National Aeronautics and Space Administration

Goddard View

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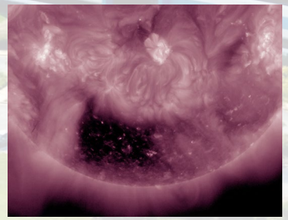
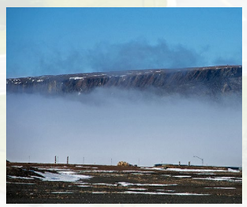
GoddardView

THE WEEKLY

Memorial Day Commemoration
Goddard's Veterans Advisory Committee invites you to attend their 2014 Memorial Day Commemorative Event on Tuesday, May 27, at 10 a.m., in the Bldg. 8 auditorium. Former Army Sergeant Kayla Williams will speak on her combat experiences. Click to learn more.

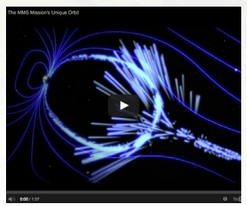
Coronal Hole Squared
A coronal hole, an area where solar wind streams into space, is one of the most noticeable features on the Sun of late. Inside the coronal hole one can see bright loops where the hot plasma outlines little pieces of the solar magnetic field. Discover more by clicking on the image.





More Glacier Surveys for IceBridge
Researchers with NASA's Operation IceBridge added three more flights to the books, continuing the campaign's data collection with surveys of major outlet glaciers and elevation across the northern Greenland Ice Sheet. Learn more by clicking on the image.

MMS Narrated Orbit Video
In March 2015, NASA will launch four identical spacecraft to study a process known as magnetic reconnection. In the video you'll learn about MMS's orbits, which will extend out toward the sun in Phase I and then will extend away from Earth to almost 99,000 miles in Phase II. Learn more. Click on the image.



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On the cover: This new Hubble picture is the sharpest ever image of the core of spiral galaxy Messier 61. Taken using the High Resolution Channel of Hubble's Advanced Camera for Surveys, the central part of the galaxy is shown in striking detail. Image credit: ESA/Hubble & NAS, Acknowledgement: Det58

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.

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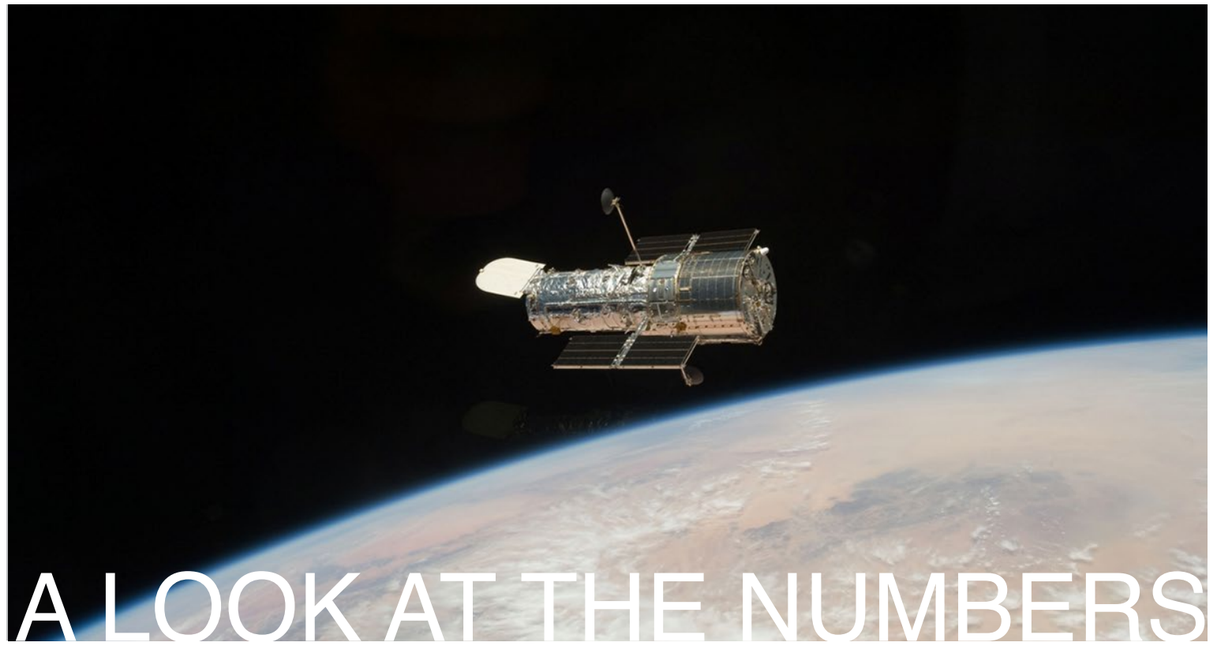


A LOOK AT THE NUMBERS

By: Rob Gutro

On April 24, 1990, the space shuttle Discovery lifted off from Earth with the Hubble Space Telescope nestled securely in its bay. The following day, Hubble was released into space, ready to peer into the vast unknown of space.

