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Goddard View

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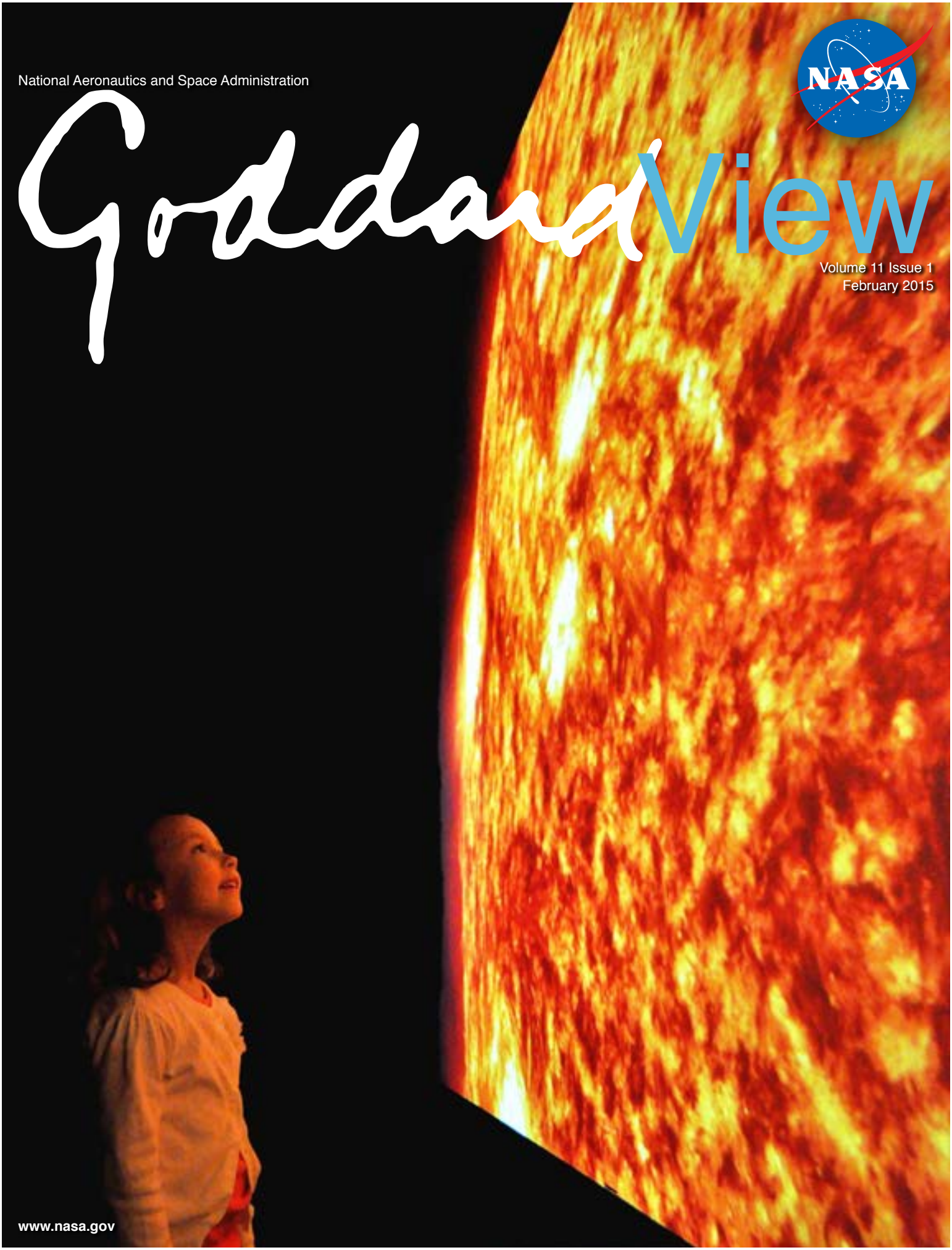

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TRENDING

Goddard Manager Delivers Keynote at White House Conference
Aprille Ericsson, program manager for small business research, was a speaker at a White House-sponsored event on increasing STEM opportunities for marginalized girls. The event was held at Georgetown University Law Center.

