National Aeronautics and Space Administration

GODDARD SPACE FLIGHT CENTER

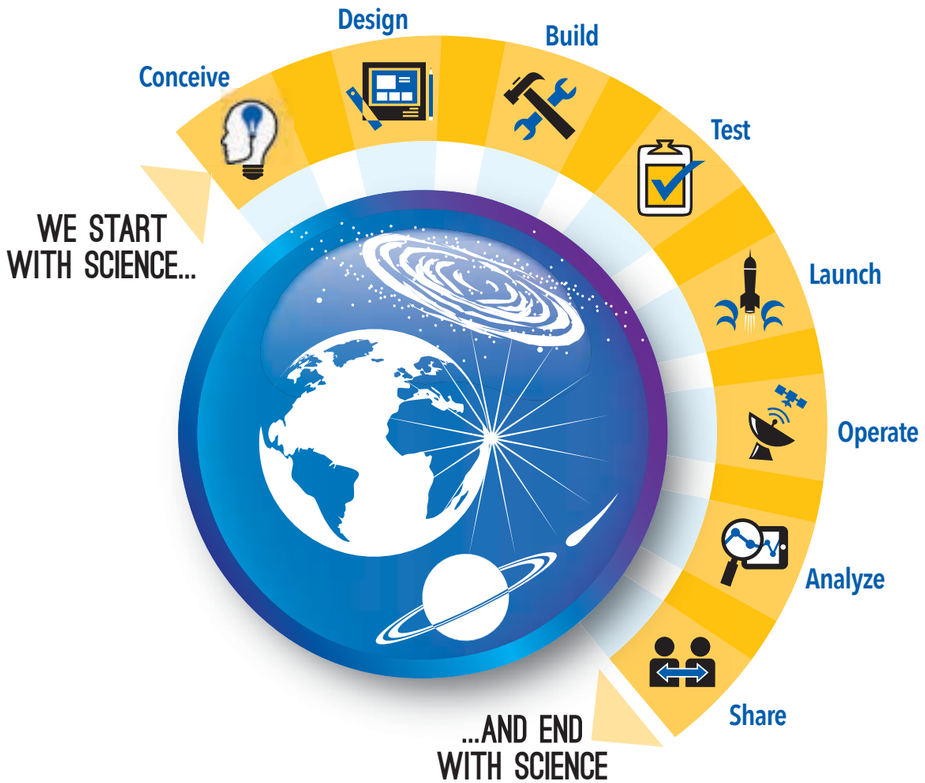
2018

ANNUAL REPORT

this is science

www.nasa.gov

THE GODDARD PROJECT LIFE CYCLE



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GLOBAL PROVIDER OF SCIENTIFIC RESEARCH, TECHNOLOGY AND MISSIONS THAT TRANSFORM OUR KNOWLEDGE OF EARTH AND SPACE

NASA's Goddard Space Flight Center has been working since 1959 to increase scientific understanding and answer humanity's most pressing questions about our world, the solar system and beyond, all for the benefit of society and the communities we serve. The center's work in science, engineering, technology and communications strengthens our ability to envision the origins of life, preserve our way of living and define our place in the universe. We identify requirements and innovations; design, build and launch spacecraft; and manage and support space missions. Our fundamental communications infrastructure enables NASA and others to retrieve knowledge from space, share it with diverse customers and apply it to society in countless ways.

ONE WORLD-CLASS ORGANIZATION:
SIX UNIQUE SITES • OVER 10,000 PEOPLE
PLUS MANY OTHER LOCATIONS WORLDWIDE

GODDARD
Greenbelt Campus • Maryland
Est.1959

WALLOPS FLIGHT FACILITY
WALLOPS ISLAND
VIRGINIA
Est.1945

WHITE SANDS COMPLEX
LAS CRUCES
NEW MEXICO
Est.1978*

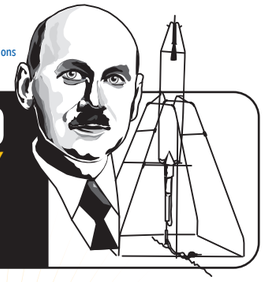
COLUMBIA SCIENTIFIC BALLOON FACILITY
PALESTINE
TEXAS
Est.1961

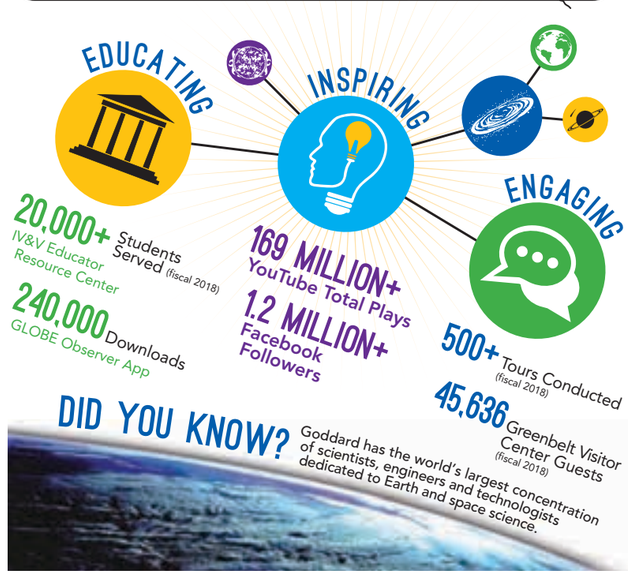
GODDARD INSTITUTE FOR SPACE STUDIES
NEW YORK CITY
NEW YORK
Est.1961

INDEPENDENT VERIFICATION & VALIDATION FACILITY
FAIRMONT
WEST VIRGINIA
Est.1993^

*Goddard-managed ground communications stations
^Goddard-assumed management

ROBERT H. GODDARD
THE FATHER OF MODERN ROCKETRY
(1882–1945) The American engineer, professor, physicist, and inventor credited with creating and building the world's first liquid-fueled rocket.



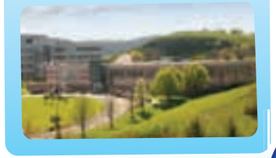


Goddard AT A GLANCE

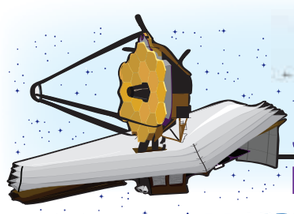
116,000+ LAUNCHES TO DATE

GODDARD has sent instruments to EVERY PLANET in the solar system

INDEPENDENT VERIFICATION & VALIDATION FACILITY
25 YEARS of Systems and Software Engineering



TERRA
100,000+ ORBITS Around Earth



JAMES WEBB SPACE TELESCOPE
LAUNCHING 2021

HUBBLE SPACE TELESCOPE
HST

28 YEARS AND COUNTING

FIVE SERVICING MISSIONS
1993
1997
1999
2002
2009

GODDARD'S FIRSTS

OPERATION ICEBRIDGE (2009 - PRESENT)

www.nasa.gov/goddard

THIS IS WHO WE ARE

NASA'S VISION

To discover and expand knowledge for the benefit of humanity.

NASA'S MISSION

Lead an innovative and sustainable program of exploration with commercial and international partners to enable human expansion across the solar system and bring new knowledge and opportunities back to Earth. Support growth of the nation's economy in space and aeronautics, increase understanding of the universe and our place in it, work with industry to improve America's aerospace technologies, and advance American leadership.

NASA'S STRATEGIC GOALS

- Expand human knowledge through new scientific discoveries.
- Extend human presence deeper into space and to the Moon for sustainable long-term exploration and utilization.
- Address national challenges and catalyze economic growth.
- Optimize capabilities and operations.

OUR LEGACY

A PLACE FOR SCIENCE

We advance NASA's mission by leading scientific research and building, launching and operating scientific instruments, spacecraft and information systems. As a science center, Goddard seeks to understand Earth and explore the universe through robust programs in Earth science, astrophysics, heliophysics and planetary science. As a spaceflight center, Goddard utilizes its core technical and programmatic expertise and facility capabilities to execute a broad range of flight missions and field campaigns. We are committed to enabling innovation and developing new technologies that expand NASA's technical capabilities in support of its overarching mission. Goddard then applies its breakthroughs to society: stimulating economic growth, educating future generations, and inspiring the nation and the world.

A MESSAGE FROM THE CENTER DIRECTOR

Six decades ago in 1958, then-President Dwight D. Eisenhower signed the National Aeronautics and Space Act that established NASA. Less than a year afterward, NASA's Goddard Space Flight Center began operations as the agency's first spaceflight center. Since our inception in 1959, Goddard has been integral to NASA's success, beginning with our support of Project Mercury—the nation's first human spaceflight program—and extending to our role as a global leader in the scientific community with pioneering missions that have expanded humanity's knowledge in astrophysics, Earth science, heliophysics and planetary science.

We have supported all of the nation's human spaceflights since our beginnings, and the communications services we continue to provide both manned and unmanned missions have become more advanced and robust. Today, our center—comprising locations in six states—boasts the world's largest concentration of scientists, engineers and technologists dedicated to the study of Earth and space. Their work has led to groundbreaking missions that provided the data that led to Nobel Prizes, and our partnerships with other organizations have led to other missions that have addressed food security, improved weather forecasting and advanced the welfare of many around the world.

This past year, we orchestrated the launches of several missions to augment our existing capabilities in monitoring and observing the Sun, Earth, solar system and universe. Many current missions produced significant returns that not only resonated in the scientific community, but will guide NASA in its exploration of new frontiers in the decades ahead.

In 2016, the Laser Interferometer Gravitational-Wave Observatory announced the detection of gravitational waves, and this year—as part of a global collaboration—several Goddard-managed missions observed first light from merging neutron stars, further confirming the existence of such waves. The detection and confirmation of their existence are significant events in astrophysics, giving insight into how the universe was formed, providing a better understanding of its fundamental laws and further supporting Albert Einstein's general theory of relativity.

The Hubble Space Telescope, which played a part in the observation, continues to make landmark discoveries 28 years after launch. Hubble marked 25 years since the first of its five servicing missions, all of which extended and enhanced Hubble's scientific capabilities far beyond its expected lifetime. The James Webb Space Telescope, a follow-on mission to Hubble, continues to undergo testing with our partners in preparation for launch in 2021. It will explore the universe in infrared light, observing the formation of the first stars and galaxies and helping discover how they have evolved over billions of years.

Following its launch in April, the Transiting Exoplanet Survey Satellite began its two-year survey of nearby stars in search of planets outside our solar system. Some of these planets, known as exoplanets, may support life.

Within our solar system, the Goddard-developed Sample Analysis at Mars instrument suite aboard the Mars Curiosity rover detected seasonal variations in methane on the Red Planet—evidence which relates to the search for life. The Lunar Reconnaissance Orbiter, meanwhile, continues to map the Moon's surface. As NASA prepares diligently for a return to the Moon and eventual manned spaceflight to Mars, the work of these missions is vital to understanding the atmospheres and surface conditions of our celestial neighbors.

Closer to the center of the solar system, Parker Solar Probe—a joint venture between the Johns Hopkins University Applied Physics Laboratory and NASA—launched in August, traveling closer to the Sun than any other mission. The spacecraft underwent rigorous testing at Goddard, ensuring its ability to explore the Sun's outer atmosphere and make critical observations on the physics of stars.

Here on our home planet, our exhaustive portfolio of Earth science missions continues to monitor our changing climate. As part of a long-standing partnership with the National Oceanic and Atmospheric Administration (NOAA), we launched the Joint Polar Satellite System-1, later renamed NOAA-20, as well as the latest Geostationary Operational Environmental Satellite—two spacecraft which provide better measurements of various environmental conditions as well as improved weather forecasting capabilities.

In September, we launched the Ice, Cloud and land Elevation Satellite-2 (ICESat-2) mission with the Goddard-developed ATLAS laser instrument. ICESat-2 follows the first outstanding ICESat mission, and the aircraft-based Operation IceBridge mission continues to measure glacier and ice sheet elevation and sea ice thickness with greatly improved accuracy.

Our Independent Verification & Validation Facility in West Virginia marked 25 years of providing software assurance and more to past and present NASA missions, while Wallops Flight Facility in Virginia launched 30 sounding rocket and balloon missions and supported two cargo resupply missions to the International Space Station.

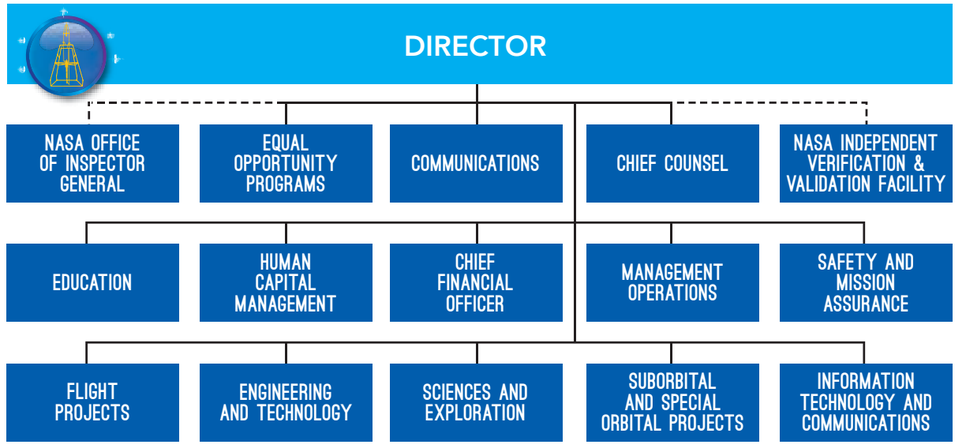
The pages that follow highlight our many achievements over the past year, underscoring not only the work of thousands who make such achievements possible, but also the contributions of those over the decades who have made Goddard what it is today.

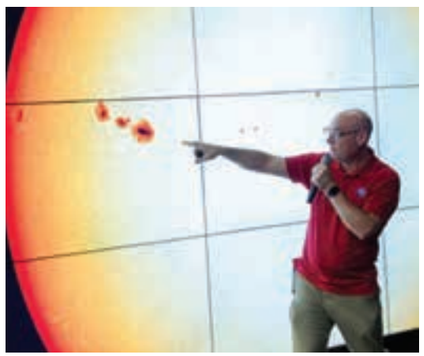
We often like to echo the words of our namesake, rocket pioneer Robert H. Goddard: "It is difficult to say what is impossible, for the dream of yesterday is the hope of today and the reality of tomorrow." As we celebrate our own 60th anniversary in 2019, our commitment to these words remains as strong as when we first opened our gates, continuously pushing forward with new discoveries and redefining the boundaries of possibility in the universe.

Chris Scolese • Center Director

NASA'S GODDARD SPACE FLIGHT CENTER HAS BUILT A LEGACY IN ADVANCING HUMANITY'S KNOWLEDGE OF THE UNIVERSE

OUR ORGANIZATION





FOSTERING INNOVATION AND NEW TECHNOLOGIES

For organizations and individuals daring to be bold, triumph and failure should be expected. NASA's Goddard Space Flight Center is fortunate that its leading researchers understand this reality. One good idea could lead to a revolutionary new technology that keeps NASA at the forefront of scientific discovery and exploration, while another may miss the mark. However, in the world of research and development, setbacks do not equate to failure; they lead to new insights.

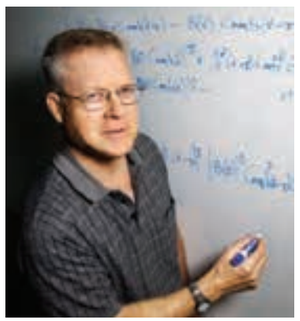
In 2018, this became abundantly clear. One researcher, for example, conceived a new technique for measuring an atmospheric chemical that determines the lifetime of methane, but he discovered an artifact that prevented him from gathering the measurement. Despite the disappointment, he discovered that his instrument was extremely sensitive to ozone. In fact, it is nearly 100 times more sensitive than commercially available instruments. His "failure" resulted in the filing of a patent application and an improved way to more accurately measure another important atmospheric chemical.

Challenges also beset the team that built, launched and now operates the Dellingr CubeSat, which was developed entirely with funding from the Goddard Internal Research and Development program. Shortly after Dellingr was deployed from the International Space Station, it began to spin, thereby preventing data collection. In response, the team wrote new software, uploaded it and used one of Dellingr's magnetometers as an attitude sensor, which provided the data needed to activate Dellingr's torquers and stabilize the spinning.

Goddard's researchers have consistently shown that misfortunes are catalysts for more innovation. This year, they won Phase A studies for important planetary missions and secured millions in follow-on research and development funding to further advance their concepts. They flew experimental instruments aboard sounding rockets, balloons and the International Space Station.

Meanwhile, the Goddard Strategic Partnerships Office continues to forge innovative partnerships that link the center's internal inventors with corporations, startups, universities and other government agencies. This year, the office was responsible for collecting 209 new technology reports, resulting in 40 patent applications filed.

Innovation remains a core value among the center's leadership and technologists. Because Goddard promotes the cross-fertilization of ideas internally and externally through partnerships, a culture of innovation is flourishing. Its technology community is fulfilling Goddard's mission as a science and spaceflight center—developing the technologies NASA will need to continue making discoveries.



EARTH SCIENCE EFFORTS IMPROVING LIVES WORLDWIDE

NASA's fleet of Earth-observing satellites has allowed us to revolutionize our fundamental understanding of how our planet works as an interconnected system.

As that fleet has expanded and computing power and access to data on the ground have improved, people continue to find ways to apply NASA's view of Earth to everyday life. From weather forecasts and regional predictions of public health factors to new global views of our most precious resources, the work being done at NASA's Goddard Space Flight Center to expand our view of Earth is changing lives.

Here are some of the ways Goddard's people and satellites enhanced life on Earth in the past year.