NASA's Hubble Space Telescope recently marked its 24th year in space and to celebrate its 25th year, NASA is taking a look at some of the amazing statistics generated by the world-famous telescope.

Hubble has reinvigorated and reshaped our perception of space and uncovered a universe where almost anything seems possible within the laws of physics. Hubble has revealed properties of space and time that for most of human history were only probed in the imaginations of scientists and philosophers alike. Today, Hubble continues to provide views of cosmic wonders never before seen and is at the forefront of many new discoveries.

Shortly after Hubble was deployed in 1990, the observatory's primary mirror was discovered to have a flaw that affected the clarity of the telescope's early images. Astronauts repaired Hubble in December 1993. Including that trip, there have been five astronaut servicing missions to Hubble. The first servicing mission occurred Dec. 2-13, 1993. Subsequent servicing missions occurred on Feb. 11-21, 1997; Dec.19-27, 1999; March 1-12, 2002 and May 11-24, 2009.

Here are some statistics on the Hubble as of its 24th anniversary on April 24, 2014:

- Hubble captures pictures of stars, planets and galaxies from its orbit around Earth while moving at 17,500 mph
- Hubble has made more the 1 million observations since its mission began in 1990.
- Hubble has observed 38,000 celestial targets.
- Hubble has orbited Earth more than 3 billion miles along a circular low-Earth orbit of about 350 miles altitude
- As of Hubble's 24th anniversary in April 2014, Hubble's observations have taken up more than 100 terabytes of data.
- Hubble currently generates 844 gigabytes of data per month.
- About 4,000 astronomers from all over the world have used the telescope to probe the universe.
- Astronomers using Hubble data have published more than 11,000 scientific papers, making it one of the most productive scientific instruments ever built.
- Hubble weighs 24,500 pounds -- as much as two full-grown elephants.
- Hubble's primary mirror is 2.4 meters (7 feet, 10.5 inches) across.
- Hubble is 13.3 meters (43.5 feet) long -- the length of a large school bus.

The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency. NASA's Goddard Space Flight Center manages the telescope. The Space Telescope Science Institute (STScI) in Baltimore conducts Hubble science operations. The Association of Universities for Research in Astronomy Inc. operates STScI for NASA. ■

Above: The Hubble Telescope as seen from NASA Space Shuttle STS-125 in May 2009. The Hubble Space Telescope was reborn with Servicing Mission 4, the fifth and final servicing of the orbiting observatory. Photo credit: NASA

“This event was particularly exciting for the IRIS team...”

NASA TELESCOPES COORDINATE BEST-EVER FLARE OBSERVATIONS

By: Karen C. Fox

On March 29, 2014, an X-class flare erupted from the right side of the sun... and vaulted into history as the best-observed flare of all time. Four different NASA spacecraft witnessed the flare, and one ground-based observatory—three of which had been fortuitously focused in on the correct spot as programmed into their viewing schedule a full day in advance.

To have a record of such an intense flare from so many observatories is unprecedented. Such research can help scientists better understand what catalyst sets off these large explosions on the sun. Perhaps we may even some day be able to predict their onset and forewarn of the radio blackouts solar flares can cause near Earth—blackouts that can interfere with airplane, ship and military communications.

“This is the most comprehensive data set ever collected by NASA’s Heliophysics Systems Observatory,” said Jonathan Cirtain, project scientist for Hinode at NASA’s Marshall Space Flight Center in Huntsville, Alabama “Some of the spacecraft observe the whole sun all the time, but three of the observatories had coordinated in advance to focus on a specific active region of the sun. We need at least a day to program in observation time and the target—so it was extremely fortunate that we caught this X-class flare.”

