National Aeronautics and Space Administration

Goddard View

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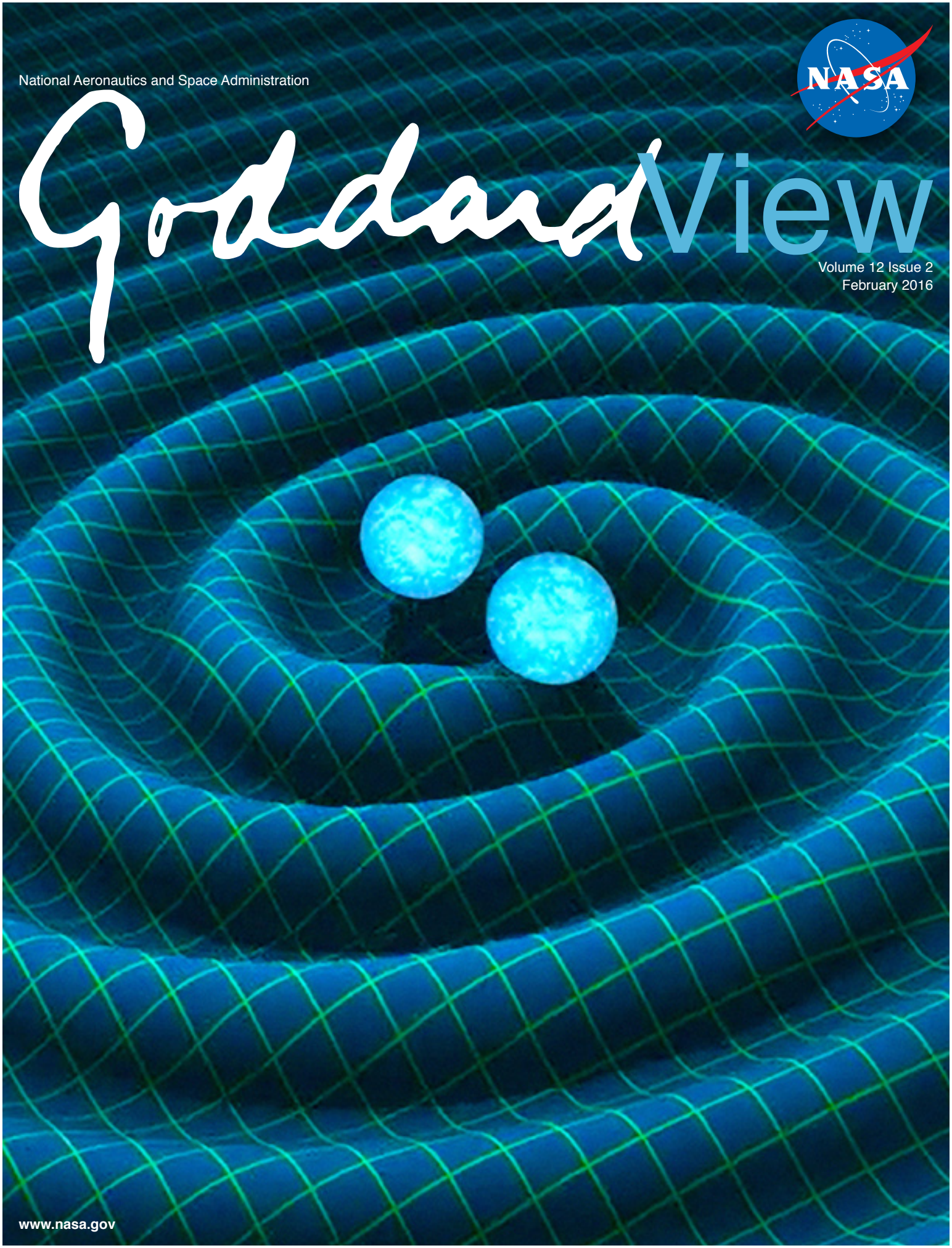

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TRENDING

GPM Celebrates Two Years
The Global Precipitation Measurement mission celebrated its second launch anniversary on Feb. 27. Managed by Goddard, GPM provides observations of rain and snow worldwide every three hours and improves the forecasting of extreme weather events.

AAAC Honors Contributions of African-American Employees
In honor of African American History Month, the Goddard African American Advisory Committee highlighted the careers of several African-American Goddard employees and how they've contributed to the center's missions.

Center Director Delivers State of Goddard Address
Following a televised viewing of Administrator Charles Bolden's State of NASA address on Feb. 9, Goddard Center Director Chris Scolese updated employees on the center's state of affairs and outlined its priorities for 2016.

Text Alerts Provide Updates to Center's Operating Status
The Goddard Office of Communications has begun disseminating text alerts to update employees on changes to the status of the Greenbelt facility. Text "GSFCGBLT" to 333111 to opt into the service.

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On the cover: An artist rendering of gravitational waves, which were recently detected by the Laser Interferometer Gravitational-Wave Observatory. Photo credit: NASA

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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 the center's mission to explore, discover and understand our dynamic universe. Goddard View is published by the Goddard Office of Communications.

