



2015

GODDARD SPACE FLIGHT CENTER

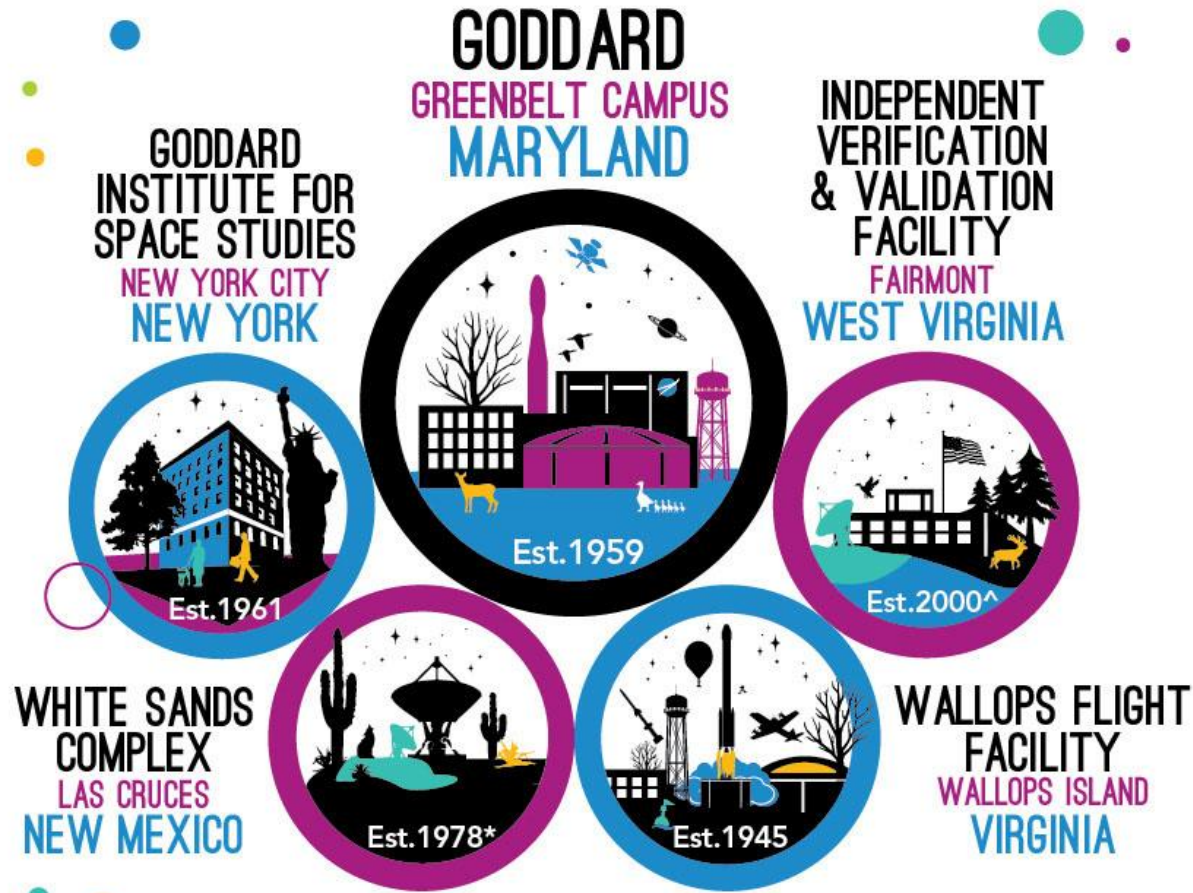
ANNUAL REPORT



ONE WORLD-CLASS ORGANIZATION:

FIVE UNIQUE SITES • OVER 13,000 PEOPLE

PLUS MANY OTHER LOCATIONS WORLDWIDE



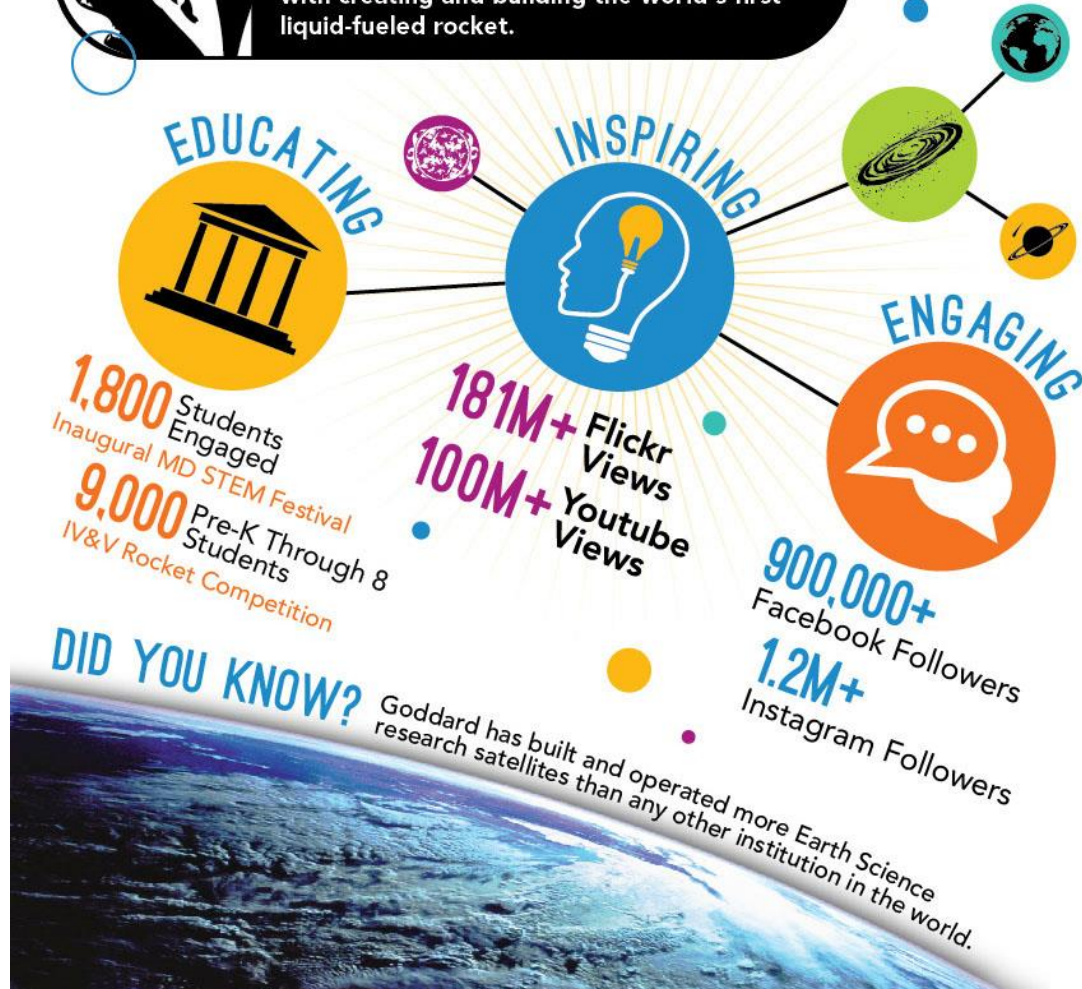
*Goddard-managed ground communications stations
^Goddard assumed management



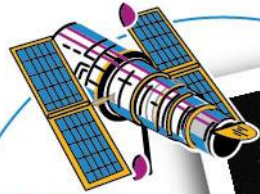
ROBERT H. GODDARD

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



100

TERABYTES OF
DATA PROVIDED
BY HUBBLE



NGC 6302, known as
the Butterfly Nebula



37,000+
LIVES SAVED

WORLDWIDE THROUGH
GODDARD-ENABLED
SEARCH & RESCUE



3,000
COMETS DISCOVERED
BY SOHO



WEBB

will be a powerful
time machine with
infrared vision that
will peer back over
13.5 billion years.



1976
Greenbelt Visitor Center
Opened! 150,000+
visitors since 2012



1 of 63 known
living Moon Trees
planted from
approximately
450
seeds taken on
the Apollo 14
mission



25th ANNIVERSARY

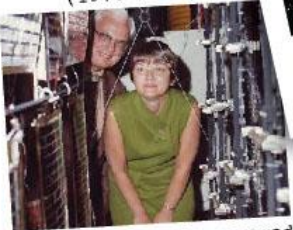
COSMIC
BACKGROUND
EXPLORER:

LAUNCHED IN 1989
LED TO A NOBEL
PRIZE IN PHYSICS



GODDARD'S
"FIRSTS"

UHURU Mission
(1970-1973)



First spacecraft managed
and launched by a woman:
Marjorie Townsend
(March 12, 1930 - April 4, 2015)

UHURU: "Freedom"
in Swahili, first
satellite devoted
to X-Ray Astronomy

1 PRIMETIME
EMMY AWARD

NATIONAL
ACADEMY OF
TELEVISION
ARTS & SCIENCES

FIRST LIVE TV BROADCAST FROM THE MOON IN 1969



NATIONAL INVENTORS
HALL OF FAME

2015: George E. Alcorn
X-ray Imaging Spectrometer



Years of
Experience
Managing the
Development
of NOAA's
Weather
Satellites



CENTER DIRECTOR'S MESSAGE

For more than 50 years, NASA's Goddard Space Flight Center has laid a foundation of scientific and technical knowledge that society will apply to its endeavors today and in the future. I am inspired by, and grateful for, the exceptional legacy that forms the backbone of our work. Since its establishment in 1959 as the agency's first spaceflight center, Goddard has been a leader in advancing our understanding of astrophysics, Earth science, heliophysics, planetary science, and engineering and technology.

This past year, we celebrated milestones for missions that have made—and continue to make—countless discoveries in our quest to understand Earth, our solar system and worlds beyond. All the while, we have remained hard at work developing future missions that will carry our legacy for generations to come. In 2015, we celebrated the 25th launch anniversary of the Hubble Space Telescope. Similarly, Goddard's Wallops Flight Facility, a leader in research and technology since 1945, marked 70 years in June. Goddard held open houses in commemoration of these anniversaries at both Wallops and Greenbelt with an extraordinary turnout for both events—evidence of the public's overwhelming appreciation for our work and the people who make it all happen.

During the year, we added the Soil Moisture Active Passive spacecraft to our constellation of Earth-monitoring sentinels and gained new insights into the climate system with the Global Precipitation Measurement mission's first global map of rainfall and snowfall. We launched two new missions in 2015—the Magnetospheric Multiscale mission and NOAA's Deep Space Climate Observatory—while two other heliophysics missions celebrated their 5th and 20th anniversaries. The Solar Dynamics Observatory studied a sunspot 80,000 miles wide, the largest yet of the current solar cycle; and the Solar and Heliospheric Observatory spotted its 3,000th comet.

As NASA moves forward with its Journey to Mars, Goddard continues to research the Red Planet as part of the agency's goal to send humans to Mars by the 2030s. The Sample Analysis at Mars instrument suite detected organic matter on the planet's surface while the Mars Atmosphere and Volatile Evolution mission made landmark discoveries about the upper atmosphere.

I invite you to explore this annual report and learn about these and many of our other notable achievements from the past year. With our breadth of work across an extensive portfolio of science disciplines, it is impossible to include them all. Please visit our website, www.nasa.gov/goddard, for greater detail regarding our efforts and accomplishments.

As 2016 begins in earnest, we can look forward to a year that will produce the next generation of missions and technologies that will further advance our scientific capabilities. We plan to launch such missions as Astro-H, Raven, OSIRIS-REx, GOES-R, JPSS, NICER, and ISS-CREAM, and we will continue progress on important projects in support of science and human spaceflight.

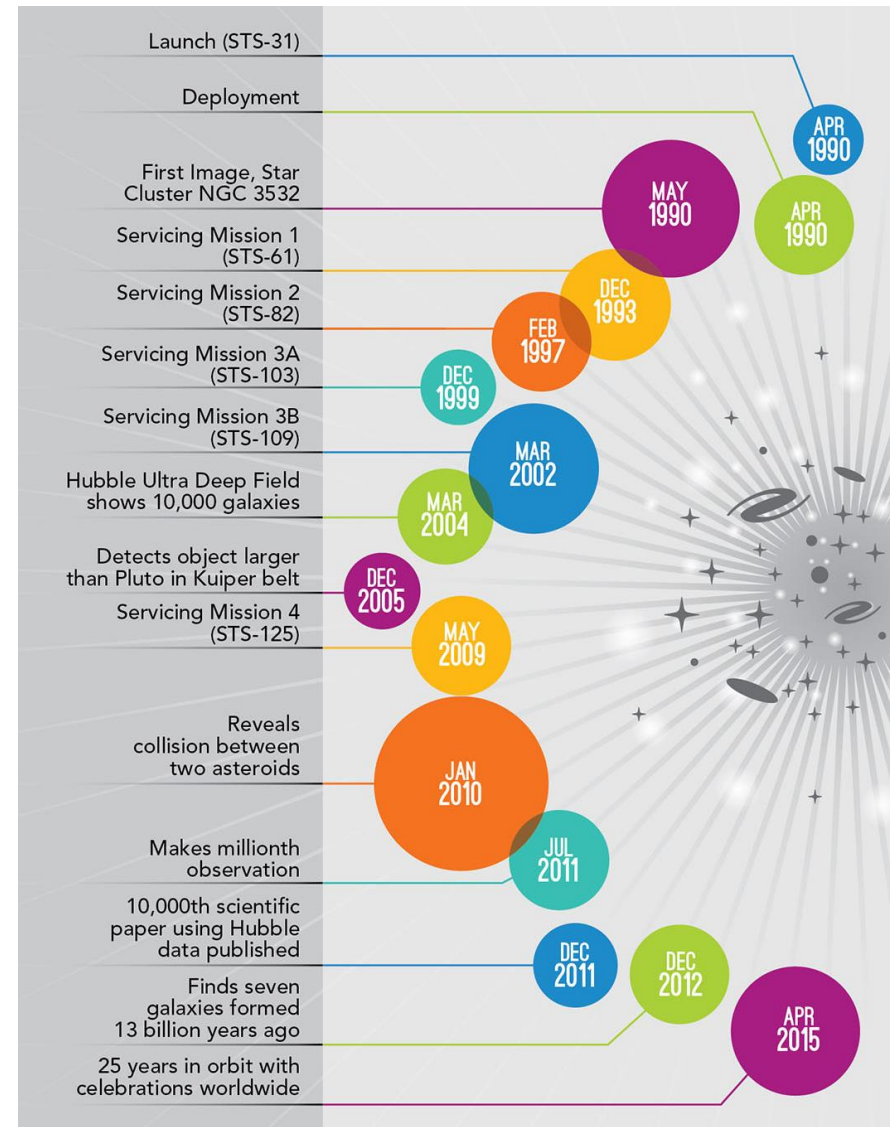
The challenges ahead of us are extraordinary, and we remain extremely proud to do the work that we do. I am privileged to be part of a group of immensely talented and committed individuals who continue to push the boundaries of what is possible in the universe.



25 YEARS OF HUBBLE'S UNIVERSE

Launched in 1990, the Hubble Space Telescope has made over 1.2 million observations of more than 38,000 celestial objects.

