

Remarks as delivered by The Honorable Shana Dale  
NASA Deputy Administrator  
St. Louis Future Forum  
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Thank you all very much. I am delighted to be here today in the “Show Me” State of Missouri – which has always been the gateway to the West. I would especially like to thank Doug King and his staff here at the St. Louis Science Center for being such wonderful hosts for this event. I would also like to extend NASA’s appreciation to our sponsors, Boeing, and Raytheon, and our key partners. They include: Washington University, the National Institute of Aerospace, the Missouri Space Grant Consortium, Innovate St. Louis, Information Technology Coalition, the Missouri Venture Forum, the Missouri Chamber of Commerce and Industry, St. Louis Regional Chamber & Growth Association, the Ferguson-Florissant School District, the Cooperating School District, and the Ansari X-Prize Foundation.

### **AMERICA’S SPACE PROGRAM**

Participating in our nation’s space program has allowed me to fulfill a life-long dream. I think all of us at NASA are attracted to the space program by the same things that keep the American people so intrigued and inspired by our mission: the excitement of discovery, that irresistible human impulse to explore beyond the next horizon, and the feeling of being a part of something grander than ourselves. Ultimately, I believe, that is what motivates this great voyage of discovery.

This year we’re celebrating NASA’s 50<sup>th</sup> anniversary, and for the last five decades we’ve made amazing achievements in space. We’ve seen complete hurricanes for the first time; we’ve stepped on to the surface of the Moon; and we’ve seen to the far reaches of the universe. We’ve discovered evidence of dark matter and dark energy, and with that, realized that all we can see is a tiny fraction of what is actually out there. There is another side of NASA, however; a critical part of our story, which does not often receive the accolades, or attention given to our exciting missions and discoveries.

## **SPACE ECONOMY**

This is what we call the “Space Economy” – the very tangible and pervasive ways in which exploration of space affects our daily lives here on Earth. The Space Economy is the full range of activities that create and provide value to human beings in the course of exploring, understanding, and utilizing space. Space is pervasive in our lives, invisible yet critical to so many aspects of our daily activities and well-being. In fact, the Space Economy impacts just about every aspect of how we live, work, and play – from weather and climate monitoring to space-based security applications that keep us safe. When we pay for gas at the pump, draw cash from an ATM, or listen to satellite radio, we can experience the benefits of the Space Economy.

Space exploration has created new markets and new technologies that have powered our economy and changed our lives in many ways. According to a 2007 U.S. Space Foundation report, the Space Economy generated nearly \$220 billion in total revenues worldwide, up nearly 20 percent from the previous year – a phenomenal rate of growth.

So what does this have to do with NASA? Our mission is not to create commercial products or to stimulate the economy, although our work has often had those effects. Our focus is not on healthcare or medical research for the general public, yet we have made significant contributions in those areas. We are not the Nation’s environmental agency yet we provide critical information that advances environmental understanding. The simple answer is that exploration of space demands that we push the limits of knowledge, technology and precision in ways that we could not have originally imagined and the benefits go far beyond our space exploration mission. NASA’s contributions to the Space Economy are through the three principal topics we will be discussing today: *Inspiration, Innovation and Discovery*.

## **INSPIRATION**

Let’s face it. It all begins with education and because space exploration is so exciting and so cool, space exploration inspires kids to go into science, technology, engineering and math. Generations of students have been inspired to pursue these studies for a glimpse into the mysteries of our universe. Over the last fifty years, many of those students have gone on to power every form of innovation from developing the computer chip to

mapping the human genome. Maintaining our Nation's leadership role in the global economy requires that we encourage more American students to focus on these fields. Using the inspirational pursuit of space exploration to spark the imagination of our youth is critical for keeping this Nation competitive and creating a scientifically literate populace.

The example of youth who dream big and achieve great things is also essential to your economy right here in St. Louis. Success in space starts in the classroom. That's why we're investing significant resources in education. For example, at Washington University here in St. Louis, we have funded research to help us remotely measure the mineralogy and characterize the rock formations on Mars, as well as to assist environmental scientists to better understand how particulates affect air quality. As you may know, the St. Louis Science Center is one of the largest and most respected science centers in the Nation, providing groundbreaking, award-winning education programs tailored to support national and statewide science curricula and standards. For NASA, for the Nation and for communities such as St. Louis, inspiring students to pursue science, technology, engineering and math fields, as the St. Louis Science Center does, is critical to economic growth and global competitiveness. I look forward to a solid discussion today on how best to build the next generation of innovators and scientists.

## **INNOVATION**

That leads me to innovation. *NASA drives innovation.* Since our mission demands putting humans, robots and rovers into harsh, extreme, and unforgiving environments, we must push the very limits of technology. This is often where we realize the greatest innovations. In October 2007, Space Shuttle Discovery was docked with the International Space Station, and while unfurling one solar array, a tear occurred. Engineers on the ground had to assess, just like during Apollo 13, what material was on board to repair the array. Repair was essential to stabilize the array and allow us to fully deploy it. The solution, using aluminum strips, tape and cord to create "cuff links," was a real testament to innovation and ingenuity. It was also a challenge because the array was "live," with no way to turn off the power. To avoid electrocution, the tools to make the repair were wrapped with non-conducting tape. And the solar array was successfully repaired during a 7-hour spacewalk by Scott Parazynski.

This was an amazing example of NASA ingenuity. But there are less visible achievements as well, like creating the key technological breakthroughs that fuel local economies and keep our nation competitive. Many of you may have heard of NASA spin-offs: specific technologies the agency has developed for its missions that the private sector has then picked up and refined or transformed for commercial use. There are over 1,500 documented NASA-derived technologies. For instance, early semiconductor companies were challenged by the Apollo program to develop integrated circuits that met stringent quality and performance requirements. In addition, they had to be smaller and more powerful than ever before. That straightforward technical requirement was catalytic. It started a cascade of developments leading to countless new products and entirely new markets.

