National Aeronautics and Space Administration

GoddardView

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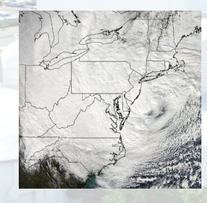
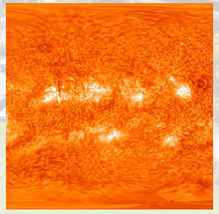
THE WEEKLY



NASA Captures Hurricane Sandy's Massive Size
NASA's Aqua satellite captured a visible image Sandy's massive circulation on Oct. 29 at 18:20 UTC (2:20 p.m. EDT). Sandy covers 1.8 million square miles, from the Mid-Atlantic to the Ohio Valley, into Canada and New England. For more on Sandy, click on the image.

STEREO Hits Milestone at Sixth Anniversary
On tOct. 25, 2006, the twin Solar Terrestrial Relations Observatory (STEREO) spacecraft launched into space. STEREO has offered scientists the ability to see all sides of the sun simultaneously for the first time in history. For more on STEREO, including more stunning images, click on the image.



NASA Optimus Prime Spinoff Award Video Contest Underway
NASA's Optimus Prime Spinoff Award Video Contest is open to students in grades 3-12 and offers students the opportunity to describe their favorite story from the 2011 edition of NASA's Spinoff publication. For rules and to register, click on the image.

NASA@Work Challenges
A new Challenge has just launched on the NASA@work, an agency-wide, collaborative problem-solving platform that connects the collective knowledge of experts (like you) from all NASA Centers. To view the challenge problem, submit your solution, and/or to check out other active challenges on the platform, click on the NASA@Work logo.

NASA @ WORK

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On the cover: From left: Director of Flight Projects Directorate George Morrow, Visitor Center Manager Bill Buckingham, LRO Project Scientist Richard Vondrak, and LRO Deputy Project Manager Cathie Peddie cut the ribbon on the new LRO exhibit at the Goddard Visitor Center.

Photo Credit: NASA/Goddard/Pat Izzo

GoddardView

Goddard View is an official publication of NASA's Goddard Space Flight Center. *Goddard View* showcases people and achievements in the Goddard community that support Goddard's mission to explore, discover, and understand our dynamic universe. *Goddard View* is published weekly by the Office of Communications.

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GODDARD CELEBRATES LAUNCH OF LRO EXHIBIT

By: Claire De Saravia

While continuing its journey around the moon, the Lunar Reconnaissance Orbiter (LRO) has now also left its mark at the Goddard Space Flight Center Visitor Center. The mechanical prototype of the spacecraft was unveiled to Goddard employees, many of whom worked on the actual spacecraft as it was built at Goddard, during a ribbon cutting as part of the new LRO exhibit that launched at the Visitor Center in September.

"The ribbon cutting was an internal event where we started by inviting people who worked on the mission and then opened it up to the greater Goddard community," LRO education and public outreach member Lora Bleacher said. "Everyone was definitely impressed and pleased with it."

Bleacher said the developers made the structural verification unit—an LRO prototype developed alongside the spacecraft as its stunt double—the focal point of the exhibit. "We had [the prototype] and didn't want to throw it away," Bleacher said. "We thought it would be really nice to preserve it."

Bleacher said models of the spacecraft's instruments and real thermal blankets were added to the unit to make it look more like the real thing. "It looks just like the actual spacecraft for the most part," Bleacher said.

Instead of being a simple model, LRO project scientist Rich Vondrak said exhibit viewers have the unique opportunity to see a real prototype that was directly involved in building the spacecraft.

"Many of the spacecraft you see hanging in the Smithsonian Air and Space Museum are simple models that weren't used in development," Vondrak said. "We had an opportunity to take a piece of hardware [that was] part of the development program, do some upgrading, and use that as the centerpiece of our exhibit."

The LRO mission—which launched in 2009 and was recently extended for two more years—has been orbiting the moon to collect information about its environment that scientists can use when planning future lunar missions.

"This mission is rewriting what we know about the moon," said Bleacher, adding that the LRO was expanding on the Apollo missions that only sampled a small area of it. "This mission is providing global coverage of the moon at higher resolutions than ever before."