- The world's first large, space-based optical telescope was named after American astronomer Edwin P. Hubble (1889- 1953). Dr. Hubble confirmed an “expanding” universe, which provided the foundation for the Big Bang theory.
- In its 25-year lifetime, the telescope has made nearly 137,000 trips around our planet. Hubble's miles traveled, 3.4 billion, is nearly the average distance from Pluto to the Sun.
- An average of 829 gigabytes of Hubble data are added to the archive every month. Hubble observations currently produce 10 terabytes of new data per year, with over 100 terabytes available for future generations of researchers.
- Scientists using Hubble data have published more than 12,800 scientific papers, including research that led to a Nobel Prize in Physics.





CELEBRATING WALLOPS

Expanding NASA's Reach for Science and Technology Since 1945

1940s

1950s

1960s

1970s

1980s

1990s

2000s

TODAY



One of the oldest launch sites in the world, Wallops Flight Facility is a key part of Goddard Space Flight Center and NASA's principal provider of suborbital programs and related services supporting U.S. aerospace technology and science research needs. The rich history of Wallops includes and even predates the early work of NASA's predecessor, the National Advisory Council on Aeronautics (NACA).

June 27, 2015, marked 70 years since the first launch, and Wallops Flight Facility welcomed members of the public and various communities at an Open House in celebration of this milestone. Today, men and women based at Wallops lead NASA's suborbital programs, having launched thousands of rockets, released hundreds of scientific balloons, and logged thousands of flight hours in support of scientific investigations. Recent balloon missions

include the launch of the Low-Density Supersonic Decelerator in Hawaii and a super pressure balloon launch from New Zealand. Recent sounding rocket missions enable scientific advances with launch platforms at Wallops, Alaska and other worldwide sites, and also support important education initiatives. Wallops' lower atmosphere airborne science missions fly 50 percent of NASA's aircraft science flight hours, with campaigns from Wallops, the Arctic, Antarctica and other global sites.

Over the years, the Wallops launch range has grown to include six launch pads, assembly facilities and state-of-the-art instrumentation. In addition, mobile launch facilities enable Goddard and NASA scientists and engineers to launch rockets from sites around the world. NASA's Wallops-based aircraft include a P-3B Orion, four C-23 Sherpas, a King Air, two C-

130 Hercules, and a UH-1 Huey, supporting the Airborne Science Pro-gram. Wallops also supports test flights of Unmanned Aerial Systems (UAS); the Virginia Commercial Spaceflight Authority will soon complete construction of a 3,000 foot UAS runway. Wallops has NASA's only owned and operated launch range and research airport. This facility collaborates on national missions with the U.S. Coast Guard, the Department of Defense, and NOAA as well as commercial space initiatives with the Mid-Atlantic Regional Spaceport.

government, industry and academic collaboration, Wallops is poised to continue as the current and future key resource for operational test, integration and certification of NASA and commercial next-generation, low-cost orbital and suborbital launch technologies. NASA and Goddard are indebted to the commitment, service, and dedication of the count-less people who have contributed to Wallops Flight Facility's important work in support of NASA's mission over many decades.

"We had an incredible 70th Anniversary celebration Saturday, June 27, with more than 7,000 guests spending the day with us, learning about our missions and the men and women who make Wallops so successful. I'm enormously grateful to all the volunteers who supported the event, as well as the exhibitors and sponsors who came out to show their support." - Bill Wrobel, Director of the Wallops Flight Facility



THIS IS WHO WE ARE

NASA Vision

We reach for new heights and reveal the unknown for the benefit of humankind.

NASA Mission

Drive advances in science, technology, aeronautics, and space exploration to enhance knowledge, education, innovation, economic vitality, and stewardship of Earth.

NASA's Strategic Goals

1. Expand the frontiers of knowledge, capability, and opportunity in space.
2. Advance understanding of Earth and develop technologies to improve the quality of life on our home planet.
3. Serve the American public and accomplish our mission by effectively managing our people, technical capabilities, and infrastructure.

OUR PURPOSE

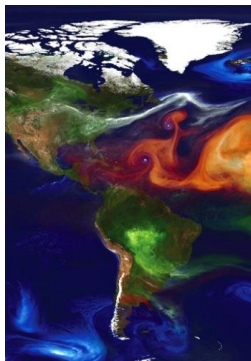
A PLACE FOR SCIENCE

For the good of our Nation and the world, Goddard leads scientific research and exploration that transforms our understanding of Earth and space and enhances the lives of people on our home planet.

We advance NASA's mission by leading scientific research, and by building, launching, and operating scientific instruments, spacecraft, and information systems. As a science center, Goddard seeks to understand the Earth and to explore the universe through a robust program of scientific research 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 the agency's technical capabilities in support of its overarching mission. Goddard then applies its breakthroughs to society: stimulating economic growth, fostering the education of the next generation, and inspiring the Nation.



OUR FOCUS AREAS



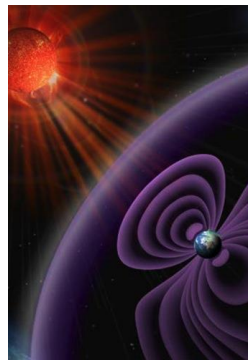
EARTH SCIENCE

Observes and studies the Earth System, to further scientific understanding of our home planet, and to improve predictions of its evolving state due to human and natural changes



ASTROPHYSICS

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



HELIOPHYSICS

Researches the Sun and its extended solar system environment (the heliosphere), and interactions of Earth, other planets, small bodies, and interstellar gas with the heliosphere.



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 & NAVIGATION

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



SUBORBITAL PLATFORMS & RANGE SERVICES

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

CROSS-CUTTING TECHNOLOGIES

SENSOR SYSTEMS & INSTRUMENT PLATFORMS

Goddard develops and builds missions and instruments, from subsystems (detectors and optical elements) to complete instruments and instrument suites.

LARGE-SCALE SCIENTIFIC INFO. SYSTEMS, DATA PROCESSING, & 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.

IN-SPACE SATELLITE SERVICING

To enable extended mission operations, reconfiguration, and recovery, Goddard's services include on-orbit spacecraft refueling and repair, assembling large structures in orbit, and modular designs.

OTHER ENABLING CAPABILITIES

PROGRAM & 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.

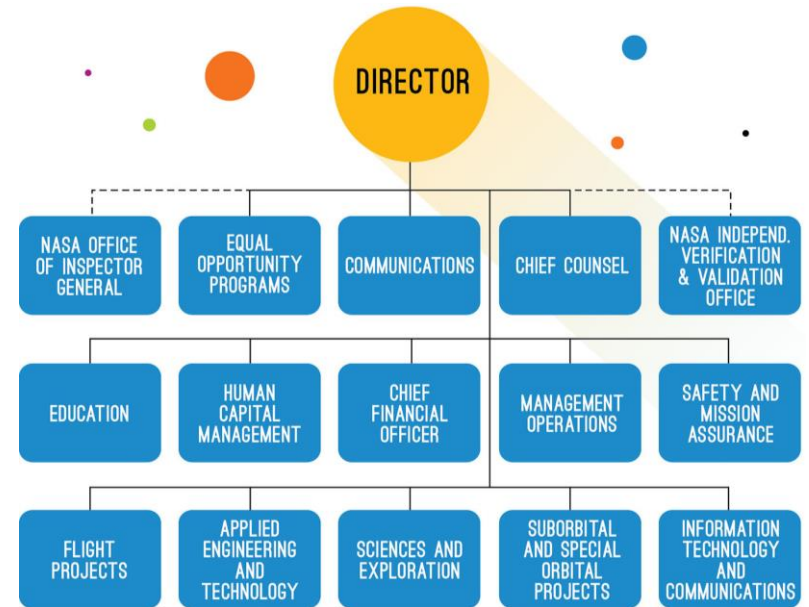
END-TO-END MISSION SYSTEMS ARCHITECTURE & ENGINEERING

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

SAFETY & MISSION ASSURANCE

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

OUR ORGANIZATION



2015 IN FIGURES



ONE GODDARD
MORE THAN 13,000 PEOPLE



3,000+ CIVIL SERVANTS
6,000+ ONSITE CONTRACTORS
1,000s OF OTHERS*
*including off-site contractors, interns, and Emeritus

38% FEMALE
(Civil Servants)



62% MALE
(Civil Servants)



450 INTERNS

48 STATES



73 HIGH SCHOOLS

180 COLLEGES & UNIVERSITIES
(24% Minority Serving Institutions)



BUDGET: \$5.0B

FY15 Budget Received in FY15

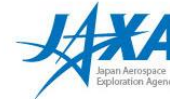
DIRECT GSFC BUDGET: \$3.5B

REIMBURSABLE GSFC BUDGET: \$1.5B

(FROM OTHER GOVERNMENT AND NON-GOVERNMENT ENTITIES)

JOINT AGENCY SATELLITES

5 AGENCIES



3 Missions in Development
Landsat 9, GOES-R, JPSS

8 Operational Missions
GOES 13-15, Landsat 7 & 8, Suomi-NPP, DSCOVR, GPM

2015 IN FIGURES



BEST

PLACES TO WORK IN THE FEDERAL
GOVERNMENT RANKING

#11

OF 320 AGENCY
COMPONENTS

4

YEARS OF NASA
VISUALIZATION
EXPLORER APP



1.5 MILLION DOWNLOADS

400 ARTICLES

- NSF/Popular Science
2015 People's Choice
Vizzie Award

PUBLICATIONS



588

EARTH SCIENCE

300

ASTROPHYSICS

180

PLANETARY
SCIENCE

200

HELIOPHYSICS

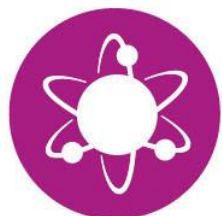


252

LIVES SAVED

IN THE UNITED STATES
THROUGH GODDARD-
ENABLED SEARCH
& RESCUE

2015 IN FIGURES



APPLYING TECHNOLOGIES



Technology Transfer

213

New Technology Reports

104

Software Usage Agreements

Invention Portfolio

40

Patent Applications

Partnership Development

11

Strategic Partnerships



JAMES
WEBB

SPACE TELESCOPE

Number of primary mirror segments: 18

5

MAJOR PROGRAM
ACHIEVEMENTS
HIGHLIGHTED
IN FY 2015 + many more.

Please visit

2015 IN FIGURES



70
YEARS
OF
WALLOPS
INNOVATION

13,750

AIRBORNE
SCIENCE HOURS
ON SOUNDING
ROCKET AND
BALLOON
MISSIONS

3,620

COLLEGE
STUDENTS
PARTICIPATED
IN HANDS-ON
FLIGHT
PROJECT
EXPERIENCES

(In past 18 months)

2,125

AIRCRAFT
HOURS IN
SUPPORT
OF EARTH
SCIENCE

16

SOUNDING
ROCKET
LAUNCHES

7

ORBITAL
LAUNCHES

(In past 3 years)

116

SOUNDING
ROCKET AND
BALLOON
MISSIONS

(In past 18 months)

3,167

ACTIVE
PROCUREMENT
INSTRUMENTS



2015 IN FIGURES



1.5 TERABYTES

OF DATA PER DAY SENT FROM THE
SOLAR DYNAMICS OBSERVATORY



25 -YEAR HISTORY OF U.S. FOREST DISTURBANCE MAPPED

Landsat data were used to produce 25 time-integrated maps depicting forest disturbance across the U.S. These North American Forest Dynamics (NAFD) maps provide the North American Carbon Program with analyses of U.S. forest health at the scale of local forest management.

IV&V FACILITY



13 NASA MISSIONS SUPPORTED

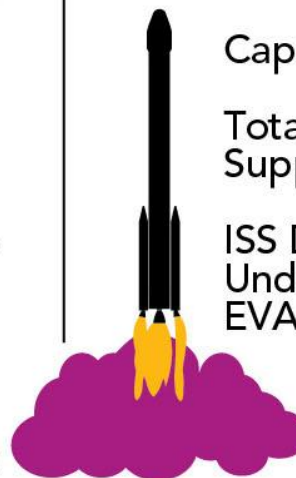
51 SEVERITY ONE ISSUES IDENTIFIED

MISSION NETWORK

Capability: **3.8** Gbps

Total Launches
Supported: **12**

ISS Docking,
Undocking, and
EVAs Supported: **27**



*Figures are for FY 2015
unless noted otherwise.*



DELIVERING YOUR DATA FROM SPACE

Since 1959, Goddard's communications networks have served NASA, the Nation, and the world as the backbone for products and services derived from satellite data.

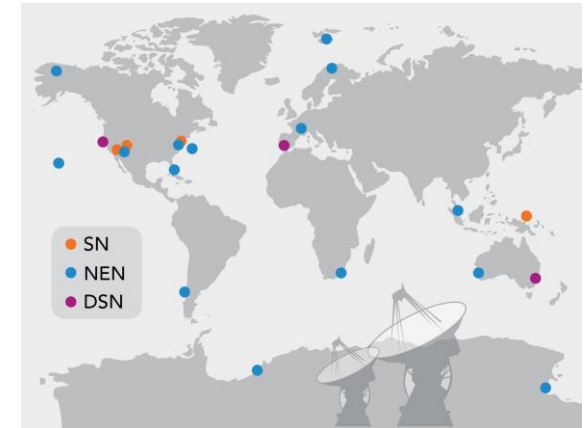
HOW WE DO IT

SPACE NETWORK (SN): A constellation of nine Earth-orbiting **Tracking Data Relay Satellites (TDRS)** and four ground terminal locations that provide a continuous global link between satellites and the ground.

NEAR EARTH NETWORK (NEN): A series of fifteen globally-located NASA-owned and contracted commercial ground terminals that provide comprehensive communications services to satellites in near-Earth orbit.

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

DEEP SPACE NETWORK (DSN) NASCOM: Also provides connectivity to the ground stations of NASA's third communications network, DSN, which is managed by the Jet Propulsion Laboratory.



KEY FACILITIES

WHITE SANDS COMPLEX: The SN ground segment at the White Sands Complex features ground terminals that provide the hardware and software necessary to guarantee a constant communication link among the customer spacecraft, TDRS, and the NASCOM interface to the customer control center.

WALLOPS FLIGHT FACILITY: One of the NASA-owned tracking stations, WFF hosts five NEN antennas that provide high-quality, low-cost communications services to supported flight missions. Its Global Monitor and Control Center (GMAcc) provides continual monitoring of passes allowing for remotely-controlled, locally unattended station operations at other sites, including the nearly completed Launch Communications Stations (LCS) at Kennedy Space Center. LCS will provide critical launch communications capabilities to the Space Launch System rocket and Orion spacecraft.

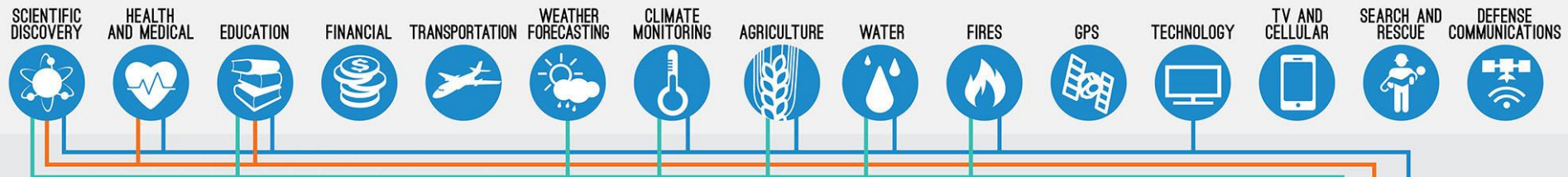
GODDARD GREENBELT CAMPUS: In addition to overall management of SN and NEN, Greenbelt manages the NASCOM which handles all data from SN, NEN, and DSN. Its global system of communications transmission, switching, and terminal facilities provides Internet Protocol (IP) routed data, high-rate data and video services. Other capabilities include mission voice communications services, and high volume data transfer among NASA super-computers including the NASA Center for Climate Simulation at Goddard.

