

**Remarks as delivered by The Honorable Shana Dale
NASA Deputy Administrator
San Jose Future Forum
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Thank you all very much. I would like to especially thank Dr. Peter Friess and The Tech Museum of Innovation for being such wonderful hosts and express NASA's appreciation to our sponsors and key partners. I also want to extend a special welcome to all of our participants in Second Life.

This is the first time we are holding a Future Forum in the virtual world, Second Life, and our Second Life attendees will also have the opportunity to take part in our panel sessions. It is an honor to have this dialogue both virtually and at The Tech Museum of Innovation, which affords approximately 400,000 visitors, including 80,000 students, the opportunity to be inspired every year.

The mission of this museum is "to engage people of all ages and backgrounds in exploring and experiencing technologies affecting their lives, and to inspire the young to become innovators in the technologies of the future." NASA's mission is to explore, and we meet our mission through inspiration, innovation, and discovery.

This year, we're celebrating NASA's 50th anniversary. During the last five decades, we've made amazing achievements. We've seen complete hurricanes for the first time, we've stepped onto 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 we have seen only a tiny fraction of what is actually out there.

Yet, there is another side of NASA – a critical part of our story, which does not often receive the accolades or attention given to our exciting missions and discoveries. This other side of NASA contributes to what we call the "Space Economy" – the very tangible and pervasive ways in which the 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 use our GPS units to keep us from getting lost, withdraw cash from an ATM, or listen to satellite radio, we experience the benefits of the Space Economy.

Today's Future Forum is about how NASA and the Space Economy contribute to *your* community. Space exploration has created new markets and new technologies that have spurred our economy and changed our lives in many ways. According to a 2008 U.S. Space Foundation report, the Space Economy generated more than \$251 billion in total revenues worldwide, up 11 percent from the previous year.

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 health care or medical research for the general public, yet, we have made significant contributions in this area. 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. Likewise, California’s Silicon Valley is a launch pad for high-tech ideas and businesses, many of which were inspired by NASA discoveries and innovations.

NASA contributes to the Space Economy through the three principal topics we will discuss today: *Inspiration, Innovation and Discovery*.

Let’s face it. It all begins with education and because space exploration is so exciting and so cool, it inspires kids to go into science, 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 50 years, many of these students have gone on to power every form of innovation from advancing the development of the computer chip to mapping the human genome. So, today I am pleased to announce a partnership between NASA and the National Institute of Aerospace, to develop NASA Education TV, a new education television program for distribution on NASA Television and the Internet beginning this fall.

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.

I look forward to a solid discussion today on how best to inspire the next generation of innovators and scientists.

Inspiration leads directly to innovation. NASA *drives innovation* by tackling hard, complex problems and overcoming seemingly insurmountable obstacles. Because 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.

Here is an example we can all relate to – NASA’s need for technology to look at images of the far reaches of the universe has enhanced our ability to look, literally, within ourselves. A technology NASA has used since 1966 is called VICAR, Video Image Communication and Retrieval, software -- developed at the Jet Propulsion Laboratory in Pasadena, one of ten NASA centers across the country.

VICAR has been improved many times over the last four decades. This software enhances our understanding of the images taken from spacecraft such as the images taken from the Mars Reconnaissance Orbiter that suggest water once flowed on Mars. Researchers at JPL partnered with scientists from the University of Southern California to use this technology to enhance diagnostic imaging in health care.

The software is now used with ultrasound to better understand images of arteries. While this imaging technology was being tested for application with ultrasound in the mid-1990s, Gary F. Thompson, an athletic entrepreneur was preparing to run the first in a series of marathons to celebrate his 50th birthday. Although he had a family history of heart disease, his doctors had given him a clean bill of health after a battery of medical tests. When he ran the first marathon, however, he suffered a heart attack.

He heard that the University of Southern California Hospital was testing a new ultrasound imaging technology, using the VICAR software. He went to this hospital for the test and intentionally did not inform them of his family history or his recent heart attack. With this new technology, the hospital test discovered what all the previous tests failed to uncover. It showed that he was indeed at risk of a heart attack or stroke due to the thickness of his artery walls.

He was so impressed that he started a company, Medical Technologies International Inc., (MTI) to make this new technology more widely available. MTI's ArterioVision software is now being used with ultrasound to measure the thickness of the two inner layers of the carotid artery which is located on each side of the neck and supplies oxygen-rich blood to the brain. This space technology is now helping to identify atherosclerosis which is a condition where fatty material collects and hardens the arteries, and is the major cause of heart attacks and strokes.

The American Heart Association has called atherosclerosis the "silent killer," because it shows no symptoms until it is often too late. This non-invasive tool allows doctors to actually determine the health of a patient's arteries through a painless technique that provides tangible information. ArterioVision software is now used in all 50 states and many countries around the world and was just inducted into the Space Technology Hall of Fame in April.

This is a technology that we refer to as a "spinoff" – a specific technology the agency has developed for its missions that the private sector then picks up and refines or transforms for commercial use. This is not a highly visible achievement of America's space program but it is critically important. It represents only one of over 1,600 documented NASA-derived technologies that fuel local economies and strengthen U.S. economic competitiveness. And many of these technologies are created through the partnership of NASA, universities, and the private sector.

