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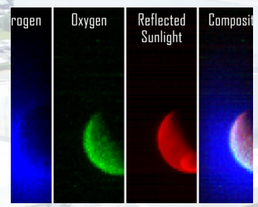
TRENDING



MAVEN Returns First Observations
NASA's Mars Atmosphere and Volatile Evolution (MAVEN) spacecraft has obtained its first observations of the extended upper atmosphere surrounding Mars. Discover more; click on the image.

Nimbus 50th Anniversary
NASA Goddard will mark 50 years since the launch of the first Nimbus satellite with a free public event on Oct. 8, from noon to 5 p.m. EDT. Anyone wishing to attend is asked to register because seating is limited. Learn more by clicking on the image.

MMS Employee Tours
What is magnetic reconnection? Why do we need to study it? Find out from the experts and get an up close look at the MMS spacecraft before they ship for launch. Register for the October 20 tours today by clicking on the image.

GOES-R Brain and Body Are Mated
Two main components of the GOES-R Satellite have recently come together. The System Module and Core Module subassemblies were successfully mated and now form the GOES-R spacecraft. Explore more by clicking on the photo.

GoddardView

On the cover: Artist's conception of NASA's Mars Atmosphere and Volatile EvolutioN (MAVEN) mission. See more on pages 3 and 10. Image 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 NASA 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.

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NASA'S NEWEST MARS MISSION SPACECRAFT ENTERS ORBIT

By: Dwayne Brown, Nancy Neal-Jones and Elizabeth Zubritsky

NASA's Mars Atmosphere and Volatile Evolution (MAVEN) spacecraft successfully entered Mars' orbit at 10:24 p.m. EDT Sunday, Sept. 21, where it now will prepare to study the Red Planet's upper atmosphere as never done before. MAVEN is the first spacecraft dedicated to exploring the tenuous upper atmosphere of Mars.

"As the first orbiter dedicated to studying Mars' upper atmosphere, MAVEN will greatly improve our understanding of the history of the Martian atmosphere, how the climate has changed over time, and how that has influenced the evolution of the surface and the potential habitability of the planet," said NASA Administrator Charles Bolden. "It also will better inform a future mission to send humans to the Red Planet in the 2030s."

onfirmation of successful orbit insertion was received from MAVEN data observed at the Lockheed Martin operations center in Littleton, Colorado and from tracking data monitored at NASA's Jet Propulsion Laboratory navigation facility in Pasadena, California. Telemetry and tracking data were received by NASA's Deep Space Network antenna station in Canberra, Australia.

MAVEN will now begin a six-week commissioning phase that includes maneuvering into its final science orbit and testing the instruments and science-mapping commands. MAVEN then will begin its one Earth-year primary mission, taking measurements of the composition, structure and escape of gases in Mars' upper atmosphere and its interaction with the sun and solar wind.

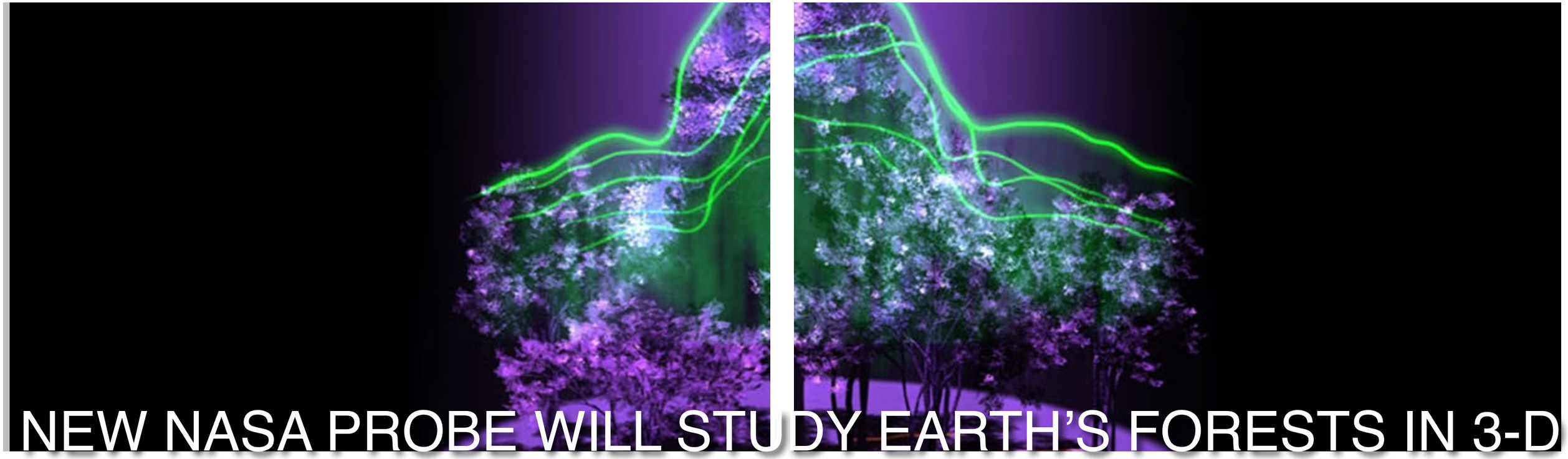
"It's taken 11 years from the original conc
ept for MAVEN to now having a spacecraft in orbit at Mars," said Bruce Jakosky, MAVEN principal investigator with the Laboratory for Atmospheric and Space Physics at the University of Colorado, Boulder (CU/LASP). "I'm delighted to be here safely and successfully, and looking forward to starting our science mission."