Images and data from the various observations can be seen in the accompanying slide show. The telescopes involved were: NASA’s Interface Region Imaging Spectrograph, or IRIS; NASA’s Solar Dynamics Observatory, or SDO; NASA’s Reuven Ramaty High Energy Solar Spectroscopic Imager, or RHESSI; the Japanese Aerospace Exploration Agency’s Hinode; and the National Solar Observatory’s Dunn Solar Telescope located at Sacramento Peak in New Mexico. Numerous other spacecraft provided additional data about what was happening on the sun during the event and what the effects were at Earth. NASA’s Solar Terrestrial Relations Observatory and the joint European Space Agency and NASA’s Solar and Heliospheric Observatory both watched the great cloud of solar material that erupted off the sun with the flare, an event called a coronal mass ejection. The U.S. National Oceanic and Atmospheric Administrations GOES satellite tracked X-rays from the flare, and other spacecraft measured the effects of the flare as it came toward Earth.

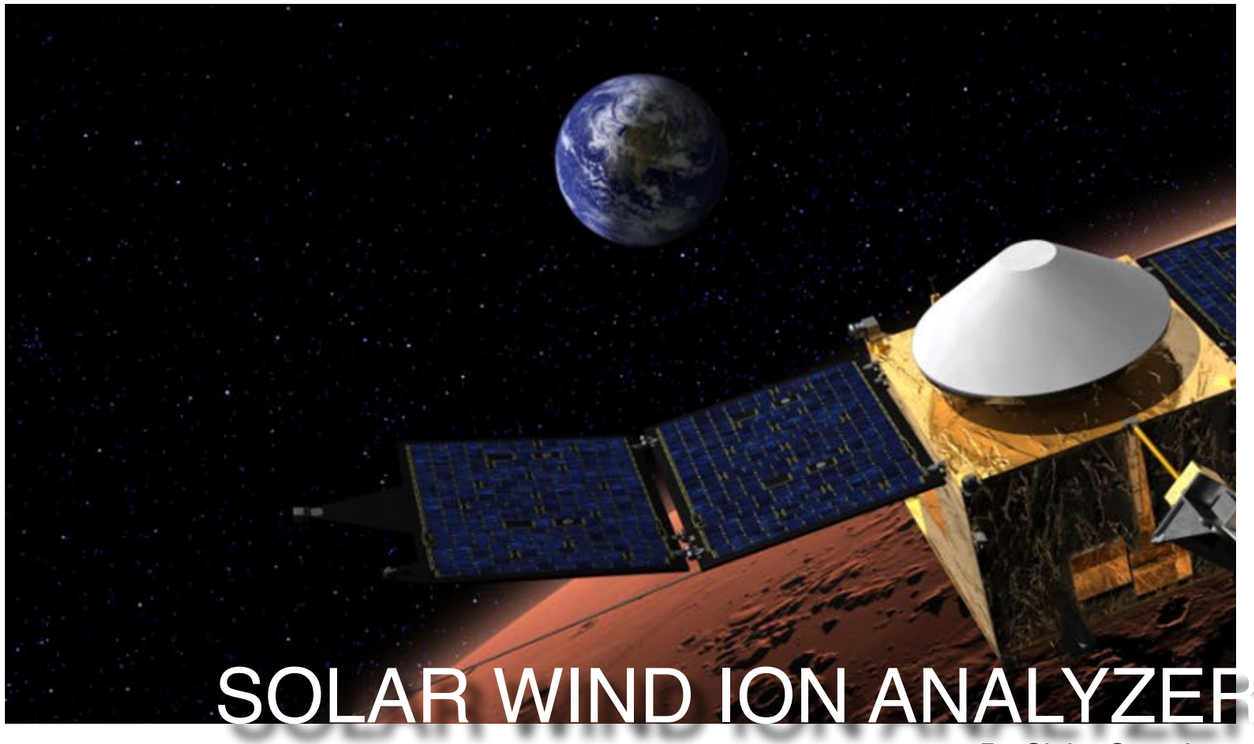
This event was particularly exciting for the IRIS team, as this was the first X-class flare ever observed by IRIS. IRIS launched in June 2013 to zoom in on layers of the sun, called the chromosphere and transition region, through which all the energy and heat of a flare must travel as it forms. This region, overall is called the interface region, has typically been very hard to untangle—but on March 29, IRIS provided scientists with the first detailed view of what happens in this region during a flare.

