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The Kids are the Stars
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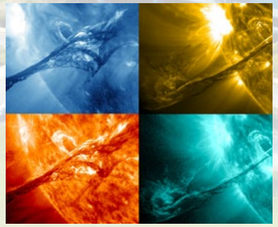
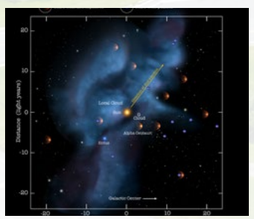
GoddardView

THE WEEKLY

NASA-funded Program Helps Amateur Astronomers Detect Alien Worlds
Open Source Differential Photometry Code for Amateur Astronomy Research will let amateur astronomers detect exo-planets by observing nearby bright stars and recording faint dips in their brightness caused by planets in orbit around them. Click the image to learn more.

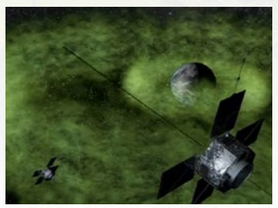
Sunday Experiment Explores SDO
The Sept. 15 Sunday Experiment will explore the Solar Dynamics Observatory. Hands-on activities this month include building an electromagnet, comparing the magnetic fields of the Earth and sun using a "magnaprobe," and experimenting with UV light detectors. Click right to learn more.





Spacecraft Show Interstellar Wind Changed Direction
The particles streaming into the solar system from interstellar space have most likely changed direction over the last 40 years. Such information can help us map out our place within the galaxy surrounding us and understand our place in space. Explore more by clicking the image.

Van Allen Probes Mark Anniversary
One year after their launch in Aug. 2012, NASA's twin Van Allen Probes have already changed how we understand the Van Allen radiation belts. Data from the probes have already led to several significant discoveries. Click on the image for video and more.



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On the cover: Center Director Chris Scolese helps Stuff-A-Truck at Goddard's Feds Feed Families food drive.
Photo credit: NASA/Goddard/Debora McCallum

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.

News items for publication in *Goddard View* must be received by noon Wednesday of each week. You may submit contributions to the editor via e-mail at john.m.putman@nasa.gov. Ideas for new stories are welcome but will be published as space allows. All submissions are subject to editing.

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LADEE LAUNCHES SUCCESSFULLY

In an attempt to answer prevailing questions about our moon, NASA launched a probe at 11:27 p.m. EDT Friday, Sept. 6, from NASA's Wallops Flight Facility at Wallops Island, Va. The Lunar Atmosphere and Dust Environment Explorer is a robotic mission, managed by NASA's Ames Research Center in Moffett Field, Calif., that will orbit the moon to gather detailed information about the structure and composition of the thin lunar atmosphere, conditions near the surface and determine whether dust is being lofted into the lunar sky.

A thorough understanding of these characteristics of our nearest celestial neighbor will help researchers understand other bodies in the solar system, such as large asteroids, Mercury, and the moons of outer planets.

LADEE is on its way to arrive at the moon in 30 days, then enter lunar orbit. As of 3:40 a.m. on September 7, NASA has confirmed that the Lunar Atmosphere and Dust Environment Explorer has separated from its ride into space, powered up and is communicating with ground controllers.

NASA's Science Mission Directorate funds the LADEE mission. In addition to designing the spacecraft, Ames manages the overall mission, operates the spacecraft, and hosts the project scientist. Goddard manages the science instruments and technology demonstration payload, the science operations center and provides overall mission support. Wallops is responsible for launch vehicle integration, launch services and operations. NASA's Marshall Space Flight Center in Huntsville, Ala., manages LADEE within the Lunar Quest Program Office.

Goddard developed the Neutral Mass Spectrometer, one of three instruments on LADEE. This instrument measures variations in the different gasses of the lunar atmosphere. Code 699 developed this instrument in-house with generous engineering support from Code 500.

The Lunar Laser Communications Demonstration aboard LADEE will be managed at Goddard by Code 450.2. This demonstration "validates and builds confidence in this technology so that future missions will consider using it," said Don Cornwell, LLCD Manager. This new ability could allow for 3D high definition video transmission in deep space to become routine. MIT/Lincoln Labs developed the demonstration with Goddard assistance.

It's the first launch to lunar orbit from WFF. It's also the first launch of a Minotaur V rocket.