NASA App Wins Vizzie
NASA Visualization Explorer won a People's Choice award at the 2015 Vizzies. Popular Science and the National Science Foundation created the awards to recognize the best visualizations in science and engineering.

SDO Celebrates Five Years
The Solar Dynamics Observatory celebrated its fifth anniversary in February ahead of the unveiling of the "Solarium" exhibit at the visitor center. Since 2010, SDO has led to numerous international collaborations, and more than 2,000 papers have been published using its data.

SVS Video Shows Moon's Other Side
NASA's Scientific Visualization Studio released a detailed video simulation of the far side of the moon, or the side that can't be seen from Earth, using data from the Lunar Reconnaissance Orbiter.

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On the cover: A young girl visits the new "Solarium" exhibit at the visitor center at NASA's Goddard Space Flight Center.

Photo credit: NASA/Goddard/Scott Wiessinger

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GoddardView Info

Goddard View is an official publication of NASA's Goddard Space Flight Center in Greenbelt, Maryland. 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 the Goddard Office of Communications.

You may submit contributions to the editor at darrell.d.delarosa@nasa.gov. Ideas for new stories are welcome, but will be published as space allows. All submissions are subject to editing.

NASA'S NEW RADIOMETER TUNES IN TO SOIL'S FREQUENCY

By Kate Ramsayer

Whether it is a parched field or a boggy marsh, the ground naturally emits microwave energy. Not much energy, but enough that NASA's newest, more technologically advanced radiometer instrument can detect it from space.

In January, the new radiometer – developed at NASA's Goddard Space Flight Center – launched into orbit aboard the Soil Moisture Active Passive satellite, which is designed to measure how much water is in the soil.

Similar to how night-vision goggles detect infrared wavelengths from heat, the radiometer measures the "brightness temperature" of the soil, a combination of surface temperature and soil moisture. By factoring out the temperature, determined by computer models, scientists can calculate the wetness of the soil.

SMAP's radiometer takes measurements over relatively large areas, with a 25-mile resolution. To make that measurement accurate on the scale of agricultural practices, scientists will integrate data from SMAP's second instrument, a radar developed and built at NASA's Jet Propulsion Laboratory in Pasadena, California. The radar, which sends out a signal and listens for the return, has a resolution of about 0.6 to 1.9 miles. But because the radar is more sensitive to vegetation and other features on top of the soil, it is not as accurate as the radiometer.

So the two instruments complement each other: The radiometer provides an accurate measurement of a large block of land, while the radar provides finer detail of the soil moisture in smaller parcels.

"Combine the two together, use the best of both, and you come up with a pretty accurate soil moisture product at a spatial resolution of 6 miles," said Peggy O'Neill, SMAP deputy project scientist.

The high-quality signal detected by the radiometer also comes with noise. Radio-frequency interference is what happens when technology, like air traffic control radars or closed-circuit televisions, broadcast at the same or neighboring frequencies. The noise bleeds over into the frequency that the radiometer is tuned into, corrupting the data. To quiet that din, SMAP's radiometer has new anti-RFI enhancements.

The technique involves separating data coming from the satellite into different bins, based on frequency and time. If there are outliers that only appear at one time or within a narrow frequency band, computer programs can throw those data out to isolate the natural signals from the soil.