Water, Farming and Food

A Goddard-led study that was published in May analyzed data from the Gravity Recovery and Climate Experiment mission to observe the trends in water storage in 34 regions around the world and attribute the causes of those trends. The first-of-its-kind study found that Earth's wet areas are getting wetter and its dry areas drier due to a variety of factors, including human water management, climate change and natural cycles. The findings hold major significance for agriculture and industry as well as people's basic need for clean, fresh water.

In addition, data from the Landsat program now provide new insight into evapotranspiration—or how water is evaporating from soil or transpiring from plants—thereby improving farmers' ability to track water usage. As part of one of many Landsat-based projects, researchers from the University of Idaho, University of Nebraska and Desert Research Institute in Nevada teamed up with Google to better map this phenomenon.

As of 2018, the U.S. Department of Agriculture's Foreign Agricultural Service is using Goddard-developed data products for vegetation and soil moisture from the Landsat and Sentinel satellites, as well as the Soil Moisture Active Passive satellite, to improve its monthly operational reports on global crop conditions.

In late 2018, NASA tapped the University of Maryland to lead a new consortium—NASA Harvest—that uses satellite data to enhance food security and agriculture worldwide. Food security is the assurance of reliable access to affordable and healthy food, which is particularly challenging in developing countries. NASA satellite data have long been used to study crop conditions globally, but NASA Harvest represents a more targeted effort to enhance the utility of satellite data to people around the world. The consortium will partner with NASA's new Goddard-based Food Security Office.

When Disaster Strikes, NASA Responds

NASA's spaceborne assets are increasingly in demand to help agencies and first responders jump into action after natural disasters. In some cases, these assets are needed not only in the immediate aftermath, but also in the subsequent months and years of recovery.

After Hurricane Maria's direct hit on Puerto Rico in the fall of 2017, Goddard scientists provided federal agencies on the ground with a new, high-definition view showing the lights visible on the island at night. Using ground-based and satellite data, including those from Landsat satellites and the Suomi National Polar-orbiting Partnership, the scientists created a map of Puerto Rico's power outages. The map was continually updated months after the storm, allowing for real-time monitoring of recovery efforts as well as analyses of vulnerabilities, helping guide the design of a more resilient electricity grid.

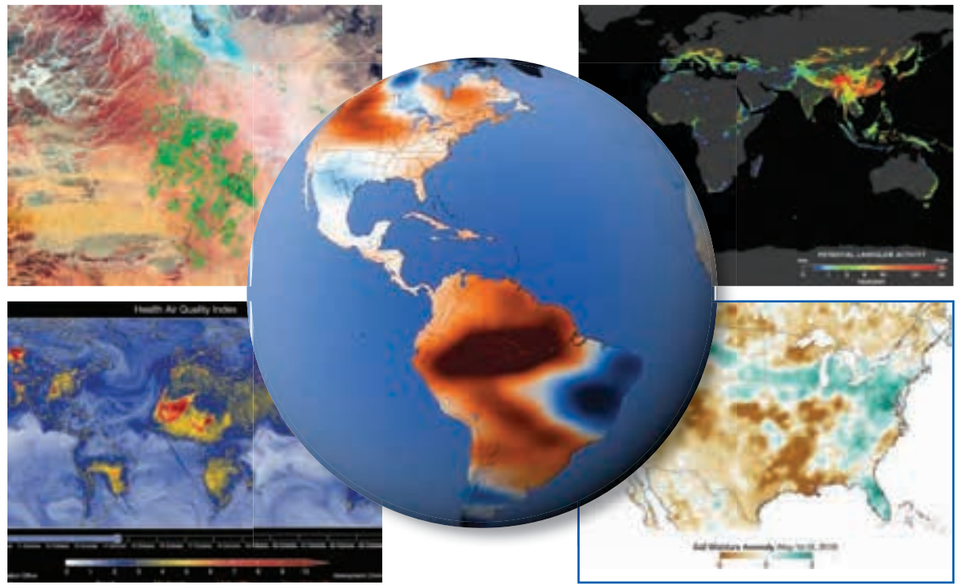
In some cases, NASA also provides a view of where disaster may strike. For the first time, scientists can look at landslide threats anywhere around the world in near real time, thanks to data from the Global Precipitation Measurement (GPM) mission and a new model developed by Goddard scientists. The model uses GPM data to identify areas with heavy, persistent and recent precipitation. Where precipitation is unusually high, the model determines if the area is prone to landslides using a susceptibility map. As with almost all NASA data, the output of the landslide susceptibility model is freely available.

Aiding Public Health

NASA data and tools are also being used to better respond to disease and public health.

In 2018, for the first time ever, measurements from NASA's Earth-observing research satellites were used to help combat a potential outbreak of life-threatening cholera. Humanitarian teams in Yemen targeted areas identified by a NASA-supported project that precisely forecasts high-risk regions based on environmental conditions observed from space. Humanitarian workers used this information to implement life-saving strategies to reduce the risk of cholera. The forecasting tool analyzes parameters from satellite observations, including precipitation from the GPM mission, air and ocean temperatures from the Moderate Resolution Imaging Spectroradiometer instruments on NASA's Terra and Aqua satellites, and measurements of phytoplankton concentrations in nearby coastal ocean areas.

Goddard researchers, working with their university counterparts, continued to advance the use of satellites to monitor air quality worldwide. Combining data from the Ozone Monitoring Instrument on the Aura satellite with Goddard's GEOS-5 atmospheric computer model, scientists are releasing an experimental global air quality forecast that can predict harmful levels of particulates, carbon monoxide, nitrous dioxide and other pollutants. Many countries still lack reliable air quality information because of the high cost of establishing and maintaining the necessary infrastructure. A global air quality model forecasting system, like the experimental version now available, can provide air quality information to everyone.



FROM GRAVITATIONAL-WAVE EVENT

For the first time, NASA scientists have detected light tied to a gravitational-wave event, thanks to two merging neutron stars in the galaxy NGC 4993, located about 130 million light-years from Earth in the constellation Hydra.

On Aug. 17, 2017, NASA's Fermi Gamma-ray Space Telescope picked up a pulse of high-energy light from a powerful explosion, which was immediately reported to astronomers around the globe as a short gamma-ray burst. The scientists at the National Science Foundation's Laser Interferometer Gravitational-wave Observatory (LIGO) detected gravitational waves—dubbed GW170817—from a pair of smashing stars tied to the gamma-ray burst, encouraging astronomers to look for the aftermath of the explosion.

NASA's Neil Gehrels Swift Observatory, Hubble Space Telescope, Chandra X-ray Observatory and Spitzer Space Telescope—along with dozens of ground-based observatories, including the NASA-funded Pan-STARRS survey—later captured the fading glow of the blast's expanding debris.

"For the first time, we've seen light and gravitational waves produced by the same event," said Paul Hertz, director of NASA's Astrophysics Division at the agency's headquarters in Washington.

Neutron stars are the crushed, leftover cores of massive stars that previously exploded as supernovas long ago. The merging stars whirled around each other hundreds of times a second, producing gravitational waves at the same frequency. As they drew closer and orbited faster, the stars eventually broke apart and merged, producing both a gamma-ray burst and a rarely seen flare-up called a "kilonova."

"This is the one we've all been waiting for," said David Reitze, executive director of the LIGO Laboratory at the California Institute of Technology in Pasadena. "Neutron star mergers produce a wide variety of light because the objects form a maelstrom of hot debris when they collide. Merging black holes—the types of events LIGO and its European counterpart, Virgo, have previously seen—very likely consume any matter around them long before they crash, so we don't expect the same kind of light show."

"The favored explanation for short gamma-ray bursts is that they're caused by a jet of debris moving near the speed of light produced in the merger of neutron stars or a neutron star and a black hole," added Eric Burns of Fermi's Gamma-ray Burst Monitor team at NASA's Goddard Space Flight Center. "LIGO tells us there was a merger of compact objects, and Fermi tells us there was a short gamma-ray burst. Together, we know that what we observed was the merging of two neutron stars, dramatically confirming the relationship."

Within hours of the initial Fermi detection, LIGO and the Virgo detector at the European Gravitational Observatory near Pisa, Italy, greatly refined the event's position in the sky with additional analysis of gravitational-wave data. Ground-based observatories then quickly located a new optical and infrared source—the kilonova—in NGC 4993.

To Fermi, this appeared to be a typical short gamma-ray burst, but it occurred less than one-tenth as far away as any other short burst with a known distance, making it among the faintest known.

The Swift, Hubble and Spitzer missions followed the evolution of the kilonova to better understand the composition of this slower-moving material, while Chandra searched for X-rays associated with the remains of the ultrafast jet.

When Swift turned to the galaxy shortly after Fermi's gamma-ray burst detection, it found a bright and quickly fading ultraviolet source.

"We did not expect a kilonova to produce bright UV emission," said Goddard's S. Bradley Cenko, Swift principal investigator. "We think this was produced by the short-lived disk of debris that powered the gamma-ray burst."

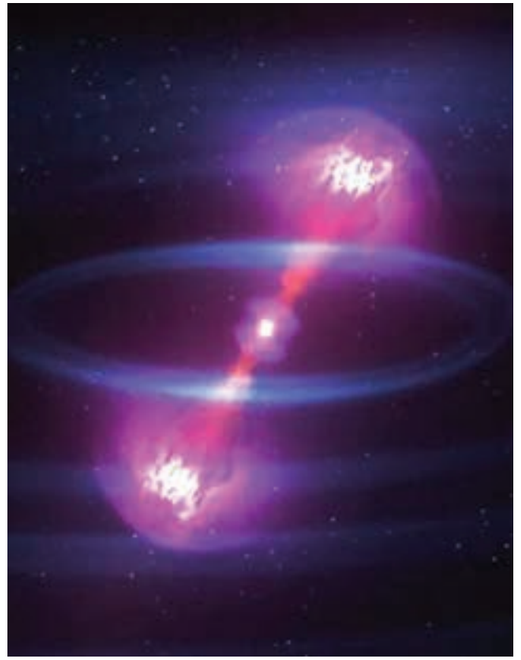
Over time, material hurled out by the jet slows and widens as it sweeps up and heats interstellar material, producing so-called afterglow emission that includes X-rays. But the spacecraft saw no X-rays—a surprise for an event that produced higher-energy gamma rays. Chandra clearly detected X-rays nine days after the source was discovered. Scientists think the delay was a result of the viewing angle, and it took time for the jet directed toward Earth to expand into the line of sight.

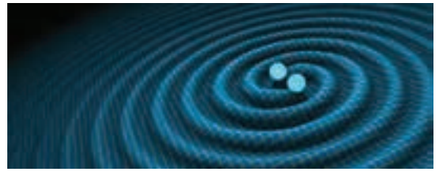
On Aug. 22, Hubble began imaging the kilonova and capturing its near-infrared spectrum, which revealed the motion and chemical composition of the expanding debris.

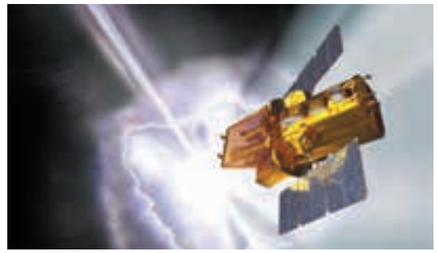
"The spectrum looked exactly like how theoretical physicists had predicted the outcome of the merger of two neutron stars would appear," said Andrew Levan at the University of Warwick in Coventry, England, who led one of the proposals for Hubble's spectral observations. "It tied this object to the gravitational-wave source beyond all reasonable doubt."

Because of its Earth-trailing orbit, Spitzer was uniquely situated to observe the kilonova long after the Sun moved too close to the galaxy for other telescopes to see it. Spitzer's observation on Sept. 30 captured the longest-wavelength infrared light from the kilonova.

Gravitational waves were directly detected for the first time in 2015 by LIGO, whose architects were awarded the 2017 Nobel Prize in physics for the discovery.







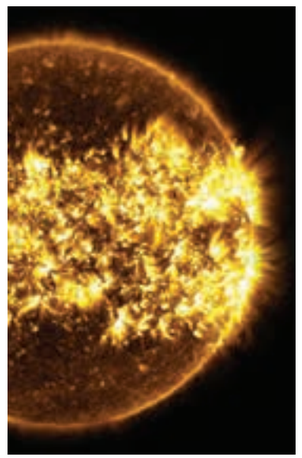
OUR FOCUS AREAS

EARTH SCIENCE

Observes and studies Earth's system to further scientific understanding of our home planet and improve predictions of its evolving state due to human behavior and natural changes.

ASTROPHYSICS

Investigates the universe through astronomy, astrophysics and fundamental physics on issues such as dark matter and energy, life-harboring planets and black holes.



HELIOPHYSICS

Studies our star and how it influences and affects our space environment—and, in turn, the atmospheres of planets and the human technology that exists there.

CROSS-CUTTING TECHNOLOGIES

Sensor Systems and Instrument Platforms

Goddard builds instruments for missions, ranging from subsystems—such as detectors and optical elements—to full instruments and complex instrument suites.

Large-Scale Scientific Information Systems, Data Processing and Dissemination

Goddard designs and implements custom, large-scale data systems and supercomputing applications for high-performance computing and archiving of a wide range of science data.

Orbital Servicing and Assembly

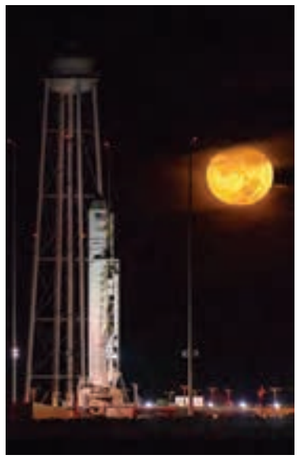
Goddard services enable extended mission operations, reconfiguration and recovery, including in-orbit spacecraft refueling and repair, and assembling large structures in orbit and modular designs.

PLANETARY SCIENCE

Investigates the planets, moons and small objects in the solar system and beyond, including their evolution, inner structures and forces that alter them.

SPACE COMMUNICATIONS AND NAVIGATION

Develops systems, technologies and services in support of science, exploration and space operations missions that are near Earth and in deep space.



SUBORBITAL PROGRAMS AND RANGE SERVICES

Manages programs and services for sounding rockets, balloons, aircraft and commercial space, including NASA's only launch facility—Wallops Launch Range.

OTHER ENABLING CAPABILITIES

Program and Project Management

Goddard conducts effective, tailored management and cost estimation, maintains schedules, develops technology, manages risk, and assures outcomes for missions and their supporting elements and services.

End-to-End Mission Systems Architecture and Engineering

Goddard addresses the full life cycles of science missions, spacecraft, *in situ* and remote-sensing instruments, and payloads, from advanced concepts through implementation.

Safety and Mission Assurance

Goddard is a recognized leader in safety and mission assurance with a lengthy history of implementing effective and innovative approaches to reduce risk and enable mission success.

2018 IN FIGURES

ONE GODDARD
MORE THAN 10,000 PEOPLE

3,000+ CIVIL SERVANTS
6,000+ ON-SITE CONTRACTORS
1,000s OF OTHERS
(including off-site contractors, emeritus employees and interns)

37% FEMALE (Civil Servants)

63% MALE (Civil Servants)

650 INTERNS (including Pathways)

45 STATES
(plus the District of Columbia and two U.S. territories)

BUDGET: $5.2B

DIRECT GSFC BUDGET: $3.7B

REIMBURSABLE GSFC BUDGET: $1.5B
(FROM OTHER GOVERNMENT AND NONGOVERNMENT ENTITIES)

JOINT AGENCY SATELLITES

7 AGENCIES

NASA, CSA ASC, NOAA, esa, USGS science for a changing world, JAXA Japan Aerospace Exploration Agency

BEST PLACES
TO WORK IN THE FEDERAL GOVERNMENT (2017 RANKINGS)

#1 NASA RANKED OUT OF 18 LARGE AGENCIES (SIXTH CONSECUTIVE YEAR)

#2 GODDARD RANKED OUT OF 150 AGENCY SUBCOMPONENT ORGANIZATIONS (HIGHEST AMONG NASA CENTERS)

HUBBLE
DATA PUBLISHED IN
15,000+
SCIENTIFIC PAPERS TO DATE

SOCIAL MEDIA FOLLOWERS

1.2+ MILLION

493,000+

2.3+ MILLION

500,000+

561 articles posted to NASA.gov

147 videos uploaded to YouTube

TECHNOLOGICAL INNOVATIONS

209 New Technology Reports

40 Patent Applications Filed

JAMES WEBB SPACE TELESCOPE

5 LAYER SUNSHIELD

18 NUMBER OF PRIMARY MIRROR SEGMENTS

4 SCIENCE INSTRUMENTS

Please visit *https://www.jwst.nasa.gov/*

1,700+
ACTIVE PROCUREMENT INSTRUMENTS

GODDARD VISITOR CENTER (GREENBELT)

2 NEW EXHIBITS

45,636 TOTAL VISITORS

CITIZEN SCIENCE PROJECTS

250,000 participants

103 countries

300+ ROBOTIC MISSIONS LAUNCHED TO DATE

WALLOPS FLIGHT FACILITY

WFF

2 ISS RESUPPLY MISSIONS SUPPORTED

1,210 AIRCRAFT FLIGHT HOURS

19 SOUNDING ROCKET LAUNCHES

11 BALLOON MISSIONS

COLUMBIA SCIENTIFIC BALLOON FACILITY

Est.1961

1,700+ Balloons Launched to Date for:
35 Universities
23 Research Agencies
33 Foreign Groups

IV&V FACILITY

15 NASA MISSIONS SUPPORTED

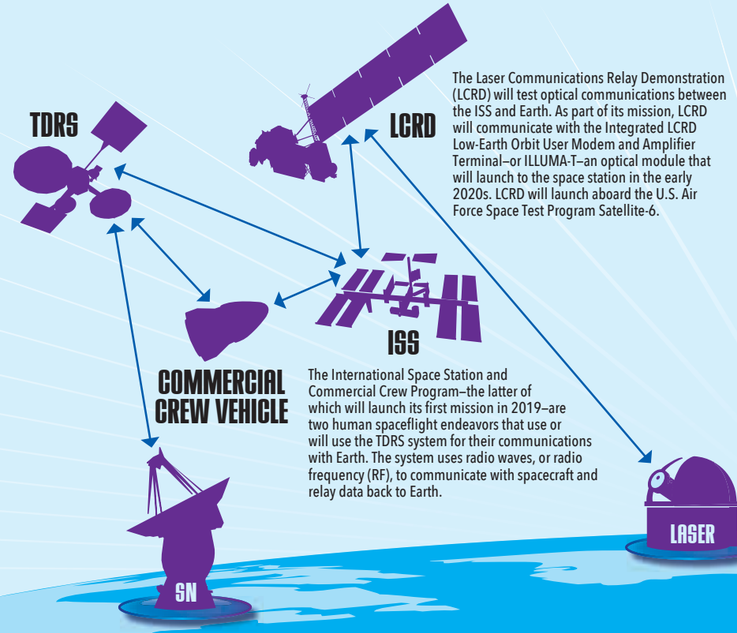
27 SEVERITY ONE ISSUES IDENTIFIED

HIGH BAY CLEAN ROOM:
THE WORLD'S LARGEST CLEAN ROOM WITH 1.3 MILLION CUBIC FEET OF SPACE

Figures are for fiscal 2018 unless noted otherwise.

