrees awarded in engineering (80%), computer sciences (78%), and physics (79%).

Similarly, in graduate studies, in 2005, women constituted 37% of graduate students in mathematics (37%), their percentage in computer sciences (25%) remains unchanged since 1985 and their percentages in engineering (22%) and physics (20%) remain low.

Some trends are inching upward. Of all science and engineering majors, 47% are women. But this includes psychology and social sciences. And women seem to lean more toward the life sciences when we choose a hard science field. In that same NSF study, 62% of the bachelor's degrees in biology were earned by women. In graduate studies, 56% of those enrolled

in biological sciences are women, and if you add all medical and life sciences, the percentage rises to 78%.

At NASA, of about 18,500 total employees nationwide, about 6500, or 35%, are women. Of the nearly 11,500 of those who are scientists and engineers, 2500, or 22%, are women.

The face of exploration is changing – our long-term goals, and the way we are doing business, and how we will be addressing those goals -- so there promise to be many more opportunities for women and men in science and technical field in the future in the aerospace industry.

For instance, with the extension of the International Space Station to 2020 or beyond, there will be many more opportunities for research in the life sciences. This is vital research that we'll need to enable the next generation of human spaceflight. There is a vast amount of information we need to learn about human physiology in space. How plant and animal systems react in microgravity. How pathogens can be tamed.

I saw a Sabatier demonstration a little earlier today. We're excited at the prospect of the station's Sabatier unit getting online this fall and helping to meet the outpost's water needs. Chemists will be needed in many ways, to help decipher closed loop life support systems and nutritional needs of explorers. To assess the samples we bring back from objects in space or to help analyze the data that is coming back from landers.

If adopted, the budget for NASA proposed by President Obama for 2011 will help us reach the goal of having many more women (and men as well) working in our field. It will also help us reach many other goals as a nation. NASA will be addressing in a more comprehensive way what we call "grand challenges." These are challenges that are hard to accomplish but have the potential to bring great benefit. Things like making space access economical. Like providing economical energy on demand. Like preventing orbital debris. Forecasting natural disasters. Providing carbon neutral mobility.

The President said in his visit last month to the Kennedy Space Center in Florida that, "Space exploration is not a luxury, it's not an afterthought in America's quest for a brighter future – it is an essential part of that quest."

With that strong vote of confidence and the promise in his budget request of the resources to make it happen, NASA has been rapidly making progress on the blueprint for implementing the President's direction. We understand that a realignment of our priorities and a more expansive vision of what we can accomplish is unsettling in some quarters.

But we are confident that once people learn more about our plans and as more details are finalized, there will be broad consensus that this is the direction America needs to head if it is to continue to be the leader among spacefaring nations, with all the economic and societal benefits that unfold from that hard-earned position. We will not only continue our space leadership for years to come, we will expand and enhance it.

So I say, let's get over our change allergy and start to embrace the things that we need to do to transform and progress.

For years now, we've suffered in this Nation and in the government from an under-investment in technology development. So for NASA, the capabilities we need to get beyond low Earth orbit don't exist. And our resources are being drained by the operations costs of our ongoing programs. This is a scenario that we can change in a number of ways.

On the technology side, upon approval of the Fiscal Year 2011 budget, we will be moving out quickly on promising development in several areas. With the lack of investment, many of these technologies have remained in the conceptual phase for decades. With the support provided by the President's FY2011 budget request, we can advance these capabilities, which have applicability across a broad range of NASA missions. We will begin advancing these space systems in FY11 and accomplish critical testing in FY2012 and FY2013 that would prove their fundamental feasibility.

We have a road map that will allow us to increase our capabilities in a progressive fashion as we approach an ever increasing number of exploration targets with an increasing difficulty in these missions. Technology advances will enable each step. First, we'll demonstrate technologies near Earth, capabilities such as fuel depots, inflatable habitats, advanced life support systems and autonomous rendezvous and docking. Simultaneously, robotic precursors will be fanning out across the solar system, giving us knowledge about potential destinations and

providing a great dividend in scientific discovery even as they, too, help us demonstrate important technologies such as precision landing, in space propulsion and in-situ resource utilization that must be demonstrated and then scaled up for human exploration applications.

Developing a more cost-effective heavy lift vehicle, based on liquid fuels, is part of this strategy. Our goal is to make it serve more customers and become cheaper to operate in the long run.

This new heavy lift capability needs to enable exploration of multiple potential destinations, including the Moon, asteroids, Lagrange points, and Mars and its environs in the most cost effective and safe manner. We are in the planning phase to develop strategies for getting this capability. We're just getting inputs on an RFI for heavy lift and will be reviewing them with great interest.

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.

This approach will strengthen America's space industry, and could provide a catalyst for future business ventures to capitalize on affordable access to space. It will also leverage a broader range of American ingenuity to keep our nation on the leading edge of human space exploration capabilities.

Giving commercial companies the opportunity to step up to the plate and provide access to low Earth orbit so NASA can focus on more challenging exploration is an incredibly important part of our strategy. We believe it will make access to space more affordable in the long run and also drive new markets, create jobs and provide numerous ways of getting crew and cargo to low Earth orbit. NASA has also just released an RFI on commercial crew and human rating. Its goal is to: "seek information to help NASA plan the overall strategy for the development and demonstration of a commercial crew transportation capability and to receive comments on NASA human-rating technical requirements that have been drafted as a part of this initiative."

