National Aeronautics and Space Administration

Goddard View

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GoddardView

THE WEEKLY

Wallops Awarded Environmental Recognition
For the fourth consecutive year, NASA's Wallops Flight Facility has been awarded the highest environmental recognition within the Commonwealth of Virginia for programs committed to protecting the area's natural resources. Learn more by clicking on the photo.

Sunday Experiment
NASA Goddard's Visitor Center will host this month's free Sunday Experiment on May 18 from 1–3 p.m. This month's Sunday Experiment will explore NASA's Satellite Servicing Capabilities Office. There's' more to explore when you click on the photo.

LRO View of Earth
NASA's Lunar Reconnaissance Orbiter experiences 12 "earthrises" every day. On Feb. 1, 2014, LRO pitched forward while approaching the moon's north pole allowing the LROC Wide Angle Camera to capture Earth rising above Rozhdestvenskiy. See more by clicking on the image.

Tornado Damage in Arkansas
On April 27, 2014, a twister cut a swath of destruction through the small towns of Mayflower and Vilonia, Arkansas. Sixteen people were killed. On May 2, NASA's Advanced Land Imager on Earth Observing-1 passed over Arkansas and offered a clear view of the damage. See more by clicking on the image.

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On the cover: Goddard Ceneter Director Chris Scolese talks with two of the winners of the OPTIMUS PRIME Spinoff Video Contest. Photo credit: NASA/Goddard

GoddardView Info

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 by Goddard's Office of Communications.

You may submit contributions to the editor 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.

OPTIMUS PRIME SPINOFF VIDEO CONTEST WINNERS VISIT NASA GODDARD

By: Claire Saravia

Students visiting NASA's Goddard Space Flight Center in Greenbelt, Maryland., experienced a touch of science and Hollywood.

The students visited the center not just to celebrate their winning the recent OPTIMUS PRIME Spinoff Video Contest, but also to raise awareness of NASA technology spinoffs being used in different industries.

The contest itself, developed by the Innovative Technology Partnerships Office (ITPO), challenged students across the country—the contest winners came from Maryland, Tennessee and Florida—to highlight NASA technology spinoffs by creating original videos.

As part of the contest, ITPO worked with Omniangle Technologies LLC to invite the seven students—ranging from elementary to high school—to visit the center and take their winning videos one step further. During their two-day visit, the students highlighted NASA Goddard spinoff technologies in videos they wrote and produced in the center's television studios. The videos may be featured on NASA's official television channel, NASA TV, later this year.

In addition to working with NASA Goddard's production crew, the students had a very special guest. Peter Cullen, the voice of the OPTIMUS PRIME character from "Transformers," worked with the students on their videos and discussed their someday playing a role in fulfilling NASA's mission.

"The Goddard Space Flight Center is perhaps one of the most magical, inspiring places on Earth," Cullen said. "I'm proud to be here, I'm excited to be here, and I can't wait to come back next year."

Although the students were hard at work making their videos, their time at the center wasn't limited to the studio. They explored different parts of Goddard, including the Satellite Servicing Capabilities Office robotics lab.

"It was really cool getting to meet a lot of people and check out this area, and getting to hang out with Peter [Cullen]," contest winner Aaron Wheeler said. "We've come in second before, and this was pretty neat to come in first and come out here to have all of this."