You may submit story ideas to the editor at darrell.d.delarosa@nasa.gov. All contributions are subject to editing and will be published as space allows.

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NASA REFLECTS ON 30TH ANNIVERSARY OF CHALLENGER DISASTER

By Sarah Schlieder

Since its establishment in 1958, NASA has made significant strides in science and exploration, thanks largely in part to the determination and dedication of its men and women. But like many endeavors, great achievements are often accompanied by great risks. The agency's annual Day of Remembrance honors those who made the ultimate sacrifice while pushing the boundaries of human achievement.

In 1967, during the first manned mission of the Apollo program, a fire during a preflight launch pad test of the space vehicle killed all three astronauts on board. In 2003, space shuttle Columbia broke apart while re-entering the atmosphere minutes before its scheduled landing. All seven crewmembers were lost. Several others have died during test flights and operations throughout NASA's history.

During this year's Day of Remembrance, NASA marked the 30th anniversary of one of the worst accidents in the country's space program — the space shuttle Challenger disaster. On Jan. 28, 1986, Challenger abruptly broke apart 73 seconds into its flight from NASA's Kennedy Space Center in Cape Canaveral, Florida, killing all seven crewmembers: Gregory Jarvis, Christa McAuliffe, Ronald McNair, Ellison Onizuka, Judith Resnik, Francis Scobee and Mike Smith.

"Whether you watched the crew prepare for flight at home with family and friends or at school with classmates, all of us are here today because of their sacrifice," Administrator Charles Bolden said in a statement.

The Challenger mission was known as the "teacher mission." McAuliffe, a high school social studies teacher from New Hampshire, was selected as the first participant for the Teacher in Space Project, designed to spur interest in science and space exploration. Students and educators would have gathered around bulky televisions to watch McAuliffe conduct a live teaching session aboard the shuttle. Other lessons would have been recorded and distributed to educators upon the crew's return.

"The original Teacher in Space lesson plans may have been lost, but the agency's commitment to inspiring new generations has remained strong," said Ed Campion, news chief at NASA's Goddard Space Flight Center and then-spokesperson for the project during the disaster.

The agency would later eliminate the Space Flight Participant Program, of which Teacher in Space was a part. In 1998, a new category of astronaut candidate was created: educator. The Educator Astronaut Program allowed teachers to apply during astronaut recruitment and, if accepted, become fully trained NASA astronauts and mission specialists tasked with bringing space exploration to classrooms. Barbara Morgan, McAuliffe's backup for the Challenger mission, was selected and flew aboard a space shuttle Endeavour mission in August 2007.

In the wake of the Challenger accident, the crew's families created the Challenger Center for Space Science Education to engage students and teachers in dynamic, hands-on activities in science, technology, engineering and mathematics. The first center opened in 1988 in Houston. Now, there are 45 centers worldwide.

"The center is building upon what the Challenger mission started," said Traketa Wray, instructional supervisor at the Howard B. Owens Science Center — a designated Challenger Center — in Lanham, Maryland.

Several scientists and engineers across the agency – including some at Goddard – passed through the Challenger Center before making their way to NASA, helping fulfill the Challenger crew's desire of inspiring future generations of space explorers.

"The 30th anniversary reaffirms our commitment to acknowledging the forward-thinking of the Challenger crew," added Wray. "They were at the forefront of inspiring kids to go to Mars and explore other solar systems. We commemorate these pioneers in space education." ■

Above: The Challenger crew (from left to right): Christa McAuliffe, Gregory Jarvis, Judith Resnik, Francis Scobee, Ronald McNair, Mike Smith and Ellison Onizuka.

Photo credit: NASA

SPINOFF AT 40: HOW TECH TRANSFER BRINGS NASA BACK DOWN TO EARTH

By Jenny Hottle

From your memory foam mattress to the digital image sensors in cellphone cameras, NASA technology developed for space exploration often winds up benefiting everyday life on Earth.

When NASA was established through the National Aeronautics and Space Act in October 1958, the government called upon the agency not only to explore space, but also to ensure that the technologies created through its work could be adapted for commercial use. In 1962, the agency established a formal program – currently NASA's Technology Transfer Program – to facilitate and report the transfer of technology to the private sector.

NASA highlights these "spinoffs" – commercial products or services that began as or have benefitted from the agency's technologies – in annual reports that are prepared for congressional budget hearings and the scientific and engineering communities, but which have also generated a great deal of public interest. The reports evolved into the full-scale Spinoff publication, which celebrated its 40th anniversary this year with the release of the 2016 issue.

"There was a remarkable amount of foresight that we would yield terrestrial, practical benefits," said Dan Lockney, executive of the Technology Transfer Program at NASA Headquarters in Washington and former Spinoff editor. "The money we spend on space research has these useful results right here on Earth."

Since 1976, Spinoff has highlighted about 2,000 spinoffs. The free publication features technologies in health, medicine, consumer goods, energy, environment, industrial productivity, information technology, public safety and transportation.