CONNECTING ASTRONAUTS TO EARTH

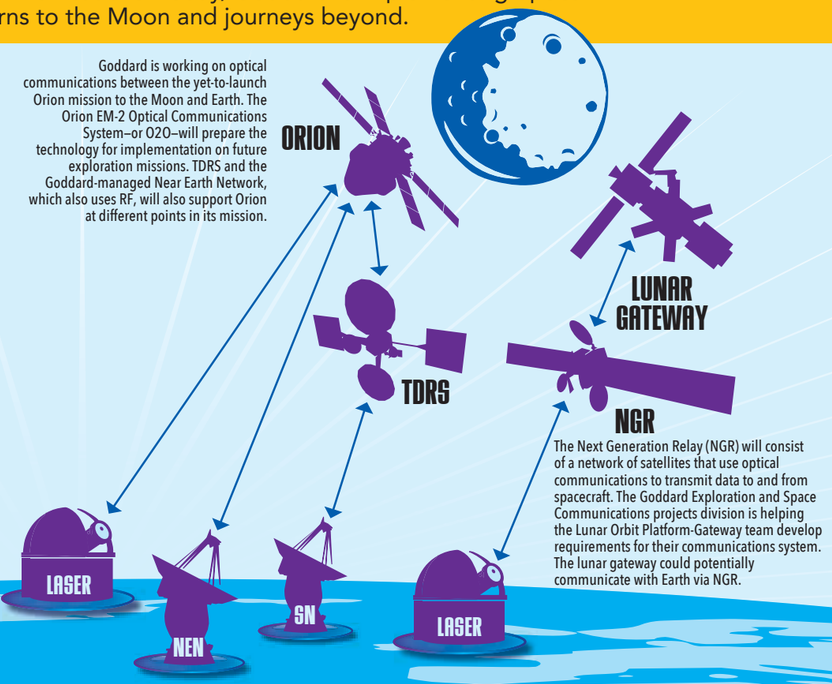
Since 1961, Goddard's communications networks have served as the backbone for NASA's human exploration missions, beginning with the use of ground-based antennas. In 1983, Goddard launched the first Tracking and Data Relay Satellite (TDRS), which provided continuous communications through space-based relays and forever changed the landscape of space communications. Today, Goddard is implementing optical communications in space, which will provide better data rates as NASA returns to the Moon and journeys beyond.



The Laser Communications Relay Demonstration (LCRD) will test optical communications between the ISS and Earth. As part of its mission, LCRD will communicate with the Integrated LCRD Low-Earth Orbit User Modem and Amplifier Terminal–or ILLUMA-T–an optical module that will launch to the space station in the early 2020s. LCRD will launch aboard the U.S. Air Force Space Test Program Satellite-6.

The International Space Station and Commercial Crew Program–the latter of which will launch its first mission in 2019–are two human spaceflight endeavors that use or will use the TDRS system for their communications with Earth. The system uses radio waves, or radio frequency (RF), to communicate with spacecraft and relay data back to Earth.

Goddard is working on optical communications between the yet-to-launch Orion mission to the Moon and Earth. The Orion EM-2 Optical Communications System–or O2O–will prepare the technology for implementation on future exploration missions. TDRS and the Goddard-managed Near Earth Network, which also uses RF, will also support Orion at different points in its mission.



The Next Generation Relay (NGR) will consist of a network of satellites that use optical communications to transmit data to and from spacecraft. The Goddard Exploration and Space Communications projects division is helping the Lunar Orbit Platform-Gateway team develop requirements for their communications system. The lunar gateway could potentially communicate with Earth via NGR.

HOW WE DO IT

Space Network (SN)
A constellation of 10 Earth-orbiting Tracking and Data Relay Satellites and four ground terminal locations that collectively provide a continuous global link between spacecraft and the ground.

Near Earth Network (NEN)
A series of more than 15 globally located NASA-owned and contracted commercial ground terminals that provides comprehensive communications services to satellites from near-Earth orbit to a million miles from Earth.

NASA Communications Network (NASCOM)
The central nervous system connected to all of NASA's communications circuits. NASCOM transports and delivers data to control centers and data centers, which process and disseminate the data for the scientific community, other agencies and the public.

Optical Communications
As the center of excellence for optical communications, Goddard is implementing next-generation communications infrastructure that uses infrared waves to deliver more data at a time—while using smaller, lighter and more power-efficient systems.

BENEFITS OF NEW TECHNOLOGY

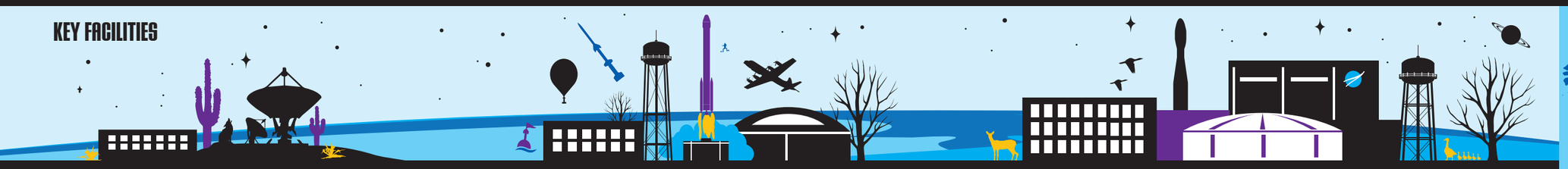
Better Data Rates
Goddard is working on implementing multiple new communications technologies that will deliver more data at a time to Earth. NEN is constructing new antennas that can communicate via Ka band to support the higher data requirements of new science missions. Optical communications also transmits more data at a time through its higher infrared electromagnetic frequency.

Size, Weight and Power Efficiencies
Optical communications can enable better data rates and its systems can be much smaller than current RF systems. Optical telescopes on the ground can be as small as a few inches, while RF antennas are at least several meters in diameter.

Technology Transfer
NASA-developed technologies are often transferred to the private sector for the public's benefit. One of NASA's goals is to transfer space communications technologies to the private sector, including the technology for optical communications payloads and ground stations.

Industry Partnerships
Working with industry provides economic benefits to NASA and helps infuse emerging commercial technologies into the agency's space communications capabilities. These collaborations also create jobs within industry.

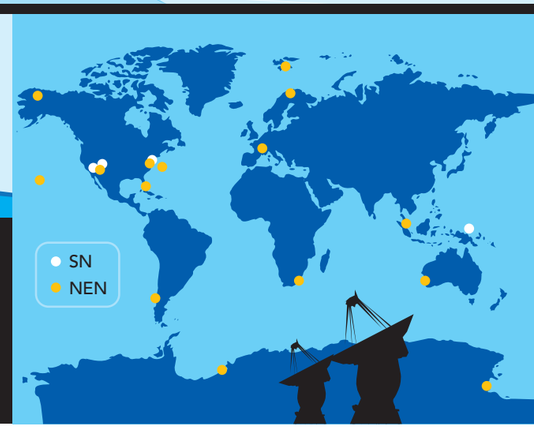
KEY FACILITIES



WHITE SANDS COMPLEX
The SN ground segment at the White Sands Complex in New Mexico features ground terminals that provide the hardware and software necessary to guarantee a constant communications link between spacecraft and the ground. TDRS and NASCOM interface with the customer control center to deliver data. The White Sands SN ground terminals will support the Orion missions to the Moon and beyond.

WALLOPS FLIGHT FACILITY
As one of the NASA-owned tracking stations, Wallops hosts several NEN antennas that provide high-quality, low-cost communications services to supported flight missions. Its Global Monitor and Control Center provides continuous monitoring of passes, allowing for remotely controlled and locally unattended station operations at other sites, including the soon-to-be-completed Launch Communications Segment (LCS) at NASA's Kennedy Space Center in Cape Canaveral, Florida. LCS will provide critical launch communications capabilities to the Space Launch System rocket and the Orion spacecraft.

GODDARD GREENBELT CAMPUS
In addition to providing overall management for SN and NEN, the Greenbelt campus manages NASCOM, which handles all data from SN, NEN and the Deep Space Network—the latter of which is managed by NASA's Jet Propulsion Laboratory in Pasadena, California. Its global system of communications transmission, switching and terminal facilities provides internet protocol-routed data, high-rate data and video services. Other capabilities include mission voice communications services and high-volume data transfer among NASA supercomputers, including the Goddard-based NASA Center for Climate Simulation.



A QUARTER CENTURY OF SOFTWARE ASSURANCE AND MORE

Established as a direct result of recommendations made by the National Research Council and the Presidential Commission on the Space Shuttle Challenger Accident, NASA's Independent Verification & Validation Facility (IV&V)—a division of NASA's Goddard Space Flight Center—in Fairmont, West Virginia, contributes to the safety and success of NASA's highest-profile missions by ensuring that software performs correctly.

The facility and its program, which both celebrated their 25th anniversary in June, have provided software assurance on approximately 100 missions and projects—the first being the International Space Station in 1994. Other past beneficiaries have included the Space Shuttle Program, Hubble Space Telescope, Cassini mission to Saturn, InSight robotic mission to Mars, Mars Science Laboratory, Magnetospheric Multiscale mission and Global Precipitation Measurement mission.

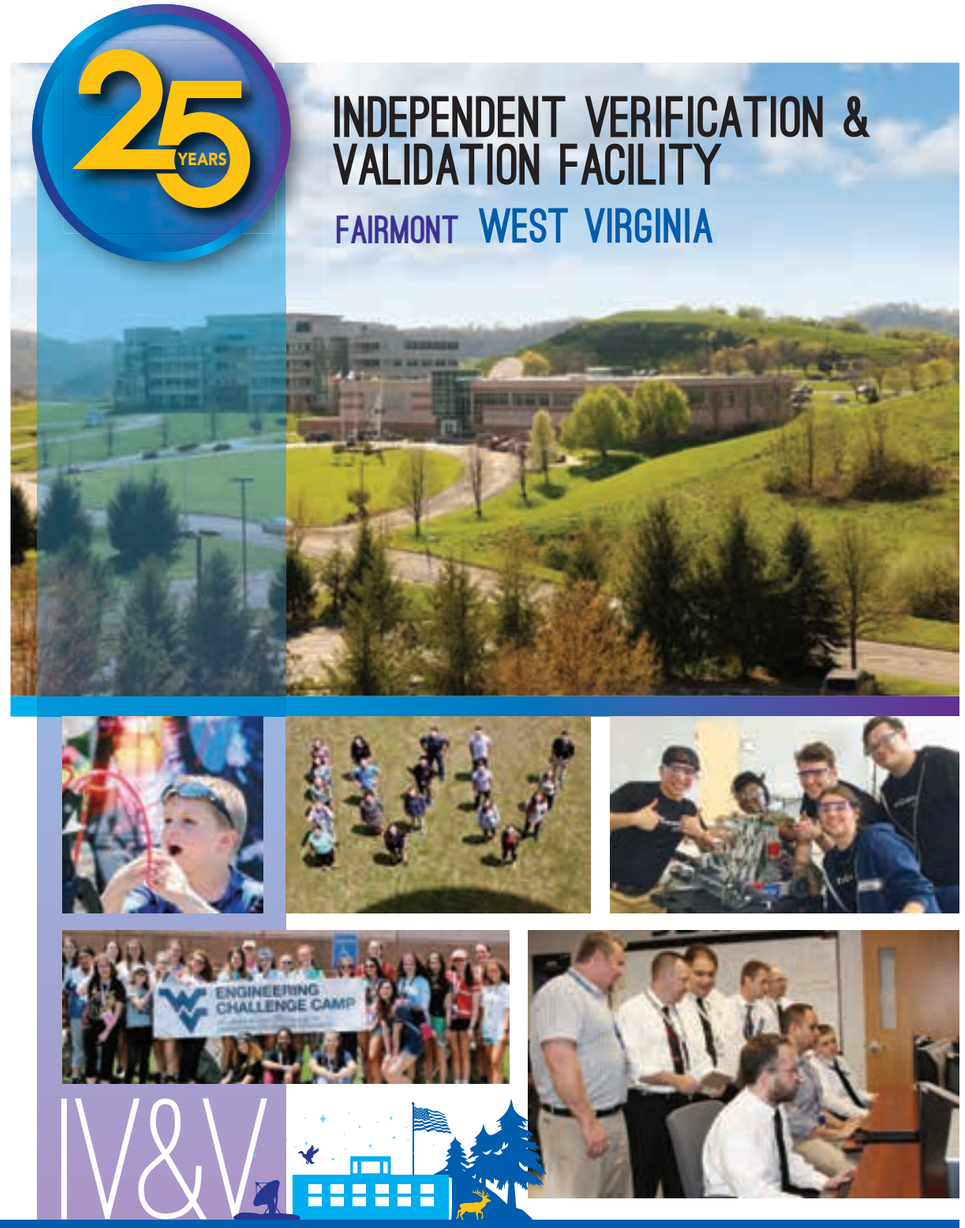
Consisting of approximately 350 employees, IV&V is currently providing services to 15 NASA missions, including the James Webb Space Telescope, Orion Multi-Purpose Crew Vehicle and Space Launch System. The program also offers general software safety and mission assurance services, including support for the Commercial Crew Program—a NASA-led initiative that partners with the U.S. aerospace industry to help develop and operate a new generation of spacecraft and launch systems capable of carrying crews to low-Earth orbit and the space station.

In addition to its NASA responsibilities, IV&V performs reimbursable work on projects for other federal agencies as well as municipal governments, contributing to the safety and success of those organizations and providing an opportunity to improve the tools and techniques used in support of NASA. Cybersecurity assurance services are also offered to various NASA offices and programs, other federal agencies, municipal governments, and other interested parties.

As part of a collaboration with the West Virginia Space Grant Consortium and West Virginia University, IV&V helped build Simulation-to-Flight 1—the state's first spacecraft set to launch in late 2018.

The program arranges and supports STEM engagement opportunities—including internships, student and educator workshops, and STEM competitions—for the next generation of scientists and engineers. In 2018, IV&V's Educator Resource Center coordinated 12 unique competitive robotics programs and hosted 51 tournaments across West Virginia, engaging more than 5,000 students.

For more information about NASA's Independent Verification & Validation Facility, visit: *http://www.nasa.gov/centers/ivv*



HIGHLIGHTS OF FISCAL 2018

- ICESAT-2
- TESS
- SOLAR RESEARCH
- SAM
- TDRS-13
- CATCHING FIRST LIGHT
- NOAA-20
- MMS
- JWST
- IV&V
- GOES-17
- LRO
- HUBBLE
- DELLINGR
- RESTORE-L
- PACE
- LCRD
- WFIRST
- JUPITER'S RED SPOT
- TSIS-1
- AURORASAURUS

ICESAT-2

Providing Better Glacier and Ice Measurements

The Ice, Cloud and land Elevation Satellite-2 (ICESat-2) launched in September, nine years following the end of the first ICESat mission in 2009. ICESat-2, whose sole instrument is the Goddard-developed Advanced Topographic Laser Altimeter System—or ATLAS—will measure glacier and ice sheet elevation and sea ice thickness. The mission will ultimately "complete the bridge" to the successful Operation IceBridge campaign, which conducted numerous survey flights over Greenland and Antarctica to cover the data gap between ICESat missions.

TESS

NASA's Newest Exoplanet Hunter

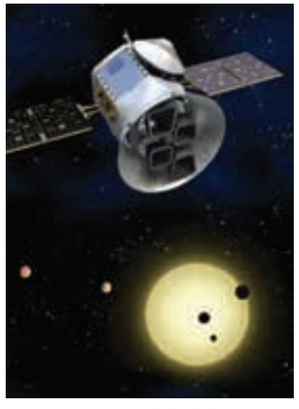
Following its launch in April, the Transiting Exoplanet Survey Satellite (TESS) began its two-year survey of nearby stars in search of planets outside the solar system, known as exoplanets. Some of these planets could even support life. The spacecraft's four cameras allow it to scan 85 percent of the sky. First science data from TESS were collected in July, and the satellite has already found potential new planets.

SOLAR RESEARCH

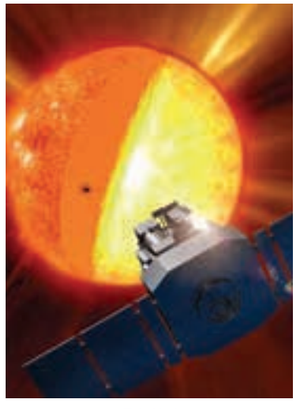
Missions Combine to Explain Mystery About Solar Flares

Observations from three missions combined to explain a decades-old mystery about how solar flares—huge explosions on the Sun that emit the entire electromagnetic spectrum—can sometimes emit gamma rays up to eight hours after a flare. Data from Fermi, the Solar and Heliospheric Observatory, and Wind showed that these "long-duration" gamma rays are created as the result of a process initiated by coronal mass ejections—giant eruptions of solar material on the Sun.