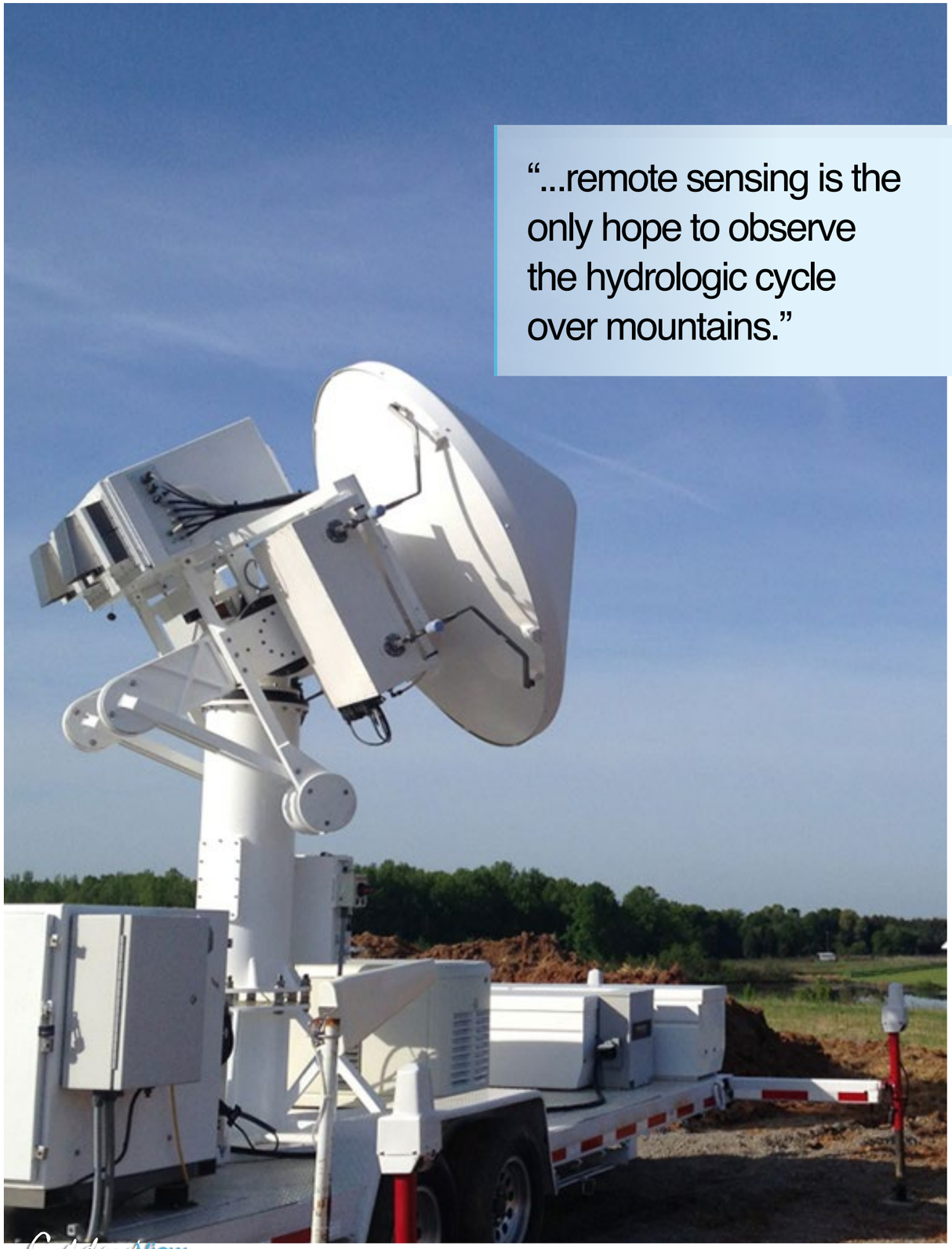
The students toured the environmental test facilities building, where satellites and instruments are tested before being launched into space.

The students had the chance to meet several of the center's scientists. In addition to a talk with Sciences and Exploration deputy director and former NASA astronaut Piers Sellers, the students also spoke with astronomer Michelle Thaller and physics Nobel laureate John Mather.

The event was an opportunity to get the winning students more excited about NASA technologies and career opportunities. By creating their own videos, the students' accomplishments also served to further educate the public about NASA spinoff technologies.

"The creativity and skill demonstrated in each of the students' videos shows their understanding of how NASA technologies are used in space applications, as well as industries such as environmental, medical and manufacturing here on Earth," ITPO chief Nona Cheeks said. ■

The contest winners were acknowledged all over Goddard, including by Center Director Chris Scolese (far right). Photo credit: NASA/Goddard



"...remote sensing is the only hope to observe the hydrologic cycle over mountains."

NASA BEGINS FIELD CAMPAIGN TO MEASURE RAIN IN APPALACHIANS

By: Ellen Gray and Keith Koehler

Rain, ice, hail, severe winds, thunderstorms and heavy fog—the Appalachian Mountains in the southeast United States have it all. On May 1, NASA began a campaign in western North Carolina to better understand the difficult-to-predict weather patterns of mountain regions. The field campaign serves as ground truth for measurements made by the Global Precipitation Measurement mission's Core Observatory.

