



The Best Place to Work, Two Years in a Row

This year NASA helped transform access to low Earth orbit even as one of our venerable spacecraft reached the boundaries of the solar system and we moved ahead on technologies that will help us carry out the asteroid mission we announced in April and move on to Mars.

I want to thank each of you in our NASA Family for your contributions to our mission and the great value you are delivering to the American public. Your hard work and commitment to the ambitious space program we are implementing has resulted in our being voted for the second consecutive year THE Best Place to Work in the Federal Government, according to a survey conducted by the Partnership for Public Service. <http://bestplacestowork.org/BPTW/rankings/overall/large>

All of the credit for this success goes to you, the folks on the frontlines of keeping the United States the world's leader in space exploration. In addition to our overall ranking, several NASA centers have once again been ranked well in the component part of the survey. Employees of the Stennis Space Center in Mississippi have again put the center in the top rankings, at number two. Congratulations to everyone at Stennis, and thank you for showing your NASA pride.

Even in a time of great change and transition, you have stayed focused on what it takes to get the job done.

Aeronautics – the First “A” in NASA

Here on Earth, we continued to mark progress in developing the next generation of air transportation systems (NextGen). Now, a new computer software tool developed by NASA's aeronautical innovators -- the Precision Departure Release Capability, or PDRC -- allows commercial aircraft to be sequenced for takeoff so that they are able to climb directly to their enroute travel altitudes instead of being required to make multiple intermediate level-offs as in the past. NASA officially presented this innovative software to the Federal Aviation Administration (FAA) during a ceremony at the FAA's headquarters in Washington on August 6. With PDRC, controllers will be able to improve the overall efficiency of air traffic management by reducing missed or delayed departures and allowing more aircraft to depart within a given timeframe. Prior to the transfer of PDRC to the FAA, NASA transferred another technology that, like PDRC, tackles an air traffic management challenge, only this time related to the congested airspace near airports that limits the number of incoming aircraft and increases local noise, emissions and fuel waste. Developed and field-tested by NASA in partnership with the FAA, the Efficient Descent Advisor, or EDA, is intended to help air traffic controllers better manage incoming traffic to reduce delays while avoiding flight path conflicts between aircraft.

When FAA fully implements these innovative NASA-developed tools at our nation's major airports, the U.S. commercial airlines would save over \$300 million per year in fuel consumption. NASA also announced a new Aeronautics strategy with six areas of focus to help address upcoming challenges in global air transportation. We tested alternate jet fuel in our DC-8 flying laboratory; selected eight large scale technology demonstrations to advance concepts for reducing aviation impact on the environment; chose six companies to partner on advanced composite materials research to enable a significant reduction in development to certification time; and flew the X-48C hybrid-wing body subscale aircraft to demonstrate concepts for cleaner and quieter air travel.

Commercial Space Progress

A little more than two years after the end of the Space Shuttle Program, we have returned International Space Station resupply missions to the United States in a powerful partnership with American companies SpaceX and Orbital Sciences who are investing here and creating good-paying jobs for our workers. We are committed to launching American astronauts from U.S. soil within the next four years, bringing this important work back home where it belongs.

Recent progress includes key milestones in commercial crew development met by three American companies: Boeing, SpaceX and Sierra Nevada; a November 19 Request for Proposals on the Commercial Crew Transportation Capability contract (CCtCap), designed to ensure commercial companies meet NASA's safety requirements for transporting NASA and international partner crews to the International Space Station; unfunded Space Act Agreements with other potential commercial providers; and creation of a Space Technology program focused on breakthrough innovations that will change future transportation options. These accomplishments have been bolstered by the extension of International Space Station operations to 2020, enabling expanded commercial and research opportunities.

Enabling Deep Space Exploration

The primary destination of these commercial launches, the International Space Station, celebrated 15 years on orbit. Humans have been in constant habitation aboard the station since October 2000, and that's an incredible, historic feat. Interest in human spaceflight remains extremely high, and this year we welcomed new astronaut candidates from a near-record applicant pool of more than 6,000. I'm delighted to report that half of the class is women, the highest percentage in any class to date. These are the explorers who will first fly on commercial rockets to low Earth orbit and help us execute missions to an asteroid and Mars.

2013 was a year of progress toward new capabilities as the agency's new Space Launch System (SLS) heavy lift rocket completed its preliminary design review and the *Orion* multipurpose crew vehicle reached many milestones on its path to undertake its first flight test next year. The heat shield that will protect *Orion* on that mission's reentry next year was delivered to the Kennedy Space Center for installation; we reached an agreement with the European Space Agency (ESA) to partner on the spacecraft's service module; and *Orion* itself underwent loads testing, a water recovery test, and full power-up.

NASA and twelve of its international partners released a Global Exploration Roadmap, sending a clear signal that the global community is committed to a unified strategy of deep space exploration, with robotic and human missions to destinations that include near-Earth asteroids, the moon and Mars.

Developing Technologies for the Future

This year, NASA created a Space Technology Mission Directorate to help advance the cutting edge technologies it will need for future missions. The agency completed testing on a prototype composite cryogenic propellant tank with a 25 percent reduction in cost and 30 percent reduction in weight, resulting in increased payload capacity. NASA and Aerojet Rocketdyne hot-fire tested a 3D printed rocket engine injector, marking a first step in using additive manufacturing to support space travel. We began the next chapter in NASA's improved entry, descent and landing capabilities through the completion of a test of a full-scale supersonic inflatable decelerator. The test successfully demonstrated our ability to deploy and pull a large parachute through the dynamic loads it would experience at Mars, using a helicopter to drop the ringsail parachute and a rocket sled to pull the parachute with 90,000 pounds of force. This technology will increase our current capability to land heavy payloads on Mars by up to 25 percent.