DID YOU KNOW? • 98% of all NASA data comes through Goddard via SN and NEN • SN and NEN collectively transmit 29.5 TB of data per day • NEN supports about 40 NASA and other agency satellites



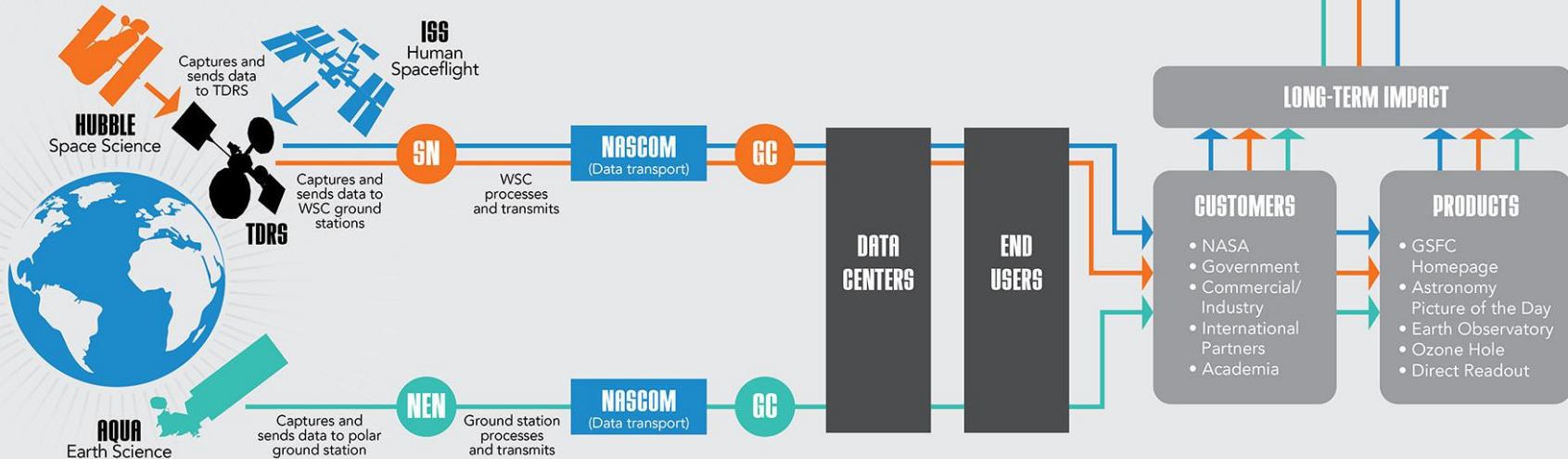
DELIVERING YOUR DATA FROM SPACE

MANY ASPECTS OF SOCIETY ARE IMPROVED BY SATELLITE DATA



JUST THREE EXAMPLES OF THE MANY WAYS WE ARE BRINGING SCIENCE HOME!

Hubble Space Telescope observes the most distant stars and galaxies in the universe as well as the planets in our solar system. The International Space Station (ISS) collects data on global climate, environmental change, and natural hazards using crew-operated and automated Earth observation payloads. Aqua is a multi-national Earth-observing research satellite studying the precipitation, evaporation, and cycling of water.



KEY FACILITIES





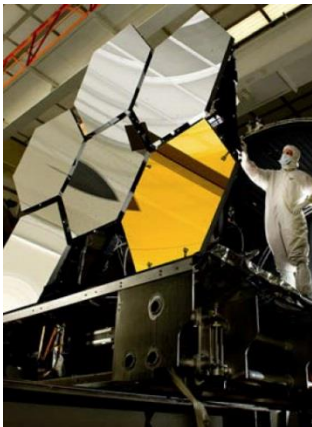
14 HIGHLIGHTS OF 2015

1

JWST

Next Strategic Astrophysics Mission Continues Progress

James Webb Space Telescope (JWST) again made significant progress toward its launch planned for no earlier than 2018. A successful 116 days testing of its heart was conducted inside Goddard's thermal vacuum chamber. Two primary test mirror segments were placed onto the support structure. The pathfinder telescope, a practice section of JWST, is now fully assembled. The special arms required to set up its secondary mirror in space were tested. The Integrated Science Instrument Module (ISIM) successfully underwent a "gravity sag test" and "severe sound" tests.



UNIVERSE

2

HUBBLE

Celebrating 25 Years of Hubble

On July 23, 2015, Goddard hosted a day of open houses, events and panel discussions in honor of the project team, and they released videos showcasing key moments in Hubble's history. In addition to these recognitions, Hubble continued to deliver compelling images revealing our mysterious universe. Releases included spectacular new views of the "Pillars of Creation"; super-rich galactic neighborhoods; young, massive, compact galaxies; debris-strewn exoplanetary construction yards; extreme exoplanets; stars ejected from ancient galaxies; Pluto's moons; and aurorae on the Moon.



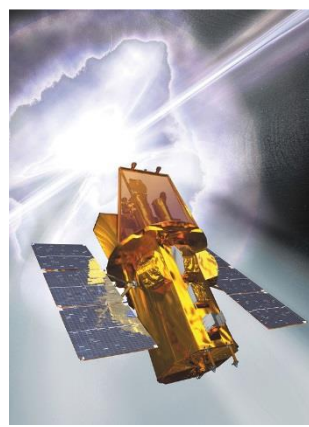
UNIVERSE

3

SWIFT/XMM-NEWTON

Revealing the Destructive Nature of Black Holes

The Swift Gamma-ray Burst Explorer, Chandra X-ray Observatory, and XMM-Newton joint mission with ESA are helping scientists solve an astronomical puzzle concerning forces that rip apart stars near black holes called tidal disruption. One such event, called ASASSN-14li, was found in the center of a galaxy 290 million light-years away. This observation has given researchers an extraordinary opportunity to understand these extreme environments. Results from the Nov. 2014 All-Sky Automated Survey for Supernovae (ASAS-SN) were published in the Oct. 22, 2015 issue of Nature.



UNIVERSE

4

GPM

First Global Rainfall, Snowfall Map from Mission

The Global Precipitation Measurement (GPM) mission has produced its first global map of rainfall and snowfall. Launched on February 27, 2014, the NASA/JAXA mission unifies precipitation measurements from a network of 12 satellites. The result is NASA's Integrated Multi-satellite Retrievals for GPM data product, called IMERG. GPM Core Observatory has provided a worldwide tour of global precipitation by taking snapshots every 30 minutes that are available in hours. In addition, GPM is engaging citizen scientists to validate ground and satellite data.



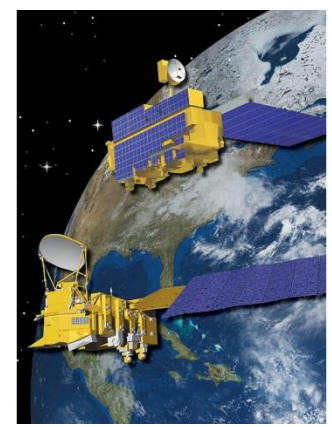
EARTH

5

TERRA/AQUA

Battling Wildfires from Space

NASA satellites have been adding to the firefighters' toolkit by providing a clearer view of these threats with new satellite-based tools to better detect fires and predict their behavior. Aqua spotted multiple fires in California, including the Rough fire—the largest in the state. Terra captured Alaskan wildfires in the 2015 fire season which surpassed the 5-million-mark for the number of acres burned. Aqua also captured an image of dozens of wildfires across the Alaska wilderness. In addition, NASA satellites captured the smoke from wildfires in the skies over Alaska, Canada, and the U.S. Great Lakes..



EARTH



14 HIGHLIGHTS OF 2015

6

ICESat-2

Measuring the Height of Earth from Space

The Ice, Cloud, and land Elevation Satellite-2 (ICESat-2), slated for launch in 2017, will continue the important observations of icesheet elevation change, sea-ice freeboard, and vegetation canopy height begun by ICESat in 2003. Together, these datasets will allow for continent-wide estimates in the change in volume of the Greenland and Antarctic ice sheets over a 15-year period, and long-term trend analysis of sea-ice thickness. Testing continued on ICESat-2's laser-based light detection and ranging (LIDAR) sensor called the Advanced Topographic Laser Altimeter System, or ATLAS.



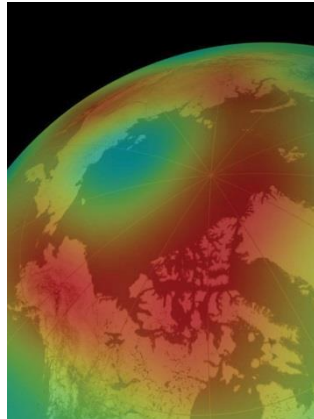
EARTH

7

PACE-OCI

New NASA Mission to Study Ocean Color

NASA is beginning work on a mission to extend critical climate measurements of Earth's oceans and atmosphere, and advance studies of the impact of environmental changes on ocean health, fisheries and the carbon cycle. Tentatively scheduled to launch in 2022, the Plankton-Aerosol Clouds and ocean Ecosystem (PACE) mission will study Earth's aquatic ecology and biogeochemistry. PACE will be managed by Goddard, which will also build the Ocean Color Instrument (OCI) to measure ocean color and observe clouds and tiny airborne particles like dust, smoke and aerosols.



EARTH

8

MAVEN

MAVEN Extends Mars Exploration Heritage

The Mars Atmosphere and Volatile Evolution (MAVEN) mission continues our exploration of Mars, which began 50 years ago with Mariner 4. Since its arrival at Mars in September 2014, the results have been stunning. MAVEN has discovered diffuse auroras that occur intermittently and observed a temporary layer of metal ions, formed from dust left by comet Siding Spring. Four "deep-dip" campaigns have investigated the lower end of the upper atmosphere. MAVEN's observations are being used to determine how quickly Mars is losing its atmosphere today—to better understand its changing climate.



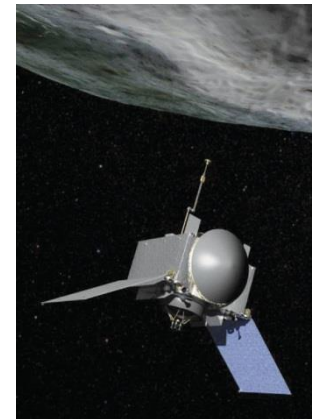
SOLAR SYSTEM

9

OSIRIS-REx

OSIRIS-REx Meets Key Milestones

Origins, Spectral Interpretation, Resource Identification and Security-Regolith Explorer (OSIRIS-REx) is the first U.S. asteroid sample return mission, planned for launch in Sept. 2016. It passed the Mission Operations Review in July 2015. That June marked the delivery of an instrument to measure the asteroid's mineral and chemical abundances, and temperature. Shortly after, two more instruments were delivered: the instrument to explore the surface of the asteroid for water and organic materials, and the suite of cameras. These three of the five mission instruments were integrated by September.



SOLAR SYSTEM

10

DSCOVR

Satellite Camera Provides "EPIC" View of Earth

In July 2015, a NASA camera on the Deep Space Climate Observatory (DSCOVR) satellite returned its first view of the entire sunlit side of Earth from one million miles away. The color images from NASA's Earth Polychromatic Imaging Camera (EPIC) are generated by combining three separate images to create a photographic-quality image. The satellite, a multi-agency collaboration (NOAA, USAF, and NASA), was launched in February. Data from EPIC will be used to measure ozone and aerosol levels in Earth's atmosphere, cloud height, vegetation properties and the ultraviolet reflectivity of Earth.



SUN

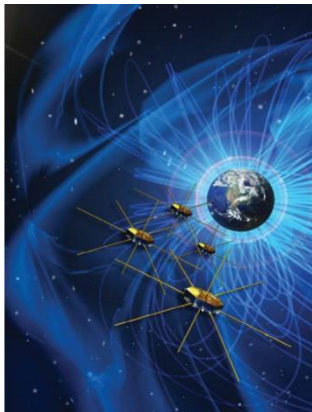
14 HIGHLIGHTS OF 2015

11

MMS

Historic Mission Launches,
Flies in Formation

In November 2014, all four of the Magnetospheric Multiscale (MMS) spacecraft had arrived at NASA's pre-launch processing facility in Florida to begin preparations for launch. On March 12, this unprecedented mission launched to study magnetic reconnection, a phenomenon that drives effects all over the universe. On July 9, MMS completed a major milestone with the planned execution of maneuvers to begin formation flying in a 160 km spaced tetrahedron. On September 1, MMS entered the Mission Operations and Science Data Analysis phase (E), with numerous publications to follow.



SUN

12

SPACE NETWORK

Initial Implementation of New
Ground Terminal

The Blossom Point Remote Station now provides customer support and is fully operational with the first of two TDRS antennas, giving the Space Network (SN) additional capability in the Atlantic Ocean Region. Blossom Point began as a green field environment, with no SN antennas or supporting ground system. In a few years, the SN installed three antennas, three radomes and a suite of hardware and software systems to manage TDRS and provide customer services. The ground system implementation effort in particular took a short 14 months from start to finish.



COMMUNICATIONS

13

Wallops 70th

Wallops Celebrates 70 Years
of Aerospace Innovation

In 2015, Wallops hosted several events commemorating the historic date of its first test launch on June 27, 1945. The Wallops 70th Anniversary Lecture Series began in March, and Wallops held a contest on "Art & the Cosmic Connection." The facility hosted an opening reception for the youth art exhibit on June 26th. Winners selected from over 300 submissions were displayed through September. On June 27, Wallops opened its doors to engage the public with celebrating and recognizing its significant contributions to NASA and the Nation, ending with a 5K run on the facility runways.



SUBORBITAL

14

Explore@NASAGoddard

Record Crowds Visit
Open House

On September 26, Goddard's main campus in Greenbelt, MD opened for the first time in four years in celebration of Hubble's 25th anniversary. Over 20,000 people attended the event. Visitors participated in over 130 science, engineering and technology activities; and interacted with experts like Nobel laureate John Mather and astronaut John Grunsfeld, a veteran of the Hubble servicing mission. Over 10 buildings were opened, including the spacecraft integration and test facility, and the High Bay Clean Room. Hundreds of the center's staff explained Goddard's work to attendees.



OUTREACH

ENGAGING THE COMMUNITY

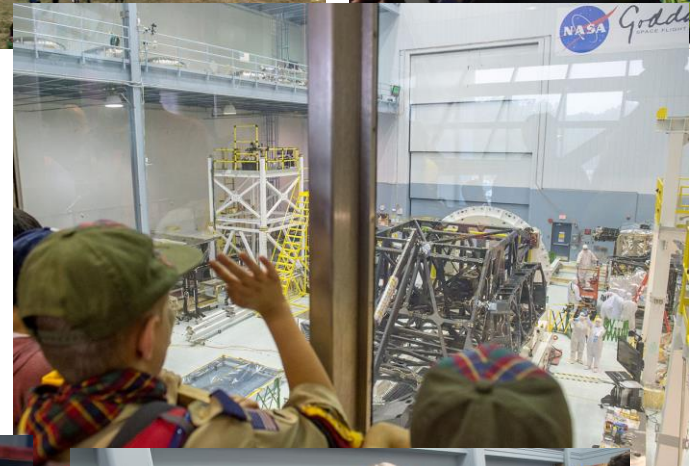


NASA's Goddard Space Flight Center in Greenbelt, Maryland, opened its doors for the first time in four years to give the public a chance to explore the center's Earth science, heliophysics, planetary science, astrophysics, and engineering and technology. In celebration of the Hubble Space Telescope's 25th anniversary, this year's event highlighted the theme "Celebrating Hubble and the Spirit of Exploration."