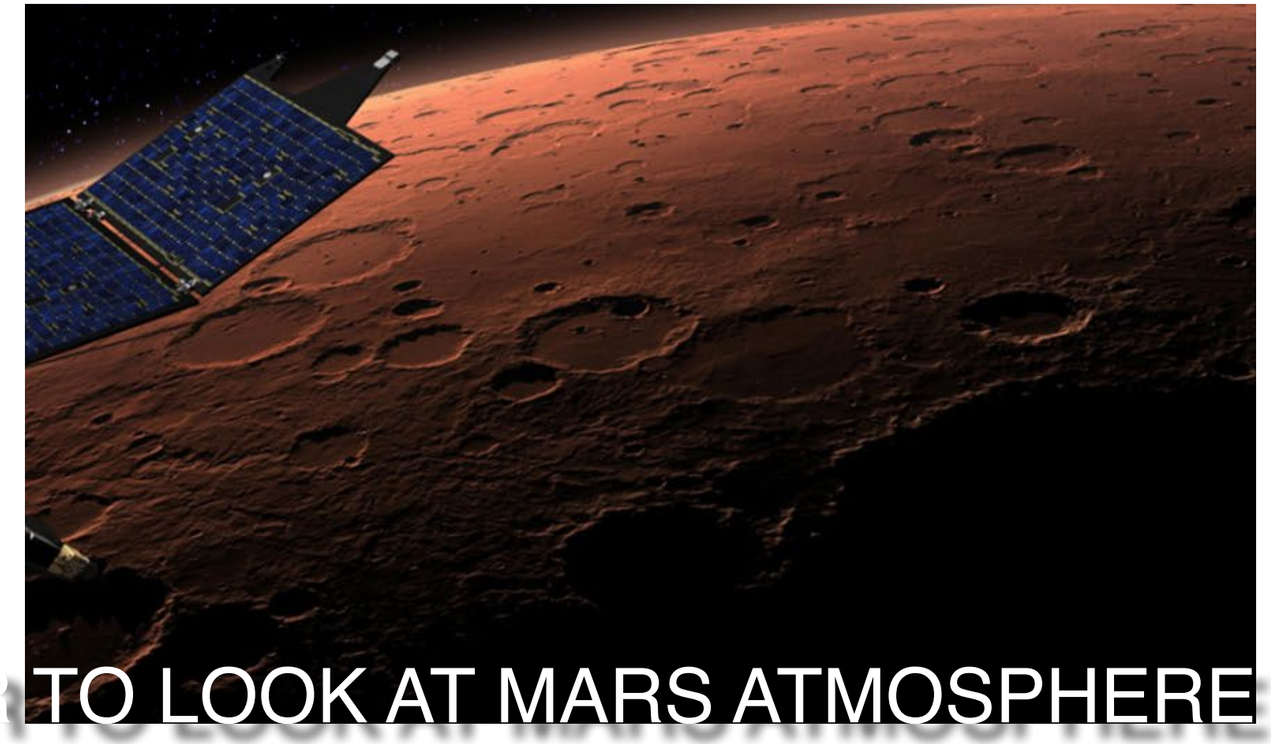
Coordinated observations are crucial to understanding such eruptions on the sun and their effects on space weather near Earth. Where terrestrial weather watching involves thousands of sensors and innumerable thermometers, solar observations still rely on a mere handful of telescopes. The instruments on the observatories are planned so that each shows a different aspect of the flare at different heights off the sun’s surface and at different temperatures. Together the observatories can paint a three-dimensional picture of what happens during any given event on the sun.

In this case, the Dunn Solar Telescope helped coordinate the space-based observatories. Lucia Kleint is the principal investigator of a NASA-funded grant at the Bay Area Environmental Research Institute grant to coordinate ground-based and space-based flare observations. While she and her team were hunting for flares during ten observing days scheduled at Sacramento Peak, they worked with the Hinode and IRIS teams a day in advance to coordinate viewing of the same active region at the same time. Active regions are often the source of solar eruptions, and this one was showing intense magnetic fields that moved in opposite directions in close proximity—a possible harbinger of a flare. However, researchers do not yet know exactly what conditions will lead to a flare so this was a best guess, not a guarantee.

But the guess paid off. In the space of just a few minutes, the most comprehensive flare data set of all time had been collected. Now scientists are hard at work teasing out a more detailed picture of how a flare starts and peaks—an effort that will help unravel the origins of these little-understood explosions on the sun. ■

Opposite: This combined image shows the March 29, 2014, X-class flare as seen through the eyes of different observatories. The dark orange square is IRIS data. The red rectangular inset is from Sacramento Peak. The violet spots show the flare’s footpoints from RHESSI. Image credit: NASA/SDO/IRIS/RHESSI/NSO/Goddard





SOLAR WIND ION ANALYZER TO LOOK AT MARS ATMOSPHERE

By:Claire Saravia

This past November, NASA launched the Mars Atmosphere and Volatile Evolution (MAVEN) mission in the hope of understanding how and why the planet has been losing its atmosphere over billions of years.