The Goddard Science Operations Center in Code 580 will monitor the three LADEE instruments. These instruments study the lunar atmosphere composition and analyze lunar dust. According to Science Operations Center co-lead, Dan Smith, Goddard employees will oversee all the payload activities and planning each instrument's weekly itinerary. ■

Above: The LADEE launch could be seen from hundreds of miles away. This photograph was taken from Annapolis, Md.
Photo credit: NASA/Goddard/Edward Campion

Click on the photo to see more images of the LADEE launch.

"It's so much better than just doing things out of a textbook."

GLOBE: BRINGING TOGETHER SCIENCE STUDENTS WORLDWIDE

By: Maria-José Viñas

Standing in front of their poster, dressed in their school's white and blue uniforms, two 17- and 18-year-old students from Thailand told a visitor that they served as human bait to trap Aedes mosquitoes for their research project. Further down the hall, three fifth-graders from Norwalk, Ohio, explained to a judge how the salt their town spread on the streets after a heavy snowfall mixed with meltwater and affected scientific readings of local creek water. With the help of a translator, two female Saudi high schoolers, clad in black from head to toe, described their research on the factors affecting the solubility of oxygen in spring water near their school.

These are some of the more than 70 students and 200 educators from around the world who are participating in the 17th Annual Partner Meeting of the Global Learning and Observations to Benefit the Environment, known as the GLOBE program. The event is being held Aug. 12-16 at NASA's Goddard Space Flight Center in Greenbelt, Md., and the nearby University of Maryland's Inn and Conference Center.

GLOBE is a science and education program for primary and secondary schools around the world that brings the scientific method to the classroom. Students, guided by their teachers and sometimes by research scientists, use instruments and protocols defined by GLOBE to make local measurements of weather, water quality, soil and other aspects of Earth science. They then upload their data into a global database for anyone to use. Some of the data is used as ground validation for NASA satellite missions.

This year's meeting participants come from 26 countries and 27 U.S. states. The largest international delegation is from Thailand, with 29 students and educators, followed by Saudi Arabia and Nigeria, with 20 participants each.

NASA Administrator Charles Bolden inaugurated the weeklong GLOBE activities on the morning of Aug.12.

"One of the biggest accomplishments of GLOBE is to make available access to science and scientific thinking to students around the world," Bolden said. "It brings kids together to help them be a part of the Earth science research community: They go out and get the data in their home country or their home state and then they enter the data into the GLOBE website." Bolden met with the students after his speech to answer their questions on NASA's projects. Bolden said that GLOBE also "has the added effect of bringing people of different backgrounds and cultures together."

At the meeting, students and educators showcase their research through oral presentations and posters, participate in field training sessions ranging from investigating the impacts of urban development to the study of fresh water macroinvertebrates, tour the Goddard campus and more.

Beyond the planned activities, the meeting lets students and teachers interact with other GLOBE participants from around the world, share their experiences using GLOBE experiments in the classroom and possibly come up with future collaborative projects.

"There's no other organization that I know of that that brings people together from all sorts of different nations, and science becomes the common language," said Diana Johns, a biology and advanced placement environmental science teacher at Crestwood High School in Wayne County, Mich. "My students today are interacting with students from Thailand. They are interacting with students from Nigeria. Where would they have a chance to do that? And so science becomes a chance to understand our planet and also to understand cultures and the diversity that's on our planet."