"Space is a bigger part of our lives than we realize. People don't always realize that when we pursue these noble things like going to space, there are side benefits that come out of it," said Daniel Coleman, current Spinoff editor at NASA's Goddard Space Flight Center. "We're not going into space just to get spinoffs, but there are all sorts of great things that come about when you try and dare to do difficult things."

This year's edition features more than 50 impactful technologies, including a rice crop model that helps farmers use sustainable irrigation practices, a pressure garment that helps stop postobstetric hemorrhaging and a new drug that treats osteoporosis. Research that focused on capturing and manipulating carbon dioxide on Mars even led to a system that allows microbrewers to capture carbon dioxide released during fermentation and use it for carbonation.

"The beauty of the Spinoff enterprise and technology transfer in general is that there are thousands upon thousands of stories to tell," added Lockney. "Each one is bizarre and wonderful." Some technologies are potentially life-saving as well, and he would be one to know.

NASA's Jet Propulsion Laboratory in Pasadena, California, created an ultrasound device that detects plaque buildup in the carotid arteries. Gary F. Thompson, founder of medical products manufacturer Medical Technologies International, distributed this hand-held machine to hospitals across the country.

Ironically, while writing a feature about the technology, Lockney underwent the ultrasound and learned his arteries were unhealthy. He took up running and switched to a vegetarian diet, and his health drastically improved a few years later when he retook the test.

"I'm tall and lean, and I had no real indication that I would have had any sort of arterial thickness," Lockney said. "It hit very close to home."

Spinoffs may not be at the forefront of the agency's mission, but NASA technologies have been successfully applied to almost every sector of the U.S. economy.

"NASA doesn't view spinoffs as the justification for the space program. We want to go to space. We're human beings and we want to explore," Coleman added. "But it's only fair to recognize that when we do these things, there are these secondary and tangible benefits." ■

Center: Covers for the 1976 (left) and 2016 editions of Spinoff.

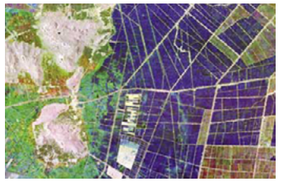
Photo credits: NASA/Spinoff

FROM RODENT RESEARCH TO BEER BUBBLES: SELECT TECHNOLOGIES IN SPINOFF 2016

The annual Spinoff publication – produced at NASA's Goddard Space Flight Center on behalf of the agency – highlights some of NASA's latest spinoff technologies in health and medicine, transportation, public safety, consumer goods, energy and environment, information technology, and industrial productivity. Some of the technologies featured in the 2016 edition are highlighted below. For the complete publication as well as archived editions, visit spinoff.nasa.gov/Spinoff2016.

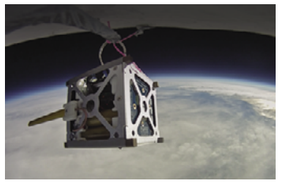
Rodent Research Contributes to Osteoporosis Treatments
NASA has long worked to mitigate bone loss caused by visits to space. NASA's Ames Research Center in Moffett Field, California, worked with biotechnology leader Amgen Inc. to test a series of new osteoporosis treatments on mice in microgravity, in the hopes of helping astronauts and the earthbound alike. The results obtained on the missions supported studies on Earth that resulted in Prolia, a new bone treatment drug, and other drugs still in development.

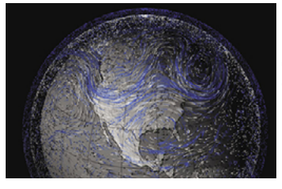
Rice Crop Models Stabilize Global Markets, Enable Efficient Irrigation
Among the world's major dietary staples, rice is the most difficult crop to predict in terms of yield. In 2012, NASA's Stennis Space Center in Bay St. Louis, Mississippi, granted Applied Geosolutions Inc. two contracts to create the Rice Decision Support System. The software uses data from Earth-imaging satellites to generate real-time global information about rice coverage, growth stages and expected yields. The information will stabilize rice markets and is already helping farmers use more sustainable irrigation practices.



CO_2 Recovery System Saves Brewers Money, Puts Bubbles Into Beer
Work that Robert Zubrin did with NASA's Johnson Space Center in Houston focused on breaking down elements abundant on Mars and turning them into resources. This included the capture and manipulation of carbon dioxide. In the beer world, large systems allow major brewers to capture CO_2 generated during fermentation and use it for carbonation, but the technology hasn't been available on smaller scales. Now, the CO_2 Craft Brewery Recovery System, made by Zubrin's Pioneer Energy Inc., is available for microbreweries.

Flock of Nanosatellites Provides a Daily Picture of Earth
While working at Ames, physicist Chris Boshuizen helped start the PhoneSat project, which aims to make satellites more affordable to build and launch without sacrificing performance. He took those same ideas with him when he co-founded San Francisco-based Planet Labs Inc. in 2011. The company is launching flocks of nanosatellites made from cheap, off-the-shelf parts that will provide a daily snapshot of Earth, benefiting a range of industries.

