REMARKS FOR ADMINISTRATOR BOLDEN

INTERNATIONAL SPACE STATION AND MARS CONFERENCE

April 6, 2011

Thank you all for inviting me to participate. My deputy Lori Garver also wanted to be here, and she sends her best wishes.

It's amazing and gratifying to see so many people with a passionate interest in the International Space Station (ISS). The ISS is the centerpiece of our human spaceflight endeavors for the coming decade – it's our anchor for human exploration. The station's extension to at least 2020 will allow it to reach its full potential as an unprecedented orbiting laboratory.

Most of you know that this engineering marvel almost didn't make it to orbit – hanging on by only one crucial House vote so many years ago. But now we've had humans living aboard ISS for more than ten years, 24/7. Through turmoil and natural disaster on Earth, the station has continued its 16 orbits per day, traveling about the distance to the moon and back, a beacon of international cooperation and of what we can achieve when we set our sights on grand challenges.

With ISS as our premier laboratory for microgravity research and technology demonstrations, over the next 10 years, we'll continue to collaborate with other nations to live and work together in space, and perform cutting edge research and technology demonstrations that are critical to our eventual exploration into deep space with humans. The ISS is the most realistic analog we have to test life support and other technologies, ensuring they function in space and most importantly, that they are reliable. A journey to Mars will require robust systems ensuring that crews stay healthy and safe. The station is the start of our journey outward.

I've said before, our ultimate goal is Mars, but we have a lot of work to do before we can get there with humans. After all, with today's technology it would take 8-12 times the mass of the station to send humans on one roundtrip mission to the Martian surface. So, for starters we'll need lighter-weight materials, more efficient in-space propulsion systems, and we'll need to learn to "live off the land" so that we can pack less for this grand journey.

Putting a human mission on the surface of the red planet has been compared to precisely landing one two story house on a small island in the Pacific right next to another that was autonomously landed in advance. This will require a host of technologies beyond the systems we use today to land our robotic explorers.

We do have the benefit today of extensive maps and information about the Martian surface. When the Mars Science Laboratory, also known as Curiosity, starts roaming around the surface next year, it's going to add to the massive amount of data we have about Mars – its geography; its atmosphere; its chemical makeup; radiation levels at the surface; and much more.

We also hope to field a sample return mission from Mars with international partners before we ever send humans there.

All of that is to say, there's going to be a lot going on at our ultimate Solar System destination in the coming years, but let me get back to our starting point.

The ISS is going to give us a lot of good information that we will use to expand our human exploration efforts. Foremost among that information is a deeper understanding of human health in space. Among many things, we have a lot to learn about radiation and bone loss; high-reliability life support; and how human beings react to being in a closed environment in space for months, even years, at a time.

The nonprofit organization we're creating to enhance our use of the U.S. side of the station as a national laboratory will help us reach more potential users and strategize about our own work on station. We're going to get industry, academia, and other government agencies more involved. Their expertise, enthusiasm, innovation, and entrepreneurship will greatly advance our national goals. Through the science, research, and technology demonstrations conducted on the National Lab, we will build foundational knowledge, advance economic competitiveness, and prepare for the grand journeys ahead.

Just yesterday, we received our first decadal survey on Biological and Physical Sciences in Space, “Recapturing a Future for Space Exploration: Life and Physical Sciences Research for a New Era”, that will provide us

guidance to develop a ten-year strategic plan to maximize utilization of the ISS.

You may know a lot of the specs of the ISS. In addition to the U.S. Destiny laboratory and Russian Svezda service module, there is the Canadian robotic arm and dexterous manipulator, and the European Space Agency's Columbus and Japan Aerospace Exploration Agency's Kibo laboratories. ISS houses 34 research racks. These include super cold refrigerators; human research facilities that enable researchers to study and evaluate the physiological, behavioral, and chemical changes induced by long-duration space flight; special racks for working with liquids and hazardous materials; a growth chamber for growing plants or microorganisms or even small arthropods. ISS also has 22 external locations for experiments. The Japanese plan to have fish in space. The Russians have a greenhouse – you get the idea. There is an incredible diversity of research going on 250 miles above us with incredible potential.

Any mission to Mars is likely to be a global effort and the partnerships and friendships we have developed in the construction and operation of the ISS have forged a path for us that we could not have foreseen at the station's

inception. The ISS is a blend of goals among the participating space agencies and it is truly beautiful in that regard alone. As we approach the massive undertaking of a Mars mission, I look forward to the many contributions that others – partners from internationals, industry, and academia – will bring to the table.

Certainly as a child, I could not have imagined that a vehicle the size of a football field, with more livable room than a conventional five-bedroom house would orbit above us. The U.S. solar array surface area is nearly an acre -- and large enough to cover eight basketball courts. As easy as we've made construction look, I don't think enough people realize that we have created one of the most amazing engineering achievements in human history. Last year the National Aeronautic Association recognized the ISS with its Collier Trophy, which honors advances in aviation. In many ways, the ISS traces its lineage back to the first planes and leaps forward in propulsion and space technology. Looking forward, the ISS will help us make the great leaps that in the last century produced an aviation industry from the Wright Brothers' first 12-second powered flight, and that first sent us peacefully into space a little more than a decade after the first long-

range rockets – originally developed for war – were exploding on launch pads.