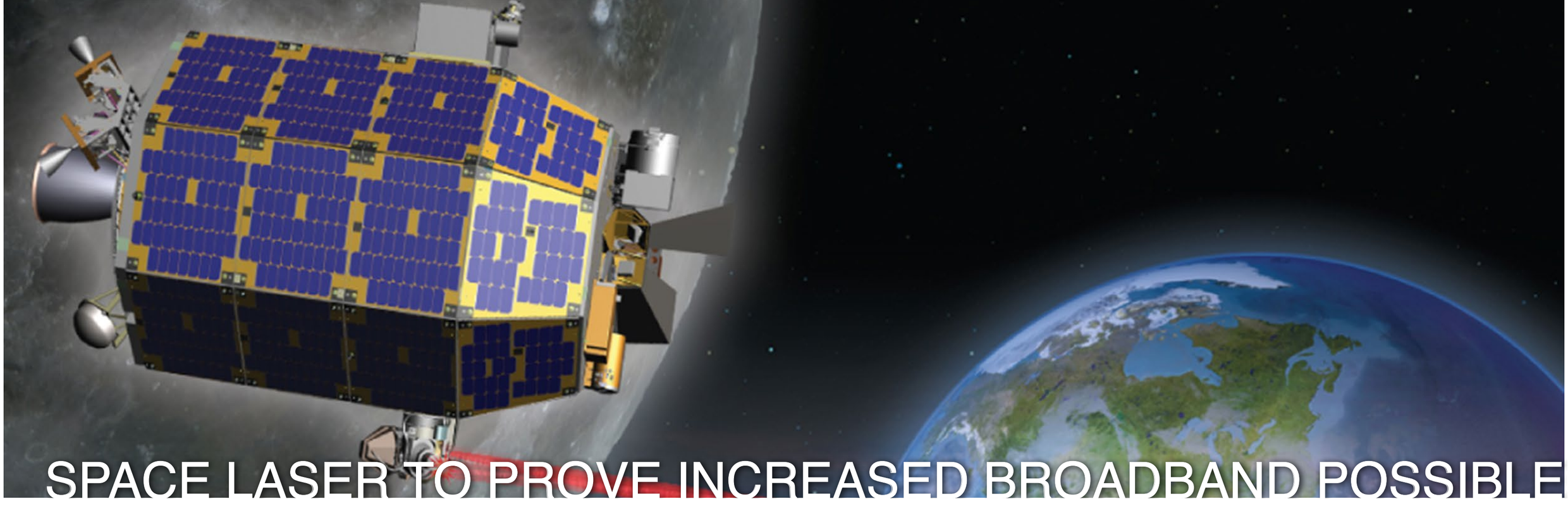
"GLOBE is just great," said Audra Edwards, a science teacher at Hawkins, a rural high school in east Texas. "It's so much better than just doing things out of a textbook. It's a real practical application; kids can see that their data is being looked up by scientists and students all around the world." Edwards is accompanying a group of students who are presenting the results of a collaborative soil research project with high schoolers from India. The joint initiative stemmed from an invitation the Texan students received to attend the GLOBE India Science Festival in New Delhi in November 2012.

Papavadee Vallikul and Jamrell Buynay are two Thai students who spent the summer studying how differences in soil, temperatures and climate due to the degradation of mangrove forests affect the population of a tiny crab. They said their GLOBE experience has given them a new perspective on the environment.

"In the mangrove forests, the crabs are very small but they oxygenate the soil, they mix it up," said Vallikul and Buynay, finishing each other's sentences. "If the crabs aren't there, it affects the soil, the whole forest. Doing the science has shown us that it's all connected."

The GLOBE program is sponsored by NASA and the National Science Foundation, and supported by the National Oceanic and Atmospheric Administration and the United States Department of State. ■

Opposite: GLOBE participants collects a water sample from the pond at NASA's Goddard Space Flight Center in Greenbelt, Md. Photo credit: NASA/Goddard/Bill Hrybyk. Click on the image to see a video of the GLOBE experience.



SPACE LASER TO PROVE INCREASED BROADBAND POSSIBLE

By: Dewayne Washington

When NASA's Lunar Laser Communication Demonstration begins operation aboard the Lunar Atmosphere and Dust Environment Explorer mission managed by NASA's Ames Research Center in Moffett Field, Calif., it will attempt to show two-way laser communication beyond Earth is possible, expanding the possibility of transmitting huge amounts of data. This new ability could one day allow for 3-D High Definition video transmissions in deep space to become routine.

"The goal of the LLCD experiment is to validate and build confidence in this technology so that future missions will consider using it," said Don Cornwell, LLCD manager. "This unique ability developed by MIT (Massachusetts Institute of Technology Lincoln Laboratory), has incredible application possibilities and we are very excited to get this instrument off the ground."

Since NASA first ventured into space, through the moon landings, shuttle program and unmanned exploration missions, radio frequency communication – also known as RF – has been the communications platform used. But RF is reaching its limit just as demand for more data capacity continues to increase. The development of laser communications will give NASA the ability to extend communication applications such as increased image resolution and even 3-D video transmission into deep space.

LLCD is NASA's first dedicated system for two-way communication using laser instead of radio waves. "LLCD is designed to send six times more data from the moon using a smaller transmitter with 25 percent less power as compared to the equivalent state-of-the-art radio (RF) system," said Cornwell. "Lasers are also more secure and less susceptible to interference and jamming."