The National Biocomputation Center is a joint partnership between Stanford University and NASA's Ames Research Center. Researchers from the National Biocomputation Center formed a spinoff company in 2005, known as Intelesense Technologies that is employing networks of wireless sensors for air, water, weather, and imagery. This information is then integrated with other data sources to help understand the interrelationship among areas—that includes preserving the environment, monitoring waterborne illnesses, detecting infectious diseases, and providing remote health care.

The current projects of Intelesense range from protecting delicate ecosystems, such as forested mountains in Hawaii, to monitoring water quality in remote regions of the world like the villages of Vietnam, to tracking emerging infectious diseases like Avian influenza throughout the world. NASA-derived technologies are also directly improving the living conditions of people in the developing world.

The 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 where clean water can mean the difference between life and death.

These are only a few examples of what NASA technologies mean for all of us here on Earth, but it is by no means an exhaustive list. The point is that technology advancement doesn't recognize boundaries. The same capabilities that apply "out there" in space also apply directly to our most critical needs back here on Earth.

Those advances are then refined, adapted, or transformed to meet the challenges we face from preventing heart attacks to detecting infectious diseases to providing clean drinking water.

These contributions also benefit San Jose and the State of California. In FY 2007, NASA spent over \$3 billion in the state. This funding went to industry, education, and non-profit institutions. Additionally, California hosts a robust space entrepreneurial industry and three of the 10 NASA Centers -- Ames, Dryden, and JPL.

Each Center contributes to the Constellation program – the program that will enable us to return to the Moon and then to Mars and beyond. NASA’s Centers are working hand-in-hand with California’s academic institutions and commercial industry. These investments, as well as our efforts in areas like Earth and space science and fundamental aeronautics research, are all helping our high tech industries stay on the cutting edge of competitiveness and the investments are driving U.S. economic growth.

NASA’s investments driving these innovations are happening on a budget with a funding level that is less than six-tenths of one percent of the federal budget. With this budget, we are embarking on the human journey back to the Moon for a mission that is vastly different from Apollo. About twelve years from now we’ll live on the surface of that world, and learn enough to take the next steps. We’re observing our Earth from the unique vantage point of space, which is essential for climate change research and disaster response and mitigation. We’re conducting fundamental research in aeronautics that will lead to quieter, safer, and more efficient airplanes. We’re expanding our knowledge about the universe and our place in it, through projects like the Hubble Space Telescope, and we’re leading the largest international cooperative endeavor in the history of science and technology – the International Space Station.

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.

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. NASA is pursuing discoveries that will enable us to accomplish this endeavor. To survive on the Moon’s surface, we must find ways to create, collect, store and use energy without access to fossil fuels. Other sources of energy must be developed into practical resources that humans can use in extreme environments. As we continue to explore new sources of energy and delivery methods, these efforts can help to address the pressing demand for energy right here on Earth.

Space exploration demands cleaner and more efficient sources of energy that can operate in extreme environments without toxic effects. The potential impact of alternate, clean energy sources is so great that we can hardly imagine it, affecting the lives of not only Americans but of every person on the face of the planet.

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. That’s what will happen in the future, but what is happening now? How is NASA’s work, right now, contributing to the sustainability of our planet? In space travel, physical space is limited, weight is critical, and resources are severely constrained. Every watt of energy is accounted for; every resource is transported and monitored.

Space exploration drives the development of technologies with minimal impact to these tiny ecologies – and, by extension, to the ecology of Planet Earth. These technologies include advanced recycling techniques; treating waste and converting it back into usable resources, as well as new, green power systems. But, perhaps NASA’s biggest contribution to sustainability is the development and operation of Earth-observing satellites.

NASA satellites supply more global climate change data than those of any other organization in the world. It is only through NASA’s investments in measuring the forces and effects of climate change that we have such insights and understand its implications to our home planet.

Based on NASA satellite data, we have not only seen the receding ice sheets of Greenland and Antarctica, but have quantitatively measured how fast these ice sheets are melting. NASA scientists have observed the smallest Arctic sea ice coverage ever recorded in 2007, and when comparing that ice coverage for the months of September over the past two years, the loss of sea ice exceeds the combined geographical areas of California and Texas.

In regards to nitrogen oxide emissions, one of the greenhouse gases that form smog, NASA sensors helped researchers document their doubling in Asia from 2000 to 2006. NASA has fourteen Earth-observing satellites in orbit today. Another seven Earth science missions are under development, three of which will launch over the next 13 months; and earlier this year, we initiated formulation activities for five Decadal Survey missions, expected to lead to five new launches before 2020. All in all, NASA invests approximately \$1.3 billion every year in Earth science. As we continue to explore, we’re making new discoveries along the way that are helping our planet.

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.

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 for the next fifty years. 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 challenges using all of our ingenuity and determination. That’s the spirit of exploration. And that’s why the space program shows us at our best -- dreaming, daring, and achieving.

I look forward to a day 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 holds for the people of San Jose, for the State of California, for our nation and for our world.

Thank you.