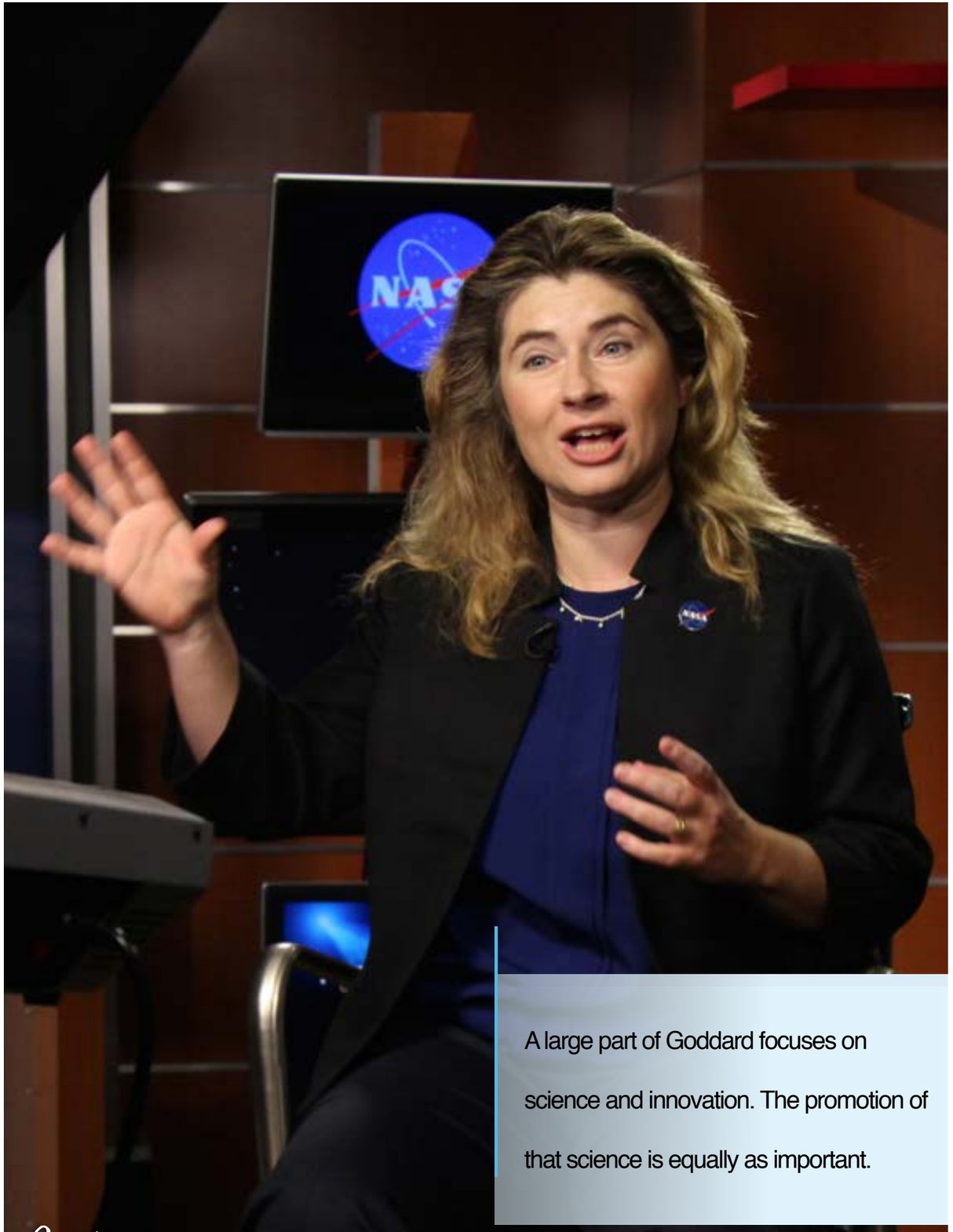
The Goddard radiometer team worked with scientists and engineers at universities to determine how bad the RFI was, as well as its potential impact on science measurements.

"We discovered that without this technology, SMAP wouldn't meet its science requirements," said Jeff Piepmeier, radiometer instrument scientist at Goddard.

As the mission progresses, the satellite will periodically flip over from its normal Earth-looking mode to take calibration measurements pointing to deep space. They will be used to keep the radiometer's accuracy consistent over time. With these accurate measurements, scientists hope to get a better view of the state of the soil in order to help farmers, emergency managers, weather forecasters and more. ■

Above: SMAP's radiometer prior to its installation aboard the spacecraft.

Photo credit: NASA



A large part of Goddard focuses on science and innovation. The promotion of that science is equally as important.

INNOVATION IN CONTENT DELIVERY: HOW LIVE SHOTS BENEFIT GODDARD

By Clare Skelly

Asteroid 2012 DA14 made a very close pass by Earth, approximately 17,200 miles above the surface, on Feb. 15, 2013. Knowing asteroid topics appeal to media, the multimedia team at NASA's Goddard Space Flight Center planned and scheduled what it calls a "live shot" event to coincide with the flyby. The live shot discussed the upcoming Origins Spectral Interpretation Resource Identification Security Regolith Explorer mission, or Osiris-Rex, that will travel to the near-Earth asteroid Bennu in late 2016 and return a sample to Earth by 2023.