"This was a very big day for MAVEN," said David Mitchell, MAVEN project manager from NASA's Goddard Space Flight Center, Greenbelt, Maryland. "We're very excited to join the constellation of spacecraft in orbit at Mars and on the surface of the Red Planet. The commissioning phase will keep the operations team busy for the next six weeks, and then we'll begin, at last, the science phase of the mission. Congratulations to the team for a job well done today."

MAVEN launched Nov. 18, 2013, from Cape Canaveral Air Force Station in Florida, carrying three instrument packages. The Particles and Fields Package, built by the University of California at Berkeley with support from CU/LASP and Goddard contains six instruments that will characterize the solar wind and the ionosphere of the planet. The Remote Sensing Package, built by CU/LASP, will identify characteristics present throughout the upper atmosphere and ionosphere. The Neutral Gas and Ion Mass Spectrometer, provided by Goddard, will measure the composition and isotopes of atomic particles.

MAVEN's principal investigator is based at CU/LASP. The university provided two science instruments and leads science operations, as well as education and public outreach, for the mission. The University of California at Berkeley's Space Sciences Laboratory also provided four science instruments for the mission. Goddard manages the MAVEN project. Lockheed Martin built the spacecraft and is responsible for mission operations. JPL provides navigation and Deep Space Network support, as well as Electra telecommunications relay hardware and operations. ■

Above: Members of the mission team at the Lockheed Martin Mission Support Area in Littleton, Colorado, celebrate after successfully inserting MAVEN into orbit around Mars. Photo credit: Lockheed Martin



NEW NASA PROBE WILL STUDY EARTH'S FORESTS IN 3-D

By: Elizabeth Zubritsky

A laser-based instrument being developed for the International Space Station will provide a unique 3-D view of Earth's forests, helping to fill in missing information about their role in the carbon cycle.

Called the Global Ecosystem Dynamics Investigation (GEDI) lidar, the instrument will be the first to systematically probe the depths of the forests from space. The system is one of two instrument proposals recently selected for NASA's Earth Venture Instrument program and is being led by the University of Maryland, College Park. The instrument will be built at NASA's Goddard Space Flight Center in Greenbelt, Maryland.

"GEDI will be a tremendous new resource for studying Earth's vegetation," said Piers Sellers, deputy director of Goddard's Sciences and Exploration Directorate. "In particular, the GEDI data will provide us with global-scale insights into how much carbon is being stored in the forest biomass. This information will be particularly powerful when combined with the historical record of changes captured by the U.S.'s long-standing program of Earth-orbiting satellites, such as Landsat and MODIS."

By revealing the 3-D architecture of forests in unprecedented detail, GEDI will provide crucial information about the impact that trees have on the amount of carbon in the atmosphere. Although it is well established that trees absorb carbon and store it long-term, scientists have not quantified exactly how much carbon forests contain. As a result, it's not possible to determine how much carbon would be released if a forest were destroyed, nor how well emissions could be countered by planting new trees.