One instrument aboard the spacecraft will study a special component of the Martian atmosphere to help solve this mystery. By studying ions, small electrically charged particles, in and above the Red Planet's tenuous atmosphere, the Solar Wind Ion Analyzer will help answer why Mars has gradually lost much of its atmosphere, developing into a frozen, barren planet.

Once the MAVEN spacecraft is orbiting Mars, the Solar Wind Ion Analyzer (SWIA)—which was designed and built at the University of California, Berkeley Space Sciences Laboratory (SSL)—will spend much of its time measuring the ions in the solar wind. Released continuously from the sun's atmosphere, the solar wind travels toward Mars at speeds around a million miles per hour, carrying with it a magnetic field that originates inside the sun. It is composed of charged particles that interact with neutral gas particles in Mars' upper atmosphere, giving them the ability to escape from Mars' gravitational pull.

Scientists think the interactions between solar wind ions and Mars' atmospheric particles are a key factor allowing the particles to escape, a process that gradually strips the planet of its atmosphere and has done so for billions of years.

SWIA instrument lead Jasper Halekas of SSL said scientists could apply SWIA's measurements of solar wind ions with the measurements of the atmosphere's escaping gases the mission's other instruments make, making connections between the two that will paint the picture of how the atmosphere has evolved.

"By combining SWIA measurements with measurements of escaping gases we can parameterize the loss of atmospheric gases from Mars as a function of solar wind conditions," Halekas said. "Ultimately, we want to know where the atmosphere, especially water, went, how it left, and what Mars has looked like over its entire history."

SWIA will specifically be measuring the solar wind speed and density, two critical factors that determine how its ions interact with the planet's atmospheric particles. Halekas said although the solar wind itself isn't packed with ions, its blazing speed ensures that a huge number of ions are hitting the Martian atmosphere, and interacting with the atmosphere's particles, every second.

MAVEN deputy principle investigator Janet Luhmann, also at SSL, said by measuring the solar wind's density and velocity, SWIA could help determine whether gusts of denser, faster solar wind contribute to greater atmospheric loss. This information will be used to estimate losses in the past, when solar wind gusts may have been prevalent thanks to an early, more active sun.

Once they hit the atmosphere, the solar wind's ions play several critical roles in aiding particles to escape from Mars' atmosphere. The solar wind is made up of both electrons, which are very small, negatively charged particles, and ions, which are larger positively charged particles.

Halekas said both ions and electrons could start the process of particle escape by transforming the atmosphere's neutral particles into charged ions. Once becoming charged, they can interact with the solar wind's magnetic field and be accelerated and carried away from the planet. The ionization step is critical, since the original neutral particles don't respond to the solar wind magnetic field and have too little energy to escape.

The ionized gases in the solar wind—known as plasma—can interact with the wind's magnetic field to form an electric field, and accelerate the newly charged particles in the atmosphere with enough energy for them to escape.

Although the solar wind ions are travelling at the same velocity as the electrons, they have a larger mass. This gives them a greater momentum, providing the newly formed atmospheric ions with more energy to escape.

In order to determine how solar wind ions work with the magnetic fields in the near-Mars environment to aid particle escape, SWIA will work with the MAVEN magnetometer. Together with the solar wind's magnetic field, the ions interact with Mars' upper atmosphere, forming a network of charged particles and magnetic field lines around Mars called a magnetosphere.