EARTH



UNIVERSE



SUN

HIGHLIGHTS OF FISCAL 2018

SAM

New Findings Support Search for Life

The Goddard-developed Sample Analysis at Mars instrument suite aboard the Mars Curiosity rover detected seasonal variations in methane on the Red Planet—evidence which relates to the search for current life. The rover also found organic molecules in 3-billion-year-old sedimentary rocks near the surface that suggest Mars could have supported life in the past. While these findings are not necessarily evidence of life itself, they set the stage for additional findings by future Mars missions.

TDRS-13

Expanding the Space Network

NASA's latest space communications satellite, Tracking and Data Relay Satellite-13 (TDRS-13), completed on-orbit testing and was accepted into the Space Network in February 2018. The Goddard-managed network, which comprises other TDRS satellites, provides communications support to more than 40 missions, including the International Space Station and Hubble Space Telescope. The inclusion of TDRS-13, known as TDRS-M prior to its launch in August 2017, enables the network to continue its role well into the next decade.

CATCHING FIRST LIGHT

Missions Catch First Light From Merging Neutron Stars

As part of a global collaboration, a series of NASA missions—including several that are managed by Goddard—detected light from merging neutron stars, further confirming the existence of gravitational waves. The detection of such waves and the confirmation of their existence are significant events in astrophysics, since the waves give greater insight into how the universe was formed, provide a better understanding of its fundamental laws and further support Albert Einstein's general theory of relativity.

SOLAR SYSTEM

SPACE COMMS

UNIVERSE

NOAA-20

Pole-to-Pole Observations of Earth

Continuing a long-standing relationship with the National Oceanic and Atmospheric Administration (NOAA), NASA launched in November 2017 the Joint Polar Satellite System-1 (JPSS-1)—later known as NOAA-20—a polar-orbiting environmental satellite that gathers global measurements of atmospheric, terrestrial and oceanic conditions. JPSS satellites are developed by Goddard for NOAA, which is responsible for the operation of the spacecraft. There are plans for three additional JPSS satellites to follow between 2022 and 2031.

MMS

Spacecraft Quartet Moves Between Earth and Sun

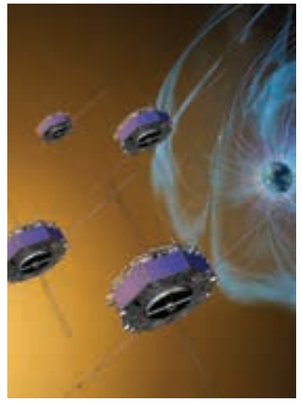
After a successful three-year nominal mission, the Magnetospheric Multiscale (MMS) mission was extended to study the space environment around Earth. The quartet of spacecraft comprising MMS were moved to a position between Earth and the Sun, allowing the mission to examine the detailed physics of the way particles, magnetic fields and energy behave in the solar wind. Such data help us better understand the space through which our astronauts and missions must safely travel.

JWST

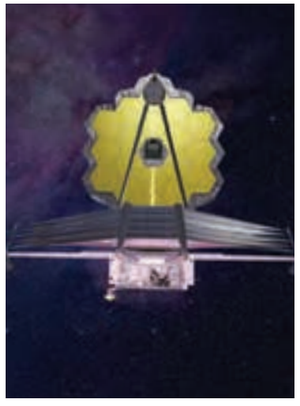
Testing Continues Prior to 2021 Launch

Following years of development, integration and testing of its telescope and instrument components at Goddard—and several months of testing at NASA's Johnson Space Center in Houston—all elements of the James Webb Space Telescope are currently at a Northrop Grumman facility in California for final integration and observatory-level testing prior to launch in 2021. Webb will explore the universe in infrared light, observing the formation of the first stars and galaxies and helping discover how they have evolved over billions of years.

EARTH



SPACE WEATHER



UNIVERSE

HIGHLIGHTS OF FISCAL 2018

IV&V

Goddard Division Celebrates 25 Years

The Independent Verification & Validation Facility—a division of Goddard—in Fairmont, West Virginia, celebrated a quarter century of providing software assurance and more to key NASA missions. Since the facility and its program began operations in 1993, they have supported such missions as the International Space Station, Space Shuttle Program, Hubble Space Telescope, InSight robotic mission to Mars and Global Precipitation Measurement mission. They are currently providing services to 15 missions, including the James Webb Space Telescope.

GOES-17

The Latest in the Weather Forecasting Series

Goddard and NASA are partners with the National Oceanic and Atmospheric Administration on the Geostationary Operational Environment Satellite (GOES) program, which has supported weather forecasting, severe storm tracking and meteorology research since 1974. GOES observations have also proven to be helpful in monitoring dust storms, volcanic eruptions and forest fires. In March, GOES-S—the second of the current generation of GOES satellites—launched into orbit and was later renamed GOES-17. The mission is expected to remain operational into the 2030s.

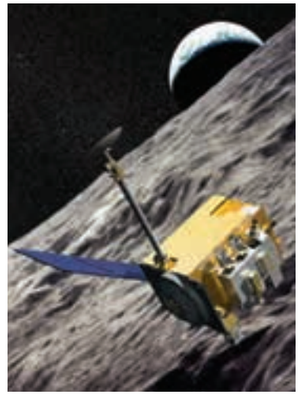
LRO

Evidence Suggests Moon's Water Is Widely Distributed

An analysis of data from the Goddard-managed Lunar Reconnaissance Orbiter—and the Moon Mineralogy Mapper aboard the Chandrayaan-1 spacecraft—suggests the Moon's water is widely distributed across its surface and not confined to a particular region or terrain. This could help researchers understand how to use the water as a resource, and future explorers might be able to drink it or convert it into hydrogen and oxygen for rocket fuel.

CENTER

EARTH



SOLAR SYSTEM

HUBBLE

28 Years of Discovery and Counting

Since its launch in 1990, the Hubble Space Telescope has established itself as an international icon of space science, changing the course of astronomy through countless discoveries in the solar system to the farthest reaches of the universe. This past year, among many other achievements, the observatory imaged a kilonova from a landmark gravitational-wave event and photographed Saturn and Mars near their closest approaches to Earth in June and July, respectively.

DELLINGR

The Little CubeSat That Could

Originally conceived in 1999, the CubeSat concept has grown in popularity thanks to lower costs, an ability to facilitate never-before-attempted observing techniques and increasing reliability of miniature components. The Goddard-funded Dellingr CubeSat mission was launched in August 2017 and deployed from the International Space Station the following November. After lessons learned in overcoming design and functionality issues, Dellingr is gathering data about the Sun's influence on Earth's upper atmosphere using a suite of miniaturized components and instruments, further proving the viability of smaller satellite designs.

RESTORE-L

Demonstrating Robotic Satellite Servicing

Restore-L will demonstrate the technologies required to robotically refuel satellites which were not originally designed for servicing. This year, using a newly acquired hexapod robot and a robotic servicing arm, the Restore-L team practiced autonomously tracking and grasping a satellite. Several of the mission's technology elements will be further developed by demonstrations during the Robotic Refueling Mission 3, which will launch in late 2018 and test methods for storing and replenishing cryogenic fluids in in-orbit satellites.

UNIVERSE

SPACE WEATHER

TECHNOLOGY

HIGHLIGHTS OF FISCAL 2018

PACE

Monitoring the Health of Our Ocean

Goddard's next ocean-observing satellite—the Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) mission—continued to hit milestones toward its expected launch in 2022. With its advanced hyperspectral measurements, PACE will push forward the 20-year record of measuring microscopic life on the ocean's surface. PACE will also help reveal how the ocean and atmosphere exchange carbon dioxide and how atmospheric aerosols may fuel phytoplankton growth in the ocean. Goddard manages the mission and is building its Ocean Color Instrument.

LCRD

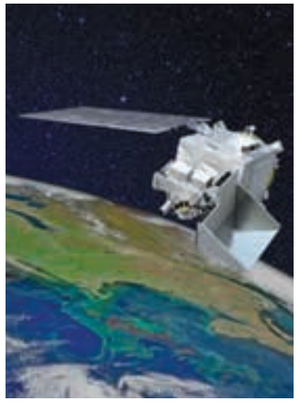
Optical Communications Payload Completes Environmental Testing

The Laser Communications Relay Demonstration (LCRD) will be NASA's third technology demonstration of optical communications in space, enabling better data rates with lower size, weight and power requirements compared to traditional radio frequency communications platforms. The payload recently completed environmental testing at Goddard and is being prepared for shipment to a Northrop Grumman facility where it will be integrated with the U.S. Air Force's Space Test Program Satellite-6 spacecraft, on which LCRD will launch.

WFIRST

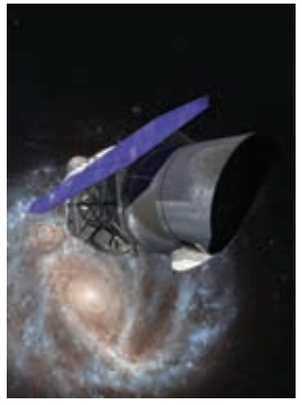
Surveying the Universe Through a Wider Field

Selected as the top priority by the National Academy of Sciences 2010 Decadal Survey for Astronomy and Astrophysics, the Wide Field Infrared Survey Telescope (WFIRST) will study the evolution of the universe, dark energy and exoplanets. In May, WFIRST passed a key milestone, clearing it to enter its preliminary design phase and begin major procurements for flight hardware. It also completed a series of reviews that keeps it on track to begin the next development phase and meet its scientific goals.



EARTH

SPACE COMMS



UNIVERSE

JUPITER'S RED SPOT

Findings Shed Light on Spot's Mystery

A team comprising scientists from Goddard and other institutions found evidence suggesting that Jupiter's Great Red Spot has been shrinking for a century and a half, but has also been getting taller in the process. Researchers drew on historical observations and combined them with data from NASA spacecraft. The group relied on annual observations of Jupiter that members have been conducting with the Hubble Space Telescope as part of the Outer Planets Atmospheres Legacy project.

TSIS-1

Measuring the Sun's Influence on Earth

The Total and Spectral solar Irradiance Sensor (TSIS-1) will help scientists better understand the Sun's influence on Earth's radiation budget, ozone layer, atmospheric circulation and ecosystem. Following its launch to the International Space Station in December 2017, the instrument became fully operational in March. Goddard had overall responsibility for the development of TSIS-1 and oversees its operations aboard the space station. The University of Colorado Laboratory for Atmospheric and Space Physics is responsible for providing solar irradiance measurements to Goddard.

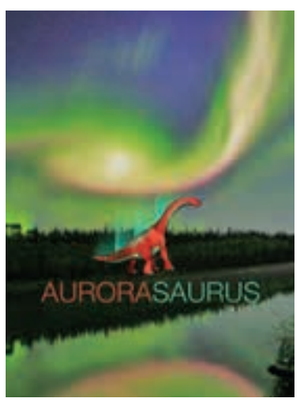
AURORASAURUS

Citizen Scientists Solve Auroral Mystery of "STEVE"

Aurorasaurus, a citizen science project funded by NASA and the National Science Foundation, tracks the aurora borealis through user-submitted reports and tweets. Over several years, citizen scientists collectively identified a narrow, purple, subauroral visible structure which was largely undocumented in scientific literature. This year, Goddard scientists with the Aurorasaurus project showed that the phenomenon—given the name STEVE—could provide better insight into how the Sun interacts with Earth's magnetic fields.

SOLAR SYSTEM

EARTH



ATMOSPHERE

OUR PRIMARY LINES OF BUSINESS

A PLACE FOR SUCCESS

We launch science. We help answer crucial science questions through complex missions that depend on dedicated and innovative teams to develop pioneering technologies. Goddard is one of the few organizations worldwide that manages a mission from the concept phase through operations, utilizing internal, partner and industry expertise and resources along the way. The depth and expertise of our scientists, engineers, technologists, project managers and support personnel form the foundation of our unique strength. With our leadership in scientific research and instrument and spacecraft development, the center has a renowned capability of conceiving and managing advanced science, technology and space systems through the entire mission life cycle.

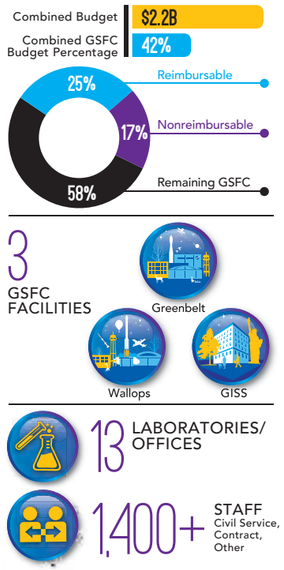
EARTH SCIENCE

After several years in development, the Goddard-managed Ice, Cloud and land Elevation Satellite-2 (ICESat-2) launched in September, nine years following the end of the first ICESat mission in 2009. ICESat-2, whose sole instrument is the Goddard-developed Advanced Topographic Laser Altimeter System (ATLAS), will measure glacier and ice sheet elevation and sea ice thickness.

In December 2017, the Total and Spectral solar Irradiance Sensor (TSIS-1) launched to the International Space Station and became fully operational in March. TSIS-1 will take long-term measurements of the Sun's incoming energy.

In January, the Goddard Institute for Space Studies released its annual analysis of global temperatures, as well as subsequent monthly analyses. Along with accompanying data from the National Oceanic and Atmospheric Administration, its studies continue to be cited as an authoritative source on Earth's changing climate.

In April, more than half a year after Hurricane Maria wreaked havoc on Puerto Rico, a NASA team surveyed damage to the island's forests as part of the recovery effort. An airborne campaign, funded by NASA and other agencies, flew Goddard's Lidar, Hyperspectral and Thermal Imager (G-LiHT) to collect data on surface temperature, vegetation structure and more. The team flew G-LiHT above the same tracks before the hurricane to study how tropical forests regrow on abandoned agricultural land.



MISSIONS AND INSTRUMENTS IN DEVELOPMENT

- Global Ecosystem Dynamics Investigation (GEDI)
- Landsat 9*
- MetOp-C*
- Plankton, Aerosol, Cloud, ocean Ecosystem (PACE)

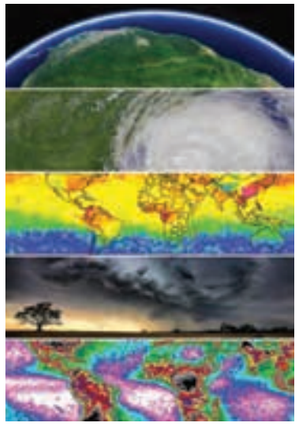
OPERATIONAL MISSIONS

- Aqua
- Aura
- Deep Space Climate Observatory (DSCOVR)*
- Global Precipitation Measurement (GPM)*
- GOES-13*, GOES-14*, GOES-15*, GOES-16*, GOES-17*
- Ice, Cloud, and land Elevation Satellite-2 (ICESat-2)
- Landsat 7*, Landsat 8*
- NOAA-20*
- Soil Moisture Active Passive (SMAP) Radiometer
- Solar Radiation and Climate Experiment (SORCE)
- Suomi-National Polar-orbiting Partnership (Suomi-NPP)*
- Terra
- Total and Spectral Solar Irradiance Sensor (TSIS-1)

*Joint Agency Satellite

NASA Strategic Objective 1.1: Understand the Sun, Earth, Solar System, and Universe. Conduct scientific studies of the Earth and Sun from space, return data and samples from other bodies in the solar system, peer out into the vast reaches of the universe, and play a catalyzing role in lunar robotic exploration by supporting innovative approaches to advancing science. These efforts are guided by National priorities and recommendations from the National Academies' decadal surveys and implemented through a balanced portfolio of programs.

PORTFOLIO



ATMOSPHERIC COMPOSITION

HYDROSPHERIC PROCESSES

CARBON CYCLE AND ECOSYSTEMS

CLIMATE AND WEATHER

EARTH SURFACE AND INTERIOR

SUCCESSES

- Terra satellite completes 100,000 orbits around Earth
- Survey flights of Hurricane Maria damage in Puerto Rico aid recovery efforts

SUCCESSES

- Operation IceBridge breaks records in calendar year 2017: seven field campaigns and 214,000 miles
- GLOBE Observer app reaches 240,000 downloads
- Citizen science projects attracted 250,000 participants from 103 countries

AWARDS

- 9 NASA Honor Awards
- 3 New American Geophysical Union Fellows
- U.N. Environment Programme "Champions of the Earth" Award
- U.S. Geological Survey William T. Pecora Award
- William Nordberg Memorial Award for Earth Science
- 2 New American Meteorological Society Fellows

HIGHLIGHTS

UNDERSTANDING OUR DYNAMIC PLANET

MAKING HEADLINES

This New Satellite Could Produce the Most Accurate Weather Predictions Yet
— Nov. 14, 2017, Los Angeles Times

Birth of a Hurricane
— Dec. 5, 2017, Slate

New NASA Maps Reveal How Rapidly Antarctica Is Melting Away
— Feb. 21, 2018, Inverse

Watch a Single Snowflake Melt
— March 30, 2018, Atlas Obscura

Join NASA's Operation IceBridge on Its Icy Polar Mission
— April 25, 2018, New Scientist

As the Ice Melts, NASA Will Be Watching
— Sept. 14, 2018, The New York Times

ASTROPHYSICS

The Transiting Exoplanet Survey Satellite launched on April 18, and it is already providing valuable data that will help scientists discover and study new exoplanets and determine whether they can support life.

The Neutron star Interior Composition Explorer has been performing well, providing high-precision measurements of neutron stars.

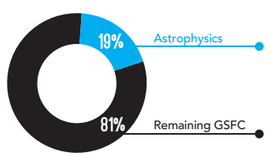
The Primordial Inflation Polarization Explorer (PIPER) balloon payload is in its second year of test flights. PIPER is investigating the theory that our nascent universe expanded by a trillion by trillion times immediately following the big bang.