"One of the most poorly quantified components of the carbon cycle is the net balance between forest disturbance and regrowth," said Ralph Dubayah, the GEDI principal investigator at the University of Maryland. "GEDI will help scientists fill in this missing piece by revealing the vertical structure of the forest, which is information we really can't get with sufficient accuracy any other way."

GEDI can do this because it's a laser-based system, called a lidar, that can measure the distance from the space-based instrument to Earth's surface with enough accuracy to detect subtle variations, including the tops of trees, the ground and the vertical distribution of aboveground biomass in forests.

"Lidar has the unique ability to peer into the tree canopy to precisely measure the height and internal structure of the forest at the fine scale required to accurately estimate their carbon content," said Bryan Blair, the deputy principal investigator for GEDI at Goddard.

GEDI will carry a trio of specialized lasers, developed in-house at Goddard, and will use sophisticated optics to divide the three beams out into 14 tracks on the ground. Together, these tracks will be spaced 1,640 feet apart on the surface creating a total swath width of about 4 miles.

GEDI will sample all of the land between 50 degrees north latitude and 50 degrees south latitude this way, covering nearly all tropical and temperate forests.

The lasers will illuminate the surface with brief pulses of light that are optimized to pass through the canopy of even very dense forests without causing harm. (The lasers are eye-safe.) The team estimates that the instrument will send out 16 billion pulses in one year.

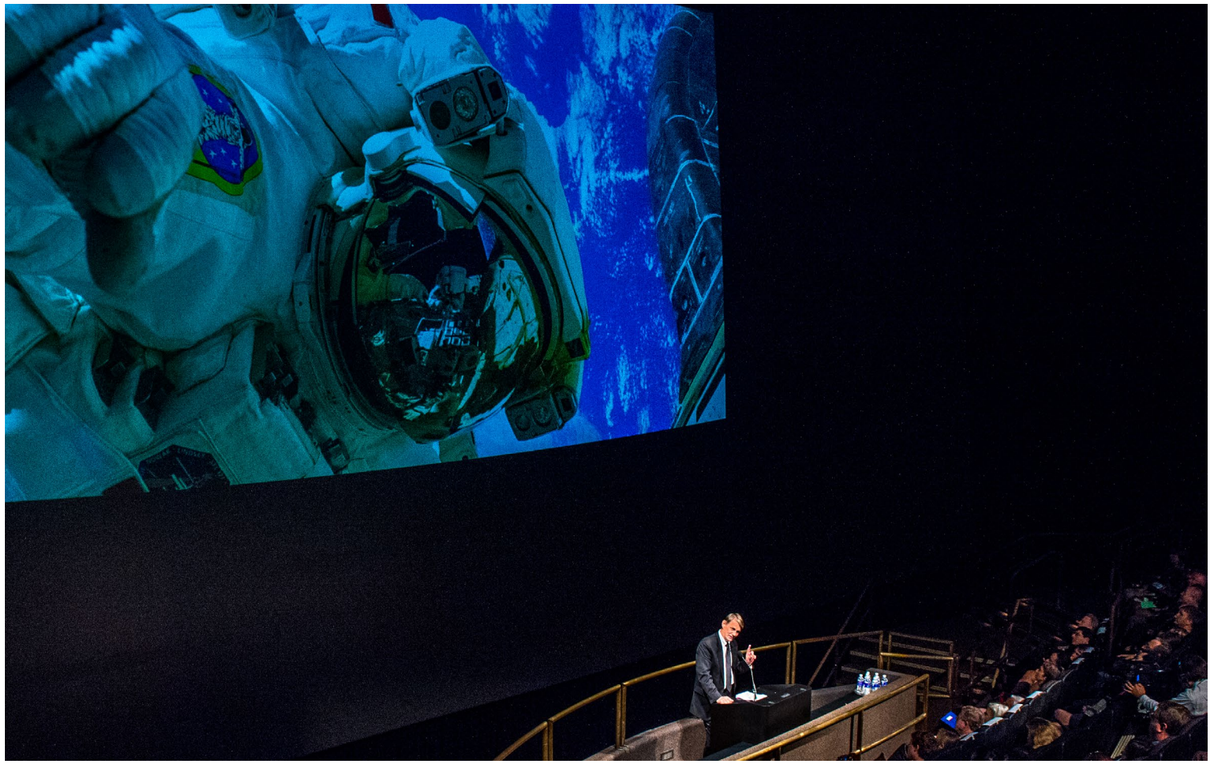
A small fraction of each pulse—the return pulse—is reflected back to a detector on the orbiting instrument. The amount of time it takes to complete this round trip is measured precisely and converted into a distance. In addition, the materials that a pulse encounters along the way will modify the signal slightly, resulting in a different fingerprint or vertical profile when a pulse interacts with leafy treetops versus woody branches and trunks or the ground.