GPM is an international satellite mission to observe rain and snow around the world. The advanced instruments on the GPM Core Observatory satellite, launched Feb. 27, provide the next generation of precipitation measurements, including the new capability to detect snow and light rain.

"What we're trying to do is study and learn about the precipitation from the summit to sea, how it evolves as it moves from the mountains to the plains," said Walt Petersen of NASA's Wallops Flight Facility in Virginia, who is leading the field campaign. "Then we use that information to improve satellite observations of precipitation and how those observations can best be used in applications like hydrologic models."

Hydrologic models are used by water managers to predict where rainwater goes after it hits the ground—underground and into streams and rivers where it supplies freshwater to the region, or becomes a natural hazard. Evaluating and improving these models is an important part of the field campaign.

"This is a region that is always under some sort of threat," said precipitation scientist Ana Barros of Duke University in Durham, N.C., who is hosting the field campaign. She's been working with local authorities in the Upper Tennessee, Catawba-Santee, Yadkin-Pee Dee and Savannah River basins, who are very interested in the outcome, to set up the rain-monitoring network for the campaign. "They have landslides, they have flash floods, they have very severe windstorms, they have lots of hail storms in the summer time, they also get hurricanes and tropical storms. So they really value and appreciate the data because they feel they can make good use of it."

Mountain precipitation is difficult to measure, even from satellites. The shape of the rugged slopes interacts with and produces a wide variety of rainfall, through poorly understood processes specific to mountains, said Barros. On the ground, rain gauges have to be set up and maintained in remote areas only accessible by foot or on horseback, and ridges block weather radars from seeing very far into the mountains.

Nevertheless, the Integrated Precipitation and Hydrology Experiment field campaign, running from May 1 to June 15, 2014, combines intense ground coverage with airborne sensors flying through and above rain clouds. When a storm moves in, they'll snap pictures of precipitation from the top of the clouds to the bottom of valleys.

Satellite overpasses from the Tropical Rainfall Measuring Mission and the GPM Core Observatory provide the view from space. In case satellites aren't overhead during a storm, NASA's ER-2 high altitude research plane flying at 65,000 feet and managed by the agency's Armstrong Flight Research Center in Edwards, Calif., carries several sensors including two that simulate measurements made by the GPM Core Observatory. At 10,000 to 25,000 feet, the University of North Dakota's Citation aircraft flies through clouds to measure raindrops and ice particles where they form.

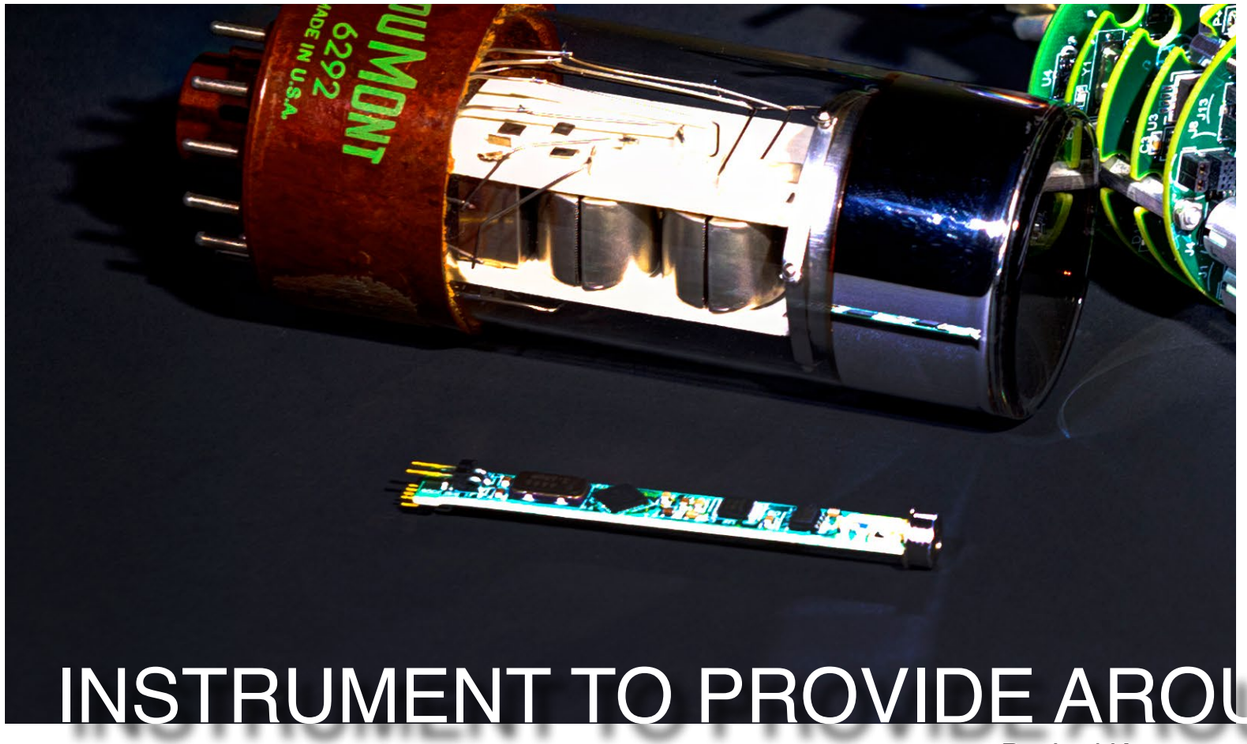
Multiple weather radars—including the NASA's transportable Polarimetric Radar and Dual-Frequency, Dual-Polarimetric Doppler Radar, as well as a NOAA polarimetric radar—measure rain as it forms in clouds and falls to the ground. Then, researchers from Duke University, NOAA's Hydrometeorological Test Bed, NASA, and others have set up a dense network of rain gauges and other equipment to measure fallen precipitation at ground level. Additional sensors to detect soil moisture underground and stream height then follow the water as it flows downstream from the mountains to the plains.