The Transient Astrophysics Observer on the ISS, a Goddard-led Mission of Opportunity proposal, was selected for a Phase A study. The mission's primary goal is to detect X-ray counterparts to gravitational waves produced by neutron stars merging with black holes and other neutron stars.

The science payload for the James Webb Space Telescope arrived at Northrop Grumman's Space Park facility in California. Communication between the spacecraft and telescope was successful during testing. Progress continues on the development work for the Wide Field Infrared Survey Telescope. The renamed Neil Gehrels Swift Observatory marked 13 years of game-changing astrophysics and remains the only satellite capable of precisely locating the universe's most powerful explosions and monitoring them before they fade from view. Orbiting Earth for more than 28 years, the Hubble Space Telescope continues to allow humanity to explore farther into the universe.

Budget $1.0B

GSFC Budget Percentage 19%



2 GSFC FACILITIES

5 LABORATORIES/ OFFICES

370 STAFF

MISSIONS IN DEVELOPMENT

- BurstCube
- High Resolution Mid-Infrared Spectrometer (HIRMES) for the Stratospheric Observatory for Infrared Astronomy
- Transient Astrophysics Observer on the ISS (ISS-TAO)
- James Webb Space Telescope
- Micro-X
- Wide Field Infrared Survey Telescope (WFIRST)
- X-ray Advanced Concepts Testbed (XACT)
- X-ray Imaging and Spectroscopy Mission (XRISM)

OPERATIONAL MISSIONS

- Burst Alert Telescope (BAT)
- Calorimetric Electron Telescope (CALET)
- Fermi Gamma-ray Space Telescope
- High Energy Astrophysics Science Archive Research Center (HEASARC)
- Hubble Space Telescope
- International Gamma-Ray Astrophysics Laboratory (INTEGRAL)*
- International Space Station Cosmic Ray Energetics and Mass (ISS-CREAM)
- Neil Gehrels Swift Observatory
- Neutron star Interior Composition Explorer (NICER)
- Nuclear Spectroscopic Telescope Array (NuSTAR)
- Primordial Inflation Polarization Explorer (PIPER)
- Transiting Exoplanet Survey Satellite (TESS)
- X-ray Multi-Mirror (XXM-Newton)*
- X-ray Quantum Calorimeter (XQC

*Joint Agency Satellite

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PORTFOLIO

PHYSICS OF THE COSMOS

How does the universe work? Probe the origin and destiny of our universe, including the nature of black holes, dark energy, dark matter and gravity.

COSMIC ORIGINS

How did we get here? Explore the origin and evolution of the galaxies, stars and planets that make up our universe.

EXOPLANET EXPLORATION

Are we alone? Discover and study planets around other stars and explore whether they could harbor life.

HIGHLIGHTS

SEEING THE COSMOS IN A NEW LIGHT

MAKING HEADLINES

Scientists Detect Gravitational Waves From a New Kind of Nova, Sparking a New Era in Astronomy
— Oct. 16, 2017, Washington Post

NASA's Hubble Discovers Wobbling Galaxies That Could Reveal Nature of Dark Matter
— Oct. 27, 2017, Newsweek

NASA's James Webb Space Telescope Arrives in California for Final Assembly
— Feb. 8, 2018, Space.com

NASA's James Webb Space Telescope to Reveal Secrets of the Red Planet
— Feb. 21, 2018, Astrobiology Magazine

NASA's Neutron Star Interior Composition Explorer Finds Pulsar in Ultracompact Orbit
— May 11, 2018, SciNews

NASA's Latest Exoplanet Hunter Spots Dozens of Potential New Worlds
— Sept. 6, 2018, Nature

HELIOPHYSICS

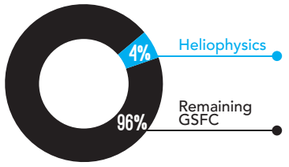
The Goddard Heliophysics Science Division saw results—and new starts—that extended its knowledge of space throughout the solar system. The division created a new laboratory focusing on the ionosphere, thermosphere and mesosphere—key parts of near-Earth space—where a mix of terrestrial weather and space weather creates an intense, constantly changing environment that can interrupt radio and GPS signals. Timely for the lab, the Global Observations of the Limb and Disk, or GOLD, mission launched in early 2018. First light observations came in September, and Goddard is looking forward to more observations from the fastest continuous scans ever gathered of Earth's ionosphere.

Goddard supported testing—and the subsequent launch—of Parker Solar Probe in August 2018. This mission to touch the Sun demonstrated that studying the Sun and outpouring of solar wind helps us better understand our closest star and how its radiation affects satellites and astronauts.

The division continues to work with CubeSat missions, with Dellingr deploying from the International Space Station in November 2017. The division's research has made use of 17 spaceborne heliophysics missions, as well as other relevant spacecraft, sounding rockets and ground observations. Highlights include: understanding how output from other suns affects the habitability of planets, determining whether solar storms affect whale and dolphin strandings, discovering a new type of aurora, and gaining insight into the space environment around Jupiter's moon Ganymede.

Budget $206.3M

GSFC Budget Percentage 4%



3 GSFC FACILITIES

5 LABORATORIES/ OFFICES

350+ STAFF

MISSIONS IN DEVELOPMENT

- Solar Orbiter*

OPERATIONAL MISSIONS

- Aeronomy of Ice in the Mesosphere (AIM)
- Geotail*
- Global Observations of the Limb and Disk (GOLD)
- Hinode*
- Interface Region Imaging Spectrograph (IRIS)
- Interstellar Boundary Explorer (IBEX)
- Magnetospheric Multiscale (MMS)
- Solar and Heliospheric Observatory (SOHO)*
- Solar Dynamics Observatory (SDO)
- Solar Terrestrial Relations Observatory (STEREO)
- Thermosphere Ionosphere Mesosphere Energetics and Dynamics (TIMED)
- Time History of Events and Macroscale Interactions during Substorms (THEMIS/ARTEMIS)
- Wind

*Joint Agency Satellite

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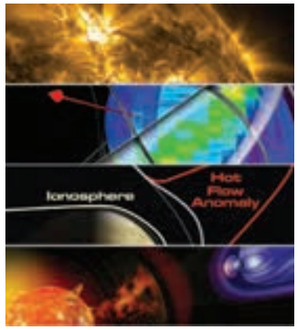
PORTFOLIO



SOLAR PHYSICS

HELIOSPHERIC PHYSICS

GEOSPACE PHYSICS

SPACE WEATHER

IONOSPHERE, THERMOSPHERE, MESOSPHERE

PUBLICATIONS

- Approximately 250 publications in scientific journals
- More than 100 primary news articles and interviews

SUCCESSES

- Supported launch, communications and commissioning of GOLD
- Supported testing, launch, communications and guest operations of Parker Solar Probe
- Awarded two mission concept studies for potential heliophysics Explorer missions
- Dellingr CubeSat deployed from International Space Station

AWARDS

- 8 NASA Honor Awards
- 7 Robert H. Goddard Awards
- American Astronomical Society Solar Physics Division Karen Harvey Prize
- American Geophysical Union Athelstan Spilhaus Award
- American Geophysical Union Space Physics and Aeronomy Fred Scarf Award
- International Alexander Chizhevsky Medal for Space Weather and Space Climate
- John Mather Nobel Scholarship

HIGHLIGHTS

OBSERVING AND LIVING WITH OUR CLOSEST STAR

MAKING HEADLINES

Stellar Storms May Light Up Signs of Life on Alien Planets
— Nov. 27, 2017, Space.com

Mystery of Whale and Dolphin Strandings May Hinge on NASA Data
— Dec. 12, 2017, LiveScience

NASA 'Goes for Gold' Thursday With Successful Mission Launch
— Jan. 25, 2018, CNN

A New Clue to the Pinkish Streak Named Steve
— March 16, 2018, Science Friday

Fly Me to the Sun
— May 1, 2018, The Atlantic

Forgotten Data From 1996 Sheds New Light on Jupiter's Mysterious Moon Ganymede
— May 1, 2018, Gizmodo

Parker Solar Probe Launches on NASA Voyage to 'Touch the Sun'
— Aug. 11, 2018, The New York Times

PLANETARY SCIENCE

The Goddard Solar System Exploration Division spearheaded efforts for the Mars Atmosphere and Volatile Evolution (MAVEN) mission; Lunar Reconnaissance Orbiter; and Origins, Spectral Interpretation, Resource Identification, Security-Regolith Explorer (OSIRIS-REx). It provided contributions to the Mars Science Laboratory and Juno mission to Jupiter.

The Sample Analysis at Mars (SAM) instrument suite aboard the Mars Curiosity rover found new evidence preserved in Martian rocks that suggests the planet could have supported ancient life, as well as new evidence in the Martian atmosphere that relates to the search for current life on the Red Planet. While not necessarily evidence of life itself, these findings are a good sign for future missions exploring the planet's surface and subsurface.

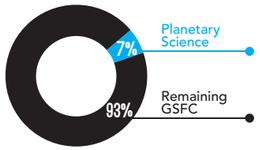
After an almost two-year journey, the asteroid-sampling spacecraft OSIRIS-REx began the final approach toward its target asteroid Bennu on Dec. 3.

MAVEN found a new type of aurora that occurs over much of the day side of Mars, where auroras are very hard to see. It discovered new ions, including metal ions in the upper atmosphere. It also discovered that Mars has an invisible magnetic "tail" that is twisted because of its interaction with the solar wind.

Goddard shipped the mass spectrometer for the Mars Organic Molecule Analyzer to Italy for integration into the ExoMars mission. The magnetometers aboard the Parker Solar Probe mission were integrated in time for the August 2018 launch.

Budget $354.6M

GSFC Budget Percentage 7%



1 GSFC FACILITY

Greenbelt

6 LABORATORIES/ OFFICES

323 STAFF

MISSIONS AND INSTRUMENTS IN DEVELOPMENT OR INTEGRATION

- Lucy
- Mass Spectrometer for MOMA (Mars Organic Molecule Analyzer) on ExoMars

OPERATIONAL MISSIONS

- Lunar Reconnaissance Orbiter (LRO)
- Mars Evolution and Volatile Evolution (MAVEN)
- Origins, Spectral Interpretation, Resource Identification, Security-Regolith Explorer (OSIRIS-REx)

OPERATIONAL INSTRUMENTS

- Linear Etalon Imaging Spectral Array (LEISA) for New Horizons' Ralph Camera
- Lunar Orbiter Laser Altimeter (LOLA) for LRO
- Magnetometer for the Deep Space Climate Observatory (DSCOVR*)
- Magnetometers for Juno, MAVEN, Parker Solar Probe, Van Allen Probes and Voyager
- Neutral Gas and Ion Mass Spectrometer (NGIMS) for MAVEN
- OSIRIS-REx Visible and Infrared Spectrometer (OVIRS)
- Sample Analysis at Mars (SAM) Instrument Suite for Mars Curiosity Rover

*Joint Agency Satellite

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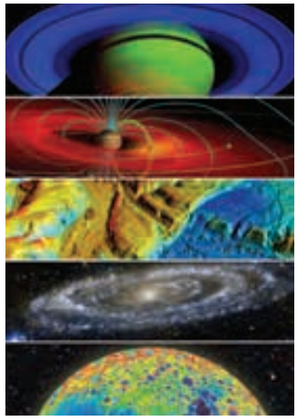
PORTFOLIO



MASS SPECTROMETRY
Sampling on the Spot

INFRARED SPECTROMETRY
Remote Sensing

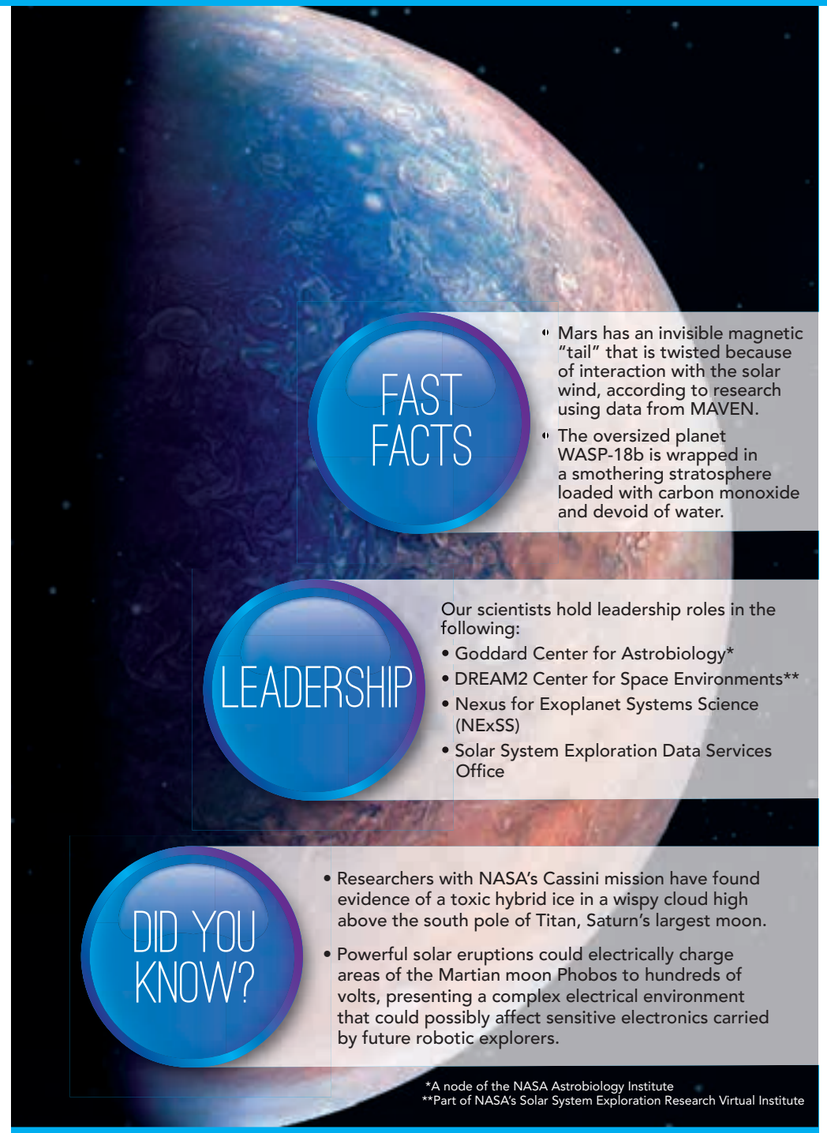
MAGNETOMETRY
The Influence of Planets

LASER AND LIDAR
Precision Measurements

ASTROBIOLOGY AND ASTROCHEMISTRY
Origins of Life and Extraterrestrial Organics

GRAVITY SCIENCE
Internal Structure and Surface Change

GEOPHYSICS AND GEOCHEMISTRY
How Planets Evolve



FAST FACTS

- Mars has an invisible magnetic "tail" that is twisted because of interaction with the solar wind, according to research using data from MAVEN.
- The oversized planet WASP-18b is wrapped in a smothering stratosphere loaded with carbon monoxide and devoid of water.

LEADERSHIP

Our scientists hold leadership roles in the following:

- Goddard Center for Astrobiology*
- DREAM2 Center for Space Environments**
- Nexus for Exoplanet Systems Science (NExSS)
- Solar System Exploration Data Services Office

DID YOU KNOW?

- Researchers with NASA's Cassini mission have found evidence of a toxic hybrid ice in a wispy cloud high above the south pole of Titan, Saturn's largest moon.
- Powerful solar eruptions could electrically charge areas of the Martian moon Phobos to hundreds of volts, presenting a complex electrical environment that could possibly affect sensitive electronics carried by future robotic explorers.

*A node of the NASA Astrobiology Institute
**Part of NASA's Solar System Exploration Research Virtual Institute

HIGHLIGHTS

EXPLORING OTHER WORLDS

MAKING HEADLINES

Forecast for Titan: Cold With a Chance of Noxious Ice Clouds
— Oct. 19, 2017, Universe Today

Jupiter's Great Red Spot Is Getting Taller as It Shrinks
— March 17, 2018, Inverse

Newest NASA Discoveries Could Boost Search for Ancient Life on Mars
— June 7, 2018, Washington Post

NASA Discovers Mars' Proton Auroras Made Possible by Stolen Electrons
— July 23, 2018, Daily Mail

Uh Oh, Mars Doesn't Have Enough Carbon Dioxide to Be Terraformed
— July 31, 2018, Universe Today

How Greenland Scorched Its Underside
— Aug. 1, 2018, BBC News

Asteroid Probe Captures First Images of Its Distant Target
— Aug. 24, 2018, CBS News

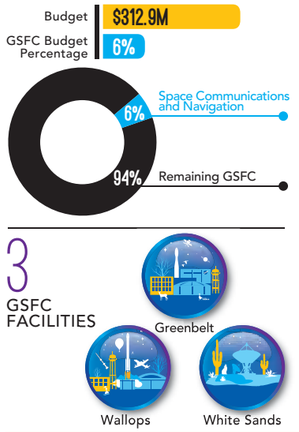
SPACE COMMUNICATIONS AND NAVIGATION

In 2018, the Goddard Exploration and Space Communications (ESC) projects division supported critical efforts in human spaceflight and made strides in developing new technology for future science and exploration missions.

ESC's human spaceflight network team used two of the agency's space communications networks—the Space Network and Near Earth Network—to communicate with NASA's next human-rated vehicle, the Orion spacecraft, at NASA's Kennedy Space Center in Cape Canaveral, Florida. This was an important milestone that will help ensure effective support for Orion's planned missions to the Moon.

The Tracking and Data Relay Satellite (TDRS) system was vital to the successful execution of the agency's Year of Education on Station campaign. The system's communications support enabled astronauts to hold a series of downlinks and engage with students around the country.

ESC also advanced numerous cutting-edge communications technologies in 2018. Together with industry partners, ESC began testing portable ground stations for integration with the Near Earth Network. Integration would enable increased network agility and expanded coverage for missions up to a million miles from Earth. The Laser Communications Relay Demonstration completed environmental testing. ESC also explored industry collaborations for the Next Generation Relay project, which will incorporate laser communications to increase data rates and reduce size, weight and power requirements for communications systems.