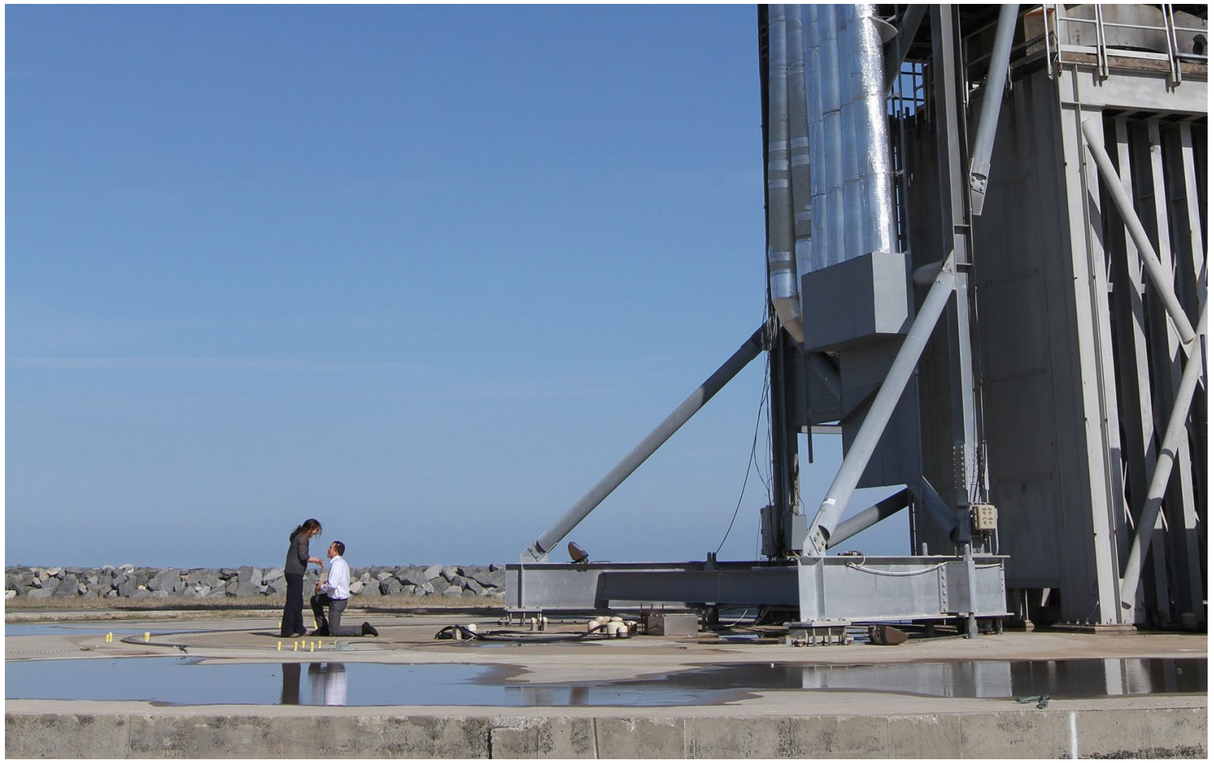
"It is the incoming solar wind ions and magnetic field that compress and warp the ionized gas into the teardrop-shaped structure we call a magnetosphere, which any escaping particles must travel through to leave the system," Halekas said.

Equipped with a field of view that covers about 70 percent of the sky and is centered on the sun, SWIA will be able to measure the entire distribution of solar wind ions.

Because SWIA will provide key insight into how solar wind behaves, MAVEN scientist Robert Lillis at SSL said the instrument would be critical in helping understand why Mars doesn't have the dense atmosphere required to maintain life-supporting properties like liquid water on its surface, and whether it ever did.

"The history of habitability and atmospheric loss on Mars are linked, and to decipher this history we need to understand how rates of loss of gas from Mars today depend on the properties of solar wind buffeting the upper atmosphere," Lillis said. ■

Above: Artist's conception of MAVEN above Mars. Image credit: NASA/Goddard



On September 6, 2013, the Lunar Atmospheric and Dust Environment Explorer launched from Pad 0B at Mid-Atlantic Regional Spaceport located at NASA's Wallops Flight Facility in Virginia. A mission of numerous firsts, LADEE was the first lunar mission from Wallops.

Exactly eight months later, on May 6, 2014, LADEE experienced another first: first marriage proposal.

David Calkins, Deputy Plans Chief for the Virginia Department of Emergency Management, was on hand to witness LADEE's launch in September. Calkins was familiar with the LADEE mission through his role and involvement in the Virginia Emergency Operations Center.

While participating in the launch activities, he conversed back and forth with his soon-to-be girlfriend, Ashley Dobbin. She was back home in Richmond, Virginia and watched the launch from her front lawn. The moment remains special in their relationship and the two view it as a launching point in their relationship—quite literally.

Eight months later, Calkins contacted officials at Wallops Flight Facility to request permission to bring Dobbin to Wallops for a very special visit. The couple arrived at Wallops on the evening of May 6.

Calkins and Dobbin met with their "tour guides" from the Office of Communications and Wallops Emergency Management. The tour guides were armed with cameras to capture the very special moment, all while allowing Dobbin to believe they were invited as part of a tour.

Upon arriving at Pad 0B, the couple was given a brief overview of the pad and then allowed the opportunity to view the pad firsthand. Calkins found the perfect spot for his mission. With the sun beginning to set and the moon in sight, Calkins dropped to one knee and asked Dobbin to marry him. Her answer was yes.