An RFI about Flagship Technology Demonstrations is also on the streets now, with responses due June 11. The primary goal of this RFI is to seek ideas relevant to an initial set of projects to develop and demonstrate the technologies needed to reduce the cost and expand the capability of future space exploration activities. In-orbit propellant transfer and storage; lightweight/inflatable modules; automated/autonomous rendezvous and docking; aero-assist/entry, descent and landing; closed loop life support; and advanced in-space propulsion (ion/plasma, etc.) are the things we're looking at here.

A goal of this and all the RFIs and RFPs we hope will follow is to create opportunities for engineers and scientists from NASA, private industry, and academia to gain experience in designing, building, and operating new space technologies and spacecraft.

So you can see we are serious about increasing the nation's capabilities as well as increasing the opportunities for scientists and engineers in the future.

This transition time has not been without challenges. Since February 1, when the President's budget request was rolled out, we've hardly had a quiet day. But President Obama wasn't elected to perpetuate the status quo, especially one that was leading to the demise of human spaceflight. I've been doing this for more than two decades, and I think I have a good sense of the trends and realities of this field. We've known for years that this is what is really necessary. Your leaders in your company have made hard choices and have changed, now we in government must change as well. And I think that what the President has proposed is exactly what we need. A re-thinking of how we do business and what we want to achieve and why we go... An expansive vision that goes way beyond the next election cycle and helps the Americans not even born yet have the capabilities of a spacefaring nation.

It has been a little tough, I know there have been charges levied at me and others about this plan. This new plan has had input from some of the best minds in our field. In one of the most open settings ever. The Augustine Committee held its meetings in the light of day for months and listened to dozens of presentations, and you can see online the reams of material they reviewed. Their job was to analyze all that information and present the

President with options that he could consider as he composed his own space policy.

Personally, I greatly respect the accomplishments of the Constellation Program. And I commend the hard work of thousands of people on Constellation both at NASA and its contractors, many of whom are represented here today. We will be building on that legacy.

But we want what we build to be sustainable. I know that our unbelievable workforce wants to work on things that will make a difference. The world has changed since Apollo and even in the past five years. There won't be an unlimited budget for exploration, and we need to make smart choices that will deliver on promises, move the ball well down the playing field, and keep us at the forefront of science and technology.

Far from limiting human spaceflight, this plan expands it. Instead of tying us to a capability based on heritage technology, the President is challenging us to come up with the new capabilities that the field has been begging us to do for years. The things I've mentioned: New in-space propulsion systems...orbiting fuel depots...inflatable habitats...precision landing...closed loop life support. These things just don't happen while you're funneling billions into a NASA-centric rocket program to reach the International Space Station right as it begins to close up shop or even later.

People have mentioned a new space race, and the ambitions of many other countries to reach the moon. That's wonderful. We want there to be increased international capacity for exploration. It's one reason we're working so hard on partnerships around the world. But America, as a nation, wants to go beyond where we've been before – we want to continue to lead the world in technology and innovation, as driven by space exploration and development.

The President said last month in Florida, “Fifty years after the creation of NASA, our goal is no longer just a destination to reach. Our goal is the capacity for people to work and learn, operate and live safely beyond the Earth for extended periods of time, ultimately in ways that are more sustainable and even indefinite. And in fulfilling this task, we will not only extend humanity's reach in space, we will strengthen America's leadership here on Earth.”

So we are expanding our vision, not contracting it. While the budget has widely been reported as a cut, in fact it increases the NASA budget by \$6 billion over five years in a time of great fiscal austerity. This budget makes NASA home once again to big ideas and keeps us at the forefront of technical innovation and a world leader in spaceflight and science. Which is a real return on the taxpayer dollar.

But I don't deny that this is one of the greatest shifts in the space program since its inception. Huge milestones in our history as a spacefaring country are being completed, while a completely new and uncharted era awaits us. That can be very scary. But it also presents exhilarating challenges for a leader.

So our challenge today, as aerospace leaders, is how to adapt to change.

At NASA, a 52 year old agency is reinvigorating itself and trying to become nimble again and become the quick thinker, the innovator on the block. The opportunity to create a vast new economic powerhouse with commercial access to space, for instance, is enormous. This sector could generate thousands of jobs and keep on generating them for decades to come. Spaceports are ready to sprout up in many places, not only here, but around the world. More people are going to have access to space, including academia, scientists and students, other government agencies and other countries.

Certainly, with a more diverse population in NASA management, in the board room and at the drafting table and in the lab, we'll have that many more perspectives. They say women like to discuss things more, that we like to talk things over more, that we're attracted to professions where we can help people. Well, I think we're on the cusp of something really big here in that regard. The aerospace industry can do so much to improve the lives of so many here on Earth—as I mentioned, we will be driven to contribute to significant “grand challenges.”

Already with our industry partners like you in the room today we're using space technology to help people get fresh water in remote and arid areas. Many medical breakthroughs in laser surgery and dialysis, just to name a couple, came about as a result of exploration. An experiment in our aeronautics division based on our investment in closed-loop life cycle

challenges has the potential to eventually generate jet fuel from algae growing in waste water. This is the kind of thing I'm talking about when I talk about a world view for aerospace and how our work has so many effects that we don't even contemplate as we watch that rocket flame disappear into the clouds and breathe a sigh of relief that everything went as planned.

I think the established aerospace firms and the up and comers are all going to have an expanding role in the future of exploration. I think the role of women in aerospace is also going to increase to a point where we won't even have to think about the fact that a woman in aerospace happens to be a woman. I'm very excited about what comes next, and I hope you are, too. I'm happy to take your questions and start that dialogue.