Organizers at Goddard said some 20,000 attended the Explore@NASAGoddard event for an exclusive look at the center's work.

- 20,000 Attendees
- 1,600 Staff (Volunteers, Presenters, Exhibitors, Partners, Performers, Facilities Personnel)
- 37 Presentations
- 21 Local Food Vendors
- 13 Facility Tours
- 108 Goddard Exhibits
- 22 External Exhibitors
- 14 Open Buildings
- 12 Science Demonstrations and Performances

<http://www.nasa.gov/explorenasagoddard-2015>



ENGAGING THE COMMUNITY





THIS IS WHAT WE DO

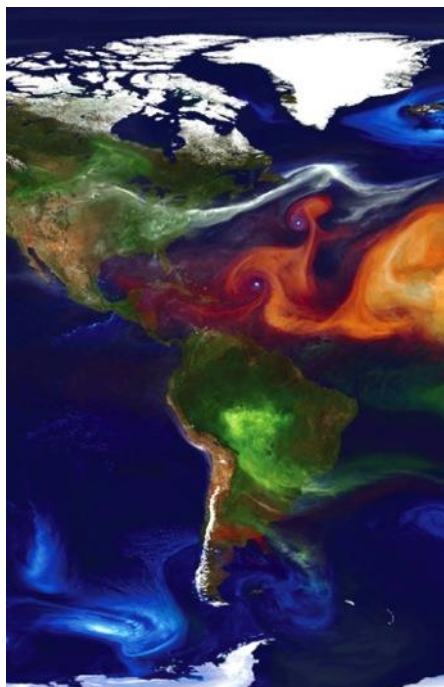
A PLACE FOR SUCCESS

At Goddard, we launch science. We help answer crucial science questions through complex missions that depend on dedicated, innovative teams to develop pioneering technologies. Goddard is one of the few organizations worldwide to manage a mission from concept through operations, which utilize internal, partner, and industry expertise and resources and cover suborbital to planetary missions.

The depth and expertise of our scientists, engineers, technologists, project managers, support personnel, and facilities form the foundation of our unique strength. With our leadership in scientific research as well as instruments and spacecraft development, the center has a notable capability to conceive and manage advanced science, technology, and space systems through the entire mission life cycle.

OUR LEADERSHIP

UNDERSTANDING OUR DYNAMIC PLANET



EARTH SCIENCE

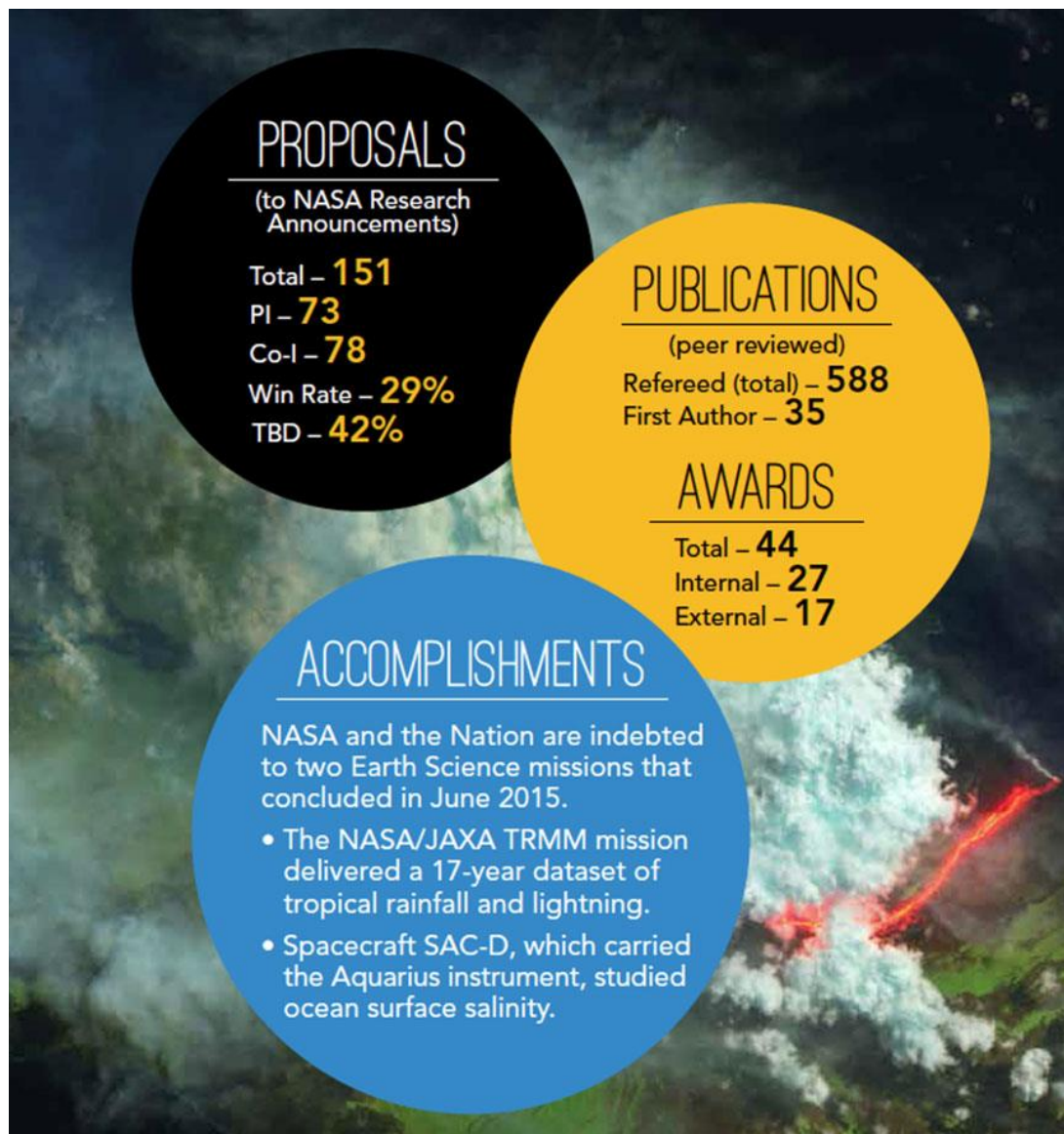
FY 2015 has yielded a number of accomplishments for Goddard Earth Science.

- CATS was launched to the ISS where it began observing clouds and aerosols; DSCOVR was launched into deep space (Lagrange Point 1) for a constant view of the entire sunlit hemisphere, or “blue marble;” and
- SMAP was launched into low Earth orbit where the GSFC-built passive microwave radiometer preserved the main objective of measuring global soil moisture.
- GEDI, GOES-R, JPSS, and ICESat-2 all made significant progress towards launches in 2016 and 2017.
- Early 2020s flagship missions Landsat 9 and PACE/OCI were formally directed to Goddard and began formulation.

Unprecedented data products emerged in 2015 including:

- A first-ever global map of precipitation every 30 minutes from GPM Integrated Multi-Satellite Retrievals;
- A global map of root-zone soil moisture from a synthesis of SMAP data with the Goddard Earth Observing System Model, Version 5 (GEOS-5); and
- A Modern Era-Retrospective Analysis for Research and Applications (MERRA) resulting from the assimilation of satellite data into GEOS-5 to produce a refined simulation of Earth’s climate system.
- In addition, GISS continues to monitor global temperatures and helped establish 2015 as the warmest year on record.

UNDERSTANDING OUR DYNAMIC PLANET



MAKING HEADLINES

Suomi NPP Satellite Can Detect Holiday Lights From Cities

— Dec 16, 2014, TIME

It's Official: 2014 Was the Hottest Year in Recorded History

— Jan 16, 2015, Washington Post

Watch How NASA Monitors Sand Flying From the Sahara to the Amazon

— Feb 25, 2015, TIME

Risk of American 'Megadroughts' for Decades, NASA Warns

— Mar 4, 2015, CNN

NASA Releases Images of the Moon Passing in Front of the Earth From a Million Miles Away

— Aug 5, 2015, Newsweek

NASA Animation Shows World's Garbage

— Aug 24, 2015, The Weather Channel

NASA Warns Sea Levels Have Already Risen and 'It's Not Going To Stop'

— Aug 26, 2015, Forbes

NASA Satellite Spies Hurricane Joaquin Replacing an Eye

— Oct 2, 2015, Yahoo

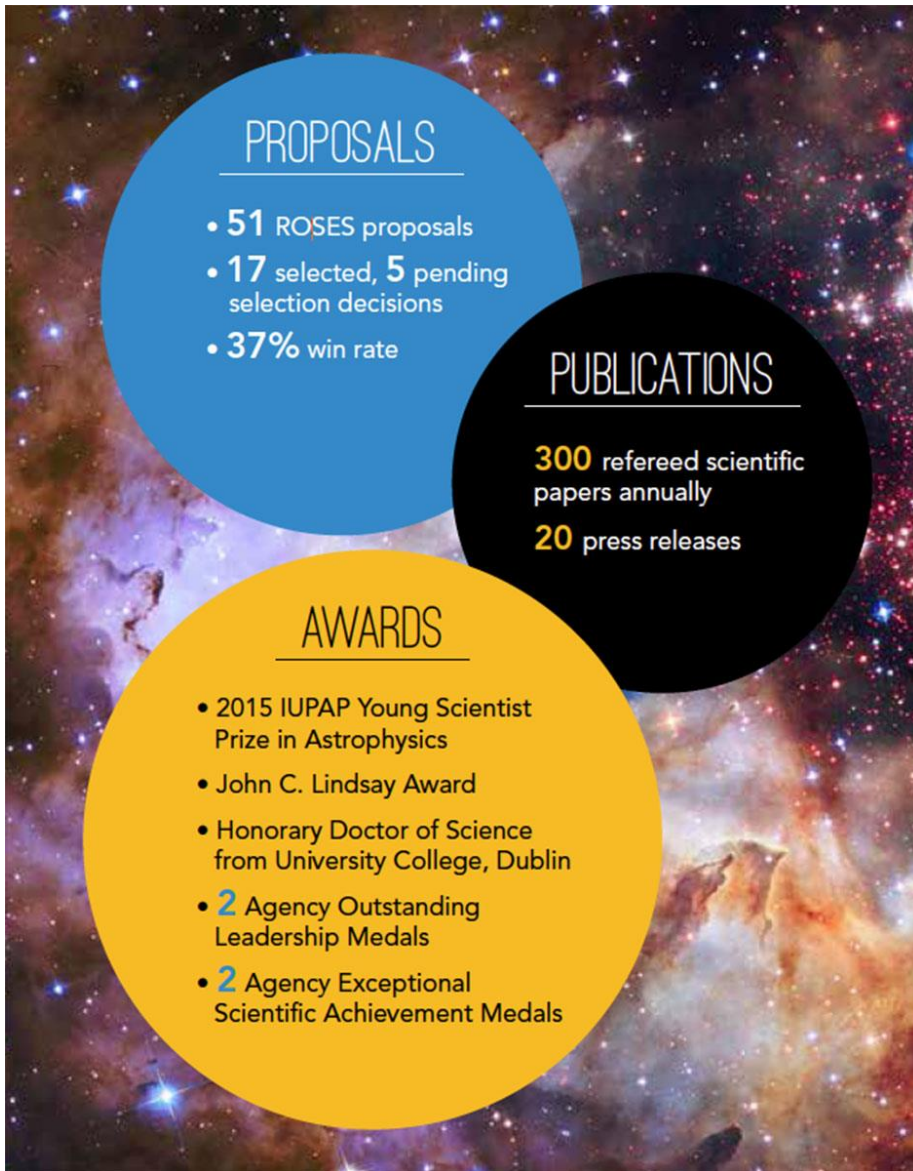
SEEING THE COSMOS IN A NEW LIGHT



- Hubble Space Telescope's return on investment has been priceless, with twenty-five years of extraordinary imagery and data helping us better understand the universe.
- Swift satellite has marked 10 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.
- Looking ahead, the next Decadal Survey strategic astrophysics mission—JWST—has met significant integration and test milestones over the past year. JWST Program remains on schedule and within budget.
- Designed as the first all-sky survey, the TESS mission was also cleared for the next development phase of its mission to search the sky for planets outside our solar system.
- The X-ray timing instrument NICER has made progress toward an October 2016 launch to ISS.
- Astro-H flight hardware is assembled and has completed testing with a launch date scheduled for late 2015.
- WFIRST Study and Science Definition Teams completed a mission concept report and engaged the community with a request for information.

ASTROPHYSICS

SEEING THE COSMOS IN A NEW LIGHT



MAKING HEADLINES

Forget Interstellar, Watch Milestones from NASA Swift's 10 Years in Space

— Nov 30, 2014, Newsweek

Gorgeous 'Pillars of Creation' Shine In New Hi-Def Hubble Photos

— Jan 6, 2015, The Huffington Post

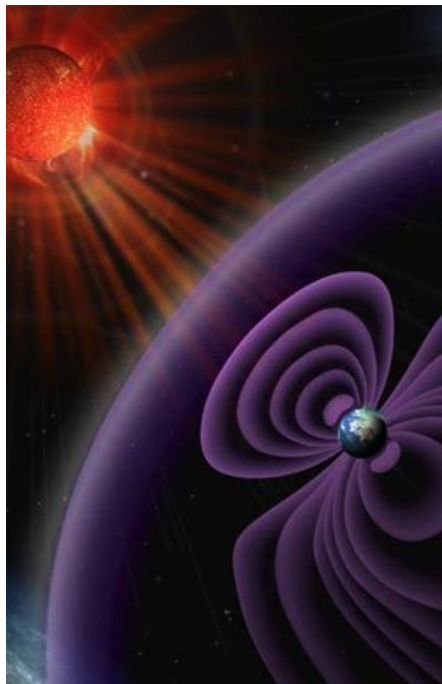
Hubble Telescope at 25—Hubble's Greatest Hits

— April 2015, National Geographic Magazine

The Best Fireworks in the Galaxy Are Coming to Earth

— Jul 4, 2015, Gizmodo

OBSERVING AND LIVING WITH OUR STAR



HELIOPHYSICS

In addition to the major accomplishments related to MMS and DSCOVR, 2015 marked a year of key milestones for Goddard Heliophysics.