Little did the team know, that same morning a different asteroid would enter Earth's atmosphere and create a large fireball over Chelyabinsk, Russia. Goddard producers recall the morning and how at that time, the lineup of news stations exploded. While this atypical live shot happened two years ago, it perfectly illustrates their unpredictable nature. The topics can evolve up to the end of the last interview.

Live shots are media campaigns that highlight research and science going on at the center. Subjects can range from mission launches to current events or more arbitrary topics such as the first day of spring. Whatever the topic, they require pitching a compelling angle that generates interest from media. On the day of the live shot, Goddard scientists give four- or eight-minute interviews to news stations across the country.

A large part of Goddard focuses on science and innovation. The promotion of that science is equally as important. Michelle Handleman, Goddard producer and live shot program lead, described live shots as "lighthearted because of the nature of the morning news." They act as a balance between technical research and traditional articles, giving the public a snapshot of the great things NASA is doing.

"Live shots help hone the research messages," said Dalia Kirschbaum, scientist within the hydrological sciences branch at Goddard and past live shot interview subject, or "talent." Kirschbaum's perspective is that live shots communicate scientific points to a broad audience while forcing scientists to be "short, sweet and to the point."

"Getting the news across doesn't always have to be in depth," Handleman said. Morning shows seek fun and exciting topics. By providing these interesting topics and linking them to NASA research, the center reaches different audiences. The national audiences include people who are perhaps unlikely to seek out NASA content on their own.

Live shots are also very visual. "Everyone loves television," said Claire Saravia, Goddard producer. She is part of a team that collects and even creates images and videos that enhance the topic. If a gripping topic cannot be paired with visuals, it will not make a great live shot. Visuals, such as the ones illustrating yearly changing global temperatures that were used for the January live shot about 2014 being the warmest year on record, aim to grab the attention of viewers and help them understand the topic.

The Goddard Office of Communications has a responsibility to "push the envelope," said Saravia. Whether the public knows it or not, it relies on the office of communications to get an idea of what is happening at Goddard. In its most recent campaign in late January, the multimedia team organized interviews for the launch of Soil Moisture Active Passive, or SMAP, a NASA satellite that measures the amount of water in the soil and whose radiometer was developed at Goddard.

"People deserve to get this news in a creative way that makes them want to pay attention," Saravia added.

Satellite media tours, such as live shots, have a 20-year history at Goddard. Still, today's live shots are quite different from the original concept. Innovation in the form of content delivery is a way to get positive attention for Goddard.

"We spend all this time for a one-minute blurb, but that blurb reaches so many people," said Saravia. ■

Opposite: NASA scientist Michelle Thaller delivers television interviews about Comet Siding Spring's encounter with Mars. Photo credit: NASA/Goddard

Below: A view of the television control room during the "Solar Max" live shot campaign. Photo credit: NASA/Goddard

DSCOVR: OFFERING A NEW VIEW OF THE SOLAR WIND

By Karen Fox

There is a fascinating spot some 932,000 miles away from Earth where the gravity between the sun and Earth is perfectly balanced. This spot captures the attention of orbital engineers because satellites can orbit this spot, called Lagrange 1, just as they can orbit a planet. But the spot tantalizes scientists as well: Lagrange 1 lies outside Earth's magnetic environment, a perfect place to measure the constant stream of particles from the sun, known as the solar wind, as they pass by.

In February, the U.S. Air Force launched a National Oceanic and Atmospheric Administration satellite called Deep Space Climate Observatory into orbit around this spot. NOAA will use DSCOVR to monitor the solar wind and forecast space weather.

However, the three solar wind instruments on board are also exciting researchers with the hope of untangling some unsolved science mysteries about the solar wind. Two of the instruments were built at NASA's Goddard Space Flight Center, and one at the Massachusetts Institute of Technology and the Harvard-Smithsonian Center for Astrophysics, both in Cambridge, Massachusetts.

"One of our main questions about the solar wind is based on the fact that it cools down as it moves toward Earth, but not as fast as we'd expect," said Adam Szabo, NASA's DSCOVR project scientist at Goddard. "There must be some heating mechanism that slows down the cooling. The solar wind instruments on DSCOVR will help us determine what's providing that extra heat."