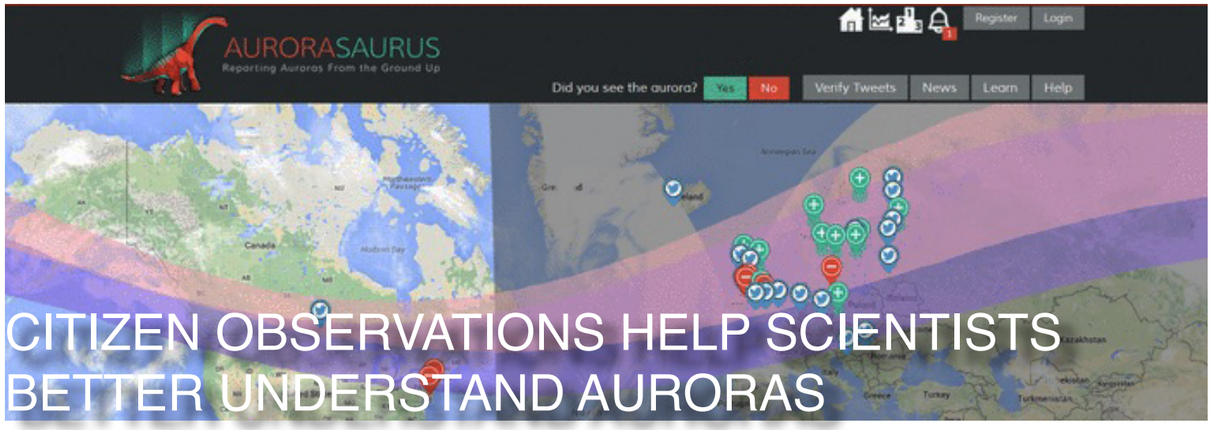




NASA Climate Analytics Support Biological Research
NASA's Modern-Era Retrospective Analysis for Research and Applications integrates data from a variety of observational instruments to create a synthetic data record of the weather. To make data more accessible to outside researchers, computer scientists at NASA's Goddard Space Flight Center created Climate Analytics-as-a-Service. iPlant Collaborative is among the first organizations to adopt CAaaS. Scientists can use CAaaS to investigate, for example, climate change's impacts on agriculture and husbandry.

Laser Vision Helps Hubble, Package Shippers See Clearly
In preparation for a repair mission for the Hubble Space Telescope, which was launched with a misshapen mirror, Goddard issued a call for optics companies to accurately measure replacement parts. AOA Xinetics, now a division of Northrop Grumman Corporation, created a tool to detect mirror defects, which it has incorporated into a commercial 3-D imaging system. Among its applications is a package-detection device now used by all major shipping companies. ■

Photos courtesy: NASA/Spinoff



CITIZEN OBSERVATIONS HELP SCIENTISTS BETTER UNDERSTAND AURORAS

By Kasha Patel

On the evening of Oct. 24, 2011, Liz MacDonald was sitting in front of her computer at her home in Los Alamos, New Mexico. Forecasts predicted a geomagnetic storm would hit Earth that night and potentially create a beautiful aurora. The aurora came, just not to Los Alamos. Nevertheless, MacDonald was still amazed – not by any bright, dancing lights in the sky, but by the number of aurora-related tweets on her computer screen.

With real-time tweets coming in from Alabama to Chicago, it was one of the first widely documented instances of aurora activity on social media.

After witnessing the viral response, MacDonald, now a space weather scientist at NASA's Goddard Space Flight Center, founded Aurorasaurus – a citizen science project that tracks auroras through the project's website, mobile apps and Twitter. For the first time, citizen science observations are being used to track auroras in real time.

"Using these observations, we can make better short-term predictions of when and where the aurora is for aurora enthusiasts – and scientists," she said.

Improving Science With Citizen Reports

Improving forecasts and studying auroras are important because auroras are features of geomagnetic storms, which can cause power outages and interrupt satellite systems. Many satellites study the sun and near-Earth space environment where auroras occur, but partly because of the infrequency of large geomagnetic storms which produce the lights, predicting the location, time and intensity of auroras is challenging.

By allowing sky watchers to report sightings through its website and apps, Aurorasaurus provides scientists more data points. The project also searches keywords on Twitter to crowdsource aurora-related tweets, which respective users can confirm or deny. Verified observations and tweets are displayed on a global map showing real-time auroral visibility.

The map also includes a "view-line" that predicts where a person should see auroras based on the National Oceanic and Atmospheric Administration's OVATION Aurora Forecast Model. After a threshold number of sightings are reported near the view-line or in a local area, Aurorasaurus sends out notifications to nearby registered users.

Supersized St. Patrick's Day Storm

On March 17, 2015 – St. Patrick's Day – skygazers worldwide were entranced by one of the biggest geomagnetic storms of the past decade, illuminating the sky with red, purple and green auroras. Users from the United Kingdom, Germany, Poland and United States reported more than 160 aurora sightings and verified more than 250 tweets, resulting in 361 viewing notifications.

After analyzing 500 observations from March to April 2015 – encompassing the St. Patrick's Day storm and several smaller ones – the Aurorasaurus team found that many people reported sightings closer toward the equator than the OVATION model suggested. The team now uses the observations to improve the view-line on the project map.