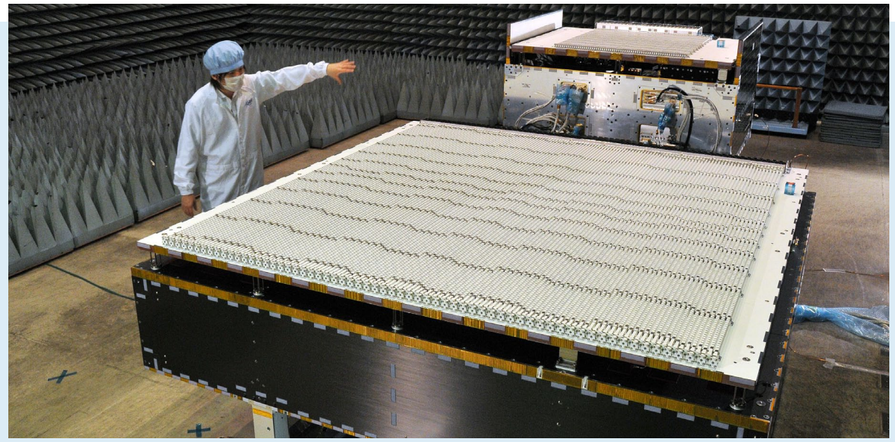
In addition to honoring the impacts the mission is making on science, Vondrak said the Visitor Center was featuring the exhibit to celebrate Goddard, which played an integral role in the mission. "I think it's important for Goddard to tell the community and visitors from near and far of the tremendous capabilities of Goddard and the wonderful things we've done," Vondrak said.

The ribbon cutting was also a special opportunity for members of the LRO team to celebrate their achievements, Vondrak said.

"I was very pleased to have participating not only the people who developed the exhibit, but also a wide representation of people who built the spacecraft and the people now operating it," Vondrak said. "I thought it was important to get the development and mission operations team there so we could celebrate the great success of LRO." ■

Above: LRO Deputy Project Manager Cathie Peddie discusses LRO development and the role of the prototype. Photo credit: NASA/Goddard/Pat Izzo

> “They found the expected small hiccups that are normal when an observatory is brought online...”



GPM COMPLETES FIRST DRY RUN

By: Ellen Gray

NASA’s Global Precipitation Measurement (GPM) Core Observatory satellite went through its first complete comprehensive performance test (CPT), beginning on Oct. 4, 2012 at Goddard. The testing ran twenty-four hours, seven days a week and lasted ten days as the entire spacecraft was put through its paces.

“This is the first time we’ve gotten to see the observatory all put together, running the way it’s supposed to be running in flight,” said CPT Test Lead Peter Gonzales, of Goddard. “The CPT is the test that verifies that the observatory can do everything we designed it to do,” he said. Gonzales spent months talking with each team that engineered the spacecraft’s subsystems and two instruments, the GPM Microwave Imager (GMI) and the Dual-frequency Precipitation Radar (DPR), to design the tests that would evaluate how the GPM spacecraft functions as a whole.

“When the observatory’s flying on-orbit, all of the subsystems are operating together. We’re not running a single subsystem in isolation,” said Gonzales. “We want to see all the subsystems work together. We want to see if we’re running a test on the RF [radio frequency communications] system, if it’s being affected by the power system and vice versa.”

In the Goddard clean room where the GPM Core Observatory was assembled, the spacecraft was oriented the way it would be if it were flying in space. It’s about the size of a small fire truck but twice as heavy. During the test, the scanning antenna of the GMI, built by Ball Aerospace Corp. in Boulder, Colo., rotated in place as it would in orbit to collect data, the High Gain Antenna for communications inched around to orient toward a simulated receiver, and the mechanisms for the solar arrays, which were not attached, turned as if tracking the sun.

In the control room next door, more than 20 engineers occupied every workstation where telemetry data from the tests streamed by lightening fast on their screens. Each subsystem and instrument was represented by the engineers that built it to make sure everything was going as expected, including a team from NASA’s partner, the Japan Aerospace Exploration Agency (JAXA), that built the DPR and will launch the GPM Core Observatory on a Japanese H-IIA rocket from an island in southern Japan.

“There are some 30 odd units being tested,” said Candace Carlisle, Deputy Project Manager for GPM. Every subsystem on the observatory, from propulsion to the two instruments, went through the process of being turned on and/or deployed after launch and then run through every function, she said.

