Goddard Celebrates Launch of New LRO Exhibit

GPM Completes First Dry Run

Always on Duty
NASA Captures Hurricane Sandy’s Massive Size
NASA’s Aqua satellite captured a visible image of 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.

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 platform, called “Imperceptible.” Submit your solution, and/or check out other active challenges on the platform, click on the NASA@Work logo.

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“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
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 are caused by cataclysmic events including even the Big Bang itself. According to advance sensors that could detect theoretically predicted gravitational waves, promise for a variety of space applications, including navigating from measuring gravitational waves to steering submarines and airplanes.

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 the team would need to detect theoretical gravitational waves.

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 550 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 minuscule movement.

“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, narrow-band 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.

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“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.”
NASA ACCEPTS INFORMATIONWEEK TECHNOLOGY AWARD

By: Scott Leonard

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 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.

Stephanie 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.

Stephanie Getty Wins Goddard’s FY12 Innovator of the Year Award

By: Lori Keesey

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By: Scott Leonard

STEMFIEL GETTY WINS GODDARD’S FY12 INNOVATOR OF THE YEAR AWARD

By: Lori Keesey

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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 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

NASA’s Global Hawk unmanned aircraft being pushed back into the aircraft hangar of NASA’s Wallops Flight Facility in Wallops Island, Va.

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 rescue pets from sewers.

Today’s firehouses 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