These fingerprints will provide enough detail to measure the height of the trees and where the tree canopy begins with an accuracy of about 3 1/3 feet. From this information, scientists will be able to estimate how much biomass the trees contain and, in turn, how much carbon they are storing.

By combining these findings with spatially comprehensive maps from other satellites showing where development and deforestation are taking place, or with studies that reveal the composition of forests, scientists will have a more powerful tool set for addressing questions about land use, habitat diversity and climate effects. For example, researchers will be able to relate forest architecture with habitat quality and the biodiversity of certain birds. They also may be able to estimate the age of trees in specific forests. The ultimate goal, Dubayah said, is to be able to monitor these and other changes in forests over time.

GEDI is scheduled to be completed in 2018. NASA's Earth Venture Instrument program is part of the Earth System Science Pathfinder program, managed by NASA's Langley Research Center in Hampton, Virginia, for NASA's Science Mission Directorate. The GEDI team includes co-investigators from Goddard; Woods Hole Research Center, Woods Hole, Massachusetts; the U.S. Forest Service, Ogden, Utah; and Brown University, Providence, Rhode Island. ■

Above: The Global Ecosystem Dynamics Investigation lidar will reveal the 3-D architecture of forests, as depicted in this artist's concept. The unprecedented detail of these measurements will provide crucial information about the impact that trees have on the amount of carbon in the atmosphere. Image credit: NASA/Goddard



VITAL SIGNS: TAKING THE PULSE OF OUR PLANET

By: Leslee Cork

On Wednesday, September 10, Goddard welcomed its fifteenth installment of its annual lecture and reception. “Vital Signs: Taking the Pulse of Our Planet” was the theme for this year’s event, hosted by the National Air and Space Museum in Washington, D.C. and sponsored by the Maryland Space Business Roundtable.

The 6:30 p.m. reception allowed attendees—representatives from NASA, industry, Congress and professional businesses—an opportunity to mix and mingle with old colleagues and meet new acquaintances. Special invited groups included Summer of Innovation Camp Directors, Wounded Warriors from Ft. Belvoir and Final Frontier students from Robert Goddard French Immersion School.

Following the reception, attendees made their way into the Lockheed Martin IMAX Theater and Albert Einstein Planetarium overflow location for the 8 p.m. program. Senior program officials included Dr. Roger Launius, associate director for Collections and Curatorial Affairs at the National Air and Space Museum; Charlie Bolden, NASA administrator; Chris Scolese, director of NASA’s Goddard Space Flight Center and Senator Bill Nelson, chairman, Science and Space Subcommittee. Lecture speakers included Dr. Piers Sellers, deputy director of the Science and Exploration Directorate at NASA’s Goddard Space Flight Center; Dr. Gail Skofronick-Jackson, project scientist of the Global Precipitation Measurement mission; Dr. Thorsten Markus, project scientist of the Ice, Cloud and land Elevation Satellite-2 mission; Dr. Lola Fatoyinbo, principal investigator for EcoSAR and Dr. Lennard Fisk, distinguished university professor of space science at the University of Michigan. ■

Above: Dr. Piers Sellers, deputy director of the Science and Exploration Directorate at NASA’s Goddard Space Flight Center speaks to guests at “Vital Signs: Taking the Pulse of Our Planet.” Photo credit: NASA/Goddard/Bill Hrybyk

THE MAKING OF A 3-D MODEL OF HURRICANE JULIO

By: Rob Gutro

Francis Reddy, a senior science writer for astrophysics, works with the NASA Goddard Office of Communications. Reddy has written books and articles on astrophysics and astronomy, and lately has been exploring the capabilities of his home 3-D printer. Most recently he used two NOAA Geostationary Operational Environmental Satellites (GOES) satellite images to create a 3-D print of Hurricane Julio.