"Without the citizen science observations, Aurorasaurus wouldn't have been able to improve our models of where people can see the aurora," said Nathan Case, a former Aurorasaurus team member and now a senior physics research associate at Lancaster University in the United Kingdom. "The team is very thankful for our community's dedication and is excited to have more people sign up." ■

Aurorasaurus is supported by NASA and the National Science Foundation and designed by researchers from NASA, New Mexico Consortium, Pennsylvania State University and Science Education Solutions. For more information on Aurorasaurus, as well as access to its channels and educational materials, visit www.aurorasaurus.org.

Above: A screenshot of the Aurorasaurus map during a geomagnetic storm on March 17, 2015.

Photo credit: Aurorasaurus

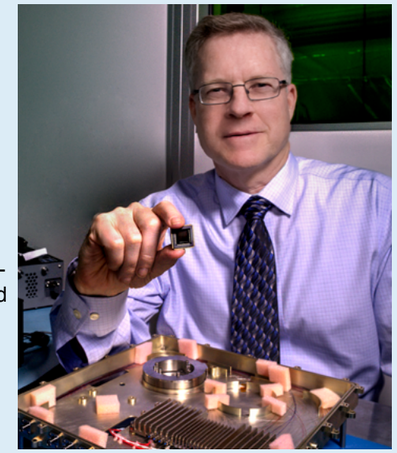
NASA ENGINEERS TAPPED TO BUILD FIRST INTEGRATED-PHOTONICS MODEM

By Lori Keesey

A NASA team has been tapped to build a new type of communications modem that will employ an emerging, potentially revolutionary technology that could transform everything from telecommunications, medical imaging and advanced manufacturing to national defense.

The space agency's first-ever integrated-photonics modem will be tested aboard the International Space Station beginning in 2020 as part of NASA's multiyear Laser Communications Relay Demonstration mission, or LCRD. The cell phone-sized device incorporates optics-based functions — such as lasers, switches and wires — onto a microchip.

Once aboard the space station, the so-called Integrated LCRD LEO (Low-Earth Orbit) User Modem and Amplifier (ILLUMA) will serve as a low-Earth-orbit terminal for LCRD, demonstrating yet another capability for high-speed, laser-based communications.



Data Rates Demand New Technology

Since its inception in 1958, NASA has relied exclusively on radio frequency-based communications. Today, with missions demanding higher data rates than ever before, the need for LCRD has become more critical.

LCRD promises to transform the way NASA sends and receives data, video and other information. It will use lasers to encode and transmit data at rates 10 to 100 times faster than today's communications equipment, requiring significantly less mass and power. Such a leap in technology could deliver video and high-resolution measurements from spacecraft over planets across the solar system, permitting researchers to make detailed studies of conditions on other worlds.

Designed to be an operational system after a two-year demonstration period, LCRD involves a hosted payload and two specially equipped ground stations. The mission will dedicate two years to demonstrating a fully operational system, from geosynchronous orbit to ground stations. Afterward, the agency plans to use ILLUMA to test communications between geosynchronous and low-Earth-orbit spacecraft.

An Exceptional Terminal

ILLUMA incorporates an emerging technology — integrated photonics — that is expected to transform any technology that employs light. This includes everything from Internet communications over fiber optic cable to spectrometers, chemical detectors and surveillance systems, to name a few.

"Integrated photonics are like an integrated circuit, except they use light rather than electrons to perform a wide variety of optical functions," said Don Cornwell, director of NASA's Advanced Communication and Navigation Division within the Space Communications and Navigation Program, which is funding the modem's development. Recent developments in nanostructures, metamaterials and silicon technologies have expanded the range of applications for these optical chips.

"We've pushed this for a long time," said Mike Krainak, who is leading the modem's development at NASA's Goddard Space Flight Center. "Our strategy to leverage integrated photonic circuitry will lead to a revolution in Earth and planetary space communications as well as in science instruments."

First Step in Demonstrating Photonics

Krainak and his team will reduce the size of the terminal, now about the size of two toaster ovens — a challenge made easier because all light-related functions will be squeezed onto a microchip. Although the modem is expected to use some optic fiber, ILLUMA is the first step in building and demonstrating an integrated photonics circuit that will embed these functions onto a chip.

"What we want to do is provide a faster exchange of data to the scientific community. Modems have to be inexpensive. They have to be small. We also have to keep their weight down," Krainak said. The goal is to develop and demonstrate the technology and then make it available to industry and other government agencies, creating an economy of scale that will further drive down costs. "This is the payoff," he added.

Integrated photonics can also be applied to terrestrial uses. For example, costly and large data centers house servers that are connected by fiber optic cable to store, manage and distribute data. Integrated photonics may dramatically reduce the need for and size of these behemoths. "Google, Facebook, they're all starting to look at this technology," Krainak said. "As integrated photonics progresses to be more cost-effective than fiber optics, it will be used. Everything is headed this way." ■

Center: Mike Krainak, Goddard laser expert, with a portion of the modem flying aboard the Laser Communications Relay Demonstration mission.