The LLCD experiment is hosted aboard NASA's LADEE: a 100-day robotic mission designed, built, integrated, tested and will be operated by Ames. LADEE will attempt to confirm whether dust caused a mysterious glow on the lunar horizon astronauts observed during several Apollo missions and explore the moon's tenuous, exotic atmosphere. LADEE successfully launched from NASA's Wallops Flight Facility in Wallops Island, Va. on September 6 aboard a U.S. Air Force Minotaur V rocket, an excess ballistic missile converted into a space launch vehicle and operated by Orbital Sciences Corp. of Dulles, Va.

The LADEE spacecraft will take 30 days to reach the moon because of its flight path. LLCD will begin operations shortly after arrival into lunar orbit and continue for 30 days afterward.

LLCD's main mission objective is to transmit hundreds of millions of bits of data per second from the moon to Earth. This is equivalent to transmitting more than 100 HD television channels simultaneously. LLCD receiving capability will also be tested as tens of millions of bits per second are sent from Earth to the spacecraft. These demonstrations will prove the technology for increased bandwidth for future missions is possible.

There is a primary ground terminal at NASA's White Sands Complex in New Mexico, to receive and transmit LLCD signals. The team at MIT designed, built, and tested the terminal. They also will be responsible for LLCD's operation at that site.

There are two alternate sites, one located at NASA's Jet Propulsion Laboratory in California, which is for receiving only. The other is being provided by the European Space Agency on the Spanish island of Tenerife, off the coast of Africa. It will have two-way communication capability with LLCD. "Having several sites gives us alternatives which greatly reduces the possibility of interference from clouds," said Cornwell.

LLCD is a short duration experiment and the precursor to NASA's long duration demonstration, the Laser Communications Relay Demonstration. It also is a part of the agency's Technology Demonstration Missions Program, which is working to develop crosscutting technology capable of operating in the rigors of space. LCRD is scheduled to launch in 2017.

NASA engineers believe this technology becomes even more advantageous for communications beyond Earth's orbit. In the past, NASA has experimented with sending low amounts of individual pulses to cameras on far-away space probes near Jupiter, Mars, and Mercury. Recently, an image of Leonardo da Vinci's painting, the Mona Lisa, was transmitted to NASA's Lunar Reconnaissance Orbiter spacecraft orbiting the moon. "But this was done at only hundreds of data bits per second," said Cornwell. "LLCD will be the first dedicated optical communication system and will send data millions of times faster."

The European Space Agency already has successfully demonstrated laser communication between satellites in Earth orbit. Recently they launched Alphasat to demonstrate laser transmission between a low-earth orbit satellite and a satellite in geostationary Earth orbit. LLCD's laser link from the moon will be ten times farther away.

NASA is looking upon laser communication as the next paradigm shift in future space communication, especially deep space. "We can even envision such a laser-based system enabling a robotic mission to an asteroid," said Cornwell. "It could have 3-D, high-definition video signals transmitted to Earth providing essentially 'telepresence' to a human controller on the ground." ■

Above: Artist's rendering of the LADEE satellite in orbit. Image credit: NASA

THE KIDS ARE THE STARS

By: Elizabeth M. Jarrell

It is one thing to be inspired; it is another thing to inspire someone else. It is in another league to lead an entire elementary school in building a real spacecraft to fly in space. That is exactly what Joe Pellegrino is doing with the approximately 400 pre-kindergarten through eighth grade students, including his son Felix, at St. Thomas More Cathedral School in Arlington, Va.

"My rewarding space career started with my seventh grade physics teacher, who lit the fire inside me to become a scientist or an engineer," said Pellegrino, a mechanical engineer and study manager for the Geosynchronous Satellite Orbit Servicing Mission. "I'm trying to do the same for these kids."

In searching for a project to engage and motivate the children, Pellegrino decided that they would build an operational satellite complete with solar arrays, payloads and even a ground station. He chose a CubeSat, a four-by-four-by-four cube weighing less than three pounds. Usually built by graduate students, this is the first time ever that grade school children are building a CubeSat – and the students are building everything themselves.

"This idea came to me on April 17, 2012, the day the shuttle flew over D.C.," said Pellegrino. "That day, the students lined up in a space shuttle formation and the shuttle flew over us." After fund raising, including money from NASA and his employer, the school purchased the $10,000 CubeSat kit and added payloads, an Earth observation camera and an asteroid observation camera. A St. Thomas More medal, recently blessed by the new Pope, will also be flown into space. Their mission kicked off a year later.