Each test was run more than once since almost all of GPM’s systems and instruments are redundant in case of failure in orbit. The electronics have an A-side and a B-side with two identical computers, though only one is active at a time. If the A-side fails, or in some cases if even a single A-side subsystem fails, the B-side can take over.

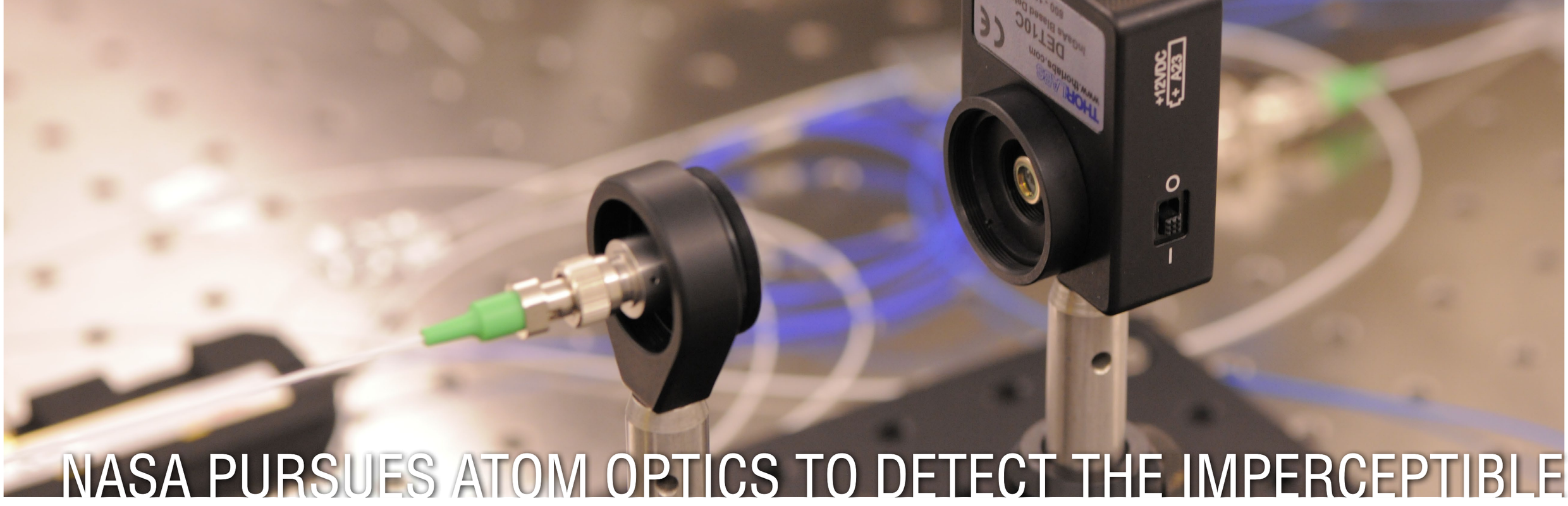
The comprehensive test went well, said Gonzales. They found the expected small hiccups that are normal when an observatory is first brought online as a unit, but no hardware problems or anything that would prevent them from moving forward, he said.

As the test progressed, the engineering teams were learning the nuances of how the spacecraft runs, said Gonzales, which is essential to know before going into the thorough environmental testing scheduled to begin in November 2012. In environmental testing, the GPM Core Observatory will be pushed to its limits as it goes through the rigors of the extreme temperature changes and electromagnetic interference it might experience in space, and the vibration and noise levels it will encounter during launch. The results of the comprehensive testing will serve as a baseline to compare to the results of the environmental tests.

The GPM mission is an international satellite mission that will set a new standard for precipitation measurements from space. The observatory will collect advanced measurements of rain and snow that will be combined into a global data set every three hours. The GPM observatory is scheduled to launch in early 2014. GPM is a joint mission between NASA and the Japanese Space Agency, JAXA. ■

Above: A JAXA scientist next to the Dual-frequency Precipitation Radar (DPR) instrument now integrated onto the GPM Core Observatory satellite at Goddard. The Japanese-built radar is designed to take 3D measurements of raindrops and snowflakes. Photo credit: NASA/JAXA

Opposite: Engineers check on the GPM spacecraft after successful completion of its first comprehensive performance test. The silver disc and drum is the GPM Microwave Imager, and the large block on the base is the Dual-frequency Precipitation Radar. The tall golden antenna is the High Gain Antenna for communications. Photo Credit: NASA



NASA PURSUES ATOM OPTICS TO DETECT THE IMPERCEPTIBLE

By: Lori Keesey

A pioneering technology capable of atomic-level precision is now being developed to detect what so far has remained imperceptible: gravitational waves or ripples in space-time caused by cataclysmic events including even the Big Bang itself.