Photo credit: NASA/Goddard/Bill Hrybyk

HITOMI TO STUDY STRUCTURE AND EVOLUTION OF THE UNIVERSE

By Francis Reddy

Black hole enthusiasts, galaxy cluster aficionados and X-ray astronomers have much to be excited about. On Feb. 17, the Japan Aerospace Exploration Agency launched Hitomi (known as ASTRO-H prior to launch), its sixth satellite dedicated to X-ray astronomy, from the Tanegashima Space Center in Japan. The observatory carries a state-of-the-art instrument and two telescope mirrors built at NASA's Goddard Space Flight Center.

Hitomi is expected to make breakthroughs in a variety of high-energy phenomena in the cosmos, ranging from the superheated material on the brink of falling into a black hole to the evolution of vast galaxy clusters. It is equipped with four advanced instruments covering a broad energy range, from low-energy X-rays to low-energy gamma rays.

"We see X-rays from sources throughout the universe, wherever the particles in matter reach sufficiently high energies," said Robert Petre, chief of the Goddard X-ray Astrophysics Laboratory and the U.S. project scientist for Hitomi. "These energies arise in a variety of settings, including stellar explosions, extreme magnetic fields or strong gravity, and X-rays let us probe aspects of these phenomena that are inaccessible by instruments observing at other wavelengths."

Hitomi is capable of observing X-ray sources, like galaxy clusters and neutron stars, more than 10 times fainter than its predecessor Suzaku, which operated from 2005 to 2015. To achieve this, Hitomi uses four co-aligned focusing X-ray telescopes and a suite of cutting-edge instruments that provide simultaneous coverage across the observatory's entire energy range.

Two identical Soft X-ray Telescopes include mirror assemblies provided by the Goddard team. Because X-rays can penetrate matter, the mirrors rely on what scientists refer to as "grazing incidence optics." Much like skipping a stone across water, X-ray light skimming the surface of curved mirror segments is deflected toward the telescope's focal point.

One Soft X-ray Telescope focuses light onto an advanced wide-field camera provided by Japan, while the other directs it into the Soft X-ray Spectrometer — an instrument developed and built by the Goddard team working closely with colleagues from several institutions in Japan. The SXS uses a technique invented at Goddard for detecting and measuring X-ray energies with extraordinary precision. At its heart is a sensor called a microcalorimeter, which measures the heat generated by each X-ray photon striking it. The SXS counts the hits by X-rays of different energies and builds up a spectrum with 30 times the detail of previously flown spectrometers.

"This has been an extraordinary undertaking over many years to build this powerful new X-ray spectrometer jointly in the U.S. and Japan," said Goddard's Richard Kelley, the U.S. principal investigator for the Hitomi collaboration. "The international team is extremely excited to finally be able to apply the fundamentally new capabilities of the SXS, supported by the other instruments on the satellite, to observations of a wide range of celestial sources, especially clusters of galaxies and black hole systems."

The observatory also carries two identical Hard X-ray Telescopes and their associated cameras, along with two Soft Gamma-ray Detectors, which are sensitive to light but do not produce images.

Hitomi was developed by the Institute of Space and Astronautical Science, a division of JAXA. It was built jointly by an international collaboration led by JAXA, with contributions from Goddard and other institutions in Japan, Canada and Europe. Additional Goddard responsibilities included development of the analysis software and data processing pipeline and creation of a facility to support a guest observer program that enables the participation of the broader U.S. scientific community in the mission. ■

Above: Hitomi launches from the Tanegashima Space Center in Kagoshima, Japan, on Feb. 17.

Photo credit: NASA/Goddard/Scott Porter

Jimmie L. Johnson

Code 113, Lead Human Resources Specialist

Why Goddard?: Goddard has proven to be a great place to start, maintain and finish your career!

Hobbies/interests: deejaying, sports, traveling

Patricia Miller

Code 490, Resource Analyst

Why Goddard?: Converted to a civil servant after working at Goddard for 26 years as a contractor.

Hobbies/interests: horses, traveling

Celena White

Code 561, Student Trainee (Engineering Technician)

Why Goddard?: I have wanted to work for NASA since elementary school.

Hobbies/interests: swimming, softball, bowling, bicycling, kickboxing, video games, cinema

Sean Bailey

Code 616, Research Oceanographer

Why Goddard?: After working with some of the brightest people in the world, I could not pass up the opportunity to do so as a civil servant.

Hobbies/interests: reading, Angry Birds, tying knots

Jason Baldessari

Code 444, Resources Analyst

Why Goddard?: I had never worked in an environment that was both challenging and dynamic and provided such great opportunities.

Hobbies/interests: time with kids, data analysis, movies, music

Holly McIntyre-DeWitt

Code 272, Archivist

Why Goddard?: The opportunity to challenge myself and to use my archival skill set to be a part of an incredible mission.

Hobbies/interests: staying busy, having fun with two young daughters

Bhanu Sood

Code 371, Commodity Risk Assessment Engineer

Why Goddard?: To enhance NASA's risk-based decision-making processes.