3-D printing makes a three-dimensional object from a computer model. The model can be designed in appropriate software or developed from an image. Many different 3-D printing technologies exist, but those most commonly available for home use involve additive processes in which successive layers of plastic material are laid down under computer control.

The model Reddy made depicts Hurricane Julio on Aug. 7, 2014, as it churned in the Eastern Pacific with maximum sustained winds near 105 mph. Satellite images from 2100 UTC (5 p.m. EDT) were used to make the model. At that time, Julio was a Category 2 storm centered near latitude 17.1 degrees north and longitude 137.7 degrees west.

The model is based on visible and infrared images taken by NOAA’s GOES-15 or GOES-West satellite. “These were merged for aesthetic effect and cropped to a square around the storm,” Reddy said. “Elevations were assigned based on the brightness of sampled pixels to generate vertical height, which is exaggerated here by about 10 times assuming a typical height of about 50,000 feet.” Printed at its default size, the Julio model is 5.3 inches on each side, which represents an actual distance of 787 miles.

Reddy took a special interest in Hurricane Julio because one of the astrophysics missions he works with, the Fermi Gamma-ray Space Telescope, caught a burst of gamma rays from the storm.

Reddy wrote of the gamma-ray burst: Shortly after 4:19 a.m. EDT on Monday, Aug. 4, NASA’s Fermi Gamma-ray Space Telescope showed that Julio packs a wallop of a very different kind when its Gamma-ray Burst Monitor (GBM) detected a quick flash of high-energy light.

This type of outburst is known as a terrestrial gamma-ray flash (TGF). Produced by the powerful electric fields in thunderstorms, TGFs last only a few thousandths of a second but emit gamma rays that make up the highest-energy naturally occurring light on Earth. Scientists estimate that, on average, about 1,100 TGFs occur each day.

Fermi’s GBM instrument can detect TGFs within about 500 miles of the spacecraft, which is too imprecise to definitively associate these flashes with specific storms. In 2012, however, Fermi scientists used lightning location data to show that TGFs also emit strong radio bursts, signals that can pinpoint the flashes with much greater precision.

Lightning emits a range of very low frequency radio waves, often heard as pop-and-crackle static on AM radio broadcasts. The World Wide Lightning Location Network (WWLLN), a research collaboration operated by the University of Washington in Seattle, uses these radio signals to pinpoint lightning discharges anywhere on the globe to within about six miles.

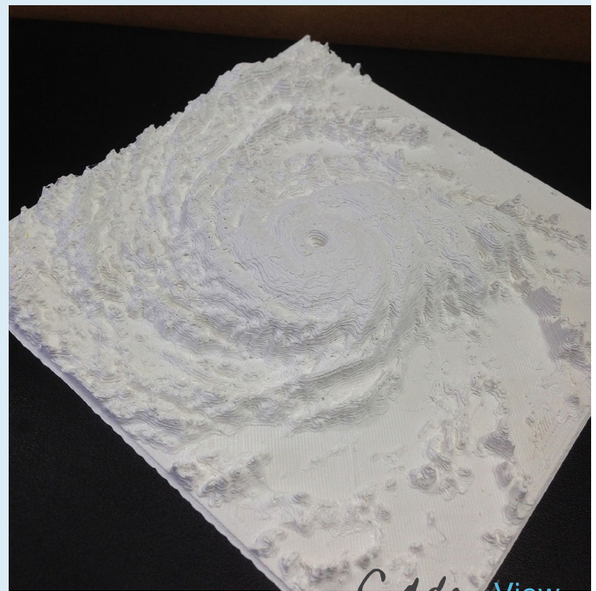
According to WWLLN data, a lightning-like radio burst occurred near Fermi just 1.89 milliseconds after the spacecraft captured the gamma-ray flash above Julio, then a tropical storm. The timing is so close that the two signals must be related. “As far as I know, a TGF from a tropical storm has never been reported before,” said Michael Briggs, a member of the GBM team at the University of Alabama in Huntsville.