Although the LADEE mission has officially ended, the mission of firsts continues. The next mission for Calkins and Dobbin? Wedding planning. ■

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

A UNIQUE MISSION AT WALLOPS

NASA ANNOUNCES WINNERS OF REELSCIENCE 2014 VIDEO CONTEST

By Rob Gutro

NASA has selected the winners of NASA's 2014 educational "REEL Science Communications" video contest. Students in Huntington, New York; Santa Cruz, California and Placerville, California created the three winning videos. There were also six videos chosen as runners-up.

"Once again, NASA received some impressive, creative videos from high school students around the country," said Claire Parkinson, project scientist for the Aqua mission at NASA's Goddard Space Flight Center. "These videos reflect a technical expertise in videography combined with an interest in science that ranges from the super serious to the playful. We are very pleased to have NASA Earth science imagery used by these talented and motivated teenagers, all of whom have the potential to become future scientists."

In the fall of 2013, NASA Earth science missions announced the second annual video contest for high school students aged 13 to 18 to produce a video that communicates NASA Earth science to engage younger students. The challenge was for high school students to produce a two-minute video for a middle school audience that communicates one of the following science concepts: water within the Earth system, how ice changes impact climate and the effects of wildfires on air quality. NASA's Aqua, ICESat and Terra missions sponsored the three categories respectively. Student producers had to use NASA resources such as audio clips, animations, visualizations or satellite images to create their video by March 31, 2014. A total of 22 entries were received.

NASA producers, communications experts and scientists judged the videos for several factors that included: scientific accuracy, creativity, the use of NASA data and video quality.

The three winning videos are: "Water of the Water Planet: Glaciers," produced by Lena Korkeila of El Dorado High School in Placerville, California; "Melting Ice Caps," by Anna Olson of Pacific Collegiate School in Santa Cruz, California; and "Forest Fire Effects on Air Quality," by Heather Forster, Sofia Bialkowski, and Suzie Petryk, of Huntington High School in Huntington, New York.

The six runners-up videos are: "How Ice Impacts Climate and Climate Impacts Ice," by Joseph Saginaw, Justin Edgar-McNerney, and Charles Beers of Huntington High School in Huntington, New York; "How Ice Impacts Climate and How Climate Impacts Ice," Adam Stadler of Homestead High School in Mequon, Wisconsin; "Water," by Vincent Prochoroff and Antek Prochoroff of Shaker Heights High School in Shaker Heights, Ohio; "Pollution from Wildfires," by Norris King and Jesse Lueb of Lakewood Christian Schools in Long Beach, California; "Hurricanes," by Shlomo Kugler and Ahron Tzvi Verschleisser of Leo Bernstein Jewish Academy of Fine Arts in Silver Spring, Maryland; and "Wildfires and Terra," by Anna Olson of Pacific Collegiate School in Santa Cruz, California.

The winners now have an opportunity to work with NASA scientists and communication experts in July 2014 and to produce an Earth Science feature video.

"Even though every submission cannot win, it was evident that each student worked very hard to research what NASA data can help answer the REEL Science questions. Contests like this really show just how important NASA research is in the eyes of our future scientists," said Brian A. Campbell, education lead for NASA's ICESat-2 mission.

Videos from winners and runners-up are posted on NASA's Aura mission and REEL Science websites. Winning videos can be seen on the REEL Science webpage. ■

Below: One of three winning videos in NASA's 2014 educational "REEL Science Communications" video contest: "Forest Fire Effects on Air Quality," by Heather Forster, Sofia Bialkowski and Suzie Petryk of Huntington High School in Huntington, New York.

HUNCH

On May 17, 2014, students and their teacher mentors got a HUNCH about NASA Goddard. High school students United with NASA to Create Hardware (HUNCH) is a partnership between NASA and high school students and teachers that benefits exploration and technological advancement.

NASA Goddard hosted an awards ceremony to honor the HUNCH students and their mentors. The awards ceremony was hosted by Stacy Hale of NASA's Johnson Space Center, the HUNCH Program Founder.

After remarks by NASA Goddard Center Director Chris Scolese, the students and teachers received certificates recognizing their participation in HUNCH. After the award distribution, all attendees watched videos created by two of the participating schools: Fairpoint High School in Fairpoint, New York and Council Rock High School South in Holland, Pennsylvania.

Before and after the ceremony, there were special events and tours for the visitors. The high schoolers and their teacher mentors were treated to tours of the machine shop in Building 5 and given an overview of the James Webb Space Telescope in front of the high bay clean room in Building 29.