"That's our dream scenario," Petersen said. "We'll learn something more about how and where rain water is actually made in the clouds, how much of it falls out of the cloud to the ground, and then what happens to the rainfall when it gets into our hydrologic network."

If the weather cooperates, the science team expects to end the six-week campaign with detailed and scientifically robust data to improve their understanding of both the fundamental science of mountain rainfall and how to best estimate rainfall using satellite observations over these remote and rugged regions.

"In a way remote sensing is the only hope to observe the hydrologic cycle over mountains," said Barros. "The potential to do this from space is great and resolves a great problem because we can look at the larger area without having to deal with these obstacles." ■

Opposite: Set up on a ranch in Rutherford County, N.C., NASA's Dual-frequency, Dual-polarization, Doppler Radar is one of several ground radars measuring rain as it falls from clouds. It has the same two frequencies as are on the GPM Core Observatory Satellite. Photo credit: NASA/David Wolff



INSTRUMENT TO PROVIDE AROUND-THE-CLOCK MEASUREMENTS

By: Lori Keesey

A team led at Goddard has developed an instrument capable of observing ocean color during normal sunlight conditions and under moonlight—a first-ever capability that will allow scientists to monitor the health and chemistry of the planet's oceans around the clock.

The prototype Ocean Color Underwater Low Light Advanced Radiometer (OCULLAR) has shown in field testing that it can measure ocean color under low-light conditions across multiple wavelength bands, from the ultraviolet to the near-infrared. In contrast, current remote-sensing instruments can obtain measurements—based on electromagnetic energy emitted by the sun, transmitted through the atmosphere, reflected off Earth's surface, or upwelled from water masses—only during daylight hours, said Principal Investigator Stan Hooker.

Of particular interest to scientists studying ocean color is phytoplankton, the microscopic ocean plants that form the base of the oceanic food web. These tiny plants use sunlight and carbon dioxide to produce organic carbon. This process, called photosynthesis, is possible because plants contain chlorophyll, green-colored compounds that trap the energy from sunlight. Because different types of phytoplankton contain different kinds of chlorophyll, measuring the color of a particular area allows scientists to estimate the amount and general type of phytoplankton there. Since phytoplankton also depend on specific conditions for growth, they frequently become the first to be affected by pollution or some other change in their environment.

"Ocean color is what we see and is a big part of understanding the ocean's diversity," Hooker explained. "You can figure out what's happening in the ocean by looking at the different colors or wavelengths, which then are used to determine what constituents in the water are creating that color."

Until now, however, obtaining these measurements was limited to daylight hours and only during the spring, summer and fall months in the polar regions—a problem Hooker sought to correct with OCULLAR. Inspired in part by NASA "black marble" imagery, which showed Earth at night, Hooker thought, "with the right technology, we could look at the planet at night."