Pellegrino is the team's mission manager. He is responsible for leading the spacecraft assembly, integration, test and launch. He also prepares educational materials for the teachers to present. His fellow mission manager, Melissa Pore, another teacher at the school, ensures that all departments of the school incorporate space into their curriculum. The art teacher has the students drawing planets, the music teacher has them making up space songs, the gym teacher has the children inventing space dances, and their religious instructor has the kids writing prayers for the satellite.

Employing the same mission management functions and structures he uses at Goddard, Pellegrino assigned every grade a particular job. The pre-kindergarten and kindergarten classes conduct outreach. The first grade has mission operations, including building the antenna and operating the ground station. The second grade is responsible for earth observation, including operating the cameras and building the solar arrays. The third grade is writing the procedures, operating the asteroid detection camera and conducting system engineering including orbit determination. The fourth grade is creating the computer-aided design of the mechanical structure and performing environmental testing. The fifth grade is the communication team, responsible for the Ham radio transmissions of images from the CubeSat to the ground station and also the battery. The sixth grade is building the spacecraft bus including the power and flight computer. The seventh grade is making the 3D compass payload, which will determine the location and orientation of the satellite. The eighth grade just successfully conducted a high-altitude balloon test.

Each one of the 400 students has an individual job title and a specific assignment, from quality control to mission artist. Every student also has a deputy one grade below that will take his or her place the next year. "I've built a whole spacecraft team in miniature at the school, which was a big challenge," says Pellegrino.

The next big test will be of the communications system in September. The students will place the CubeSat on the highest bell tower of the Washington National Cathedral, in Washington, D.C., take photos and transmit the photos to a ground station set up at Arlington National Cemetery in Arlington, Va. Pellegrino also dreams of later including the space station's astronauts in a similar test by asking them to send images from space to the children's ground station via Ham radio.

A year from now, Pellegrino hopes to ask Goddard for permission to use Goddard's vacuum chamber and vibration chamber for environmental tests.

When launched, the CubeSat will take photos every 30 seconds and continuously transmit the photos to Earth. The CubeSat will orbit Earth several times a day, passing over the same place two to three times a week. Pellegrino intends to set up a worldwide team of schools equipped with Ham radios, a computer and an iPad application to receive images and track the spacecraft. His wife Stephanie, who teaches at the school, is the network mission manager responsible for putting pins on a map to mark the position of remote ground stations.

The CubeSat will be ready for launch next year. Pellegrino is currently writing a proposal for NASA Headquarters to get onto a launch vehicle. If accepted, NASA will decide on which launch vehicle their CubeSat will fly and when it will launch. Their options include an expendable launch vehicle or, their preference, a trip on a space station cargo element with deployment by the space station's astronauts. As a backup, ATK has already agreed to save a spot for the CubeSat on their new Athena IIC launch vehicle to be launched out of Alaska in 2015.

Pellegrino's young team only has one CubeSat, but they hope to have follow-on missions with different payloads. Whether or not the CubeSat actually works, his true goal is inspiring these children. A number of them already want to become NASA engineers or scientists. Says Pellegrino, "For me, if we get 100 engineers or scientists from this effort that will be mission success." ■

Above: Josie Majowka and Kathryn Howard assemble a ground station antenna. Photo provided by Melissa Pore

GODDARD EMPLOYEES STUFF IT

By: John M. Putman

On August 28, 2013, the Goddard community came together in the spirit of giving and the spirit of competition. The first Goddard "Stuff-A-Truck" event was held in Building 28 with center management contributing and helping fill boxes with donations of food for local food banks.

The event was held in conjunction with Feds Feed Families, an annual government-wide effort, led by the Chief Human Capital Officers Council. The 2013 Campaign officially began on June 1 and will run through the end of August.

Before the event, Goddard had only been at approximately 30 percent of its goal of collecting 10,000 pounds of food. With the help of the Goddard community, the event collected an additional 5,950 pounds, which enabled the center to reach and surpass its goal.

Besides the desire to help others, employees at Goddard were also driven by the desire to win for their directorate. As part of the event, donated food was placed in boxes according to the directorate making the donation. The boxes were then weighed, with the winning directorate receiving a unique trophy constructed at Goddard by Code 500. Many directors were in attendance as well as the center director, Chris Scolese.