MISSIONS IN DEVELOPMENT

- Laser Communications Relay Demonstration (LCRD)
- Laser-Enhanced Mission Communications Navigation and Operational Services (LEMNOS)

OPERATIONAL MISSIONS

- Tracking and Data Relay Satellite-3, 5-13 (TDRS-3, 5-13)

3 LABORATORIES/ OFFICES

NASA Strategic Objective 2.1: Lay the Foundation for America to Maintain a Constant Human Presence in Low Earth Orbit Enabled by a Commercial Market. Enable space-based low Earth orbit economy by transitioning ISS operations and maintenance to commercial and international partners, while continuing to leverage ISS for research, technology development, and to extend human presence in space.

NASA Strategic Objective 3.1: Develop and Transfer Revolutionary Technologies to Enable Exploration Capabilities for NASA and the Nation. Advance revolutionary technologies for NASA and the Nation, involving commercial space products, specifically for utilization of near-Earth space; efficient transportation through space; access to planetary surfaces; enabling human space exploration; next generation science missions; and growth and utilization of the U.S. industrial and academic base.

NASA Strategic Objective 4.2: Enable Space Access and Services. Support the communication, launch service, rocket propulsion testing, and strategic capabilities needs of NASA's programs.

NASA Strategic Objective 4.6: Sustain Infrastructure Capabilities and Operations. Enable NASA's Mission by providing the facilities, tools, and services required to efficiently manage, operate and sustain the infrastructure necessary to meet mission objectives.

PORTFOLIO

SATELLITE TELECOMMUNICATIONS
Space Network: Four ground terminals to support 10 TDRS spacecraft. Near Earth Network: fifteen ground terminal locations with 50 percent of services by commercial providers.

LASER COMMUNICATIONS
Engineering lead and operations coordinator for three optical stations.

SEARCH AND RESCUE
Architecture and engineering support for 93 international GEO/LEO/MEO local user terminals.

SPECTRUM MANAGEMENT
Identification of mission parameters and frequencies within radio spectrum allocations for communications or data transfer.

NAVIGATION
Life cycle trajectory designs, orbit, estimation and associated space/ground system development.

SUCCESSES

- TDRS-13 completed on-orbit testing and was accepted into the Space Network.
- A new Near Earth Network antenna in Alaska, AS-2, became operational.
- The Space Network supported its 122nd consecutive launch with 100 percent communications proficiency.

SUCCESSES

- ESC facilitated a disruption-tolerant networking communications demonstration, pushing the technology closer to more widespread use.
- An experiment that will conduct the first demonstration of next-generation X-ray communications completed system-level vibration testing at NASA's Johnson Space Center in Houston.
- The Laser Communications Relay Demonstration completed environmental testing. The payload is being prepared for shipment and eventual integration with a spacecraft.

SEARCH AND RESCUE

The Search and Rescue mission office completed upgrades to, and is now testing, its Goddard ground station, making it the first station compatible with second-generation distress beacons, which were also developed at Goddard. In an emergency, these beacons will provide a significantly more accurate location than current beacons, making it easier for rescue teams to find those in distress.

HIGHLIGHTS

BRINGING KNOWLEDGE BACK TO EARTH

MAKING HEADLINES

Interplanetary-Internet Test Sends Antarctic Selfie to Space Station
— Nov. 29, 2017, Space.com

Live High Definition Video From Mars? NASA Is Getting Ready
— March 14, 2018, NPR

Top Five Technologies Needed for a Spacecraft to Survive Deep Space
— Aug. 6, 2018, Space Daily

NASA to Study Use of Commercial Partnerships for Space Communications Services
— Aug. 22, 2018, Space News

NASA to Use Data Lasers to Beam Data From Space to Earth
— Aug. 30, 2018, Network World

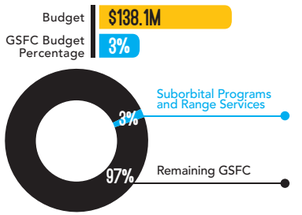
Communications Infrastructure on Mars Could Be the Envy of Earth
— Sept. 6, 2018, Forbes

SUBORBITAL PROGRAMS AND RANGE SERVICES

In fiscal 2018, Wallops Flight Facility's suborbital flight platforms were critical to enabling about 40 science, technology development and education missions worldwide. Two Antares commercial cargo resupply missions to the International Space Station delivered nearly 15,000 pounds of cargo and experiments to astronauts. In addition, advances in the facility's SmallSat portfolio, sustained partnerships and ongoing facility upgrades all contributed to a highly productive and successful year.

Some notable technology advancements included using Wallops' sounding rocket capability to deliver a scaled version of a supersonic parachute to a test altitude and speed similar to conditions seen when entering Mars' atmosphere. The successful tests led to the final certification of the parachute technology for use in the Mars 2020 mission. The Scientific Balloon Program conducted two successful test flights of its 60-million-cubic-foot balloon, which is the largest heavy-lift scientific balloon the agency flies.

Key facility upgrades were finalized. The new Mission Operations Control Center serves as the hub for interfacing with rockets, payloads and associated support systems during launch operations. The new Wallops Island Fire Station enhances the facility's response in support of operations. Continued airfield enhancements continued as well as planning for conducting a beach nourishment project for the Wallops Shoreline Protection program, which is key for protecting $1.2 billion in assets on Wallops Island. The facility also supported a whole host of education programs.



MISSIONS IN DEVELOPMENT

- HaloSat and TROPICS small satellite missions
- Northrop Grumman missions for Antares and Minotaur launches
- Range support to Rocket Lab's first flight from Wallops
- Scientific balloon missions (18)
- Sounding rocket missions (25)

OPERATIONAL MISSIONS

- Airborne Carbon and Transport – America (ACT-America)
- Cloud and Aerosol Monsoonal Processes – Philippines Experiment (CAMPEX)
- Grand Challenge Initiative
- International Space Station Commercial Resupply Services
- Observation of Aerosols above Clouds and their intEractionS (ORACLES)
- Operation IceBridge

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NASA Strategic Objective 3.2: Transform Aviation Through Revolutionary Technology Research, Development, and Transfer. Maintain and advance U.S. global leadership in aviation through application of new concepts and technologies pioneered by NASA and developed in partnership with U.S. industry that lead to transformative improvements in mobility, efficiency, and safety.

NASA Strategic Objective 4.3: Assure Safety and Mission Success. Assure effective management of NASA programs and operations to complete the mission safely and successfully.

PORTFOLIO

SOUNDING ROCKETS

SCIENTIFIC BALLOONS

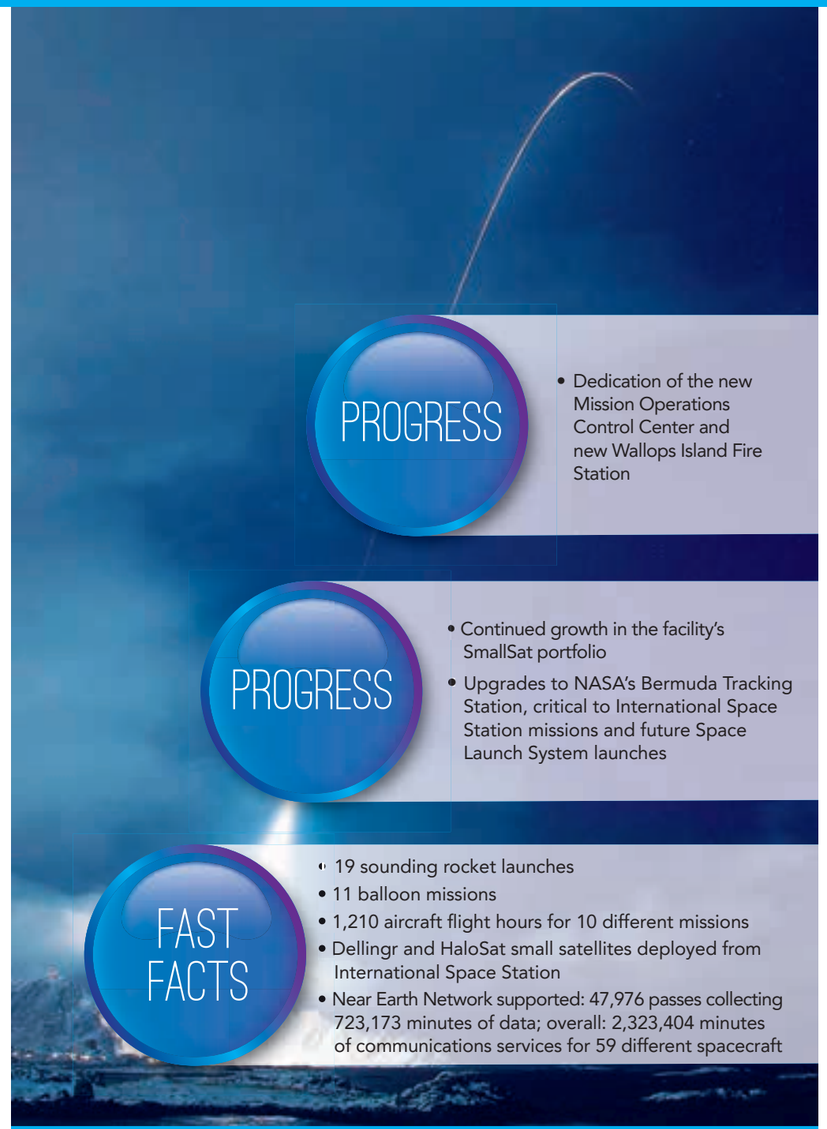
RESEARCH AIRCRAFT

LAUNCH RANGE/MISSION MANAGEMENT

NEAR EARTH NETWORK

EARTH SCIENCE FIELD SUPPORT OFFICE

SMALL SATELLITES



HIGHLIGHTS

ENABLING SCIENCE AND EXPLORATION

MAKING HEADLINES

Orbital ATK's Antares Rocket Sends Cygnus Cargo Ship to Space Station With a 'Nation'
— Nov. 12, 2017, GeekWire

Students Get an Out of This World Experience at NASA Wallops Flight Facility
— Feb. 3, 2018, WMDT.com

Antares Rocket Launches NASA Cargo to Space Station in Dazzling Predawn Liftoff
— May 21, 2018, Space.com

NASA Rocket With Student Experiments to Launch Tuesday From Wallops
— Aug. 13, 2018, Delmarva Now

NASA Successfully Launched a Football Stadium-Sized Scientific Balloon
— Sept. 5, 2018, Aerotech News

Wallops Visitor Center Celebrates NASA 60th Anniversary Sept. 22
— Sept. 22, 2018, Shore Daily News

ORBITAL SERVICING AND ASSEMBLY

On June 7, the Goddard Satellite Servicing Projects Division (SSPD) completed a crucial series of tests for the Robotic Refueling Mission 3 (RRM3). The mission—scheduled for launch in late 2018—will test the techniques necessary to transfer and store cryogenic fluid in orbit, advancing satellite servicing and helping enable long-duration travel to such destinations as the Moon and Mars.

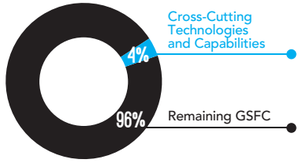
SSPD also completed important tests for Restore-L, which will demonstrate the technologies required to robotically refuel satellites not designed for servicing. Using a newly acquired hexapod robot and a robotic servicing arm, SSPD practiced autonomously tracking and grasping a satellite.

The division made advances in specialized robotic tools. It provided a commercial SSPD-designed Advanced Tool Drive System for use at NASA's Langley Research Center in Virginia and Northrop Grumman Innovation Systems' Commercial Infrastructure for Robotic Assembly and Services project. It also issued two licenses of its Cooperative Service Valve (CSV) to two interested companies. The CSV is helping pave the way for designing satellites with servicing in mind, and the licenses are key to SSPD's strategy to transfer technologies to U.S. companies. SSPD has been actively transferring its technologies to industry, and more than 20 companies have expressed interest. The Robotics Tool Stowage project, which will provide storage for the Robotic External Leak Locator 2 outside the International Space Station, completed a robot design review.

Cross-Cutting Technologies and Capabilities

Budget: $213.5M

GSFC Budget Percentage: 4%



1 GSFC FACILITY

Greenbelt

MISSIONS IN DEVELOPMENT

- Alpha Magnetic Spectrometer (AMS) Repair Mission (Tools Support)
- Restore-L
- Robotic External Leak Locator 2 (RELL2)
- Robotic Refueling Mission 3 (RRM3)
- Robotics Tool Stowage (RiTS)

OPERATIONAL MISSIONS

- Raven

NASA Strategic Objective 2.1: Lay the Foundation for America to Maintain a Constant Human Presence in Low Earth Orbit Enabled by a Commercial Market. Enable space-based low Earth orbit economy by transitioning ISS operations and maintenance to commercial and international partners, while continuing to leverage ISS for research, technology development, and to extend human presence in space.

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NASA Strategic Objective 4.1: Engage in Partnership Strategies. Support cooperative, reimbursable, and funded initiatives through domestic and international partnerships.

PORTFOLIO

RENDEZVOUS AND PROXIMITY OPERATIONS

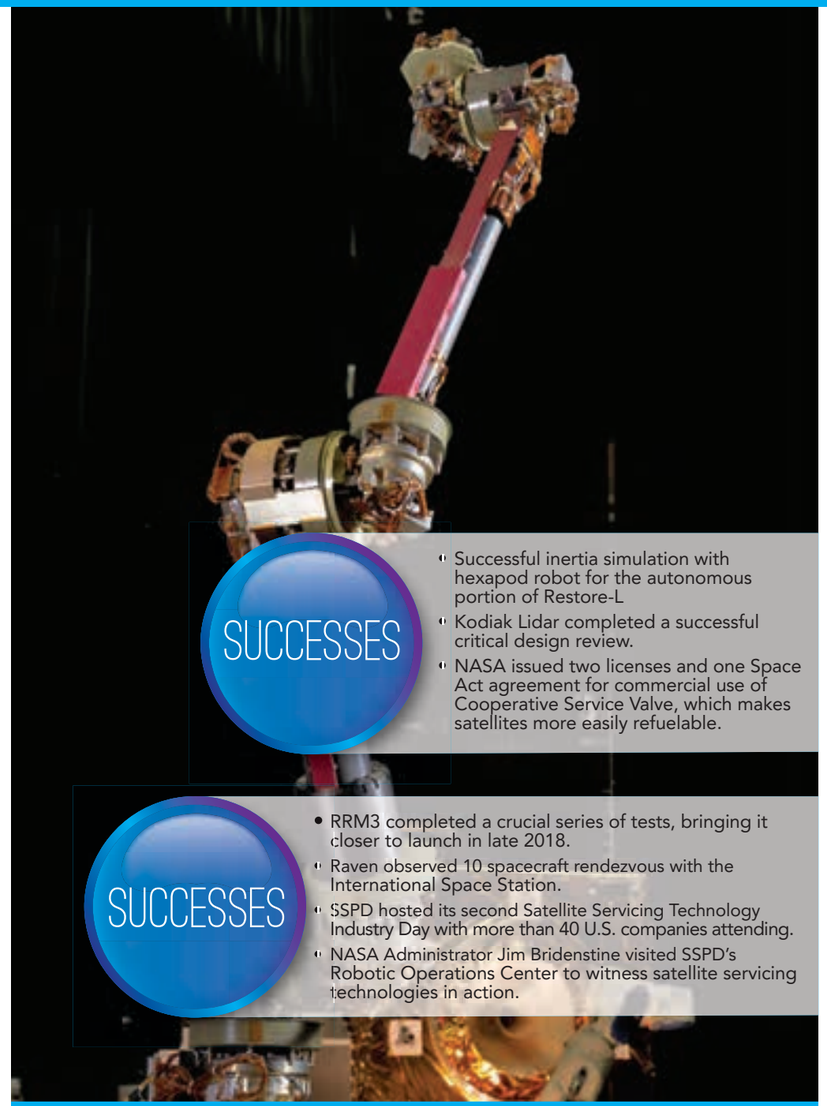
HIGH-SPEED, HYBRID COMPUTING

DEXTEROUS ROBOTICS

FLUID TRANSFER

SPECIALIZED TOOLS

COOPERATIVE SERVICING AIDS



SUCCESSES

- Successful inertia simulation with hexapod robot for the autonomous portion of Restore-L
- Kodiak Lidar completed a successful critical design review.
- NASA issued two licenses and one Space Act agreement for commercial use of Cooperative Service Valve, which makes satellites more easily refuelable.

SUCCESSES

- RRM3 completed a crucial series of tests, bringing it closer to launch in late 2018.
- Raven observed 10 spacecraft rendezvous with the International Space Station.
- SSPD hosted its second Satellite Servicing Technology Industry Day with more than 40 U.S. companies attending.
- NASA Administrator Jim Bridenstine visited SSPD's Robotic Operations Center to witness satellite servicing technologies in action.