The need, he said, was compelling. "The light levels are so low, you literally lose hours of data around the world and, at the polar areas, an entire season of data."

The team, which also includes Charles Booth and John Morrow, both scientists with Biospherical Instruments Inc. in San Diego, created the new capability by pairing two light-measuring, but distinctively different, detector systems: a miniature and ruggedized photomultiplier tube (PMT) with an existing silicon photodetector microradiometer, with an embedded microprocessor. When commercialized, hybrid OCULLAR instruments would be equipped with seven PMTs paired with seven silicon photodetectors. An eighth photodetector will measure a wavelength useful to ocean color, but difficult to measure with a PMT.

When photons strike a silicon detector, the photons cause a response that is measured as voltage. When fewer and fewer photons are detected, the detector reports a smaller and smaller voltage. As a result, the microradiometer's computer instructs the second detector system—the photomultiplier tube—to swing into action. The PMT multiplies the effect of the photons that enter the system to create a cascade that OCULLAR can easily sense.

Considerably smaller than older legacy ocean-color instruments, which could be as large as an office trash can, an OCULLAR instrument will measure three-and-a-half inches in diameter and about a foot in length—making it compact enough for use on a range of platforms.

"We thought we could pair a photomultiplier tube with a smart silicon photodetector, which we equipped with a computer brain, but we had never done it before," Hooker said. "So we used R&D funds to test that hypothesis. We were completely successful."

During a field campaign the team proved the prototype's ruggedness and high sensitivity over a large range of light. "In fact, we were more successful than we thought we would be," Hooker added.

"A human can see objects under full sunlight and barely see objects under a moonless night," explained Hooker. "The illumination for the former is about a billion times the illumination of the latter. The value can be represented as 10 raised to the ninth power, or nine decades of dynamic range. OCULLAR sensors have 14 decades of linear dynamic range, with the added responsivity at the low end of illumination. So, OCULLAR sensors have five more decades of response to low light than the human eye."

The successful demonstration leads the way to anticipated commercialization and creates a new capability for oceanographers, climate scientists and others interested in quantifying, understanding and monitoring the biological productivity of oceans, coastal areas and inland waters.

The next step is to develop a flight-ready instrument that could be flown first at low altitude and then ultimately on a high-altitude research aircraft. The team wants to commercialize the new technology as a low-cost instrument. The idea is to dispatch as many of these instruments as possible to obtain global ocean observations. "We want to start on the ground and keep going upward," Hooker said. Ultimately, the team wants to fly the technology in space.

"We're building something that sees better than the human eye," Hooker said, adding that the instrument could measure conditions under twilight, moonlight and even beneath sea ice. "And that's quite an accomplishment." ■

Above: The OCULLAR prototype, right, next to a legacy photomultiplier tube (top left) and a new silicon photodetector microradiometer is on the bottom left. Photo credit: NASA/Goddard/Bill Hrybyk

NEW PLAYERS FOR THE BETTII PUZZLE

By: Talya Lerner

If all goes according to plan, a balloon the size of a football field will loft NASA's BETTII mission above 99.5 percent of Earth's atmosphere next year to study star formation.

This mission will use a technique called spatial interferometry to combine observations of smaller telescopes to effect the viewing power of a larger one. BETTII will be NASA's first such mission.

Dr. Stephen Rinehart, associate chief of the Observational Cosmology Laboratory at NASA's Goddard Space Flight Center in Greenbelt, Maryland, has worked with interns on BETTII, short for Balloon Experimental Twin Telescope for Infrared Interferometry, for many years now.

For the spring, Joe Gibson and Yamil Huertas are thrilled they are part of this team. "Both of them are doing really well—once again, we've got some great students!" Rinehart said.

Last summer's seven students worked tirelessly to finish parts of BETTII's control system, which will be used to guide BETTII and stabilize it for clearer pictures. "It has been performing very well." Rinehart said. "They did a great job."

Huertas, a senior studying electrical engineering at the University of Puerto Rico, Bayamón Campus, chose BETTII because it let him work on fields related to mechanics, electronics and computers. Huertas worked on two projects this summer. He focused on BETTII's Star Camera, which will tell scientists where BETTII is pointing, and developed a circuit that will read BETTII's temperature sensors.