To explore the various theories about what heats the solar wind, one must immerse oneself in the physics of very hot, charged gases called plasmas. On Earth, plasmas are found almost exclusively in laboratories and neon signs. However, plasmas dominate most of the universe, filling up space and fueling stars. Because the particles are charged, the gas is ruled by the laws of electromagnetism, in which charged particles help maintain magnetic fields and those same fields help guide the way the particles can move. The constant feedback between these phenomena creates a complex system in which small events can have big consequences.

There are two broad categories of theories as to what heats the plasma in the solar wind. The first set of theories posits that some kind of electromagnetic wave coursing through the plasma provides heat, kicking individual particles into faster movements simply because their movements are in sync with the particles, like the perfectly timed push of a swing.

The second set of theories relies on grand-scale movements – think giant ocean waves of moving particles – that cascade down to ever smaller scales of motion, eventually providing energy and heat to the individual particles themselves. In the ocean wave analogy, this might be like how the energy of a large wave incites smaller motions such as the froth riding at its crest.

Distinguishing between these two broad camps requires monitoring three facets of the solar wind: the movement of the positive particles, the movement of the negatively charged electrons and the alignment of the magnetic fields present in the plasma and its electric fields.

DSCOVR carries an instrument for each of these measurements. The velocity and direction of the positively charged particles are measured by something called a Faraday cup, built by MIT and operated by the Harvard-Smithsonian Center for Astrophysics and the University of Michigan in Ann Arbor.

The magnetic field and electron instruments on DSCOVR were both built at Goddard. A similar magnetic field instrument, called a magnetometer, is on Wind, Voyager and the Advanced Composition Explorer, or ACE.

Such instrumentation, of course, is also key to DSCOVR's primary job as a NOAA operational space weather satellite. NOAA is the U.S. government's official source for space weather forecasts and warnings. Since 1997, NOAA has incorporated crucial data from NASA's ACE in order to monitor the solar wind in real time. DSCOVR will provide a new set of input to succeed that solar wind workhorse. The DSCOVR mission is a partnership between NOAA, NASA and the U.S. Air Force. NOAA will operate DSCOVR from the NOAA Satellite Operations Facility in Suitland, Maryland, and process data at the Space Weather Prediction Center in Boulder, Colorado, for distribution to users within the United States and around the world. The data will be archived at NOAA's National Geophysical Data Center in Boulder, Colorado.

NASA received funding from NOAA to refurbish the DSCOVR spacecraft and its solar wind instruments, develop the ground segment and manage launch and activation of the satellite. The Air Force funds and oversees the launch services for DSCOVR. DSCOVR also hosts NASA-funded secondary sensors for Earth and space science observations. NASA provided funding for the refurbishment of the Earth-viewing instruments. The Earth science data will be processed at NASA's DSCOVR Science Operations Center and archived and distributed by NASA's Atmospheric Science Data Center. ■

Above: Three instruments on DSCOVR will help measure the solar wind (from left to right): the Faraday cup to monitor the speed and direction of positively charged solar wind particles, the electron spectrometer to monitor electrons and a magnetometer to measure magnetic fields.

Photo credit: NASA/DSCOVR

By Tashiana Osborne

"SOLARIUM" CAPTIVATES VISITOR CENTER GUESTS

Have you ever wondered what the sun would look like up close? How about what it would sound like? We are talking enormous solar storms and incredibly hot intergalactic plasma spat out from the sun's deepest layers. On Feb. 11, leaders from government, science, art and academia had a chance to see and hear for themselves during the opening ceremony for "Solarium" at the visitor center at NASA's Goddard Space Flight Center.

The new video installation combines science and art by showcasing awe-inspiring imagery from NASA's Solar Dynamics Observatory on a floor-to-ceiling projection. Images produced by SDO become time-lapse videos for "Solarium," which displays enhanced views of enthralling solar events, selected for their aesthetic quality.

In addition to highlighting the artistic side of heliophysics – the study of the sun and its effects on Earth and space – the exhibit also provides visitors with visuals to show how materials travel throughout the solar atmosphere. Viewers observe solar flares, sunspots and eruptions as materials and gas flow along the sun's magnetic field lines. Fiery explosions of energy, projected in combination with soothing sounds, captivate audiences.