HIGHLIGHTS

PIONEERING CROSS-CUTTING SATELLITE SERVICING TECHNOLOGIES

MAKING HEADLINES

Satellite on the Fritz? Aerospace Companies Are Building a Geek Squad of Space Robots
— Nov. 20, 2017, Los Angeles Times

Restore-L Satellite-Servicing Mission Passes NASA Design Review
— Dec. 21, 2017, Aerospace Technology

NASA Working on Robots Capable of Fixing Satellites in Space
— July 20, 2018, Autoevolution

Next-Generation Photodetector Camera to Deploy During Demo Mission
— July 31, 2018, Science Daily

NASA Plans to Transfer Satellite Servicing Technologies to Commercial Sector
— Aug. 29, 2018, ExecutiveBiz

It is difficult to say what is impossible, for the dream of yesterday is the hope of today and the reality of tomorrow.
– Robert H. Goddard

OUR LIFE @ GODDARD

A PLACE FOR SERVICE

Our talented people, driven by a common and worthwhile purpose, have made countless contributions toward enhancing our collective knowledge and way of life. We safeguard the long-term public trust by cultivating our workforce, ensuring a safe and sustainable workplace, effectively meeting our mission commitments, and applying our scientific breakthroughs to stimulate economic growth, foster education, inspire the nation and impact the world. We achieve this through a broad spectrum of institutional support efforts, including:

- Legal
- Procurement
- Information technology
- Financial management
- Human capital management
- Equal opportunity programs
- Diversity and inclusion
- Conflict management (alternative dispute resolution, anti-harassment)
- Protective services
- Environmental and medical management
- Facilities management and transportation
- Logistics
- Knowledge and information management
- Government and community relations
- Proposal development
- Education and public outreach
- Public communication

PAVING THE ROAD TO MISSION SUCCESS

Goddard is committed to providing comprehensive center support services for its workforce and current missions, as well as to transforming and preparing the center for the missions of tomorrow. Overall, institutional support includes procurement operations, facilities management, protective services, medical and environmental management, and information and logistics management.

NASA Strategic Goal 4: Optimize Capabilities and Operations

2018 HIGHLIGHTS OF CENTER SUPPORT FOR GODDARD'S MISSION:

1. With more than 1,700 active procurement instruments, NASA's Goddard Space Flight Center continues to maintain one of the agency's largest and most diverse acquisition portfolios and leads the agency in the number of procurement transactions. To ensure that the center meets its mission needs and agency commitments, Goddard completed eight major contract awards with 10 additional competitions in progress. In addition, Goddard exceeded its small business obligations in fiscal 2018, achieving 26.8 percent against a goal of 23.3 percent.

2. Goddard broke ground on the Instrument Development Facility after clearing the site previously occupied by the Building 16 warehouse complex. Goddard also completed the relocation of two Landsat Mission Operation Command Centers and finished repairs and improvements for the Horizontal Integration Facility and airfield runways at Wallops Flight Facility in Virginia. Underground power feeders were also replaced at the Goddard central plant and Wallops to enhance reliability.

3. Consistent with the center's focus on Earth science, Goddard's Energy Conservation Performance Plan outlines how Goddard will reduce its energy consumption by 25 percent from 2015 through 2025. We began construction on a 13-megawatt, ground-mounted solar photovoltaic system at Wallops. The system will provide 80 percent of the electrical needs on the main base, reducing greenhouse gas emissions by 19,880 metric tons.

4. Acquisitions of electrical, electronic and electromechanical parts for Goddard missions exceeded $22 million. Goddard also planned and provided mission-critical shipping operations for the James Webb Space Telescope; the Advanced Topographic Laser Altimeter System space instrument; the Ice, Cloud, and land Elevation Satellite 2; and the Global Ecosystem Dynamics Investigation space instrument.

5. Goddard completed construction and took beneficial occupancy on two new buildings: the Wallops Island Fire Station that houses the personnel and equipment in support of the local fire department, and the Mission Operations Control Center that supports all launch control, mission monitoring and launch operations for Wallops. A formal ribbon-cutting ceremony was held for both buildings. Goddard leadership, NASA Headquarters personnel, and several local and state dignitaries attended.

ENHANCING CUSTOMER CAPABILITY TO ENABLE GODDARD'S MISSION

The past year featured multiple information technology projects and services to support Goddard's mission and its customers across all locations. The Secure Lab Enclave network was developed with scientific and engineering communities across the center to allow for more secure operations under a reduced risk profile. Goddard began implementing Internet Protocol television to enable upgraded TV and video services, increase coverage and enhance information services on the Greenbelt campus while replacing the current TV systems at Wallops Flight Facility in Virginia. Goddard completed the transition of agency mission-routed data services from the legacy network and established the NASA Communications System mission backbone to significantly improve the management of cybersecurity risk for flight projects and mission customers. Goddard completed IT outfitting for Wallops' Mission Operations Control Center, which manages the facility's launches.

The Goddard Institute for Space Studies in New York renovated its communications infrastructure and relocated carrier services to enable employees to work more efficiently. Goddard transitioned its mission support organizations to a common infrastructure, thereby improving IT operations.

Goddard provided mission-critical communications support for more than 35 events. The Goddard-managed Solutions for Enterprise-Wide Procurement contract had a record number of product and service orders in fiscal 2018.

ONGOING PROJECTS

Cloud Services: Goddard has been implementing a computing strategy to support programs and projects through public and private cloud services. This strategy includes a better account provisioning model. The Goddard Private Cloud is being developed to provide in-house cloud capabilities.

Cybersecurity: Goddard streamlined the process for traveling internationally with approved IT devices. Goddard's progress on the federal personal identity verification (PIV) mandate supported NASA in achieving 87 percent compliance. Goddard led the development of a configuration management solution to enable PIV on native macOS capabilities across NASA. Goddard met the Department of Homeland Security's Hypertext Transfer Protocol Secure-only mandate for external facing systems, addressing more than 1,150 websites.

End User Services: The Goddard IT and Communications Directorate has been working with the agency to enhance the customer experience and provide greater security. A cost-reducing service model for multifunction devices was developed and implemented. Mobile device management was rolled out to NASA-approved devices, providing the ability to securely access and encrypt emails on phones. Goddard and the agency are moving toward a new end services contract to promote seamless collaboration.

NASA Strategic Objective 4.5: Ensure Enterprise Protection.
Increase the resiliency of NASA's enterprise systems by assessing risks and implementing comprehensive, economical, and actionable solutions.

PORTFOLIO

MANAGEMENT AND OPERATIONS

INFORMATION SECURITY

COMMUNICATIONS

END USER SERVICES

APPLICATIONS

DATA CENTER

BRINGING NASA TO THE WORLD

Goddard's scientific discoveries and technological advancements have benefitted society in countless ways. The center's commitment to outreach and communications ensures that the public—our most important stakeholder—is constantly informed and engaged in our missions and projects.

www.nasa.gov/goddard

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NASA Goddard

@nasagoddard

THE GATEWAY TO GODDARD

NASA Strategic Objective 3.3: Inspire and Engage the Public in Aeronautics, Space, and Science. Inspire, engage, educate, and employ the next generation of explorers through NASA-unique Science, Technology, Engineering and Mathematics learning opportunities.

2018 PUBLIC COMMUNICATION HIGHLIGHTS

Social Media

Goddard is an agency leader in maintaining high-profile social media accounts, whose followings continue to grow. As traditional social media platforms mature, the center is also focusing more on supporting Goddard content that is embedded in main NASA accounts, which have millions of followers.

- Approximately 75 percent of content posted to flagship NASA social media accounts comes from Goddard. The large following of @NASA on Twitter, Facebook and Instagram brings Goddard an extended audience.
- Five of the 15 largest agency Facebook accounts, in terms of followers, are based at Goddard.
- Four of the 10 largest agency Instagram accounts, in terms of followers, are based in part at Goddard.
- Goddard is an agency leader in using existing social media platforms in newer ways, organizing more than 20 "live show video" broadcasts and spearheading the agencywide "vertical video" revolution in which content is developed for Instagram TV.

The Stories We Tell

Goddard posted 561 articles to www.nasa.gov in fiscal 2018. The majority span the center's core focus areas of astrophysics, Earth science, heliophysics, planetary science, and engineering and technology.

Top 10 Articles		Views
1	Public Invited to Come Aboard NASA's First Mission to Touch the Sun	599,139
2	Hubble's Messier Catalog	277,552
3	Hubble Paints Picture of the Evolving Universe	169,254
4	Saturn and Mars Team Up to Make Their Closest Approaches to Earth in 2018	146,848
5	Traveling to the Sun: Why Won't Parker Solar Probe Melt?	138,651

Top 10 Articles		Views
6	Improved Hubble Yardstick Gives Fresh Evidence for New Physics in the Universe	128,251
7	Hubble Sees Galaxy Cluster Warping Space and Time	125,481
8	Hubble Finds an Einstein Ring	123,968
9	Sounds of the Sun	114,195
10	NASA Finds a Large Amount of Water in an Exoplanet's Atmosphere	105,245

Multimedia and Television Production

A total of 147 videos were posted to Goddard's YouTube account in fiscal 2018, helping present the center's work in engaging visual formats.

Top 14 Videos		Plays
1	Tour of the Moon in 4K	2,456,229
2	Our Living Planet From Space	1,890,703
3	Why Won't It Melt? How NASA's Solar Probe Will Survive the Sun	1,238,066
4	The Birth of a New Island	1,161,961
5	2018 Hurricanes and Aerosols Simulation	651,572
6	A New Time-lapse of an Island Forming in Tonga	639,393
7	Doomed Neutron Stars Create Blast of Light and Gravitational Waves	508,243

Top 14 Videos		Plays
8	The Unique Orbit of NASA's Newest Planet Hunter	219,671
9	Moonlight (Clair de Lune)	194,094
10	NASA's TESS Catches a Comet	179,568
11	NASA Sees Definitive Evidence of the Montreal Protocol's Success	178,433
12	For 15 Years, GRACE Tracked Freshwater Movements Around the World	177,793
13	NASA's Worldview – Two Decades of Earth Data at Your Fingertips	153,654
14	It's Surprisingly Hard to Go to the Sun	131,925

Visitor Center and Tours

The Goddard Visitor Center showcases Goddard's innovative and exciting work for space explorers of all ages.

- Total attendance from fiscal 2018 was 45,636.
- A total of 19,222 attended tailored meetings, events and programs.
- A total of 10,087 participated in 392 group tours.
- New exhibits: "TESS: ABCs of Exoplanets" and "Sixty Years of Advancing Humanity's Future in Space"
- NASA 60th Anniversary Public Event
- International Space Station Downlink
- JPSS-1 Launch Viewing
- GOES-S Launch Viewing
- Parker Solar Probe Friends and Family Day
- ICESat-2 Friends and Family Day
- Insiders' Guide to Astronauts
- Insiders' Guide to the Universe
- Lockheed Martin Mars Experience
- International Observe the Moon Night
- Children's Inn at the National Institutes of Health
- Take Your Child to Work Day

Media Resources

Goddard's media resources provide external news organizations and others direct access to the center's activities, subject matter experts and products, further allowing us to communicate our work to the public. These resources include live shot campaigns and live social video programs.

14 Live Shot Campaigns			615 Interviews
• Colliding Neutron Stars • JPSS-1 Prelaunch • Living Earth: 20 Years of Observations • Hubble Holiday Lights • Global Temperature Update	• Rare Super, Blue Blood Moon • TDRS Fleet's Newest Addition • GOES-S Prepares to Launch • TESS Planet-Hunting Mission	• Hubble Celebrates 28 Years • Hubble Captures Mars at Opposition • Parker Solar Probe (two campaigns) • ICESat-2 Prelaunch	• 412 Satellite Interviews • 100 Radio Interviews • 103 Other (print, in person, etc.)

Outreach Events

Outreach events, organized by both Goddard and the agency, are held year-round to engage the public with NASA's missions, programs and achievements.

- Conducted 95 VIP facility tours throughout the year, totaling 2,298 participants
- Coordinated the 19th annual Goddard Fall Reception and Lecture, presented by The Maryland Space Business Roundtable and Goddard, at the Smithsonian National Air and Space Museum in Washington, D.C.
- Presented NASA's missions and technology at Maryland Day 2018, organized by the University of Maryland, College Park
- Celebrated the 48th Earth Day at Union Station in Washington, D.C. Goddard contributed hyperwall presentations, demonstrations and hands-on activities.

EDUCATING, ENGAGING AND INSPIRING
TOMORROW'S STEM WORKFORCE

The Goddard Office of Education engages and inspires the nation's formal and informal K-12 and higher education students and educators through NASA's mission, research, discoveries and innovations. The following are notable highlights from fiscal 2018.

NASA Internships, Fellowships and Scholarships invest in NASA's workforce of tomorrow.

- More than 500 summer, fall and spring interns—from high schools to doctoral programs—worked alongside scientists, engineers, technologists and mission support professionals across Goddard's locations. They represented 45 states, the District of Columbia, Puerto Rico and the U.S. Virgin Islands.
- Fifteen Goddard undergraduate and graduate student interns were honored as 2018 Mather Nobel Scholars by the John and Jane Mather Foundation for Science and the Arts. Scholars were awarded travel grants to present their research at a professional conference.
- The Goddard Sciences and Exploration Directorate hosted underrepresented undergraduate and graduate students throughout the year. Notable accomplishments included contributions to optics and instrumentation at Delaware State University, establishment of a physics undergraduate program at the University of the Virgin Islands, development of successful underrepresented undergraduate researchers at Howard University and the University of Maryland Baltimore County, development of undergraduate research capabilities in space weather and heliophysics, and advancement of student capabilities in computational sciences for large-scale modeling of Earth.
- The Goddard Institute for Space Studies (GISS) successfully completed the third year of the Climate Change Research Initiative (CCRI), a yearlong STEM engagement research program that employs STEM teachers and interns to work with and contribute to research projects relating to climate change. CCRI teams produced a variety of published articles in scientific journals.
- Wallops Flight Facility hosted its first NASA Community College Aerospace Scholars program event with 31 scholars from 14 states and 25 community colleges. Students developed a fictitious aerospace company and designed and tested a robotic rover that could retrieve rocks and other rovers from Mars.

STEM Engagement connects learners of all ages with NASA's unique resources.

- The Greenbelt and Wallops campuses conducted International Space Station downlinks with NASA astronauts Ricky Arnold and Drew Feustel as part of NASA's Year of Education on Station. The events drew more than 1,200 participants, including Maryland Sen. James Mathias.
- Students from nine academic institutions participated in the Independent Verification & Validation Facility (IV&V) Space Flight Design Challenge program, a student outreach initiative designed to enhance the knowledge and skills of future engineers and scientists in West Virginia by allowing participants to build scientific payloads and operate them in space.
- Goddard citizen science projects attracted 250,000 participants from 103 countries. The projects co-hosted an agencywide Citizen Science Day in April. In March, Goddard launched a new citizen science project called Landslide Reporter, educating citizen scientists on why NASA and scientists elsewhere study landslides and how to identify types of landslides.
- The 11th Wallops Rocket Week attracted more than 300 students and educators from across the country. The week provided participants with opportunities to build and launch model rockets and taught them the basics in building and developing a scientific payload for flight aboard a suborbital rocket.
- With the launch of the Ice, Cloud and land Elevation Satellite-2 (ICESat-2) on Sept. 15, the mission's outreach and communications team planned, developed and implemented many prelaunch programs and activities.
- GLOBE Observer, an app-based citizen science program that enables anyone to make Earth science observations, continues to grow as a citizen science engagement tool for adults and out-of-school youth audiences. As of Sept. 30, nearly 240,000 people had downloaded the app, which includes options for observing clouds, mosquito breeding sites and land cover.
- The IV&V Educator Resource Center (ERC), a partnership with Fairmont State University in West Virginia, coordinated 12 competitive robotics programs and hosted 51 tournaments across the state with more than 5,000 total student participants. The ERC also organized more than 60 workshops on the use of NASA and STEM-based educational kits, serving 16,672 students.

Educator Professional Development provides NASA-unique STEM content and hands-on learning experiences for in-service, preservice and informal educators.

- In collaboration with GISS, 27 teachers representing seven schools from across the North Bergen School District in New Jersey participated in the yearlong North Bergen STEM Institute, which provided K-9 teachers with beginner engineering and citizen science training while introducing a variety of NASA educational resources.
- Wallops organized the fourth STEM Takes Flight Community College Faculty Case Study Workshop from May 21 to 23. Nineteen faculty members representing 16 Virginia community colleges focused on the application of modern workplace skills through a hands-on case study on teamwork, troubleshooting and real-time decision-making.
- The Goddard Astrophysics Education Team conducted a two-day hands-on workshop for 37 informal educators from a variety of local and national organizations. The workshop featured Afterschool Universe, a growing curriculum designed to teach middle school students about what is in the universe and how astronomers learn about it.

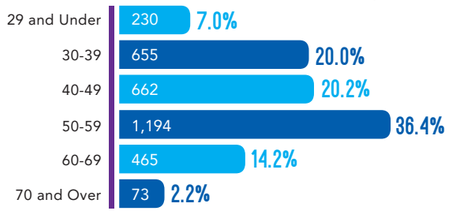
Institutional Engagement builds academic and research capacity for increasing the participation of underrepresented minorities in NASA-related STEM.

- The Goddard Mesoscale Atmospheric Processes Laboratory hosted four workshops at the Native Youth Community Adaptation and Leadership Congress at the National Conservation and Training Center in West Virginia. Students and educators were taught how to use the GLOBE Observer app. Seventy-two high school students and five adults participated.
- The NASA Minority University Research and Education Project (MUREP) at Goddard engaged six minority-serving institutions through competitive awards. In addition, collaborations among the faculty at the four historically black colleges and universities in Maryland and Goddard technical staff, along with student internships, are building relationships that will grow NASA's STEM capabilities and long-term associations.
- Goddard manages the MUREP for American Indian and Alaska Native STEM Engagement (MAIANSE) activity on behalf of the agency. MAIANSE seeks to increase engagement of American Indian and Alaska Native students by fostering connections between NASA missions and tribal colleges and universities, as well as with American Indian and Alaska Native-serving institutions. MAIANSE directly engaged 2,674 students.

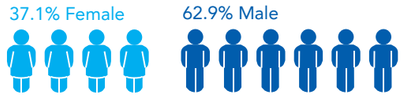
NASA Strategic Objective 3.3: Inspire and Engage the Public in Aeronautics, Space, and Science. Inspire, engage, educate, and employ the next generation of explorers through NASA-unique Science, Technology, Engineering and Mathematics learning opportunities.