Gibson is a senior at Grand Valley State University in Grand Rapids, Michigan, studying computer engineering. Gibson works with Stephen Maher, a computer scientist at Goddard, writing code for the communication and control software on BETTII. His code will send information from the Star Camera to the control system to map exactly where in the sky BETTII takes its pictures.

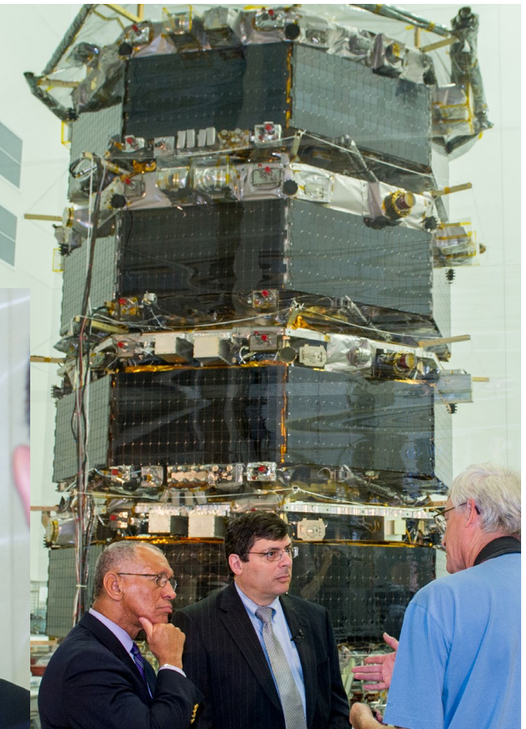
"We are a team and all of us work for the greater good and success of the project," Huertas said.

"It is a childhood dream to be working here," Gibson said. "After such an amazing experience, the only thing I can say is that I sincerely hope to return some day."

Gibson and Huertas' amazing experiences, those of the students before them, and students yet to come are what will enable BETTII to reach its 2015 launch date and study stellar evolution like never before. ■

Above: Yamil Huertas (left) and Joe Gibson are two interns working on the BETTII mission. Photo credit: NASA/Goddard/Talya Lerner

NASA ADMINISTRATOR CHECKS OUT MMS



NASA Administrator Charles Bolden got a firsthand look at work being done on the Magnetospheric Multiscale (MMS) spacecraft during a visit to NASA's Goddard Space Flight Center in Greenbelt, Maryland, on Monday, May 12.

Bolden visited Goddard's Integration and Test Facility where the four MMS spacecraft are undergoing testing. The spacecraft will be in a rare four-stack arrangement inside a clean room after completing vibration testing. The clean room itself will be temporarily altered to allow a close-up view of the approximate 20-foot high collection of four observatories in their launch configuration.

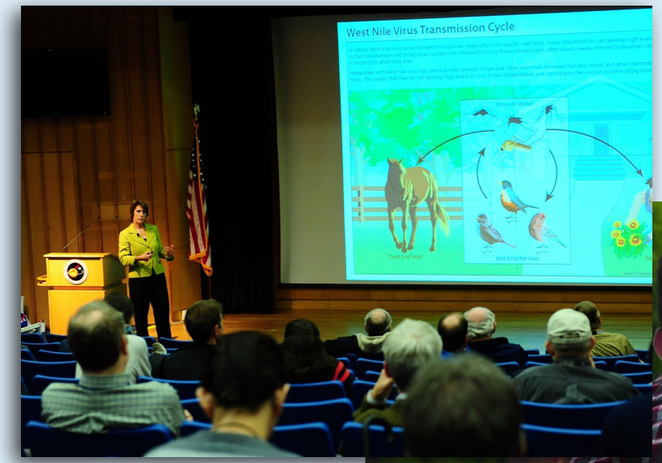
During its two-year mission, MMS will explore the mystery of how magnetic fields around Earth connect and disconnect, explosively releasing energy—a process known as magnetic reconnection. The four MMS spacecraft will provide the first three-dimensional views of this fundamental process that occurs throughout our universe.