A team of researchers at Goddard, Stanford University in California, and AOSense, Inc. recently won funding under the NASA Innovative Advanced Concepts (NIAC) program to advance atom-optics technologies. Some believe this emerging, highly precise measurement technology is a technological panacea for everything from measuring gravitational waves to steering submarines and airplanes.

"I've been following this technology for a decade," said Bernie Seery, a Goddard executive instrumental in establishing Goddard's partnership with Stanford and AOSense two years ago. "The technology has come of age and I'm delighted NASA has chosen this effort for a NIAC award," he said.

Although the researchers believe the technology offers great promise for a variety of space applications, including navigating around a near-Earth asteroid to measure its gravitational field and deduce its composition, so far they have focused their efforts on using Goddard and NASA Research and Development seed funding to advance sensors that could detect theoretically predicted gravitational waves.

Predicted by Albert Einstein's general theory of relativity, gravitational waves occur when massive celestial objects move and disrupt the fabric of space-time around them. By the time these waves reach Earth, they are so weak that the planet expands and contracts less than an atom in response. This makes their detection with ground-based equipment more challenging because environmental noise, like ocean tides and earthquakes, can easily swamp their faint murmurings.

Although astrophysical observations have implied their existence, no instrument or observatory has ever directly detected them. Should scientists confirm their existence, they say the discovery would revolutionize astrophysics, giving them a new tool for studying everything from inspiralling black holes to the early universe before the fog of hydrogen plasma cooled to give way to the formation of atoms.

The team believes atom optics or atom interferometry holds the key to directly detecting them. Atom interferometry works much like optical interferometry, a 200-year-old technique widely used in science and industry to obtain highly accurate measurements. It obtains these measurements by comparing light that has been split into two equal halves with a device called a beamsplitter. One beam reflects off a mirror that is fixed in place; from there, it travels to a camera or detector. The other shines through something scientists want to measure. It then reflects off a second mirror, back through the beamsplitter, and then onto a camera or detector.

Because the path that one beam travels is fixed in length and the other travels an extra distance or in some other slightly different way, the two light beams overlap and interfere when they meet up, creating an interference pattern that scientists inspect to obtain highly precise measurements.

Atom interferometry, however, hinges on quantum mechanics. Just as waves of light can act like particles called photons, atoms can be cajoled into acting like waves if cooled to near absolute zero. At those frigid temperatures, which scientists achieve by firing a laser at the atom, its velocity slows to nearly zero. By firing another series of laser pulses at laser-cooled atoms, scientists put them into what they call a "superposition of states."

The power of atom interferometry is its precision. If the path an atom takes varies by even a picometer, an atom interferometer would be able to detect the difference. Given its atomic-level precision, "gravitational-wave detection is arguably the most compelling scientific application for this technology in space," said physicist Babak Saif, who is leading the effort at Goddard.

Since joining forces, the team has designed a powerful, narrowband fiber-optic laser system that it plans to test at one of the world's largest atom interferometers—a 33-foot drop tower in the basement of a Stanford University physics laboratory. Close scientifically to what the team would need to detect theoretical gravitational waves, the technology would be used as the foundation for any atom-based instrument created to fly in space, Saif said.

During the test, the team will insert a cloud of neutral rubidium atoms inside the 33-foot tower. As gravity asserts a pull on the cloud and the atoms begin to fall, the team will use its new laser system to fire pulses of light to cool them. Once in the wave-like state, the atoms will encounter another round of laser pulses that allow them to separate spatially. Their trajectories then can be manipulated so that their paths cross at the detector, creating the interference pattern.

The team also is fine-tuning a gravitational-wave mission concept it has formulated. Similar to the Laser Interferometer Space Antenna (LISA), the concept calls for three identically equipped spacecraft placed in a triangle-shaped configuration. Unlike LISA, however, the spacecraft would come equipped with atom interferometers and they would orbit much closer to one another—between 500 and 5,000 kilometers apart, compared with LISA's five-million-kilometer separation. Should a gravitational wave roll past, the interferometers would be able to sense the miniscule movement.