### **SPACE-DERIVED TECHNOLOGIES**

Some of those space-derived technological benefits hit close to home here in Missouri: one example has been a life-saving innovation in space and on Earth. Monsanto, a Missouri-based company, developed a chemically treated fabric called Durette, which will not burn or produce noxious fumes. Such fabric is critical in the oxygen-rich, pressurized environment of a spacecraft. This nonflammable fabric was selected as a material for Apollo astronaut garments and was also used in the Skylab and Shuttle programs. Such fire-resistant suits are critical for astronaut safety. The fibers and fabrics have evolved and been modified over the years, making them lighter in weight and expanding their uses for non-space-related activities to those such as firefighting. The suits protect our firefighters as they put their lives on the line to protect us. They are also used by drivers, refuelers, and crew chiefs in the auto racing industry.

NASA-derived technologies are also making a difference here and abroad. For instance, a robot created for Mars exploration has been further developed into a tactical reconnaissance robot. These robots are saving the lives of our service men and women. Our U.S. troops use these robots in Afghanistan and Iraq to clear caves and bunkers, to cross minefields, and to deal with the dangers of improvised explosive devices. According to iRobot, the company that makes them, soldiers have given their robots nicknames. The *Washington Post* has reported that the robots' military keepers have become so attached that they have even awarded the robots with unofficial "purple hearts" and "battlefield promotions."

NASA-derived technologies are also improving the conditions of people in the developing world. Water recycling and filtration systems engineered to sustain astronauts living on the International Space Station have been adapted to provide safe, affordable drinking water in poor or remote regions of the world. These are only a few examples of what NASA technologies mean for all of us here on Earth. These advances also benefit St. Louis, and the State of Missouri, in direct ways. Over the past five fiscal years, NASA has invested over \$83 million in the state of Missouri. NASA's investments driving these innovations – are happening on a budget with a funding level that is six-tenths of one percent of the federal budget. With this budget we are, among other things, engaged in:

1. Embarking on the human journey back to the Moon for a mission that is vastly different from Apollo. About 12 years from now, we'll have people living on the Moon, and will learn from this valuable experience the skills to enable us to take the next steps to go to Mars and beyond;
2. Observing our Earth from the unique vantage point of space, which is essential for climate change research, disaster response and mitigation;
3. Conducting fundamental research in aeronautics that will lead to quieter, safer, and more efficient airplanes;
4. Expanding our knowledge about the universe and our place in it, through projects like the Hubble Space Telescope;
5. Leading the largest international cooperative endeavor in the history of science and technology – the International Space Station; and
6. Engaging the commercial aerospace industry in an exciting initiative to facilitate U.S. private industry development of reliable, cost-effective access to low Earth orbit. Through these efforts, NASA is helping our high tech industries, a major force in U.S. economic growth; stay on the cutting edge of competitiveness.

## **DISCOVERY**

From innovation, NASA opens the door to new discoveries. NASA's pursuit of *discovery* pushes the extremes of science to answer fundamental questions; to achieve a greater understanding of the universe; and to determine what is happening to the Earth's climate and why. We have discovered a great deal through NASA's research into lightweight composite materials, quieter and cleaner aircraft engine technologies, and advanced air traffic management tools. These are all making air travel safer, more efficient and more environmentally friendly. The discoveries from our aeronautics research program have contributed to innovations like winglets. Winglets are vertical extensions of wingtips that improve an aircraft's fuel efficiency, cruising range, as well as the space required at the airport. They're being used around the world on all types of aircraft.

A more recent NASA/industry research collaboration has resulted in a new engine nozzle design, which reduces engine noise. In space exploration, we are in an exciting new age of discovery, going to the Moon, Mars, and beyond. In cooperation with our international partners, we'll construct an outpost there, a sustained human presence on the Moon. Let me emphasize those words "sustained human presence." NASA is pursuing discoveries that will enable us to accomplish this endeavor. Outposts on the Moon, as well as travel to Mars, will require lighter materials, manufacturing techniques with little waste or pollution, and even better methods of recycling and reuse, contributing to the development of sustainable systems in our own world.

Inspiration, innovation and discovery: each is interdependent and through a circle of renewal they combine to create a formula for future growth, prosperity and an improved quality of life. This symbiotic relationship forms the essence of the Space Economy and it is through inspiration, innovation, and discovery that NASA makes its most fundamental contributions to life here on Earth.

## **CONCLUSION**

Space exploration is about imagining the future. It's about taking new steps, exploring beyond our limitations, creating something bigger and better than ourselves. Along the way, there are countless benefits, invaluable discoveries and technologies borne through the trials of exploration that enhance our lives on Earth. That's been true for NASA's first fifty years.

And I have no doubt that it will be true in the next five decades. Quests of discovery are as old as humanity itself.

We go to see what is beyond the horizon, to test ourselves against the unknown, to face our fears and overcome the challenges using all of our ingenuity and determination. We will continue our quest for new discoveries through the James Webb Space Telescope, which will find the first galaxies that formed in the early Universe, connecting the Big Bang to our own Milky Way Galaxy. We will pursue our aeronautics research program to make our air transportation system safer, cleaner, and more efficient. We will establish a sustained human presence on the Moon, place the first footprints on Mars, and then go even further.

I look forward to a morning of discussion about the future. A future brightened by the prospect of a growing space economy and continued space exploration, and all the promise that this holds for the people of St. Louis, for our nation and for our world.

Thank you.