"This event was a great opportunity for the larger Goddard community to come together for a good cause and have some fun and good-natured competition at the same time," said Scolese.

The Building 28 Atrium was full of food bank collection boxes for each directorate awaiting donations. Besides the typical food donations, items like healthy treats for kids, toothpaste, toothbrush, shampoos, and diapers were also given by the directorates.

Code 110 won the competition by donating 1,250 pounds of food. The winning directorate was determined by taking the total weight of contributions from the event and dividing by the total number of civil servants within that directorate.

The Stuff-A-Truck event brought together many organizations to make it a success. Codes 115 and 130 executed the overall planning. Code 200 supported the overall planning effort and provided logistical support. Code 500 developed the trophy design.

Since the Feds Feed Families campaign began, federal workers have donated and collected 15.2 million pounds of food and other non-perishable items to support families across America. Last year the campaign collected more than 7.2 million pounds of food. ■

Photo credit: NASA/Goddard/Debora McCallum

OUTSIDE GODDARD

By: Elizabeth M. Jarrell

SOLOING MT. FUJI IN THE DARK

Systems engineer Theo Bugtong always achieves his goals–and he sets high goals. Through working with Japanese partners on projects at Goddard, Bugtong was inspired to set a goal to see the sunrise from the top of Mt. Fuji, all 12,389 or so feet.

"Mt. Fuji is extremely important in Japanese culture," said Bugtong. "If I understand their culture more, I may understand the people and their language more." In August 2009, he soloed Mt. Fuji in the dark.

"I did not really think it through," admits Bugtong. "My plan was to buy my gear there, but I could not find a lot of stuff. I used what I had and it was pretty inadequate." He carried a backpack, two flashlights, water, candy, sneakers, long pants, a sweatshirt, a towel and a sun hat. His biggest mistake, he says, was wearing layers of light clothing, which did not afford enough protection against the unexpected wind and cold during his night climb.

There are ten stations or levels going up to the peak, each marked by a hut or similar structure and a sign. Most people start climbing at night in order to reach the summit by sunrise. Bugtong started at level 5, where the bus from Tokyo dropped him off, at 7:00 p.m. He knew enough Japanese to be able to say important things like "where does the trail start." He was surprised, however, by how many people there spoke English.

He bought a wooden walking stick topped with a small, red and white flag and bells to help him be seen and heard. "Every time you reach another station, they will brand the stick with a special character and the altitude. The first and lowest one is the sun coming up over the horizon. As you get higher, the designs get more elaborate. The last and highest one is a Japanese character topped by a picture of the summit," said Bugtong.

The rough-cut trail was marked with signs and ropes. "The trail was not a sidewalk. If you went past the rope in some places, there was a shear drop down. I could easily have fallen off the edge in some steep parts," said Bugtong.

Bugtong was never worried, remaining focused on his goal. "Unless the mountain erupted, I thought I'd be okay. My biggest concern was climbing to the summit in time to see the sunrise and then getting back down in time to catch the bus back to Tokyo," he said.

Bugtong used a hand-held GPS as a guide and to mark his arrival at each station. He also took videos and photos of himself throughout the climb.

He got to level 8 around midnight, but needed to rest. He was at level 8 ½ at sunrise and arrived at the summit around 8:00 am.

"The sunrise was really nice, nicer than I had thought it would be. I was above the cloud level, so I saw the sun come up through the clouds creating all these great colors. Even better, it had warmed up," said Bugtong. Once he arrived at the marked summit, he noticed an even higher hill, Kengamine Peak, so he climbed that too.

Although the trail down was not as steep, it was switch-backed so it took longer. His only regret is that he missed a lot of nice scenery. "Even coming down," he says, "I was on a forced march." He missed his bus back to Tokyo, but was able to ride back on another one.

"My adventure reinforced the idea that you have to keep your eye on the goal even when things go wrong. My goal was to see the spectacular sunrise viewable only from the mountain. Achieving the goal is far more important than all the little things that may stand in your way. Expand your experiences and keep challenging yourself to increase what you are capable of accomplishing." ■

Center: Bugtong at the summit of Mount Fuji. He carried a pack and other gear on the climb, but removed them for the picture. Photo provided by Theo Bugtong