- In December 2014, the Wind mission marked 20 years of characterizing the constant stream of particles from the sun.
- Nearing ten years of service, the Solar and Heliospheric Observatory (SOHO) discovered its 3,000th comet on Sept. 13, 2015, cementing its standing as the greatest comet finder of all time.
- In operation for five years, the Solar Dynamic Observatory (SDO) observed a sunspot 80,000 miles across—the largest active region seen in the current solar cycle, which began in 2008.
- In addition, NASA officially confirmed the Ionospheric Connection Explorer (ICON) mission, clearing it to move forward into the development phase. ICON will explore a swath of Earth's atmosphere where weather close to the ground impacts the dynamic space environment.
- The EXOCUBE CubeSat successfully launched, providing flight validation of the mini-Ion and Neutral Mass Spectrometer (mini-INMS) instrument.
- Finally, Goddard CubeSat instruments are slated to demonstrate NASA firsts in 2016 on a small satellite called Dellingr which is taking its developers just one year to design, build, and integrate.

OBSERVING AND LIVING WITH OUR STAR



MAKING HEADLINES

Solar Flair: NASA Mission Provides Mesmerizing Images of the Sun

— Feb 16, 2015, CNN

WATCH as a Massive Eruption of Incandescent Plasma Explodes Far Into Space from the Sun

— May 5, 2015, Discover Magazine

ACE Solar Observatory to Make 3,000th Comet Discovery

— Aug 17, 2015, Discovery.com

Solar Flares From 80,000-Mile Wide Sunspot Threaten Earth

— Oct 24, 2015, Tech Times

EXPLORING OTHER WORLDS



PLANETARY SCIENCE

In 2015, Planetary Science at Goddard continued its leadership related to MAVEN and OSIRIS-REx.

- MAVEN completed its first year in orbit, observing an unexpected high-altitude dust cloud and an aurora that reached deep into the atmosphere.
- OSIRIS-REx continues on schedule for a 2016 launch, with its three primary scientific instruments integrated onto the spacecraft.

Additional milestones include the following:

- Mapping of methane on the surface of Pluto by our infrared instrument on New Horizons.
- Earlier in the year, the DSCOVR mission launched with a Goddard magnetometer on board.
- In December 2014, our Sample Analysis at Mars (SAM) suite on the Curiosity Rover made the first detection of organic matter on the Red Planet.
- As we look toward the future, work continues on the mass spectrometer for the MOMA instrument on the ExoMars mission and on magnetometers for Solar Probe Plus.
- In addition, our team was chosen this year to develop the thermal infrared sensor for Landsat 9 as well as a high-resolution infrared spectrometer for the Lunar Ice Cube, a mission selected under NASA's Next Space Technologies for Exploration Partnerships.

EXPLORING OTHER WORLDS



FAST FACT

MAVEN arrived at Mars shortly before the flyby of comet Siding Spring... the closest recorded approach of any comet to a planet in the solar system.

DID YOU KNOW?

Goddard leads NASA's Space Geodesy Network, which provides state-of-the-art positioning measurements needed for nearly all space-based Earth observations and interplanetary navigation.

LEADERSHIP

Our scientists hold leadership roles in the:

- Goddard Center for Astrobiology*
- DREAM2 Center for Space Environments**
- NExSS (Nexus for Exoplanet Systems Science)
- Remote *In Situ* and Synchrotron Studies for Science and Exploration**
- Solar System Exploration Data Services Office
- In addition, we published 180 papers and won 30 research grants in 2015

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

MAKING HEADLINES

Mars May Have Had an Ocean Comparable to Earth's Atlantic

— Mar 6, 2015, CNN

Mystery Dust Cloud and Aurora Spotted on Mars

— Mar 18, 2015, Nature

NASA's Curiosity Rover Finds Fresh Signs of Ingredients for Life on Mars

— Mar 23, 2015, Los Angeles Times

OSIRIS-REx Asteroid Sampler Enters Final Assembly

— Apr 1, 2015, Universe Today

Why This Tuesday is Going to be Exactly One Second Longer

— June 29, 2015, People

The Many Ices of Pluto's Surface, in Living Color

— July 15, 2015, Wired

This Shoebox-sized Probe Will Hunt for Ice on the Moon

— Aug 4, 2015, Popular Mechanics

How NASA's Lunar Reconnaissance Orbiter Deals With a Supermoon Eclipse

— Sept 23, 2015, BBC Newsbeat

BRINGING KNOWLEDGE BACK TO EARTH

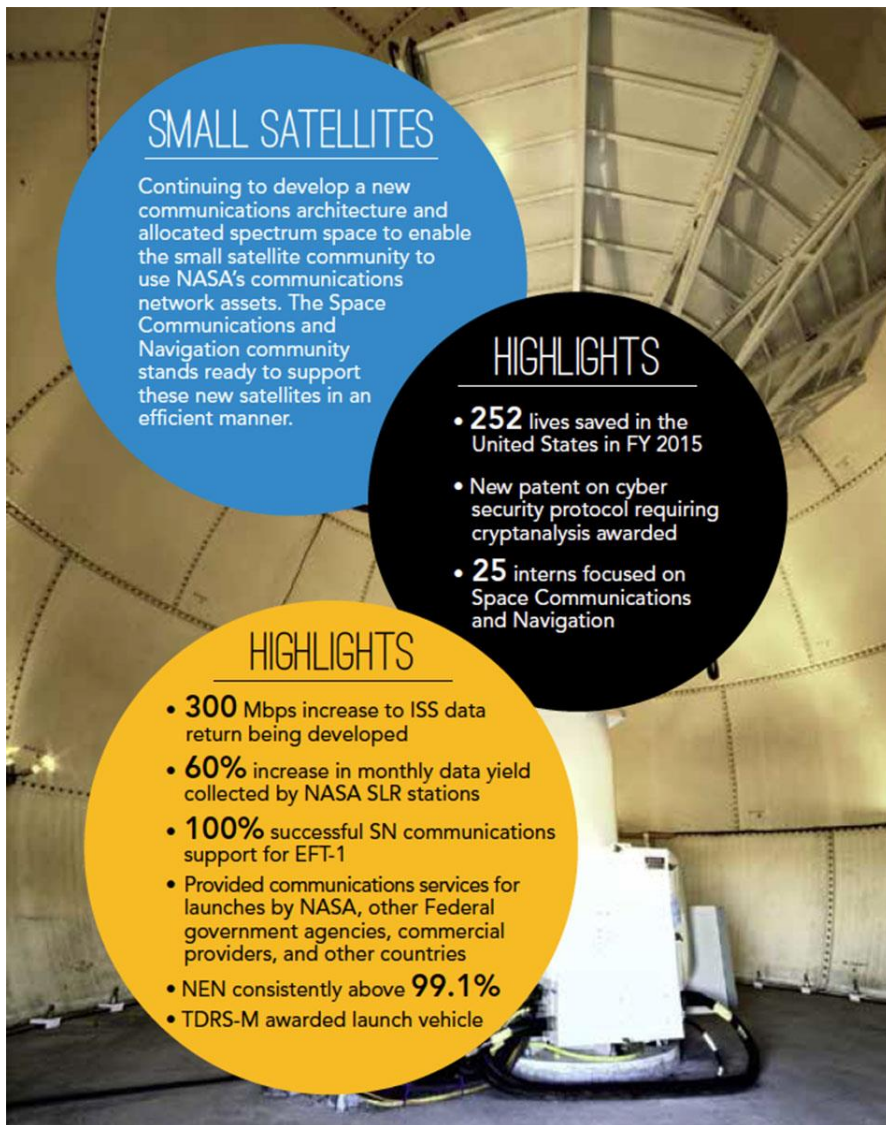


SPACE COMMUNICATIONS & NAVIGATION

NASA's Communications Networks provide reliable and secure voice, video, and data services to support development, launch, and spacecraft operations. Critical applications include: telemetry, commands, acquisition, tracking, and raw science data.

- Goddard continued its reliability and strong performance, coordinating the critical communications support coverage through SN and TDRS of the test flight of the Orion spacecraft and its Delta IV rocket in December.
- This year, the SN debuted a new ground terminal in Blossom Point, MD, increasing its capability. The SN also performed at 99.97% proficiency, and NEN operated above 99.1% proficiency.
- The NEN and SN worked together to implement the McMurdo TDRSS Relay System in time for the SMAP launch, allowing for low latency data transfer.
- New strides in new service capabilities included an optical communications laboratory, network upgrades for the future of human spaceflight, and major studies to map the future of space relay satellites.
- The innovative Navigator led navigation with GEONS flight software, demonstrating GPS at a record 43,500 miles above Earth, and performing as the fastest (over 22,000 mph) operational GPS receiver in space.
- We also continued leadership in Search and Rescue operations, and led crash tests at NASA Langley which strengthened our position as the technical lead in the international arena.

BRINGING KNOWLEDGE BACK TO EARTH



SMALL SATELLITES

Continuing to develop a new communications architecture and allocated spectrum space to enable the small satellite community to use NASA's communications network assets. The Space Communications and Navigation community stands ready to support these new satellites in an efficient manner.

HIGHLIGHTS

- **252** lives saved in the United States in FY 2015
- New patent on cyber security protocol requiring cryptanalysis awarded
- **25** interns focused on Space Communications and Navigation

HIGHLIGHTS

- **300** Mbps increase to ISS data return being developed
- **60%** increase in monthly data yield collected by NASA SLR stations
- **100%** successful SN communications support for EFT-1
- Provided communications services for launches by NASA, other Federal government agencies, commercial providers, and other countries
- NEN consistently above **99.1%**
- TDRS-M awarded launch vehicle

MAKING HEADLINES

Goddard Monitors Orion EFT-1 Test Flight

— Dec 12, 2014, NASA.gov

NASA Technology is Behind Air, Sea and Land Rescues

— July 16, 2015, NASA.gov

Why NASA Crash Testing Small Planes Could Someday Save Lives

— July 30, 2015, cbsnews.com

NASA Awards Launch Services for Next Tracking, Data Relay Satellite

— Oct 30, 2015, NASA.gov

FEATURE

Marking 50 Years of Satellite Laser Ranging

— On Nov. 13, 1964, NASA announced the first successful tracking of a satellite using brand new laser technology, a technique now standard for precisely determining satellite orbits. The "Goddard Laser" or GODLAS was fired at Explorer 22, a small satellite measuring charged particles in the ionosphere. By 1970, 5 stations in the United States and France were equipped for laser ranging. Now, more than 40 stations are located on every continent except Antarctica.

ENABLING SCIENCE AND EXPLORATION

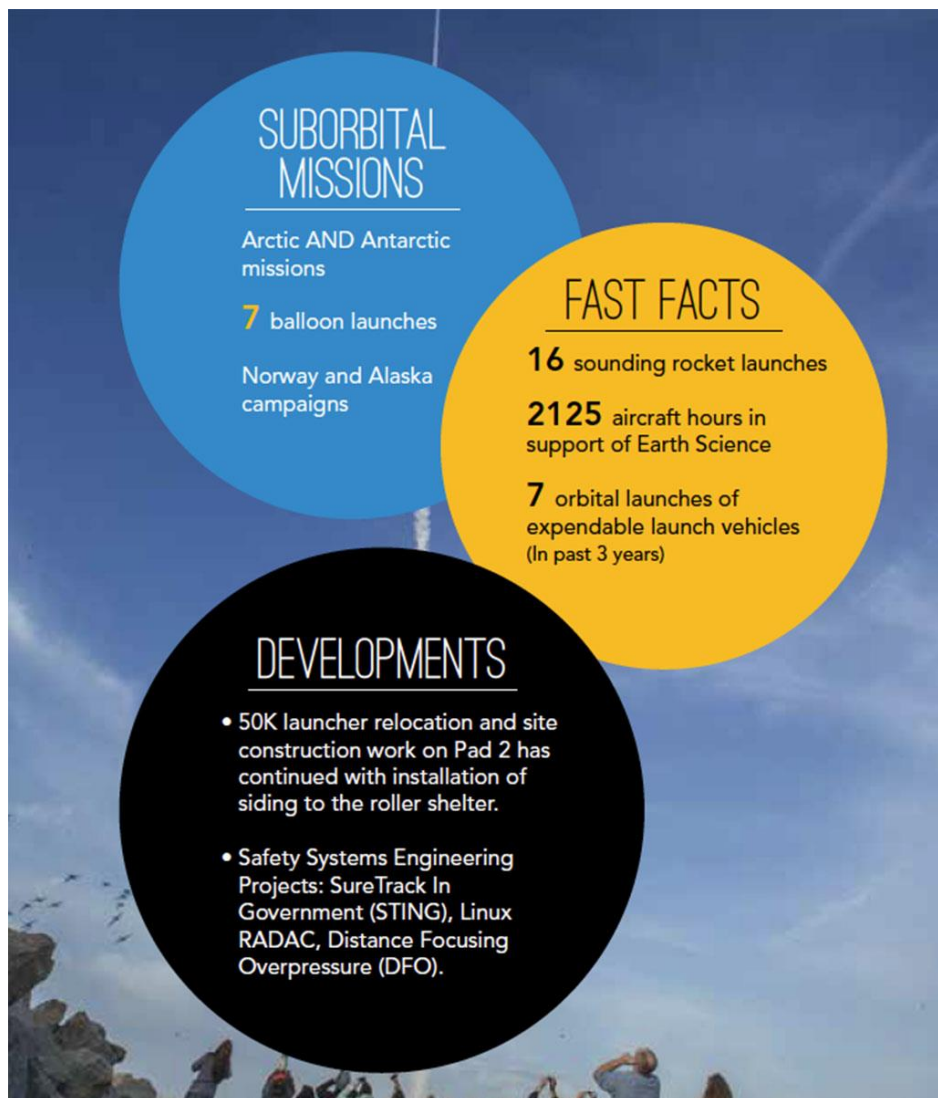


SUBORBITAL PLATFORMS & RANGE SERVICES

FY 2015 featured support across the full spectrum of NASA's missions. LDSD-2 support included a balloon launch, systems testing and range/safety for all mission events.

- In addition to 10 annual missions, the Balloon Program achieved a super pressure balloon launch and month-long flight from New Zealand.
- More than 20 sounding rocket missions flew from sites world-wide.
- The Hurricane and Severe Storm Sentinel completed its third year of Earth Venture flights.
- Sensing Hazards with Operational Unmanned Technology (SHOUT) is a NASA/NOAA effort with NASA Ames using a GSFC instrument and WFF runway/range services to study Atlantic basin weather.
- As part of the Mid-Atlantic Aviation Partnership, WFF is enabling UAS capabilities by hosting a Virginia-owned UAS runway on Wallops Island.
- ISS-CREAM systems integration was supported in advance of expected launch in FY 2016.
- The Wallops Incident Response Team and Safety Office provided assessment and support to the Mid-Atlantic Regional Spaceport as pad repairs were completed and tested for return to flight by spring 2016.
- Aircraft activities included Operation IceBridge as well as continuation of CARVE.
- The National Geospatial Intelligence Agency tested laser systems and equipment on WFF research range.

ENABLING SCIENCE AND EXPLORATION



MAKING HEADLINES

Alaska Shows No Signs of Rising Arctic Methane

The new result shows that the changes in this part of the Arctic have not yet had enough impact to affect the global methane budget.

— Nov 17, 2014, *Phys.org*

Sounding Rocket Hopes to Learn What Makes Up a Supernova Remnant

"OGRESS" will study the X-rays streaming from a supernova remnant called Cygnus Loop and assess what the debris from the 20,000-year-old explosion is made of.