"I believe this technology will eventually work in space," said Mark Kasevich, a Stanford University professor and team member. "But it presents a really complicated systems challenge that goes beyond our expertise. We really want to fly in space, but how do you fit this technology onto a satellite? Having something work in space is different than the measurements we take on Earth."

That's where Goddard comes in, Saif said. "We have experience with everything except the atom part," he said, adding that AOSense already employs a team of more than 30 physicists and engineers focused on building compact, ruggedized atom-optics instruments. "We can do the systems design; we can do the laser. We're spacecraft people. What we shouldn't be doing is reinventing the atomic physics. That's our partners' forte." ■

Above: The Goddard-designed breadboard laser system critical to advancing atom-optics instruments. The device will be tested in the Stanford University drop tower. Credit: NASA/Goddard/Pat Izzo

NASA ACCEPTS INFORMATIONWEEK TECHNOLOGY AWARD

By: Scott Leonardi

The Innovative Partnerships Office and the Information Technology and Communications Directorate at Goddard accepted *InformationWeek* magazine's Best Innovative Government Agency award.

The award was presented during the InformationWeek 500 conference, which took place September 9–11, 2012, in Dana Point, Calif. The InformationWeek 500 Conference is held annually to honor the most innovative U.S.-based users of business technology. This year's conference featured talks and presentations from many of today's leading technology visionaries and hosted over 275 of the nation's top business technology executives.

Goddard's Innovative Partnerships Office (IPO) is responsible for the identification, review, and evaluation of an average of 250 advanced aerospace technologies and innovations per year for intellectual property protection with commercial potential for patenting, and/or licensing options. IPO handles the negotiations of mutually beneficial collaborations between NASA and private industry, academia, or other governmental organizations that have the potential to solve near- and long-term NASA engineering or scientific challenges. As part of this technology-transfer function over the past few years, IPO Technology Managers have negotiated patent and copyright licenses that have resulted in the return of royalties in the hundreds of thousands of dollars shared among NASA, civil-servant inventors, and the U.S. Treasury.

IPO also manages the center's Small Business Innovation Research (SBIR) program, which awards small businesses more than $9 million per year; these awards, in turn, stimulate local economic development. Over the past several years, IPO has been instrumental in seeking recognition for outstanding technologies developed by Goddard innovators. Such recognitions have resulted in winning numerous awards including the research and development 100, Women in Aerospace, Space Technology Hall of Fame, NANO 50, and various Federal Laboratory Consortium awards.

NASA's Information Technology and Communications Directorate (ITCD) provides a full range of information technology capabilities and communications support for Goddard. These services range from consulting and desktop support to network engineering and containerized computing. With assistance from its academic and industry partners, ITCD designed a benchmark study testing open-source cloud computing solutions, which resulted in standing up a Eucalyptus Cloud in Goddard's containerized environment for Geoscience applications in April 2012. This study rides on the coattails of a previous Agency study in which ITCD team members had significant contribution, analyzing cloud readiness to support Earth Sciences in industry cloud platforms. The ITCD study expanded the analyses for open source cloud.

The results yielded open-source cloud solutions ready to support on-demand VM provisioning and benefit NASA as direct alignment into NASA's strategic plan for the concept of operating Cloud services for its scientists and engineers. ■

Above: Innovative Partnerships Office Senior Technology Manager Ted Mecum (left) and ITCD Director and Chief CIO Adrian Gardner, accept the award for Best Innovative Government Agency during the InformationWeek 500 Conference. Photo credit: NASA

STEPHANIE GETTY WINS GODDARD'S FY12 INNOVATOR OF THE YEAR AWARD

By: Lori Keesey

The Goddard Office of the Chief Technologist (OCT) has announced that Goddard technologist Stephanie Getty was selected as this year's "Innovator of the Year," an award the organization bestows annually on technologists who exemplify the best in research and development.

The OCT selection committee chose Getty because of her advanced thinking and sustained effort developing innovative instrument concepts for detecting organic compounds, including amino acids, on comets, asteroids, and the icy moons in the outer solar system. In achieving her success, Getty demonstrated the ability to leverage her ideas with other research and development successes to create wholly new instrument concepts—the quintessential definition of innovation, said Goddard Chief Technologist Peter Hughes.