Hobbies/interests: volunteering, running

EMPLOYEE SPOTLIGHT

Goddard is pleased to welcome these new employees to the NASA community.

THREE OF GODDARD'S BEST AMONG PRESIDENTIAL RANK AWARD RECIPIENTS

By Crystal Gayhart

The annual Presidential Rank Awards honor a select group of employees from the federal government's Senior Executive Service, Senior Level, and Scientific and Technical corps for their outstanding career accomplishments in leadership and service.

Such executives and professionals "have earned and kept a high degree of public confidence and trust and have demonstrated their success in balancing the needs and perspectives of customers, stakeholders, and employees with organizational results." They are nominated by their agency heads and evaluated by citizen panels. Recipients are approved by the U.S. president and conferred with one of two ranks: Distinguished Executive or Meritorious Executive.

In any given award period, no more than 1 percent and 5 percent of senior career employees may be named Distinguished Executives and Meritorious Executives, respectively.

This year, three employees from NASA's Goddard Space Flight Center were recognized as Meritorious Executives:

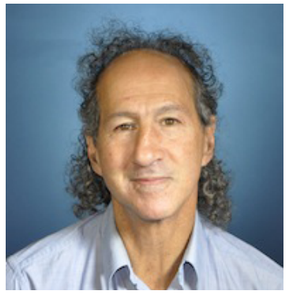
David F. Mitchell serves as the director of flight projects at Goddard. He provides executive leadership in the delivery of flight project missions and mission support areas consisting of 10 spaceflight and ground system projects currently in study or formulation phases, 25 projects in developmental or implementation phases, and more than 30 operational in-orbit satellites.

He is responsible for an annual budget exceeding $3.8 billion in new obligation authority and oversees a workforce of more than 1,400 employees.

Throughout his career, he has provided leadership and guidance for many Goddard missions, including the Origins-Spectral Interpretation-Resource Identification-Security-Regolith Explorer, Global Precipitation Measurement, Geostationary Operational Environmental Satellite, and Mars Atmosphere and Volatile Evolution Mission.

Gregory Blaney was appointed director of NASA's Independent Verification & Validation Program in December 2010 after serving as acting director for one year. He oversees nearly 300 employees who independently assure that NASA's safety- and mission-critical software will operate dependably.

Because of Blaney's record of success, the mayor's office in New York sought out IV&V in 2011 for systems engineering assistance with the city's Emergency Communications Transformation Program, a multibillion-dollar development effort associated with its emergency call system. The IV&V team improved the quality of the ECTP system by identifying and ensuring fixes to 89 percent of system requirements, detecting missing performance measures, improving the system architecture, and enhancing the system's testing capability.



Murzy Jhabvala is the chief engineer for solid state devices at Goddard, where he has been working since 1974. He is currently leading the joint NASA-European Space Agency detector screening, acceptance, assembly and delivery of the infrared imaging system for the Euclid space mission. Jhabvala is also leading the development, fabrication and construction of the microfilament blackbody source assemblies for OSIRIS-REx. He has served as a Goddard senior fellow since his appointment in 1992.

Many past, present and future missions have depended on technologies he has helped developed. Such missions include the International Sun Earth Explorer, Cosmic Background Explorer, New Horizons and James Webb Space Telescope. Jhabvala is the recipient of two NASA Exceptional Achievement Medals, the NASA Exceptional Service Medal, the NASA Outstanding Leadership Medal, the Goddard Moe Schneebaum Award and multiple Robert H. Goddard awards, among others. In 2001, he was inducted into the Space Technology Hall of Fame. ■

Photo credits: NASA/Goddard, NASA/IV&V

TO THE MOON AND BACK: NEW SMITHSONIAN EXHIBIT FEATURES LRO IMAGERY

By Nancy Neal Jones

Launched on June 18, 2009, the Lunar Reconnaissance Orbiter has collected a treasure trove of data with its seven powerful instruments, making invaluable contributions to our knowledge about the moon. Managed by NASA's Goddard Space Flight Center, LRO has already collected as much data as all of NASA's other planetary missions combined. The mission has also produced the most accurate topographical map of the moon to date.

Nearly seven years after launch, the public has an opportunity to see these accomplishments firsthand through newly displayed images at the Smithsonian National Air and Space Museum in Washington, D.C.

The new exhibit, "A New Moon Rises: New Views from the Lunar Reconnaissance Orbiter Camera," displays the dramatic lunar landscapes captured by the spacecraft's LRO Camera. Showcasing everything from Apollo landing sites to majestic mountains that rise out of the darkness of the lunar poles, the 61 large prints on display reveal a neighbor that is surprisingly dynamic by celestial standards. They illustrate newly formed impact craters, recent volcanic activity and a crust being fractured by the shrinking of a cooling interior.

"Most people do not realize that the moon is still a very active place, and that it has breathtaking landscapes that are both familiar and alien," said Tom Watters, senior scientist at the museum's Center for Earth and Planetary Studies and curator of the exhibit.