— May 2, 2015, *NASA.gov*

NASA's LDSD Project Completes Second Experimental Test Flight

A high-altitude balloon carrying the LDSD test vehicle launched from the U.S. Navy's Pacific Missile Range Facility (PMRF) on Kauai. As planned, the vehicle separated from the balloon at about 120,000 feet above the ocean. An onboard rocket motor then took the vehicle to 180,000 feet, where the first braking technology, the Supersonic Inflatable Aerodynamic Decelerator (SIAD), deployed at about Mach 3.

— June 9, 2015, *NASA.gov*

NASA's Wallops Flight Facility to Hold Open House For Public

NASA's Wallops Flight Facility is holding an open house for the public to celebrate its 70th anniversary. The event will be held on Saturday. Wallops launched its first rocket on June 27, 1945.

— June 22, 2015, *The Washington Times*

A young boy with dark hair and glasses is looking through a large telescope. The telescope is mounted on a tripod and has a camera attached to it. The background is a bright blue sky with white clouds and a large, bright sun that creates a lens flare effect. The boy is wearing a light green shirt.

THIS IS WHY IT MATTERS

*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 passion toward a common and worthy purpose, have made possible countless improvements to our 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. All of this is accomplished 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 missions of today as well as 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.

Throughout 2015, Goddard provided a safe and reliable workplace for its community, and enhanced the quality of work-life for all employees through new badging kiosks, upgrades to the Goddard Child Development Center, and upgrades to the Visitor Centers and Educator Resource Centers of Greenbelt and Wallops.

1

With over 3,167 active procurement instruments, Goddard has one of the agency's most diverse acquisition portfolios and leads the agency in number of procurement transactions. In FY 2015, Goddard completed 7,454 procurement actions. To ensure that the center meets its customer needs and agency commitments, Goddard also completed 15 major contract awards. In addition, Goddard exceeded its FY 2015 small business obligations at 26.5% against a goal of 22.1%.

2

Planned and executed more than \$129.5M of construction, including a new Goddard integration and testing complex, a new program and project management facility, a new mission command center, and utility system upgrades for enhanced center facility readiness and reliability.

3

Provided program security support for the opening of the Tracking and Data Relay Satellite System (TDRSS) Blossom Point Facility located in Southern Maryland, and conducted necessary background investigations for 180 people needing access to the OSIRIS-REx mission technology.

4

Consistent with the center's focus on Earth science, Goddard's Site Sustainability Plan has helped reduce Goddard's energy consumption intensity by 26% from 2003 to 2015. Goddard also leads the agency on coastal resilience initiatives including the Wallops shoreline restoration program and the Mid-Atlantic Coastal Resilience Institute (MACRI).

5

Critical electrical, electronic, and electromechanical parts acquisitions (\$20M) and custom shipping operations were provided for missions including Webb, GPM, ICESat-2, MMS, OSIRIS-REx, and Operation IceBridge.

6

Provided comprehensive institutional support for International Space Station resupply missions from the Wallops Flight Facility.



ADVANCING NASA'S WORK THROUGH IT



Goddard works diligently to provide its workforce with the Information Technology and Communications needed to achieve the center's science and technology mission in support of NASA's goals.

FY 2015 featured many related accomplishments that provided positive impact to the Goddard community, contributed to an effective workplace, and enabled mission success.

Next Generation Voice project replaced Goddard's aging telephone system with a modern, IP-based system that provides greater scalability, mobility, and cost savings. It allows employees to make and receive calls from their desk phone numbers even when working off-site.

The Wireless Upgrade Project expanded wireless service to more buildings across Goddard's Greenbelt campus, providing faster network speeds and more consistent access to employees.

The Mission Launch Command Center (MLCC) project limited costly damage to Wallops Flight Facility's IT infrastructure from the Antares launch failure by burying exposed cables and improving the cable plant infrastructure to support range and launch facilities on the south end of Wallops Island.

Goddard's Solutions for Enterprise-Wide Procurement (SEWP) Program released SEWP 5, a government-wide acquisition vehicle for IT products and solutions with a total value of \$20 billion over five years. SEWP's effective management resulted in the lowest fees of any government-wide acquisition contract.

Goddard made progress on the Federal Data Center Consolidation Initiative by consolidating two data centers at Greenbelt, reducing power consumption and improving disaster recovery and security. Goddard also made progress against OMB's requirement to use PIV smartcards for authentication by enabling employees to use their smartcards to log into their Windows 7 machines, resulting in both a more secure environment and an enhanced user experience with fewer passwords to remember.

ONGOING PROJECTS:

- **Mission Network:** Goddard is leading the deployment of the next generation of NASA mission networks through two Agency projects: the Mission Next Generation Architecture (MNGA) and the Mission Backbone Transition (MBT). These projects will provide improved and expanded capabilities to support spaceflight and other mission customers, while improving security, accelerating service delivery and reducing recurring backbone circuit costs by an anticipated \$2M annually.
- **Web Services:** Goddard is working with center web site owners to move to IPv6, the next version of the internet protocol. This project will make web browsing faster and more secure.
- **Cybersecurity:** Goddard continues to focus on security, providing continuous diagnostics and mitigation to address incidents and vulnerabilities and work proactively with customers to improve the center's security posture.



SHARING GODDARD WITH THE WORLD

2015 PUBLIC COMMUNICATIONS HIGHLIGHTS

	FANS/FOLLOWERS/SUBSCRIBERS					TOTAL VIEWS	
Date	Facebook	Instagram	Twitter	Twitter (photo)	YouTube	YouTube	Flickr
12/31/2014	611,606	709,342	207,838	144,315	223,938	70,515,363	140,282,123
12/30/2015	926,098	1,295,961	294,214	253,802	326,807	105,977,693	182,444,180
Growth	51.4%	82.7%	41.6%	75.9%	45.9%	50.3%	30.1%

Top 10 Articles		Views
1	Hubble's High-Definition Panoramic View of the Andromeda Galaxy	851,092
2	From a Million Miles Away, NASA Camera Shows Moon Crossing Face of Earth	644,043
3	NASA Study: Mass Gains of Antarctic Ice Sheet Greater than Losses	452,136
4	Goddard's Homepage	426,412
5	Views of Pluto Through the Years	398,215

Top 10 Articles		Views
6	NASA Scientist Sheds Light on Rare Sept. 27 Supermoon Eclipse	328,698
7	Hubble Goes High-Definition to Revisit Iconic "Pillars of Creation"	309,173
8	NASA Mission Reveals Speed of Solar Wind Stripping Martian Atmosphere	292,177
9	NASA Releases New High-Resolution Earthrise Image	239,865
10	Hurricane Patricia	214,716

Top 13 Videos of 2015		Plays
1	SDO: Year 5	4,616,984
2	Thermonuclear Art - The Sun In Ultra-HD (4K)	4,286,637
3	Supermoon Lunar Eclipse	3,951,531
4	Massive Black Hole Shreds Passing Star	3,393,443
5	A View From The Other Side	2,297,461
6	Jupiter in 4k Ultra HD	2,040,268
7	5 Year Time-lapse of the Sun	760,039

Top 13 Videos of 2015		Plays
8	Measuring Mars' Ancient Ocean	712,780
9	Solar Wind Strips Martian Atmosphere	660,496
10	Satellite Tracks Saharan Dust to Amazon in 3-D	581,341
11	2014 Continues Long-Term Global Warming	576,038
12	Arching Eruption	420,015
13	Earth and Moon Photobomb SDO	299,929



SHARING GODDARD WITH THE WORLD

2015 PUBLIC COMMUNICATIONS HIGHLIGHTS

- Total attendance for FY 2015 at the Visitor Center was 56,600, which includes 20,000 attendees of Explore@NASAGoddard.
- 16,686 people attended tailored meetings, events, and programs at the Visitor Center in FY 2015.
- For FY 2015, 368 tour groups were conducted for a total of 9,806 attendees.
- The Visitor Center debuted two major exhibits in 2015: 1) The "Solarium" art installation derived from SDO imagery was also installed at other locations nationwide and highlighted by ArchitecturalDigest.com, National Geographic, and Space.com; 2) A ribbon-cutting ceremony unveiled the James Webb Space Telescope exhibit. As Webb's assembly continues and its 2018 launch date approaches, space enthusiasts can learn about the premier observatory through this dynamic, interactive exhibit.

12 Live Shot Campaigns

- Comet Siding Spring
- Sunspot
- 2014 Warmest Year on Record
- Soil Moisture Active Passive (SMAP) Pre-launch Campaign
- Magnetospheric Multiscale (MMS) Mission Pre-launch Campaign
- New Global Precipitation Map - GPM IMERG

- Hubble Space Telescope Celebrates 25 Years
- NASA's "Flying Saucer" Ready for Test Flight (LS for HQ)
- Historic New Horizons Pluto Flyby
- A Tale of Two Extremes: Droughts and Floods
- Sea Level Rise
- Rare Supermoon Eclipse

338 Interviews

- 302 Satellite Interviews
- 17 In-person Interviews
- 6 Print Interviews
- 13 Radio Interviews

- VIP Center Facility Tours were held 105 times throughout the year serving 1,544 participants.
- The 16th Annual Goddard Fall Reception and Lecture was held at the Smithsonian National Air and Space Museum (NASM) on September 30, 2015, presented by the Maryland Space Business Roundtable (MSBR) and Goddard.
- Maryland Day 2015 was organized by the University of Maryland, College Park, to engage the public with the school and local community. Goddard engaged attendees with NASA science and technology.
- Celebration of the 45th Earth Day involved employees agency-wide. Goddard contributed with hyperwall presentations, demonstrations, and hands-on activities during events on the National Mall and Union Station in Washington, DC.



INSPIRING THE FUTURE

We are driven by NASA's education vision: *"To advance high quality Science, Technology, Engineering, and Mathematics (STEM) education using NASA's unique capabilities."* As a result, Goddard education is grounded in the work of NASA's missions, projects, engineering, and IT services to provide exceptional opportunities for learners, educators, and institutions across an 11-state service region and nationwide through four lines of business. The following represent a few notable highlights from 2015.

NASA Internships, Fellowships, and Scholarships

invest in NASA's workforce of tomorrow through competitive awards and financial assistance that enable real-world learning opportunities for students pursuing STEM careers today.

- In 2015, 450 high-school through doctoral-level interns and fellows worked alongside Goddard scientists, engineers and technologists at Greenbelt, GISS, IV&V, WSC, and Wallops. Approximately 36% of interns were from underrepresented populations.
- A year-long Climate Change Research Initiative pilot program launched at GISS, involving teams of GISS scientists; high school educators; and graduate, undergraduate, and high-school students.

Educator Professional Development

programs train educators to nurture NASA's STEM students through in-person institutes, partner-delivered workshops, online-and distance-learning, as well as local, state, and regional community programs.

- Goddard partnered with Maryland, Pennsylvania, West Virginia and Virginia education agencies to increase in-service, pre-service, and informal educators' ability to deliver NASA STEM content and inspire completion of STEM degrees.
- Four week-long solar system exploration education workshops brought 148 middle school educators from the U.S. and India to Goddard. A fifth workshop engaged 31 librarians from DC and Prince George's County, MD.

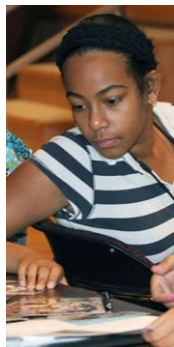
- GISS, the Intrepid Sea, Air & Space Museum and Queens College, City University of New York supported three days of GLOBE training, expert talks, and activities for teachers in New York City.
- Twenty high school educators from Maryland, Virginia, New York, New Jersey, Georgia, Pennsylvania and Delaware successfully completed the Wallops Rocket Academy for Teachers & Students.

Institutional Engagement builds the academic and research capacity of partner institutions to increase the participation of minorities and underrepresented communities in NASA-related STEM.

- Goddard's Maryland Historically Black Colleges and Universities (HBCU) Pre-Service Education

Network is a collaboration with Bowie State University, Coppin State University, Morgan State University and the University of Maryland Eastern Shore. The network developed STEM content modules, trained 32 pre-service teachers, and delivered content to 175 middle and high school students at community-based summer camps.

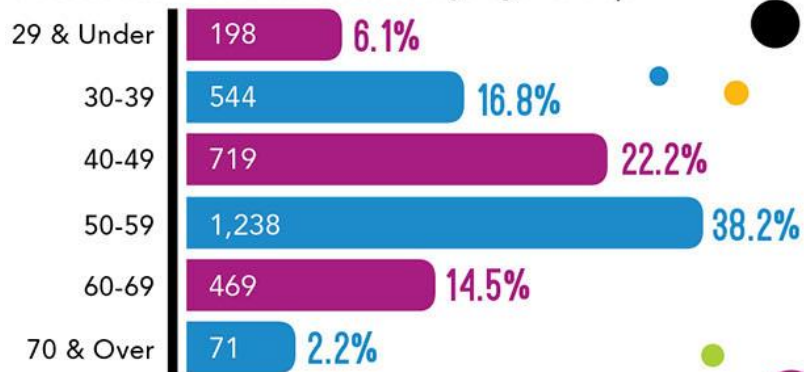
- Thirty-nine high school students, counselors, and faculty from the Morehouse College and Clark