Hughes added that Getty has become one of the Center's most productive and prolific researchers. Hired in 2004 to apply nanotechnology solutions to instrument designs, she consistently applied for and won research funding to develop miniaturized instrument components, including a miniaturized electron gun to ionize gas molecules so that a spectrometer can measure their masses, and a chemical field effect transistor to analyze liquids on planetary bodies—technologies that she has been able to leverage.

With her demonstrated can-do spirit, and remarkable ability to devise, build, and test innovative instrument components, Stephanie personifies the attributes that make our Internal Research and Development (IRAD) program among the Agency's most effective, Hughes added.

Although Getty has applied her skills to a number of technology-development efforts, she began focusing in recent years on one goal in particular. "I knew I wanted to take the devices I developed to gather measurements that would support planetary science," Getty said. In 2012, her wide-ranging research efforts paid off.

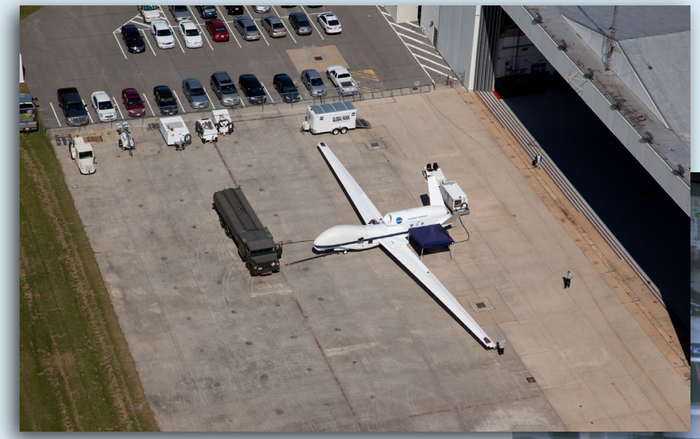
She received $2.2 million in NASA follow-on funding to advance two new instrument concepts for detecting and analyzing organic compounds, including life-sustaining amino acids, on extraterrestrial bodies. Both instruments borrow heavily from instrument components she and her colleagues developed under previous IRAD-funded efforts.

"Stephanie is an innovator," said Anne Kinney, Solar System Exploration Division director. "She does an excellent job of coming up with new and interesting approaches to planetary technology. The fact that she has won two NASA technology proposals in the same year is a testament to her ability to think outside of the box and demonstrates her top-notch proposal-writing skills."

Getty will be celebrated at the FY12 "IRAD Poster Session" on Thursday, Nov. 29. The annual event will be held from 1–4:00 p.m. in the Building 8 auditorium. ■

Top: Technologist Stephanie Getty reacts to the news delivered by Goddard Chief Technologist Peter Hughes (right) that she had been selected as this year's "Innovator of the Year." At the time, she was explaining her technology to NASA Chief Technologist Mason Peck (left), who was visiting the center that day. Photo credit: Bill Hrybyk

NASA'S GLOBAL HAWK SOARS DURING HS3 2012 MISSION



The Hurricane and Severe Storm Sentinel (HS3) is a five-year mission specifically targeted to investigate the processes that underlie hurricane formation and intensity change in the Atlantic Ocean basin. HS3 is motivated by hypotheses related to the relative roles of the large-scale environment and storm-scale internal processes.

Clockwise from top left: This aerial photo of NASA's Global Hawk was taken at the Wallops Flight Facility, Wallops Island, Va., outside of hangar N-159. Nearby cars put the size of the Global Hawk in perspective. The 44-foot-long Global Hawk has a wingspan of more than 116 feet, a height of 15 feet, and a gross takeoff weight of 26,750 pounds. Global Hawks are part of the Hurricane and Severe Storm Sentinel (HS3) mission.

NASA's Global Hawk unmanned aircraft being pushed back into the aircraft hangar of NASA's Wallops Flight Facility in Wallops Island, Va. NASA's Global Hawk lifts off the runway at NASA's Wallops Flight Facility, Wallops Island, Va. The Global Hawk took off to investigate Tropical Storm Nadine. Nadine is located near the Azores Islands in the Eastern Atlantic Ocean.

NASA's Global Hawk unmanned aircraft being hooked up to a lift, to be guided toward the aircraft hangar at NASA's Wallops Flight Facility in Wallops Island, Va.