Made possible by the support of NASA and Arizona State University in Tempe, "A New Moon Rises" is divided into six themes: Global Views, Exploration Sites, Discoveries, Vistas, Topography and Craters. These themes helped determine which of the thousands of images taken would be chosen for display.

"To me, the LROC images reveal the moon to be a mysterious and beautiful place — a whole world just three days away," said Mark Robinson, ASU's principal investigator for the LROC instrument.

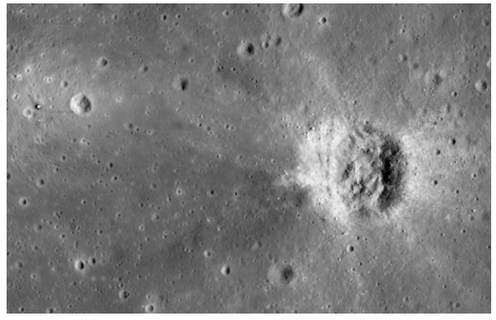
"The lunar landscape is truly spectacular, and it's gratifying to know that this exhibit will bring new views of the moon to the huge audience that visits NASM every year," added John Keller, LRO project scientist at Goddard.

Visitors will also have the opportunity to see new images from LROC projected onto a large screen. In addition, the exhibit includes a display of spare cameras and a large 3-D model of a young lunar crater.

The exhibit opened on Feb. 26 and will be on display through December. ■

Above: Entrance to the "A New Moon Rises: New Views from the Lunar Reconnaissance Orbiter Camera" exhibit at the Smithsonian National Air and Space Museum in Washington, D.C. Photo credit: Smithsonian National Air and Space Museum/Eric Long

Below: One of the images of the Sea of Tranquility, as taken by the Lunar Reconnaissance Orbiter Camera, on display at the Smithsonian National Air and Space Museum. Apollo 11 astronauts completed their moon landing on the Sea of Tranquility in 1969. Photo credit: NASA/Goddard, Arizona State University.



DAVID RAPHAEL: BUILDS SPACECRAFT SUBSYSTEMS AND PAYS IT FORWARD

By Elizabeth M. Jarrell

What do you do and what is most interesting about your role here at NASA's Goddard Space Flight Center?

I'm an associate branch head, so my job varies from day to day. As a supervisor, I provide my direct reports with whatever they need to get their jobs done. I am also a technical consultant and evaluate the technical merit, cost and schedule of proposals. In addition, I help troubleshoot project issues and respond to upper management's requests. Most recently, I was selected as the head of the Goddard Flight Data Systems and Radiation Effects Branch.

What does the Goddard Telecommunication Networks and Technology Branch do?

The branch provides expertise in both spaceflight and ground network engineering and works closely with flight projects and mission services to develop space-to-space and space-to-ground mission operations communications.

What makes a supervisor effective?

You must possess people skills. You need to relate to people and understand their issues in order to help them get their jobs done. There also has to be mutual – and earned – respect as well as trust between a supervisor and his or her employees to create a workable partnership.

What do you think about when troubleshooting a problem?

Do not panic, and do not think the worst has happened. The simplest solution is often the correct solution. Find out what happened, then work backwards to the root of the issue. Eventually, you'll find the culprit and generate a solution.

How did you come to work for Goddard?

As a junior at Hofstra University in New York, I attended a job fair at a National Society of Black Engineers convention and submitted my résumé. As a result, I became a summer intern.

How do you pay it forward?

Our branch has interns every summer. I've served as a mentor in the past. I make sure that they are given projects that will facilitate their growth, that they have the necessary resources and that they have a good experience. My advice is always the same: Learn as much as you can while you are here.

What is unique about you?

I was born in New York. When I was a few months old, my mother took me to visit family in Haiti where she unexpectedly passed away. My paternal grandmother took me into her home and raised me. I returned to Florida for high school to live with my maternal grandparents. I was truly loved by my extended family and am extremely grateful to them. I am who I am because of them, but I also learned at a young age to be self-reliant. My paternal grandmother instilled in me the desire to get a good education. Unfortunately, she passed away three months before I received my bachelor's degree.

What is the coolest thing you've ever done as part of your job?

I was the product development lead for the Command and Data Handling subsystem on the Magnetospheric Multiscale mission. We delivered 55 circuit cards for a total of six boxes, four of which are now flying. It was really awesome watching MMS launch. After reviewing the telemetry received from the spacecraft, I knew then that our units were working. It felt fantastic, and I truly felt like a proud father.

What makes Goddard great?

Goddard is home to one of the largest and best concentrations of scientists, engineers and technologists in the world. We build cool stuff for space. We promote diversity whether it is race, gender, religion or disability. We invest in people's education for technical and personal growth.

What part of Haiti remains in you?

I am fluent in Creole, French and English. I make bouillon, which is a style of soup, as well as rice and beans. I also make soup joumou, a pumpkin soup. On rare occasions, I even make beef pâté. On a deeper level, living in a third-world country teaches you what is truly important. I've learned to be grateful for what I have and not to worry about what I don't have. ■

Center: David Raphael

Photo credit: NASA/Goddard/Bill Hrybyk