"The sound cocoons the space," said Scott Wiessinger, a heliophysics video producer at Goddard.

More than 90 guests were in attendance, including Emmett Jordan, mayor of Greenbelt, Maryland, as well as representatives from the offices of Sens. Ben Cardin and Barbara Mikulski, both D-Md. Alex Young, associate director for science at Goddard's heliophysics division, officiated the event.

"What an exciting way to engage, entertain and teach using the imagery from NASA's Solar Dynamics Observatory," said Jordan.

Remarks were delivered by Goddard Deputy Director Rick Obenschain, NASA Interim Heliophysics Director Jeffrey Newmark and Heliophysics Multimedia Producer Genna Duberstein.

"When you think about SDO and the images it creates, you realize this is a remarkable engineering feat," said Duberstein. "We are making the invisible visible; we are exploring our very own star in detail like never before."

A production four years in the making, "Solarium" was brought to life by the artistic minds of Duberstein, Wiessinger and Heliophysics Visualizer Tom Bridgman. The public can fully experience the beauty and wonder of the sun in this innovative video art exhibition, now on permanent display at the visitor center.

"'Solarium' does something greater than inform," added Duberstein. "It inspires." ■

Above: Genna Duberstein, lead "Solarium" producer, addresses guests during the exhibit's opening ceremony at the visitor center.

Photo credit: NASA/Goddard/Bill Hrybyk

NASA TEAM DEVELOPS NEW COMMUNICATIONS SYSTEM TO BREAK THROUGH NOISE

By Lori Keesey

The radio frequency band that many NASA missions use to communicate with spacecraft — S-band — is getting a bit crowded and noisy, and likely to get more jammed as science missions demand higher and higher data rates.

A team of technologists at NASA's Goddard Space Flight Center just may have a solution, particularly for potential missions that plan to operate in low-Earth orbit and have limited real estate to accommodate communications gear.

Under two different research and development projects, technologists Mae Huang and Victor Marrero-Fontanez have collaborated to test and verify components of a prototype end-to-end Ka-band space communications system, which promises significantly higher data rates over more traditional S-band systems.

Huang is working with Goddard's Jeffrey Jaso — a pioneer in Ka-band communications — to develop a Ka-band transmitter. Marrero-Fontanez, meanwhile, is designing Ka-band antennas to receive the Ka-band signals. Huang and Marrero-Fontanez plan to assemble a prototype in 2015.

Huang also will be delivering an engineering test unit of her transmitter to a Goddard team that is considering the technology's use on the proposed Wide-Field Infrared Survey Telescope. WFIRST would carry out wide-field imaging and slitless spectroscopic surveys of the near-infrared sky, with an emphasis on studying dark energy and exoplanets.

WFIRST isn't the only mission looking for a compact, low-power, end-to-end system. Future Earth-observing missions are also expected to generate higher and higher data rates that could overwhelm the S-band allocations that are shared by space missions using NASA's Near-Earth Network and Deep Space Network as well as federal and commercial operations.

"In a sense, it's like rush-hour traffic. When you start your morning commute you may notice fewer cars, but before you know it, you're in stop-and-go traffic as more cars merge onto the highway," Huang said.

"Although NASA has had the Ka-band allocation for years and has used the frequency on past missions, the band has remained underused for a variety of reasons, mainly because of limited technology development and perceived technical challenges, among other things," Marrero-Fontanez said.

Making the switchover to Ka-band is further complicated because technologists have few, if any, options to buy Ka-band hardware and components from commercial vendors.

"The design is challenging and Goddard has past experience in developing reliable space hardware, and more specifically, reliable Ka-band hardware," Huang said.

To overcome those challenges, Huang received support from both NASA and Goddard to advance what she believes is the bandwidth of the future for NASA communications in low-Earth orbit — at least until more advanced techniques, such as laser or X-ray communications, become broadly available.

"Our technology achieves high data rates and includes several innovations," Huang said, adding that Jaso deserves most of the credit for pioneering Goddard's Ka-band technology. The Solar Dynamics Observatory, launched in 2010, used a first-generation Ka-band transmitter. The Lunar Reconnaissance Orbiter, launched in 2009, contained a second-generation Ka-band unit.