Center: A look inside the control room at NASA's Wallops Flight Facility, Wallops Island, Va. where pilots prepare NASA's Global Hawk to take off for a fly-over of Tropical Storm Nadine.

The fifth science flight of NASA's Global Hawk concluded when the aircraft landed at NASA's Wallops Flight Facility, Wallops Island, Va. after flying over Tropical Storm Nadine in the Eastern Atlantic Ocean. The Hurricane and Severe Storms Sentinel (HS3) mission scientists changed the flight path during the Global Hawk flight to be able to overfly Nadine's center.

Photo credit: NASA Wallops ■

OUTSIDE GODDARD

By: Elizabeth M. Jarrell

ALWAYS ON DUTY

Engineer and Greenbelt Volunteer Fire Department and Rescue Squad member Brian Roberts is always on duty. "The only exception is when I'm home and my wife asks me to do something," he says. In fact, his biggest rescue occurred when he was home one evening and his neighbor's house was struck by lightning and caught fire. Roberts ran over, woke him up, and got the neighbor out of the house while his wife called the fire department.

Being a firefighter is not entirely what you might expect. Most are unpaid. Their one-story firehouse does not have a fire pole. They replaced their last Dalmatian with sirens and horns decades ago. Roberts has never driven the fire engine. He also does not cook. "I've never delivered a baby but I've come close. I told that mother, 'Hold on, we're right around the corner from the hospital,'" explains Roberts. Firefighters today do not necessarily rescue cats stuck in trees, but they will recue pets from sewers.

Today's fire houses have either a fire engine, which has a two-story ladder plus hoses and water, a fire truck with a twelve story ladder, or a heavy rescue vehicle. Almost every station also has an ambulance. The station is more likely to be called for its ambulance than for its fire engine. "New construction has sprinklers and better electrical systems. Also, people generally have smoke detectors and fire extinguishers," he notes.

Every other Saturday night from 7:00 p.m. to 6:00 a.m., Roberts stays at the station. He rides in the back with four or five others. "Each duty night is different. I carry in the water hose, the axes for entry, or serve as a backup. We rotate assignments," he says. The station gives them money towards food, which is usually fast food, but sometimes they cook dinner together.

Prince Georges County is one of the busiest departments nationally due to its proximity to the Capital Beltway, the George Washington Parkway, Goddard, and the University of Maryland in College Park, Md. In the past, the majority of their big rescues were fire runs, but today about 80 percent of their calls involve accidents on the Beltway or Parkway and involve pulling people out of cars, stopping the bleeding, and performing CPR. Their more typical runs involve someone who boiled water or left food on the stove and then walked out of the house, electrical smells or gas leaks, or faulty smoke detectors that automatically triggered a call. "We're only there about fifteen minutes for these kinds of calls," notes Roberts.

"Our biggest event was 9/11," recalls Roberts. "We were one of the first responders to the Pentagon. There was so much going on that day. What really struck me was walking into offices where the coffee mugs, keys, and family photographs were still there as if someone had left in a hurry."

Firefighters have GPS but are more likely to rely on hand-drawn maps that show each street including the location of all hydrants and sprinkler attachments. "Things move so fast we don't always have time to even type in the address into a GPS," says Roberts.

All firefighters receive almost a year of training in firefighting and in emergency medical services. They must also climb the twelve-story ladder. "You can see for miles," recalls Roberts. They also participate in regular training burns either in a concrete building built just for burns or in an abandoned structure. "It is more realistic when the drywall falls on top of your head," he remarks.

The gear weighs about fifty pounds and consists of a hood, jacket, pants, helmet, facemask with air tank, gloves, and boots. "It's as thick as a snow suit and can be very hot and exhausting going up flights of stairs in the summer but it's nice in the winter. We are also issued red suspenders, but I chose not to wear them," he notes. The hose can add an additional 75 pounds.

Although Roberts has suffered second degree burns requiring treatment at a special burn unit, more firefighters die each year from heart attacks than from actual burns. "You go from a resting heart beat to full out in a split second when the alarm goes," explains Roberts.

His parting message: "A lot of people, old and young, think that a fire won't happen to them. It can." ■

Below left: Brian in the door of an apartment complex in Prince George's County used for training. Below: Brian on one of the company's fire engines. Photos provided by Brian Roberts