Just take a look at the station's water recovery system as well as the extensive knowledge we've gained about human-robotic interaction. Exciting examples of developments are technologies such as the lab on a chip that enables explorers to quickly examine their environment for pathogens and experiments with microencapsulation that enable drugs to be targeted to problem areas. These have all come from the station just during its ramp-up period. They're applicable to the lives of people here on Earth even as they're helping us make the next advances in space exploration.

A mission to Mars will require the utmost of our innovation, skill and perseverance.

But it's the kind of challenge NASA relishes and to which we've always risen throughout our history. In parallel to the development of the launch and crew vehicles required for deep space exploration, NASA will develop the in-space technologies required for such journeys. We will build the

technological foundation from which to reach an array of destinations. And, as I mentioned, it will be an international effort, with many nations joining us in the global space exploration enterprise.

What NASA does best is focus on the space frontier – those things that aren't possible yet, but are achievable if we work hard toward them and marshal the best of our energies and talents as a nation – as a global people concerned with human achievement and exploration.

Even in these difficult fiscal times, the President’s Fiscal Year 2012 budget reinvigorates NASA as part of a national focus on research, technology, and innovation. It gives us the means to win the future. And by dedicating ourselves to challenging missions like Mars, we'll be winning that future by helping our nation create new capabilities, high tech jobs and new job fields, and inspiration for a whole new generation.

Right now, our number one priority in the near term is safely flying out the shuttle and carrying out our research and development activities on the ISS in a manner that maintains the safety and well being of our U.S. and international partner flight crewmembers.

We are working steadfastly to plan an integrated, comprehensive human space flight program. This will include the heavy-lift rocket, or Space Launch System (SLS), and multipurpose crew vehicle, or MPCV, that will be crucial to exploring all of our beyond-Earth destinations. We will release plans for these critical spaceflight systems later this year. We will leverage the assets and experience gained from the Constellation Program to ensure early successes with the SLS and MPCV.

America is the nation we are today because of the technological investments made in the past fifty years. Our lives have been greatly improved by directing scarce resources toward exploring space in ways that spin off technologies for the betterment of humankind. Knowledge from weather and other Earth science spacecraft; efficiency improvements in both ground and air transportation; biomedical applications – they have all benefited from our nation's investment in exploration. NASA's space technology makes a difference in our lives every day and can be a spark to an economy that is becoming more technology-based over time.

NASA's successes over the past 50 years have inspired countless people to pursue science, technology, engineering, and mathematics careers and the outcome of NASA’s endeavors, both in technology advancements and intellectual capital, has transformed our world. NASA has had its failures as well, but in every case, we’ve done our best to learn from those failures and incorporate those lessons into our follow-on work.

NASA's renewed focus on innovation and technology is vital. By investing in high payoff, disruptive technology that industry cannot tackle today, NASA matures the technology required for its future missions in aeronautics, science, and exploration while proving the capabilities and lowering the cost for other government agencies and commercial entities that want to get to space.

Consider, for a moment, how the architectural options for human exploration of our solar system will change when reliable commercial access to low-Earth orbit, propellant depots, inflatable habitats, and advanced in-space propulsion technologies are available. For our science missions, consider the improvements possible from new optics, lightweight materials, structures, and power systems and high-bandwidth

communications. Consider the efficiency gains in radiation shielding and life-support systems that may become possible from improved knowledge of human adaptability to the space environment gained through scientific experiments on the ISS. All of this applies to human travel to Mars.

The President's FY2012 Budget funds a diverse array of human spaceflight programs that maximize our use of current capabilities such as the ISS, facilitate innovative approaches to ensure U.S. leadership in low Earth orbit, and position us to explore the frontiers of deep space.

As we increase our capabilities, we'll apply them to many different types of missions and move on to the next challenge incrementally. We need to get started on a lot of these technologies today and we will.

Over the next decade, innovative technology investments are required to bring future missions such as exploration of near-Earth objects, the Moon, or Mars, within our reach. These transformative technologies will reduce the cost and risk of future missions.

Achieving great things also involves taking informed risks. Landing on Mars will never be a low-risk venture. But an informed risk-taking strategy, commensurate with the agency's goals and expectations is not only acceptable, but required. How else can we accomplish the grand achievements our nation has come to expect of NASA?

At NASA, a goal of the President's innovation strategy is to reposition the aerospace community on the cutting-edge, pushing the boundaries of the aero sciences with the technical rigor our nation expects of its space program. Innovation, education, and technology development will be essential to America's success in the 21st century global marketplace. They will be required for us to reach new destinations in the solar system and are the engines that will create economic opportunity and lower costs for these massive undertakings.

This is where we are today. I'm looking toward Mars, but I'm looking at it as part of a bigger picture. We can't have tunnel vision. We will achieve this vision through stepping-stones, and produce value for the American taxpayer on the road to Mars.

I know my granddaughters will be witnessing humans arriving at Mars. Like the President, I believe such a journey is possible in my lifetime. But what I know today is that we have an amazing engineering resource in space right now – the ISS. And we're moving out on the innovation and technological breakthroughs that are required to get us to our neighboring planet.

I look forward to hearing what all of you have to say about humankind's next big adventure. Thank you.