CURRENT STATE OF THE WORKFORCE 2018

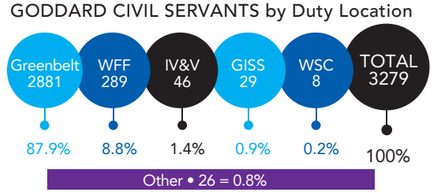
GODDARD CIVIL SERVANTS by Age Group



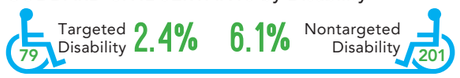
GODDARD CIVIL SERVANTS by Gender



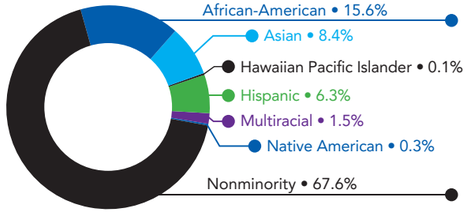
GODDARD CIVIL SERVANTS by Duty Location



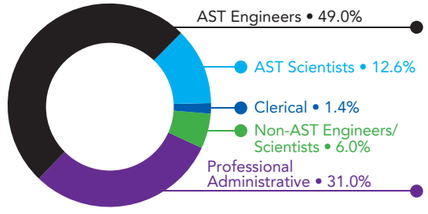
GODDARD CIVIL SERVANTS by Disability



GODDARD CIVIL SERVANTS by Ethnicity



GODDARD CIVIL SERVANTS by Skill Mix



BEST PLACES TO WORK IN THE FEDERAL GOVERNMENT

http://bestplacestowork.org

Compiled by the Partnership for Public Service. Scores are based on an index measuring employee engagement. Rankings are in relation to other federal agency subcomponents.

Rankings and Scores by Category	2017 Rank	2017	2011	2005
Overall	2 of 150	83.5	77.1	73.9
Teamwork	6 of 148	82.5	77.0	79.6
Innovation	2 of 148	83.4	78.3	N/A
Effective Leadership	4 of 147	76.3	69.8	64.6
Support for Diversity	2 of 148	80.7	76.4	76.5
Training and Development	8 of 149	80.1	74.7	72.5
Employee Skills-Mission Match	2 of 149	87.3	84.9	80.5
Work-Life Balance	12 of 148	74.1	66.1	67.8
Performance-Based Rewards and Advancement	1 of 147	70.5	62.5	60.9

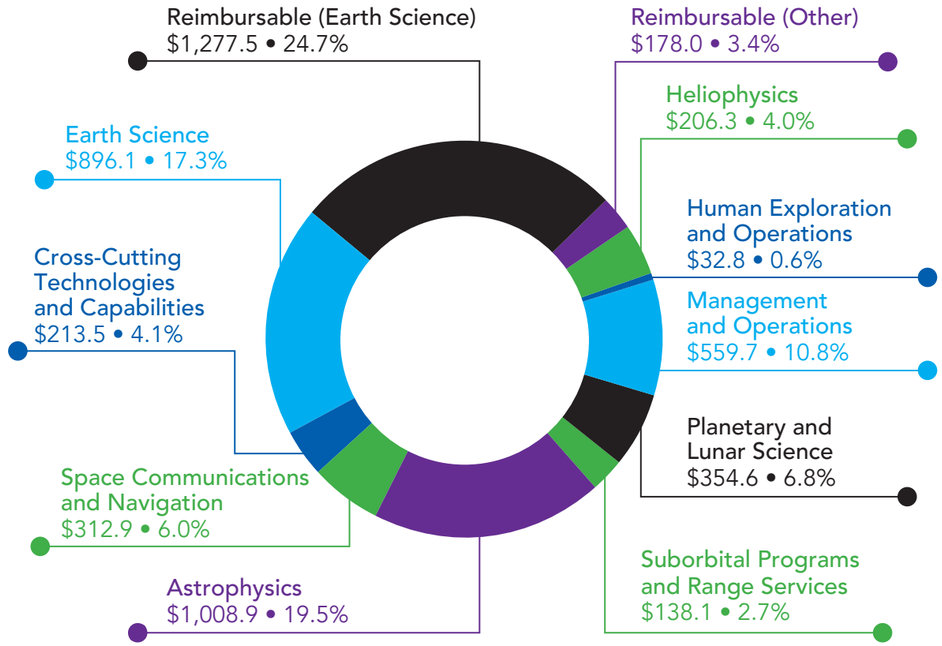
NASA ranked No. 1 in 2017 among all large federal agencies. Goddard ranked highest among all NASA centers in overall agency subcomponent rankings.

BUDGET: $5.2B

DIRECT GSFC BUDGET: $3.7B
REIMBURSABLE GSFC BUDGET: $1.5B

Goddard Program Year 2018 BUDGET Categorized by Lines of Business (as of Sept. 30, 2018)

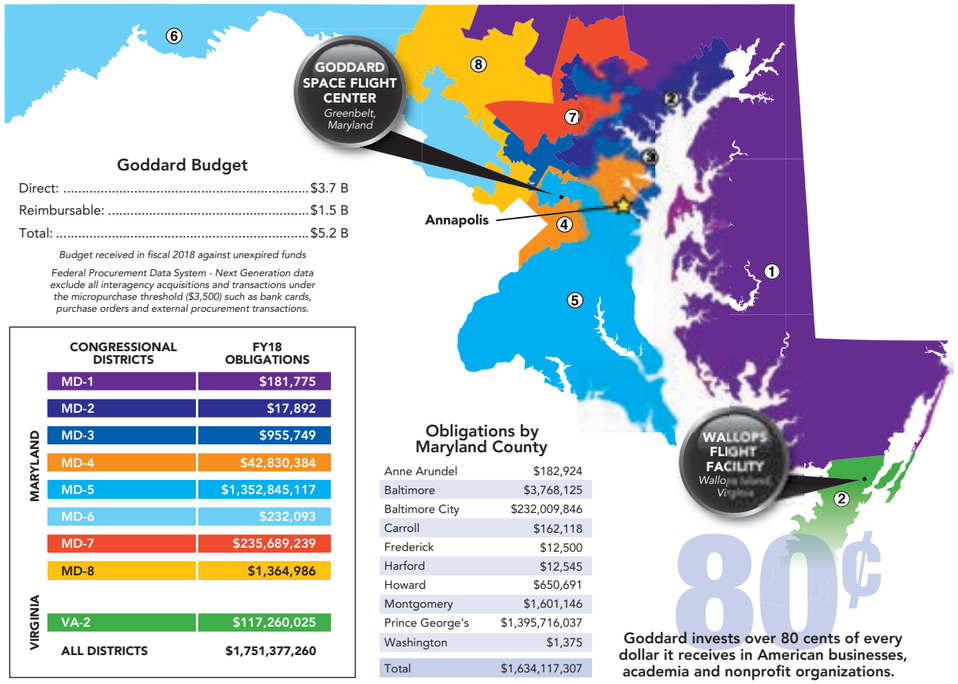
Chart is in $Ms



ECONOMIC IMPACT

Goddard's success in enabling NASA missions and applying these scientific achievements to society is evident. Each of Goddard's locations supports the center's ability to stimulate and strengthen economic activity by:

- Expending goods and services to perform its mission.
- Generating technology transfer and spinoff activities.
- Broadening small business opportunities through its robust contracting program.



Goddard Budget

Direct:	$3.7 B
Reimbursable:	$1.5 B
Total:	$5.2 B

Budget received in fiscal 2018 against unexpired funds

Federal Procurement Data System - Next Generation data exclude all interagency acquisitions and transactions under the micropurchase threshold ($3,500) such as bank cards, purchase orders and external procurement transactions.

	CONGRESSIONAL DISTRICTS	FY18 OBLIGATIONS
MARYLAND	MD-1	$181,775
	MD-2	$17,892
	MD-3	$955,749
	MD-4	$42,830,384
	MD-5	$1,352,845,117
	MD-6	$232,093
	MD-7	$235,689,239
	MD-8	$1,364,986
VIRGINIA	VA-2	$117,260,025
	ALL DISTRICTS	$1,751,377,260

Obligations by Maryland County

Anne Arundel	$182,924
Baltimore	$3,768,125
Baltimore City	$232,009,846
Carroll	$162,118
Frederick	$12,500
Harford	$12,545
Howard	$650,691
Montgomery	$1,601,146
Prince George's	$1,395,716,037
Washington	$1,375
Total	$1,634,117,307

Goddard invests over 80 cents of every dollar it receives in American businesses, academia and nonprofit organizations.

Goddard's Top Contractors

1.	ORBITAL ATK	$384.7 M
2.	NORTHROP GRUMMAN SPACE AND MISSION SYSTEMS CORPORATION	$318.0 M
3.	RAYTHEON COMPANY	$247.8 M
4.	ASSOC UNIV RESEARCH ASTRONOMY	$231.3 M
5.	HARRIS CORPORATION	$176.8 M
6.	PERATON INC.	$175.8 M
7.	LOCKHEED MARTIN CORPORATION	$159.8 M
8.	AS AND D, INC.	$138.2 M
9.	SCIENCE APPLICATIONS INTERNATIONAL CORPORATION	$126.1 M
10.	GENERAL DYNAMICS MISSION SYSTEMS, INC.	$116.8 M
11.	ATA AEROSPACE, LLC	$106.8 M
12.	INUTEQ, LLC	$94.5 M
13.	BALL AEROSPACE AND TECHNOLOGIES CORPORATION	$92.4 M
14.	KBRWYLE TECHNOLOGY SOLUTIONS, LLC	$85.8 M
15.	SCIENCE SYSTEMS AND APPLICATIONS, INC.	$72.5 M

All numbers are based on NASA Procurement Data View and FPDS obligation data for fiscal 2018 as of Oct. 23, 2018.

ENVIRONMENTAL IMPACT

A leader in Earth and atmospheric science, Goddard is committed to executing its mission without compromising the planet's resources. Sustainability practices have been implemented across all operations and levels of management. The center's four sustainability objectives, along with select accomplishments, are listed below:

1

Reduce energy consumption, associated air emissions and other environmental impacts

- Decreased fiscal 2017 energy intensity by 21.9 percent from 2015
- Reduced greenhouse gas emissions by 16.2 percent from 2008 to 2017
- Established requirement for low-emission vehicles in service contracts
- Increased use of clean energy by 29.4 percent and renewable electricity by 11.9 percent

2

Increase the number of sustainable buildings

- Constructed two buildings to satisfy the Leadership in Energy and Environmental Design's (LEED) silver status
- One net-zero-capable building is under construction.
- Retrocommissioning studies are in progress to meet guiding principle goals.

3

Reduce potable water consumption and improve stormwater management

- Reduced potable water consumption from 2007 by 33 percent
- Reduced untreated stormwater runoff through construction of collection and filtration devices in newly constructed LEED-certified buildings, increasing use of meadows, swales and other permeability improvements

4

Pollution prevention and waste reduction

- Diverted 495 tons, or 35.2 percent, of solid waste and 47 tons, or 97.3 percent, of construction and demolition waste from landfills in fiscal 2017
- Established green purchasing requirements in procurement contracts on center
- Excess electronics are reused or recycled.

LOOKING FORWARD

Consistent with the center's focus on Earth science, Goddard's sustainability efforts continue.

These include:

- Improving heating and cooling systems in several buildings
- Constructing a 13-megawatt photovoltaic system at Wallops Flight Facility in Virginia that will provide 80 percent of the base's energy load with on-site renewable energy
- Initiating a heating and power plant optimization project that will increase efficiencies
- Goddard Living Laboratory for Coastal Resilience, NASA's largest shoreline protection program, is preparing for its second beach renourishing project on Wallops Island to protect the agency's only launch range. The Goddard-led Mid-Atlantic Coastal Resilience Institute will continue to study the impacts of storms and rising sea levels in the area.

A COMMITMENT TO DIVERSITY, INCLUSION AND EQUAL OPPORTUNITY

LGBTAC — Lesbian, Gay, Bisexual, and Transgender Advisory Committee

AAAC — African American Advisory Committee

EAAC — Equal Accessibility Advisory Committee

NDPAC — New and Developing Professionals Advisory Committee

VAC — Veterans Advisory Committee

NAAC — Native American Advisory Committee

WAC — Women's Advisory Committee

APAAC — Asian Pacific American Advisory Committee

HACE — Hispanic Advisory Committee for Employees

NASA's Goddard Space Flight Center values the diversity of experiences, viewpoints and talents that employees bring to work each and every day. Diversity, inclusion and equal opportunity are not just organizational goals. They are vital to the center's mission, helping drive innovation, collaboration and creativity along the path to mission success.

Goddard's policies and programs are designed to promote and advance this commitment. To this end, nine advisory committees on center help ensure that the interests of employees from all backgrounds are represented in recruitment, hiring, retention, outreach and professional development.

From hosting speakers during heritage months to organizing outreach efforts for future scientists and engineers, Goddard's advisory committees were active throughout the year. Several of their activities and achievements are as follows.

- The Goddard Hispanic Advisory Committee for Employees (HACE) continued its recruitment and outreach efforts at several Hispanic-serving institutions across the United States. Its continued partnership with the University of Puerto Rico resulted in a significant increase in the number of Hispanic interns in the summer of 2018. NASA scientist Miguel Roman delivered the keynote address during HACE's Hispanic Heritage Luncheon in September.
- The Goddard African American Advisory Committee co-hosted NASA astronaut Alvin Drew during the center's annual Martin Luther King Jr. Day commemorative event. It supported the Wallops Flight Facility Office of Education for several outreach events. In collaboration with the National Society of Black Engineers, the committee hosted an African American History Month event in February.
- The Goddard LGBT Advisory Committee conducted a centerwide survey to assess its impact after a decade in existence. During LGBT Pride Month in June, the committee hosted several social events as well as a panel discussion with Goddard employees.
- The Goddard Asian Pacific American Advisory Committee co-sponsored the annual Taste of Asia and the Pacific Islands during Asian Pacific American Heritage Month in May. Stephen Shih, NASA associate administrator for diversity and equal opportunity, served as the keynote speaker. A heritage month event was also held at NASA's Independent Verification & Validation Facility in West Virginia. The committee co-sponsored Chinese New Year and Mid-Autumn Festival events.
- The Goddard Native American Advisory Committee, celebrating its 10th anniversary, participated in the American Indian Science and Engineering Society's national conference career fair. The committee co-hosted a talk by renowned environmentalist Winona LaDuke during National Native American Heritage Month in November 2017.
- The Goddard Women's Advisory Committee co-hosted Wendy Morton-Huddleston, a principal of accounting and advisory firm Grant Thornton, as the keynote speaker for a Women's History Month event in March.
- The Goddard Veterans Advisory Committee helped organize a makeshift memorial on center as part of a Memorial Day commemoration. During Veterans Day in November 2017, the committee—in partnership with the Goddard New and Developing Professionals Advisory Committee (NDPAC)—hosted veteran Jared Marinos as he spoke about the transition to civilian life for millennial veterans.
- NDPAC also visited the Department of the Interior for an interagency engagement meeting and hosted a painting night with Wallops employees.
- The Goddard Equal Accessibility Advisory Committee co-hosted an event featuring Elise Roy—a prominent deaf attorney, artist and human rights advocate—during National Disability Employment Awareness Month in October 2017.

SOCIAL MEDIA SNAPSHOTS

As we celebrate our collective achievements, we also honor all of those who have contributed to Goddard and are no longer with us.

Your dedication and talent will never be forgotten.

*Active civil servants who passed away from October 2017 through September 2018 include:

FELICIA S. DONNELL
NICOLE M. RAPHAEL

‡Contractors, former civil servants and others whose reported passing occurred from October 2017 through September 2018 include:

WILLIAM H. ANONSEN
MICHAEL J. BERZONSKY
CHRISTOPHER O. BRYAN SR.
JAMES S. BURNESKIS
WILLIAM J. CAMPBELL
BRIAN CARNAHAN
RICHARD D. CARPER
ROLAND H. CHASE
MILTON R. CROMER
WILLIAM G. DEWELL
CLARENCE E. DOLL JR.
MARION F. FEDERLINE
MCLEAN M. GRANT
DONALD G. HENRY
TED HERMELING
BERNITA B. JUSTIS
FLORENCE D. KENNY
ROBERT A. KICHAK
JOHN S. KNOLL
YOJI KONDO
GEORGE E. KRAFT
BRIAN LEM
GERALD W. LONGANECKER
CHESLEY H. LOONEY JR.
DENNIS K. MCCARTHY
ORMOND W. MCDANIEL
WYLIE M. MCMILLAN
RICHARD G. MULLIGAN
ALTON D. PAYNE JR.
LLOYD C. PAYNE
JACK E. POWNELL
LEONARD RABB
PAUL M. RALL
KENNETH F. REHMANN
CHARLES F. RICE JR.
JAMES W. RIDGLEY JR.
STEVE ROOKER
DOUGLAS H. ROSE JR.
DAVID H. SCHAEFER
PHILIP T. SMITH
WILLIAM J. SMITH
PAUL L. SPADIN
THEODORE P. STECHER
EDWIN O. STENGARD
ROBERT G. STEPP
ROBERT L. STILMAR
ROBERT E. STREITMATTER
CARLOTTA TEAGUE
VIGDOR L. TEPLITZ
BETTY F. THOMAS
IVA L. VOLKMER
CLAUDE WARD
ARTHUR F. WHITE
RICHARD M. WINDSOR
WILLIAM R. WITT JR.
FRANK T. WOLF
ANNABELLE G. WRIGHT
GERALD R. YOUSE

*NASA does not have access to this information for former NASA civil servants. The report authors have been informally notified of such individuals who have been added to the list under contractors and others.

‡NASA does not have access to this information for contractors and others affiliated with Goddard. An earnest attempt was made to manually collect this information. However, the nature of the process could result in an incomplete list.

Please email omissions to Darrell Dela Rosa at darrell.d.delarosa@nasa.gov. The electronic version of this report will be updated accordingly.

Goddard
SPACE FLIGHT CENTER

Set goals, challenge yourself, and achieve them. Live a healthy life... and make every moment count. Rise above the obstacles, and focus on the positive.

– Robert H. Goddard

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www.nasa.gov/goddard

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