In April and November, we sent two early designs and one more mature PhoneSat cubesats to space as part of the agency's Small Spacecraft Technology Program. The first three PhoneSats successfully orbited Earth for a week, sending back pictures and demonstrating that an off-the-shelf commercial smartphone can serve as a spacecraft operating computer. The fourth PhoneSat, launched in November, and is expected to be in space for a year, proving the longevity of a smartphone cubesat in space, powered by solar panels.

We strengthened our early-stage pipeline with the nation's brightest and best by engaging in over 400 activities with 75 accredited U.S. universities to enable future missions and our continued leadership in space. For the third consecutive year, we awarded competitive technology fellowships for graduate research on the agency's most difficult space technology challenges. Sixty-five new fellowships were awarded this year, bringing to 193 the total number of graduate student space technology development efforts funded to-date. Several fellowship graduates are already making an impact in the nation's aerospace and innovation workforce.

Asteroid Mission

The public imagination has been captured by the mission we announced in April to redirect an asteroid into a stable retrograde orbit in the lunar vicinity using cutting edge space technology such as solar electric propulsion, so astronauts can visit it, study its characteristics and bring samples home. In November, we held a workshop to discuss nearly 100 of the best ideas we received from around the world about both identifying asteroids and figuring out what to do about those that are a threat as well as how to best carry out the asteroid redirect mission (ARM). Mission formulation review was completed, and we'll move into mission baseline discussions next year. The Wide Field Infrared Survey Explorer (WISE) spacecraft, having completed its mission, was reactivated to hunt for asteroids. OSIRIS-Rex, our robotic mission to return samples from an asteroid, moved from formulation to the development phase this year. NASA also announced an Asteroid Grand Challenge to find and characterize asteroid threats and gather ideas for capturing and redirecting an asteroid for human exploration. The public is incredibly interested in asteroids, and we expect strong participation in this initiative.

Amazing Science

NASA science this year uncovered new knowledge about our home planet and the farthest reaches of the galaxy. Analysis showed that the *Voyager I* spacecraft has entered interstellar space and, at 12 billion miles away, is the most distant man-made object ever created.

The Lunar Atmosphere and Dust Environment Explorer, LADEE, launched to study lunar dust and help us better understand other planetary bodies and their formation. It also carried the Lunar Laser Communication Demonstration (LLCD) -- breakthrough new technology to improve communication with deep space missions that we will continue to refine and advance. We also launched the Interface Region Imaging Spectrograph, IRIS, to study how solar material moves, gathers energy and heats up. The Landsat Data Continuity Mission (LDCM) was launched for the U.S. Geological Survey (USGS) to maintain one of the longest-term imagery data sets about our Earth ever -- more than 40 years now.

Earth Science continues to be a high priority, and our amazing fleet of Earth-observing satellites helped us see how an amplified greenhouse effect is shifting the northern latitudes' growing season. A study this year of Landsat data yielded the best view to date of global forest losses and gains during this century.

The Kepler mission awed us with new exoplanet findings including discovery of numerous planets in the habitable zone. We'll be evaluating Kepler data long after this now-completed mission.

The James Webb Space Telescope, NASA's successor to the Hubble Space Telescope, continued to move toward its 2018 launch. In November, the telescope's primary mirror backplane support structure, essentially the spine of the massive telescope, completed a rigorous testing regime. The final three of JWST's 18 primary mirrors arrived at the Goddard Space Flight Center in Greenbelt, Md. in December for integration. Once on orbit, the 18 hexagonal mirror segments will work together as one 21.3-foot (6.5-meter) primary mirror, the largest ever flown and the first to deploy in space.

Elsewhere in Astrophysics, we saw one of the brightest gamma ray bursts ever with the Fermi, Swift and NuStar telescopes and learned more about the black hole at the center of the Milky Way using Chandra. Fermi celebrated five years on orbit and the Spitzer Space Telescope celebrated 10 years of incredible science.

Mars

Mars is the centerpiece of NASA's planetary exploration. Curiosity continues to rove the Red Planet, and in its first year has already accomplished its primary goal of determining that Mars could indeed have

supported life in the past, possibly much later than we thought. Curiosity's Radiation Assessment Detector instrument is helping us assess round-trip radiation doses for a human mission to Mars. NASA also launched the Mars Atmosphere and Volatile EvolutionN, *MAVEN*, spacecraft to study the Martian upper atmosphere. The 2016 InSight mission narrowed its landing sites while the Mars 2020 team outlined its goals for our next rover to Mars.

Public Engagement, Economic and Societal Benefits

We also continued to transfer the benefits of exploration to improving life on Earth. NASA and Homeland Security, for instance, collaborated on FINDER to detect life signs in piles of rubble after a disaster.

NASA continues to effectively engage the public, and this year, the International Space Apps Challenge drew more than 9,000 hackers, designers and explorers in 83 cities around the world to contribute their ideas to space exploration missions. Our Minority University Research and Education Program (MUREP) funded 148 interns and continued to help draw minority students into STEM careers. Sally Ride EarthKAM, a camera on the space station that students can use to focus on specific areas of our planet they want to study, saw a 576% increase in participation and was used by 166,000 students in 63 countries.

NASA's Twitter account, with 5.5 million followers, is the most followed in government while millions also engage with the space program through Facebook, Google+ and other platforms, and our new Instagram profile drew 400,000 followers. NASA's website had its second-busiest year on record with 115 million visits.

All of this incredible success is thanks to you and your hard work, your professionalism and your passion. I look forward to even more success in 2014 with many more incredible things planned and in motion. From the entire senior management team, I thank you and wish you all a safe and blessed holiday season!

Charlie B.