Bolden was also at Goddard for a town hall with Goddard employees to discuss the NASA budget for fiscal year 2015. ■

Top right: A reporter (right) talks with Bolden (left) and NASA Goddard Center Director Chris Scolese in front of the four MMS spacecraft stacked in a clean room. Top left: Bolden speaks with MMS Project Manager Craig Tooley. Bottom: Bolden poses with the MMS team. Photo credit: NASA/Goddard/Bill Hrybyk

SAFETY AWARENESS CAMPAIGN

Photo credit: NASA/Goddard/Debora McCallum and Bill Hrybyk



During the week of April 28 through May 2, NASA Goddard ignited its passion for safety during its annual Safety Awareness Campaign. The weeklong event is filled with classes, seminars and training opportunities for all employees.

This year's theme, Ignite Your Passion for Safety, recognized the second leading safety issue cited by NASA: fire safety. Being alert to, and knowledgeable about, fire safety can go a long way toward preventing loss of resources, time, and injury or death to personnel.

In addition to fire safety, there was a wide variety of safety and health activities as well as training courses offered during the week to enhance people's knowledge and awareness of personal safety and safety in the workplace.

The campaign again included Directorate Safety Stand-Down sessions. During these sessions, employees received information about Goddard's safety programs and information specific to each Directorate's safety plans and procedures.

The event kickoff featured former NASA astronaut Paul Richards who spoke on fire safety during the STS-102 mission onboard the ISS. ■

I AM GODDARD

By: Claire Saravia

Shannon Rodriguez knows something about working hard to get ahead. As the head of the microwave and telecommunications branch (Code 567), Rodriguez spends the day supervising employees and works with communications systems for spacecraft, infusing technology into future missions.

Rodriguez started at Goddard as a summer intern in 2003 before earning a full time position in 2004, after graduating from the University of Puerto Rico with a bachelor's degree in electrical engineering. She earned her master's degree in electrical engineering from Johns Hopkins University in 2009.

Since then, Rodriguez worked to climb Goddard's ranks, spending her first five years at the center in microwave instruments (Code 555) before moving to microwave and telecommunications as an associate. She was named branch head in 2013.

Rodriguez has built her career on the concept of "get involved and take action," a principle that has forced her to make herself stand out by putting in extra work, opening her up to new opportunities, allowing her to get ahead.

She took advantage of Goddard's different leadership clubs and was part of the NASA FIRST leadership development program in 2008. Participating in different programs helped her earn the opportunities she constantly works towards.

"There's a lot of stuff to do at the center, as long as you're willing to raise your hand," Rodriguez said.

Although Rodriguez has held this attitude her whole life, she said Goddard's commitment to diversity has provided her with the right environment to apply the approach to her career.

"Goddard is a very diverse place and cares about each person," Rodriguez said. "The people here want you to make all of these efforts if you're up for them."

Since transforming her opportunities at Goddard into a successful career, Rodriguez has worked to ensure young professionals are instilled with the same principles that helped her move forward. Until recently, she served as the chair of Goddard's New and Developing Professionals Advisory Committee, advising young NASA employees on how to develop their careers.

Rodriguez said she has used her driven personality to help other Goddard employees realize their potential and take advantage of opportunities at the center—especially the ones they may not see.

"Sometimes people say there's no opportunities, but you have to be willing to put yourself out there and do extra work," Rodriguez said.."

Rodriguez said she tries to instill her principles in the employees in her branch, particularly those who started through internship programs.

"I have a good amount of employees in my branch, and I've worked closely with them to develop projects," Rodriguez said. "They give me energy to do other things."

Rodriguez said Goddard's expanding diversity initiative has made it easier for her to motivate young employees, particularly since programs like NDP are becoming official advisory committees at the center.

"Making programs like NDP official shows that Goddard thinks these younger people are important," Rodriguez said. "It shows the center is paying attention to people with different needs and that we're always moving forward."

Because Goddard is in a diverse location and features a lot of different personalities, Rodriguez said the different initiatives on campus she has been a part of help showcase Goddard's diversity.

"Here at Goddard, you can see someone in a Hawaiian shirt and flip flops or a serious business person," Rodriguez said. "Goddard tries to represent its diversity in the workforce, and it tries to ensure we're moving forward through initiatives."

Although Rodriguez has worked hard to get to this point in her career, she said she intends to use her experiences to keep encouraging young employees to take advantage of Goddard's many opportunities.

"You have to work very hard because you never know what happens in life when you do—people notice and an opportunity will present itself for you to step up," she said. "I've been very lucky in my career." ■

Center: Shannon Rodriguez. Photo credit: NASA/Goddard/Bill Hrybyk