Photo credit: NASA/Goddard/Bill Hrybyk

Guests were invited to return to the Goddard Visitor Center to experience a presentation on Goddard internship opportunities by Kathy Bender, a STEM education specialist in Goddard's Office of Education. Following Bender's presentation, Michelle Thaller, assistant director for science communication and higher education in the Sciences and Exploration Directorate, gave an overview of Goddard's mission using the Science on a Sphere projection system.

As a partner in HUNCH, NASA receives cost effective hardware and soft goods fabricated by the students. In turn, the students receive hands-on experience and, in some cases, NASA certification in the development of training hardware for the International Space Station crewmembers or ground support personnel. The goals of this program are to obtain training and flight-certified hardware and soft goods that are used by NASA ISS astronauts and personnel, and to inspire the next generation of explorers

NASA technicians and engineers mentoring the schools in the fabrication of the desired item accomplish the HUNCH mission goals. The program provides NASA engineers with one-on-one time with students. The skills students learn in HUNCH classes inspire them to pursue careers in STEM areas. ■

OUTSIDE GODDARD

The Full SPECTRUM

By: Elizabeth M. Jarrell

In 1988, Aerospace Engineer and Project Safety Manager Carol Hamilton cofounded SPECTRUM, a free youth enrichment program for children aged 7 to 10. The program is affiliated with People's Congregational United Church of Christ in Washington, D.C. Over the past 23 years, Hamilton has helped about 300 kids.

"We want to get children at the age where they begin making life choices to help them make the right ones," said Hamilton. "I don't have kids, which gives me a little more time to do this."

While volunteers from all walks of life staff the program, the kids are mostly from D.C. Many are church members. Some are not.

"We have some kids whose mothers are homeless, from halfway houses, or in jail and other kids are affluent," said Hamilton. "Once when we asked the kids to make a prayer, one prayed for his father to get out of jail."

The program runs during the school year. The group ranges from 10 to 20 kids. They meet for two hours three Saturdays a month and serve lunch too. Every Saturday they have an activity highlighting one of the values of SPECTRUM, which stands for spiritual, physical, educational, cultural, talent, relationships, unity and motivation or, as summarized by Hamilton, "love, pride, service and peace."

"We're exploring their options and giving them a taste of the world," said Hamilton. "We let them think about the choices they can make."

The group has a hotline for parents to find out the next week's activity, to RSVP or just to reach the volunteers. The parents are always invited to attend; some do, some don't.

Hamilton, who does most of the programming, tries to make everything fun yet still instructive. Here are some examples of her creative activities illustrating SPECTRUM's values:

- Spiritual: meditating or holding a value auction where they list values—such as being kind—and the kids bid on them.
- Physical: learning about nutrition by making a healthy breakfast.
- Educational and economic: playing the "budget game," where the kids get a budget and have to make life choices or "the taste test game," where the kids compare budget to brand name cereals, or even visiting Goddard.
- Culture: going to a museum, holding their Christmas-Kwanzaa party, or having a contest between sweet potato tarts and pumpkin tarts baked and served by the kids using proper etiquette.
- Talent: holding a talent show with a science theme or writing for their newspaper called "The SPECTRUM Gazette."
- Relationship: playing "Through Our Eyes," where the kids interview an older family member about their childhood, or making an anti-bullying video.
- Unity: doing community service such as making gifts to give to those in need on Thanksgiving or cleaning their local park.
- Motivation: having goal-setting parties with subsequent parties to monitor progress or hosting a mini talk show where the kids come dressed as the person they would like to become as adults—such as world-famous lawyer—and explain the steps they plan to accomplish to succeed.

SPECTRUM exists largely through fundraising, church funds and grants. One of their biggest fundraising events is selling the delicious SPECTRUM holiday sweet potato cake for Thanksgiving and Christmas. The volunteers are always spending money too. SPECTRUM has received multiple awards including the prestigious Points of Light Excellence in Volunteer Service Award from President George H.W. Bush in 1989.

"Some of our students are now 30. I'm still friends with a few of them. We're reaching out to the second generation now, including the first child of one student and a niece of another. Sometimes you don't realize the difference you've made until years later when you run into a former student or their relative," said Hamilton.

Hamilton's mother is a teacher. Hamilton's mother is encouraging her to write a book about SPECTRUM highlighting her creative programming. ■

Center: Carol Hamilton. Photo credit: NASA/Goddard/Bill Hrybyk