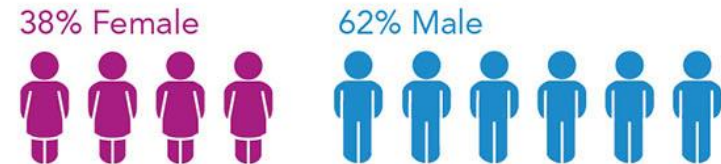


CURRENT STATE OF THE WORKFORCE

GODDARD CIVIL SERVANTS by Age Group



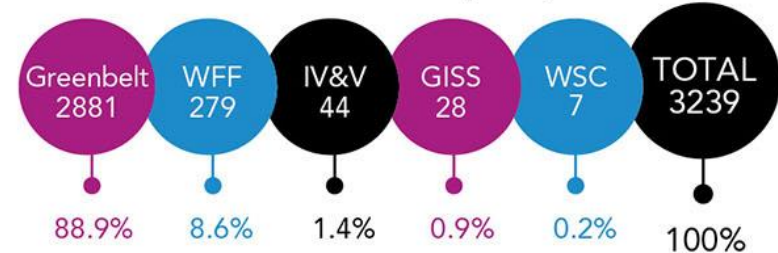
GODDARD CIVIL SERVANTS by Gender



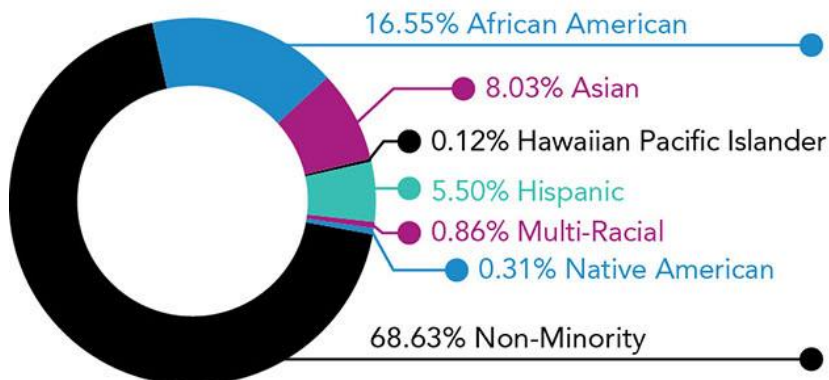
GODDARD CIVIL SERVANTS by Disability



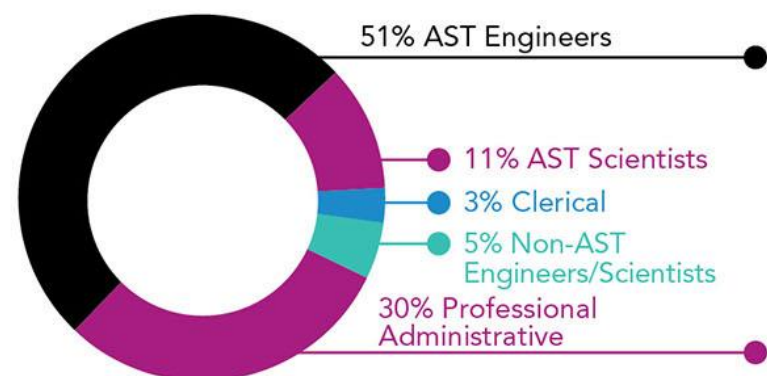
GODDARD CIVIL SERVANTS by Duty Location



GODDARD CIVIL SERVANTS by Ethnicity



GODDARD CIVIL SERVANTS by Skill Mix



BEST PLACES TO WORK IN THE FEDERAL GOVERNMENT 2015



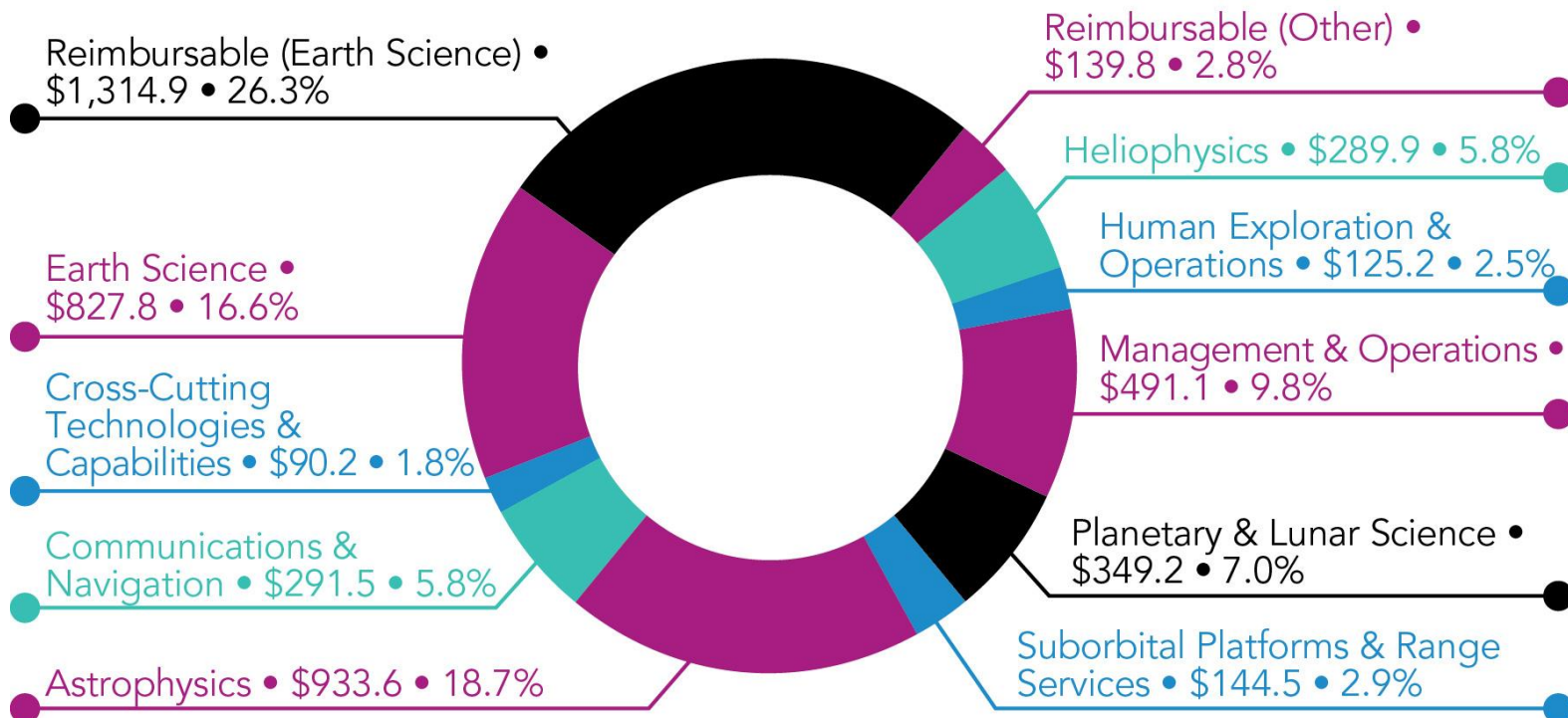
Scores By Category	2015 Rank	2015	2010	2005
Overall	11 of 320	78.6	79.5	73.9
Teamwork	11 of 319	80.6	77.4	79.6
Innovation	4 of 318	79.9	78.8	N/A
Effective Leadership	6 of 318	72.4	70	64.6
Support for Diversity	4 of 319	76.4	77.2	76.5
Training and Development	13 of 319	76.5	75.5	72.5
Employee Skills-Mission Match	8 of 319	84.8	84.7	80.5
Work-Life Balance	29 of 319	71.2	67.7	67.8
Performance-Based Rewards & Advancement	6 of 318	65.4	64.2	60.9

<http://bestplacetowork.org>, <http://ohcm.gsfc.nasa.gov/>



GSFC Program Year 2015 BUDGET Categorized by Lines of Business (as of 9/30/15)

Chart is in \$Ms

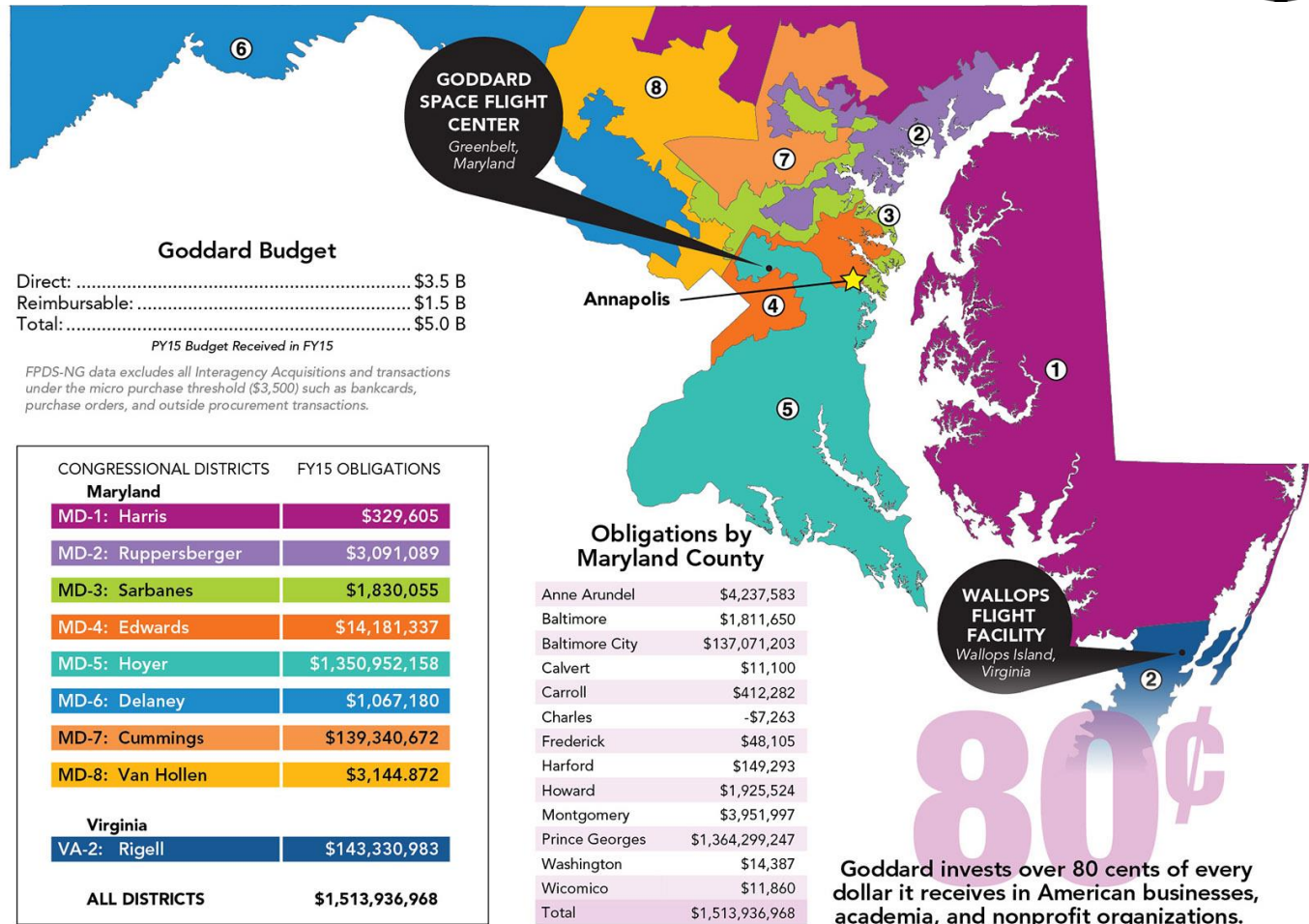


ECONOMIC IMPACT



Goddard's success in enabling NASA missions and applying these scientific achievements to society is evident. Each of Goddard's five 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's Top Contractors

1. LOCKHEED MARTIN CORPORATION	\$463.7 M	9. BALL AEROSPACE AND TECHNOLOGIES CORPORATION	\$116.6 M
2. NORTHROP GRUMMAN SPACE AND MISSION SYSTEMS CORPORATION	\$402.4 M	10. GENERAL DYNAMICS C4 SYSTEMS, INC.	\$116.3 M
3. RAYTHEON COMPANY	\$328.8 M	11. HONEYWELL TECHNOLOGY SOLUTIONS INC.	\$87.1 M
4. EXELIS INC.	\$307.0 M	12. INUTEQ, LLC	\$67.5 M
5. SGT, INC.	\$235.8 M	13. THE REGENTS OF THE UNIVERSITY OF CALIFORNIA	\$62.0 M
6. ORBITAL SCIENCES CORPORATION	\$165.2 M	14. LJT & ASSOCIATES, INC.	\$60.3 M
7. AS AND D, INC.	\$149.6 M	15. SCIENCE SYSTEMS AND APPLICATIONS INCORPORATED	\$55.9 M
8. ASSOC UNIV RESEARCH ASTRONOMY	\$137.0 M		

All numbers are based on NPDV and FPDS obligation data for FY14 as of 3/26/15. Not based total contract value.

ENVIRONMENTAL IMPACT



Goddard is now implementing the 2015 Sustainability Plans strategies at all levels of management and operations, through five objectives:

Green Goddard: With its unique understanding as a global leader in Earth Science, Goddard is committed to identifying and implementing strategies that ensure continued human progress, productivity, and prosperity while sustaining natural species and systems.

The 2014 Sustainability Report evaluated the relationships among Goddard's activities and natural systems, resources, and local communities. The center then produced a 2015 Sustainability Plan in response to White House Executive Order 13693: *Planning for Federal Sustainability in the Next Decade*.

- Mid-Atlantic Coastal Resiliency Institute (MACRI) - Launched in June 2014, the MACRI is a Goddard-led, multi-state, multi-disciplinary research collaboration among 12 world-class organizations that aims to integrate science and its applications to support resiliency for human and natural coastal communities.
- Goddard's Living Laboratory for Coastal Resilience - In NASA's largest shoreline protection program, sand is being added to Wallops beach to ensure ongoing protection of the agency's only launch range. Active climate adaptation science investigation (CASI) teams are providing science-based analysis and tools.

1

Reduce energy consumption, associated air emissions, and other environmental impacts.

- **26%** reduction in Goddard's energy consumption intensity from 2003 to 2015.
- **26%** of square footage of Goddard's buildings is rated LEED Silver or better.

2

Manage water impacts including consumption, pollution, and climate change impacts.

- **25** tons of acid rain emissions producing sulfur oxides prevented each year by replacing fuel oil heat system at Wallops with clean-burning propane-based system.

3

Reduce waste through lifecycle materials management from source reduction and green purchasing to reuse and recycling.

- **23%** of Goddard's energy obtained from renewable sources.
- **20,000** tons of carbon dioxide emissions prevented each year by using landfill gas in place of natural gas at Greenbelt.

4

Promote transportation alternatives to reduce environmental impacts and promote universal access to the center.

- Goddard is promoting a bike share program for employee use onsite and has made significant progress in transitioning fleet vehicles and other institutional support vehicles to hybrid or electric power.

5

Support local ecosystems by caring for the lands that support NASA operations.

- *Continued Preservation of Maritime Dune Woodland:* Planning of the North Wallops Island UAS runway prevented unnecessary impacts to the ecosystem of the rare habitat designated the North Wallops Island Conservation Site.
- *A Concerted Effort to Protect Wetlands:* Storm water management, drainage planning for construction, erosion mitigation practices and pollution prevention are in place to protect the habitat surrounding Wallops.
- *Shoreline Protection and Beach Nourishment:* Recovery activities undertaken in 2012 and immediately following Hurricane Sandy restored large areas of Wallops Island beach, creating over 150 acres of new beach habitat.





WALLOPS FLIGHT FACILITY

EXTENDING NASA'S REACH FOR SCIENCE AND TECHNOLOGY

CELEBRATING

70

YEARS
OF
INNOVATION

JUNE
1945

First test rocket launched from Wallops to test its range assets.

JULY
1945

Tiamat is first research rocket launched. The program lasted until 1948 with nine more launches.

1948

OCT
1954

Launched the first U.S. four-stage rocket, the Nike-T40-T55 hypersonic heat-transfer vehicle.

OCT
1958

NASA begins operations. National Advisory Committee for Aeronautics' Pilotless Aircraft Research Station becomes separate facility called Wallops Station, operating under NASA HQ.

1959

1961

Project Mercury capsules were tested at Wallops in support of NASA's manned spaceflight program before astronauts were launched.

MAR
1961

Goddard Space Flight Center dedication.

FEB
1961

Explorer IX launches from Wallops, first payload launch into orbit.

MAR
1970

During a total solar eclipse, a total of 32 sounding rockets were launched during a three-day period.

1974

Wallops Station renamed Wallops Flight Center, expanded its horizons to include Earth studies of ocean processes and used its research airport for runway surface and aircraft noise reduction studies.