Reddy’s model is in the public domain. The original GOES-15 images used to develop it were retrieved through the NASA/NOAA GOES Project at NASA’s Goddard Space Flight Center.

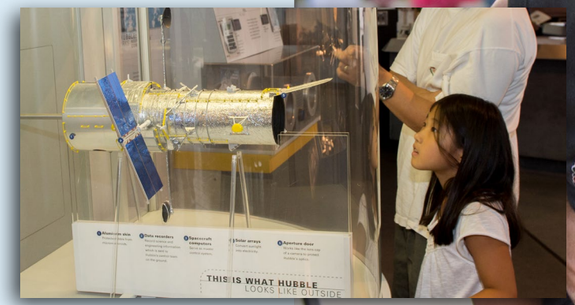
Reddy also submitted the model to the NASA Ames-based NASA 3-D Resources page to enable anyone else to make the same model.

For NASA’s Hurricane Web page, visit: www.nasa.gov/hurricane. Follow NASA hurricanes on Facebook and Twitter. ■

Below: 3-D printed version of Hurican Julio. Photo credit: NASA/Goddard/Aries Keck

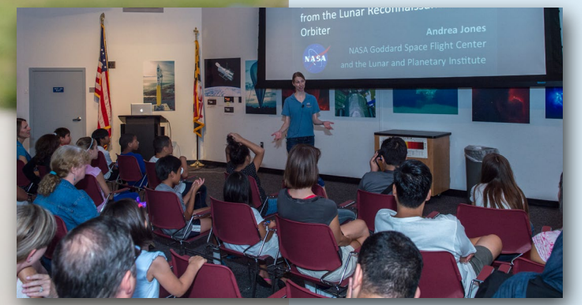


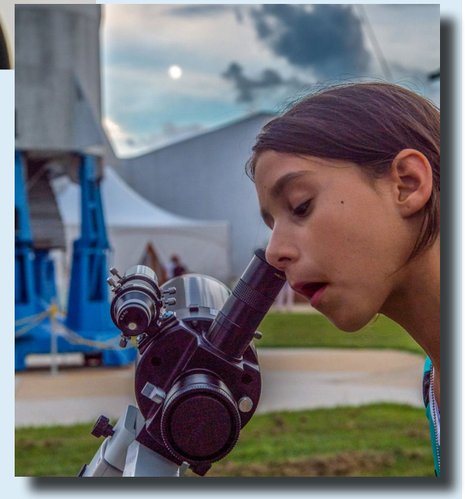
INTERNATIONAL OBSERVE THE MOON NIGHT



NASA's Goddard Space Flight Center Visitor Center in Greenbelt, Maryland, hosted a public event on September 6 to celebrate five years of observing the moon. This free event was for families with middle-school-aged children and older.

This was the fifth anniversary of International Observe the Moon Night (InOMN), a public campaign to celebrate and observe Earth's nearest neighbor. InOMN was established shortly after the launch of NASA's Lunar Reconnaissance Orbiter, which is celebrating its fifth year in orbit around the moon. For more information about InOMN, visit: http://observethemoonnight.org.





International Observe the Moon Night is an annual event dedicated to encouraging people to look up and take notice of our nearest neighbor, the moon. From looking at the moon with a naked eye to using the most sensitive telescope, every year on the same day, people from around the world host events and activities that celebrate the moon.

See more images on Flickr. ■

Photo credit: NASA /Goddard/Bill Hrybyk

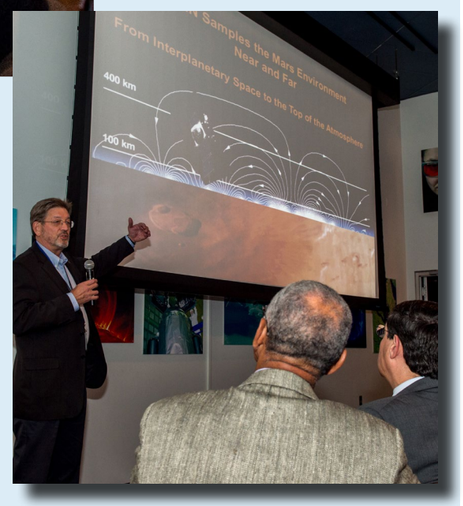
MAVEN ORBIT INSERTION AT GODDARD VISITOR CENTER

Goddard's Visitor Center hosted an event for MAVEN team members during this past Sunday's orbit insertion at Mars. NASA Administrator Charles Bolden and Goddard Center Director Chris Scolese spoke at the event, as well as Dr. Jim Green, Planetary Science Division director at NASA Headquarters. See the photos.