The Goddard team has tested and verified the current third-generation technology. Instead of a fixed frequency, the third generation operates over the entire Ka-band downlink range with a tunable data rate while in operation. Huang has started investigating the possibility of integrating data encoding as a core function of the Ka-band transmitter.

"Missions will be interested in our technology not only because it provides a low-risk option, but because it can be adopted without spending on nonrecurring engineering," she said. "It really has great potential." ■

Below: NASA technologists Mae Huang (left) and Victor Marrero-Fontanez.

Photo credit: NASA/Goddard/Bill Hrybyk

GODDARD'S 2015 MLK DAY CELEBRATION

By Trena Ferrell

Freeman A. Hrabowski III, president of the University of Maryland, Baltimore County, was the keynote speaker for this year's "The Legacy of Dr. Martin Luther King, Jr." program at NASA's Goddard Space Flight Center. A consultant on science and math education for national agencies, universities and school systems, he discussed increasing students' participation in science, technology, engineering and math – or STEM – careers.

President Barack Obama recently appointed him to chair the White House Initiative on Educational Excellence for African Americans. Time magazine named him one of the 100 Most Influential People in the World in 2012, and U.S. News and World Report selected him one of America's Best Leaders in 2008.

The program also included musical performances by children from the NASA Goddard Child Development Center. ■

Photo credits: NASA/Goddard/Bill Hrybyk

OUTSIDE GODDARD

By Elizabeth M. Jarrell

Nine to Midnight

There is a little-known law of physics: Put three physicists in a basement at night and you get a rock band.

About nine years ago, physicists David Chuss (vocals and guitar), Peter Colarco (bass guitar) and Mark Olsen (drums) started jamming together in Chuss' basement. All three have young children, so their sessions generally start at 9 p.m. after their kids are in bed and last until around midnight. They use headphones in order to play as quietly as possible.

"Being in a band adds balance to our lives as a creative outlet," said Olsen. "It is enjoyable to feed off of and expand on each other's musical ideas when constructing or playing a song."

Theirs is an unusual rock band. Their most devoted groupies are, of course, their own children. They never play for money. And they never keep the same name for more than one, at most two, shows. Their current name, decided after tossing words written on slips of paper across a room, is ladderShark, although that will probably change soon, too.

"Changing band names frequently is an old trick for getting invited back to play a second time," noted Colarco. "Plus it helps to keep things light."

They play mostly classic rock, alternative rock and pop music from the '70s through the '90s. They have a couple of original songs including one called "Fall Over You." They enjoy playing at friends' parties and at their laboratory holiday party. Mostly, though, they play for themselves to have some fun together.

All three were in bands during school. Chuss' former band, Mercury Redstone, played in the Chicago area and even cut two albums, "Mercury Redstone" and "Something, Anything, More." Colarco was in a Christian rock band in college and later in a more traditional rock band that had original music featured on the soundtrack for the independent film "Caught in a Funk," which was screened at the Big Bear Lake International Film Festival in 2001. Olsen's band played primarily original songs at various bars and small outdoor festivals in the region around Iowa State University.

"Creativity is a common thread between music and physics," said Chuss. "Both may come from some common area of our psyches."

They tend to practice more seriously when they have an upcoming gig. One of their favorite songs is "I Want an Alien for Christmas" by Fountains of Wayne. Other favorites include "Driver 8" by R.E.M. and "The Old Apartment" by Barenaked Ladies.

Their camaraderie is readily apparent. Colarco delights in telling jokes, often at the expense of drummers. "What's the difference between a drummer and a large pizza?" he asks. "One of them can feed a family of four." Olsen is the first to laugh good-naturedly as he points out that drummer jokes are generally one-liners so that bass players can understand them.

"Playing music together is, in some respects, how we do science, too," said Colarco. "We work as a team over a period of time to get to a point where we can either write a paper or a song that's pretty tight." ■

Center: The rock band ladderShark is made up of Goddard physicists: Mark Olsen, on the drums; Peter Colarco, the bassist; and David Chuss, guitarist and lead singer.

Photo credit: Mark Olsen