1945

1955

1965

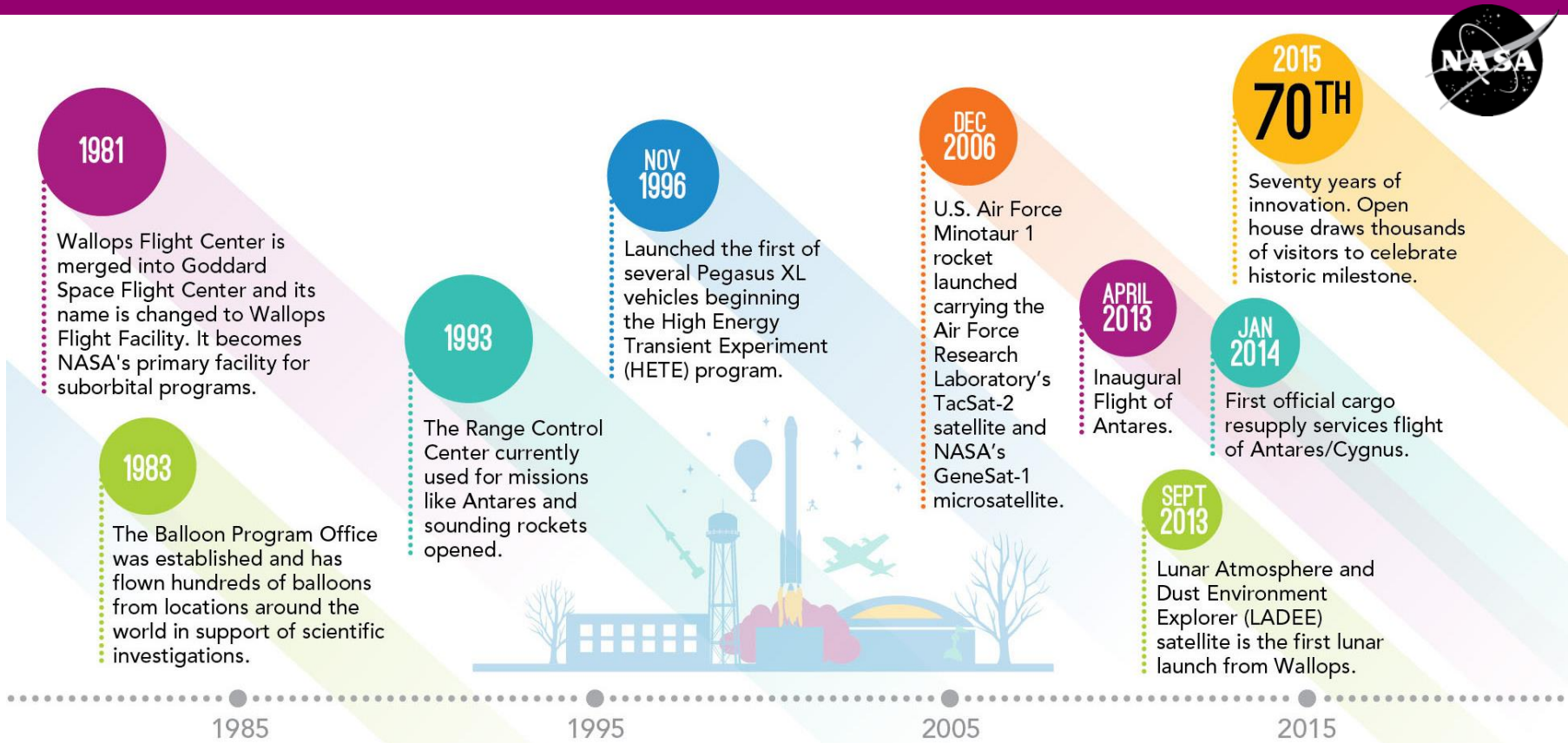
1975

OUR LOYALTY

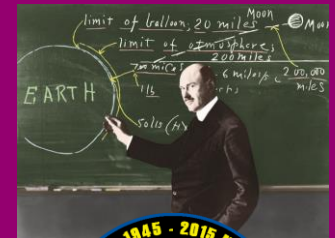
Goddard's strength is anchored in our proven capabilities, one-of-a-kind facilities, and our dedicated workforce. Goddard employs more than three thousand civil servants, over six thousand onsite contractors, and thousands of others (including off-site contractors, interns, and Emeritus) working in various technical and professional administrative positions. Goddard has a diverse and inclusive workforce that inspires creativity, collaboration, and innovation. At our core, we embrace inclusion that opens a broader view and seeks diversity of thought and perspective. We honor individuality, equality, and human dignity. We are committed to creating an environment that empowers us to be ourselves, contribute through our own experiences, thrive, and do our best work.

NASA's core values (safety, teamwork, integrity, and excellence) and key priorities are inherent in and embodied by the people who are leading the effort to achieve its mission. At Goddard, we recognize that our workforce is our greatest asset. Together, all facets of the diverse Goddard community are dedicated to the pursuit of the following objectives for the benefit of the agency and the public:

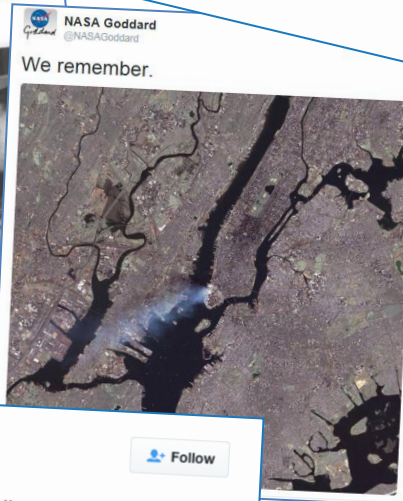
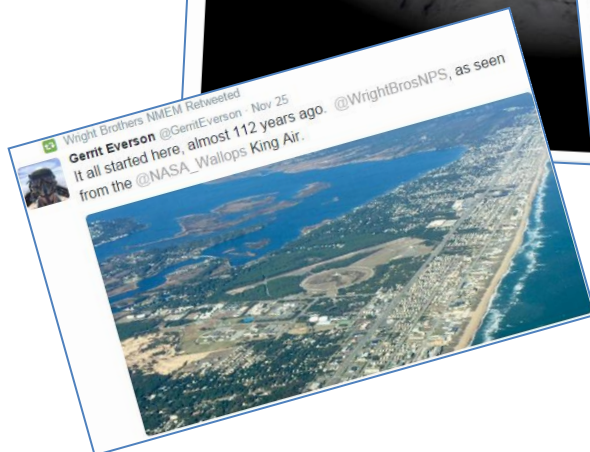
- Conduct NASA's missions while fully minimizing risk to life, property, communities, and the environment. Safety and environmental stewardship are vital to NASA's continued success.
- Meet our commitments to the agency and its customers by delivering high-quality products on time and on schedule. It is our highest priority to uphold the agency's reputation of scientific distinction and reliability.



- Foster effective collaboration among individuals, teams, and management within the center, across NASA, and externally. Goddard's accomplishments result from these successful relationships as well as numerous strategic partnerships.
- Protect, support, and encourage employees by engaging, enabling, and empowering them in all of their efforts to safeguard the public trust. We maintain a world-class workforce dedicated to the execution of NASA's mission by:
 - Demonstrating confidence, fairness, honesty, and balance.
 - Providing opportunities for development and mobility.
 - Promoting diversity and inclusion.
- Ensure the success of our missions by supporting and sustaining employee dedication, agility, creativity, and commitment to excellence at all levels in the organization.
- Promote transparency and accountability by actively sharing our results and activities with customers, stakeholders, and the public, as well as engaging communities who are the ultimate beneficiaries of our work.
- Support NASA's other overarching approaches to finding new ways of doing business and investing in new technology.



ACROSS THE UNIVERSE



A special welcome to the family of Dr. Noel Hinners, former Goddard center director. We're naming our Building 8 auditorium after him



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

Your dedication and talent will never be forgotten.

*Current civil servants who passed during 2015 include:

ANGELITA KELLY
PETER MEDLEY

‡Contractors, former civil servants, and others whose passing occurred or was reported during Sep 2014 – Dec 2015 include:

MARY ADKINS
AUGUSTIN (GUS) ALICEA
EARL ANGULO
VINCENT ARILLO
JOHN ARMIGER, JR
DAVID ATLAS
FAYE AUKERMAN
ALFRED BABECKI
JOSEPH BADEN
ZEB BARFIELD, SR
ROBERT BARNES
EVELYN BAUMANN
MOLLIE BERNATOWICZ
RONDA BISHOP
LOUISE BOZMAN
WILL BULLOCK
EMMETT BUNDICK
VALORIE BURR
MELVIN (MEL) CLARK
OLIVER CLARK

WILLIAM COLEMAN
THOMAS COLLINSON
BLANCHE CONNER
DONALD CONRAD
WARREN CROCKETT
MARSHALL CURTIS
RICKY DAUGHERTY
SEAN DAVIS
ANNE DAVIS
EDWARD DEVINE
ROBERT EAVES
EDWARD EISELE, JR
HOWARD ESTEP
DOUGLAS ESTES, JR
CHARLES FALKENHAN
ROBERT FARQUHAR
EDWARD FERN
THEODORE FERRARO
ORVILLE FLEMING, JR
DWIGHT FORTNA
HERBERT FULLER
INDALECIO GALICINAO
MICHELE (MICKEY)
GARRETT
DONALD GIMPEL
HAROLD GOLDBERG
BETTY GROTON
KENNETH HALLAM
ROBERT HALLI, SR
RUDOLF HANEL
CAROLYN HANNA
BETTY JANE HAYDEN

RICHARD HICKS
OTTO HILDEBRAND
NOEL HINNERS
RUSSELL HOFFMAN
BARBARA HOLLAND
RICHARD HOLT
GEORGE HOPE
JACK HOWARD
DAN HUDSON
JANIE JOHNSON
WILLIAM JOHNSON
ALBERT KAMOSA
SAMUEL KELLER
LINDA LETELLIER
CHARLES LIPSETT
JOE LOPEZ
JAMES LYNCH
GEORGE MARECHEK, JR
SHERMIN MCCASLIN
LESLIE (LES) MEREDITH
DONALD MILLER
WILLIAM MISH SR
GRAHAM MOORE
SEATON NORMAN
CARMEN PARSEN
BOB PATTERSON
VUK PERIC
WILLIAM POLAND, JR
LORREL POPP
HENRY PRICE JR
ROBERT PRINCE
EARL QUIREY

WALTER RASKIN
RICHARD REEVES
HERBERT RICHARD
WILLIAM RICHARDSON
BURREE RICHARDSON
MICHAEL ROBERTO, JR
ANDREW ROLINSKI
NANCY MENGEL
ROSENSWEIG
KAREN SHANNON
CLIFFORD SHORTER
MILTON SING
ROGER SMITH
DEAN SMITH
GEORGE STITT
ROBERT SULLIVAN
HELEN THAYER
OTTO THIELE
ROGER THOMAS
MARJORIE TOWNSEND
JOHN TRESANSKY
JAMES VETTE
JOHN VOLPE
CARL WAGENFUEHRER
KEN WATHAL
H. JOHN WOOD III
RICHARD WRIGHT

*NOTE: 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 data 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 the list being incomplete.

Please email omissions to Shanessa Jackson (shanessa@nasa.gov) and copy Mary Pat Hrybyk-Keith (mary.p.hrybyk-keith@nasa.gov) and Peter Hughes (peter.m.hughes@nasa.gov). The electronic version of this report will be updated accordingly. Updated 5.5.2015.



Goddard

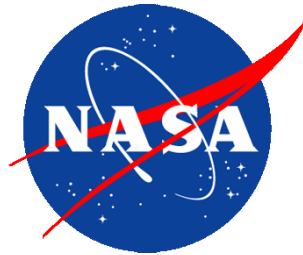
SPACE FLIGHT CENTER



There can be no thought of finishing—for aiming at the stars, both literally and figuratively, is the work of generations—but no matter how much progress one makes, there is always the thrill of just beginning.

— Robert H. Goddard

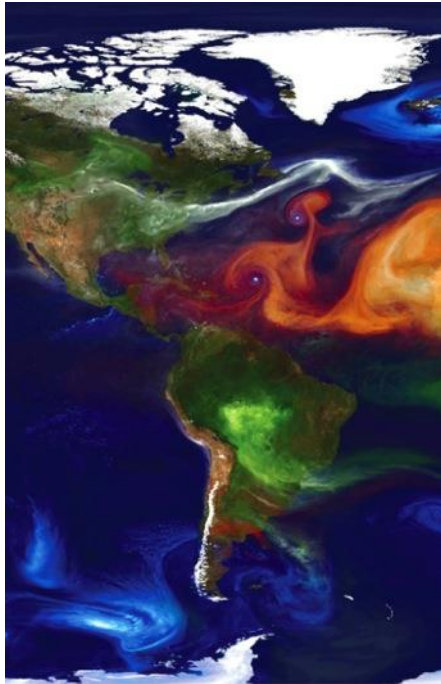




For more information, please visit our web site:
www.nasa.gov/goddard

BACK-UP SLIDES

OUR FOCUS AREAS



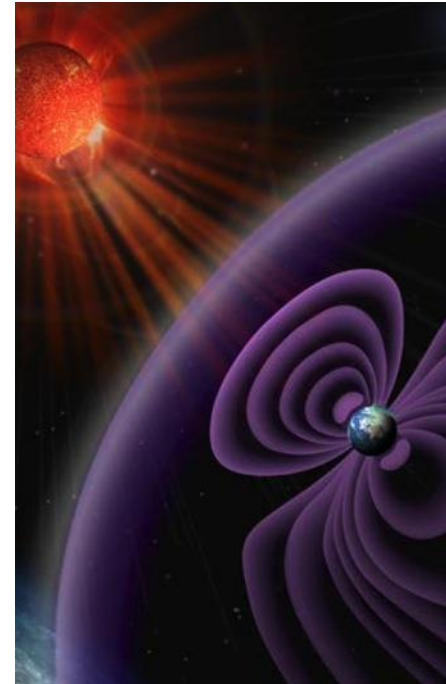
EARTH SCIENCE

Observes and studies the Earth System, to further scientific understanding of our home planet, and to improve predictions of its evolving state due to human and natural changes



ASTROPHYSICS

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



HELIOPHYSICS

Researches the Sun and its extended solar system environment (the heliosphere), and interactions of Earth, other planets, small bodies, and interstellar gas with the heliosphere.

OUR FOCUS AREAS



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 & NAVIGATION

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



SUBORBITAL PLATFORMS & RANGE SERVICES

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



CROSS-CUTTING TECHNOLOGIES

Sensor Systems & Instrument Platforms

Goddard develops and builds missions and instruments, from subsystems (detectors and optical elements) to complete instruments and instrument suites.

Large-Scale Scientific Information Systems, Data Processing, & 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.

In-Space Satellite Servicing

To enable extended mission operations, reconfiguration, and recovery, Goddard's services include on-orbit spacecraft refueling and repair, assembling large structures in orbit, and modular designs.

OTHER ENABLING CAPABILITIES

Program & 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 &

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

Safety & Mission Assurance Goddard is a recognized leader in safety and mission assurance, with a lengthy history of implementing effective, innovative, and cost-effective approaches to reduce risk and enable mission success.



SCIENCE



SENSOR SYSTEMS AND
INSTRUMENT PLATFORMS



SAFETY AND MISSION ASSURANCE



PROGRAM AND PROJECT
MANAGEMENT



IN-SPACE SATELLITE SERVICING



SPACE COMMUNICATIONS
AND NAVIGATION



END-TO-END MISSION SYSTEMS
ARCHITECTURE AND ENGINEERING



SUBORBITAL PLATFORMS AND
LAUNCH RANGE SERVICES



LARGE-SCALE SCIENTIFIC
INFORMATION SYSTEMS, DATA
PROCESSING, AND DISSEMINATION



CORE COMPETENCIES

CROSSCUTTING COMPETENCIES

ENABLING COMPETENCIES