

**Remarks as delivered by The Honorable Shana Dale  
NASA Deputy Administrator  
California Space Day  
Sacramento, California  
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Thank you Andrea for that kind introduction. I'm delighted to be here with you today in the Golden State of California. California Space Day is important because it allows public officials and the aerospace community to discuss space policy and the space economy.

Tomorrow, as part of NASA's Future Forum series, a day-long forum will be held in San Jose on the role of space exploration in advancing science, engineering, and math education and the economy. As you may know, we at NASA are celebrating our 50<sup>th</sup> anniversary this year. And the Future Forums are a part of our celebration. We're holding only seven of them this year in seven cities around the country.

California has played a critical role in space exploration and continues to do so today. California is home to three of the 10 NASA centers located throughout the country and hosts a robust space entrepreneurial industry. NASA and California have a long successful history together.

During 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 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 exploration has created new markets and new technologies that have spurred our economy and changed our lives in many ways. These benefits are 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, or withdraw cash from an ATM, or listen to satellite radio, we experience the benefits of the Space Economy. According to a 2008 U.S. Space Foundation report, the Space Economy generated more than \$251 billion in total revenue 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 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. 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.

These space innovations are then refined for the challenges we face here on Earth. For instance, algorithms developed to analyze images from Mars have been adapted to an advanced diagnostic tool for heart disease that can detect arterial blockage earlier and more effectively than other techniques.

Critically-ill heart patients waiting for heart transplants are now being kept alive by implanted heart pumps developed by supercomputer experts from NASA's Ames Research Center, engineers from NASA's Johnson Space Center, and Dr. Michael De Bakey. Using the same methodologies we've been employing to analyze fuel and oxidizer flow through rocket engines, the NASA team analyzed blood flow through the heart pump.

And thanks to high resolution, real time imaging technology derived from the Hubble Space Telescope program, biopsies for breast cancer can be performed with a needle instead of a scalpel. The needle biopsies leave only a small mark instead of a large scar, cost significantly less than traditional biopsies, and can be performed in a doctor's office as opposed to an operating room.

These are the technologies 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. These represent only a few of over 1,600 documented NASA-derived technologies that fuel local economies and strengthen U.S. economic competitiveness.

And 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.

These contributions benefit the state of California. In FY 2007, NASA obligated over \$3 billion in the state. This funding went to business, education and non-profit institutions. NASA Centers are working hand-in-hand with California's academic institutions and commercial industry. And each NASA Center is contributing to the Constellation program – the program that will enable us to return to the Moon and then to Mars and beyond.

NASA's Dryden Flight Research Center located near Palmdale, California is the lead for the abort flight test integration and operations for our crew exploration vehicle called the Orion. The Jet Propulsion Laboratory, located in Pasadena, California will support Orion's thermal protection system advanced development. NASA's Ames Research Center, located at Moffett Field, in California is the lead for Orion's thermal protection system and the launch abort system software requirements, interface, and verification for Ares I, the crew launch vehicle. Ames is also the home to NASA's new Lunar Science Institute, which will advance our human exploration efforts on the Moon.

These investments, as well as our efforts in areas like Earth and space science and fundamental aeronautics research, are helping our high tech industries stay on the cutting edge of competitiveness and thereby driving U.S. economic growth. And 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, in about 12 years from now we will establish an outpost on the surface of that world, and learn what is needed to take the next steps;
- Observing our Earth from the unique vantage point of space, which is essential for climate change research and disaster response and mitigation;
- Conducting fundamental research in aeronautics that will lead to quieter, safer, and more efficient airplanes;
- Expanding our knowledge about the universe and our place in it, through projects like the Hubble Space Telescope; and Leading the largest international cooperative endeavor in the history of science and technology – the International Space Station.

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. 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? 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.

All in all, NASA invests approximately \$1.3 billion every year in Earth science. NASA's Earth-observing satellites also helped monitor the spread of the terrible wildfires that ravaged Southern California. We sent an unmanned aerial vehicle equipped with thermal-infrared sensors and sophisticated real-time transmission equipment over the fires. This vehicle, named Ikhana, was built by General Atomics Aeronautical Systems, a San Diego company, and obtained by NASA in 2006. Ikhana is operated through a cooperative effort between two of the California NASA Centers: Ames and Dryden. The drone peered through heavy smoke and darkness and found hot spots and flames. It then transmitted the information to the National Interagency Fire Center which distributed the imagery to fire incident commanders over the Internet. That information gave firefighters a much better understanding of the situation, and aided commanders in allocating firefighting resources.

As we continue to explore, we're making new discoveries along the way that are helping our planet. 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.

This has been true for NASA's first 50 years, and will no doubt be true for the next 50 years. This is why the space program shows us at our best -- dreaming, daring, and achieving -- and all the promise that holds for the state of California, for our nation, and for our world.

Thank you.