MAVEN successfully entered Mars' orbit at 10:24 p.m. EDT Sunday, September 21. MAVEN will now begin maneuvering into its final science orbit and testing the instruments and science-mapping commands. MAVEN then will begin its one Earth-year primary mission: measuring the composition, structure and escape of gases in Mars' upper atmosphere, and its interaction with the sun and solar wind.

More images available on Flickr. ■

Photo credit: NASA /Goddard/Bill Hrybyk



OUTSIDE GODDARD

By: Elizabeth M. Jarrell

How to Make a Dream Come True

Aerospace engineer Megan Meehan says that keeping humble makes her work harder. She has been working hard since the third grade when she decided to become an engineer.

Meehan's career epiphany happened during her 10th birthday party while watching the movie "Apollo 13."

"There is a scene where mission controllers are in a conference room after the explosion damaged the air filtration system. One mission controller said to the other, 'We've got to make this fit into the hole for this using nothing but that.' The 'that' was a box of available spare parts, and the movie showed how the engineers worked through the problem, found a solution and helped to save the crew," recalls Meehan.

In sixth grade, Meehan accompanied another class to the Buehler Challenger and Science Center in Paramus, New Jersey. She thought it was the coolest thing ever.

The Buehler Challenger and Science Center is home to one of the Challenger Learning Centers, part of Challenger Center for Space Science Education, a not-for-profit organization that encourages students in science, technology, engineering and mathematics. The families of the crewmembers lost in the 1986 Challenger accident founded the organization. Dr. June Scobee Rodgers, widow of Challenger commander Dick Scobee, was the founding chairperson.

After eighth grade, Meehan served as a voluntary junior counselor at the Buehler Center's annual summer camp. She mentored middle school students in science experiments and simulated space missions in the center's replicated space station and mission control.

Throughout high school, she continued to volunteer every summer. A highlight was the annual Family Science Morning event, for which Meehan and her classmates provided interactive science demonstrations geared towards the elementary and middle school children. Meehan also assisted the center with other special events including guest speakers.

It was during one of these events that she met a NASA engineer who built robots. "It was pretty awesome to meet a real, live, interesting NASA engineer," said Meehan. "I wanted to emulate him." Years later, she ran into him and thanked him for changing her life. He was very surprised, but she thought it was important to tell him.

In college, Meehan continued her involvement with the Family Science Morning events by demonstrating her own research and designs for advanced spacesuit technologies. Her senior year in college, she and several classmates were guest speakers for the Alexandria, Virginia center explaining their senior capstone design project.

Upon college graduation in 2006, Meehan already had a job at NASA Goddard as an aerospace engineer for the Hubble Space Telescope. She is currently working with the Atmospheric Topographic Laser Altimeter System.

"I'm literally living the dream I've had since I was a third grader," said Meehan. "In 2009, when we launched STS-125, the Hubble Servicing Mission, it really hit me that everything had come full circle when I walked into mission control and put on a headset."

She attributes much of her success to her early association with Challenger Center and the Buehler Challenger and Science Center. Without their help, she believes that she would not be what she is today. In Dr. Rodgers' 2011 book "Silver Linings," which includes the story of how she helped establish Challenger Center, she details Meehan's involvement as one of Challenger Center's success stories.

"It is our mission to help educate our students and to inspire and excite them about STEM subjects and future careers in these important fields," said Dr. Scobee Rodgers. "It is truly gratifying to hear how our center did just that for Megan, and to know that she combined that inspiration with her own ability, dedication and commitment to fulfill her dreams."

"I recognized and took advantage of opportunities, but I also worked incredibly hard," said Meehan. "I'm very thankful to my parents, several mentors and Challenger Center for helping me recognize these opportunities and provide the encouragement to live my dream." ■

Center: Meehan at Kennedy Space Center for the STS-125 HST Servicing Mission roll out. Photo provided by Megan Meehan