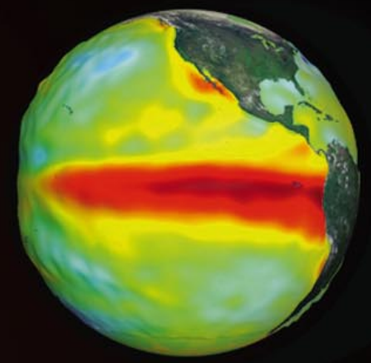
Goddard Space Flight Center

1998 Annual Report

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



Fortieth Anniversary
Pioneering the Future

NP-1999-01-004-GSFC

Cover photo: *Proof positive of a dramatic space rescue, this image of the Sun was captured by the Extreme Ultraviolet Imaging Telescope more than three months after contact was completely lost with the Solar and Heliospheric Observatory. Recovery teams were able to reacquire control of the spacecraft and begin the delicate task of switching on its scientific instruments.*

Message From the Director

I am very pleased to provide this report outlining the events and accomplishments of 1998. The past year's announcements of achievements, new people, processes, and partners seem to be events that simply happened overnight. Far from it. It was the culmination of everyone's hard work and determination. It was a year marked both by remarkable results, as well as some disappointments and losses.

During the past year, I was struck by the Center's will to succeed and become better than ever. I witnessed many organizations working with others to develop and reinforce partnerships and involve more groups in our research and technology. Our impact on our various communities is the emphasis of this report: how we made a difference to science, engineering, the economic base, education in our schools, neighborhood, as well as to enrich our own experiences. This report highlights results from investigations; collaborations with special groups; the impact of resources that flow to the country not only through industry, but also through higher education; and a look at our employees and their unique contributions.

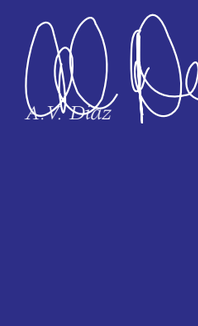
I emphasized three themes in 1998. First was safety, with emphasis on the work environment as well as mission-related factors. Second was ISO 9001, which served as a framework for process definition and review. As part of reviewing our processes, we kicked off Project Goddard and initiated a fresh look at promotion practices; both are guides for the challenges of the next century. Finally was enhanced communication, with such activities as regularly held meetings with supervisors, open email, and personal notes from me delivered in everyone's electronic mailbox. These themes won't disappear in 1999, rather they will be strengthened by the work accomplished to date.

We've encountered setbacks with launch delays and technical challenges. But these issues fail to deter the steadfast regimen of employees seeking excellence for the American taxpayer.

In our explorations, we made El Niño a household word around the globe. We know more about how the Earth lives, in the oceans and land, than ever before because of SeaWiFS. The Solar and Heliospheric Observatory (SOHO) is a dramatic story of a nearly lost spacecraft nursed back to full operational mode. SOHO's track record of delivering quality data about the Sun and space weather is nothing less than extraordinary. The Tropical Rainfall Measurement Mission revealed tall chimney clouds in Hurricane Bonnie, a view of a storm we'd never experienced. The Rossi XTE showed us how a new star can accelerate its rotation by pulling gas from a companion star.

In our local community, we awarded resources for incubator programs to build up application of NASA technology. We changed the way educators provide instruction in classrooms, building on the use of our information and quick access to the latest and greatest. And, despite some tough starts, we are well on the road to a process that improves how grants are awarded to higher education organizations.

These are only examples of the many, many contributions people made during the past year. There were some changes in key positions as well. Bill Townsend was named Deputy Director and Mary Kicza, Associate Director. I named Nancy Abell as the Center's Chief Financial Officer and asked Dan Krieger to join the Director's staff for one year to help us focus on the diversity issues that came out of our culture survey. The Goddard workforce continues to be the greatest asset of the Center. Our studies, reports, and findings will testify to the dedication and commitment of our people to Robert H. Goddard's quote from his 1904 high school speech: "The dream of yesterday is the hope of today and reality of tomorrow." He believed in that and so do we.



A.V. Diaz

Goddard as a Unique National Resource

NASA's Goddard Space Flight Center takes pride in its people, its state-of-the-art facilities, laboratories, and capabilities as well as its tradition to "be good" and "do good" in what we do. The Center's commitment to its value-centered mission strengthens every project and endeavor.

Center of Excellence for Scientific Research

Goddard Space Flight Center is NASA's Center of Excellence for Scientific Research, giving Goddard a focused Agencywide leadership responsibility in this area. Goddard is charged with being preeminent within the Agency with respect to the human resources, facilities and other critical capabilities associated with scientific research. Goddard must maintain or increase the Agency's preeminent position in scientific research in line with NASA's program requirements of the Space Science and Earth Science Enterprises.

ABOVE:
Earth-orbiting satellites and global monitoring make it possible to see conditions such as the extent of cloud cover and the temperature of the ocean's surface waters as they are on the Earth today.

To support NASA's Space Science Enterprise, Goddard leads the mission of physics and astronomy to create opportunities for conducting research through a broad variety of flight opportunities. Goddard promotes the development of advanced technology designed to enhance scientific capabilities at an affordable cost.

In collaboration with our customers and partners worldwide, Goddard seeks answers about how the universe formed, what it is made of, how its components interact, and how it evolves. The Center also contributes to the quest to learn how stars and planetary systems form and evolve. Goddard will take part in determining the nature of the Sun's interaction with its surroundings. Similarly, Goddard will work with others to discover the properties of interplanetary space as well as the plasma environment of the planets.

To support NASA's Earth Science Enterprise, Goddard leads the mission of Earth system science and plays a major role in this new interdisciplinary field. Goddard works with its customers and partners to identify and develop faster and at less cost the technology needs for advanced Earth science sensors.

Research in this area will advance understanding of the Earth as an environmental system by determining how its components have developed, how they function, how they interact with one another, and how they evolve on various times scales. This will enable scientists to quantify the practical impacts that both natural and human activities will have on the Earth's resources during the next decade and over the next century.

Goddard is committed to the development and infusion of cutting-edge technology to increase mission performance and capabilities while reducing the costs of performing scientific measurements from space. To accomplish this, Goddard provides Agency leadership to advance next generation spacecraft, sensor, and instrument technology. This leadership will result in

advanced Earth observing satellites and space science missions at reduced costs.

By creating and maintaining synergy among the science, engineering, and project management disciplines, Goddard will ensure the maximum return on its technology investment.

As a Center of Excellence, Goddard plans and coordinates technological research and development both within the Center and with external partners. The Center serves as a catalyst for forming teams among academic, government, and commercial concerns to draw on the best capabilities of each. Goddard also transfers the technology that is developed to the private sector to strengthen the national economy.

Strategic Implementation Plan

Goddard's Strategic Implementation Plan provides a framework for decisions and actions and for the future direction of the Center. The plan establishes a vision for the Center, consistent with its Center of Excellence and Missions roles and responsibilities, of revolutionizing knowledge of the Earth and the universe through scientific discovery from space to enhance life on Earth. The plan also sets forth Goddard's values: Agility, Balance, Creativity, Dedication, Integrity, Respect, and Teamwork. These seven guiding principles determine the culture and set the context in which decisions are made.

Goddard's Mission

Goddard's mission is to enable discovery through leadership in Earth and space science. We serve the scientific community, inspire the nation, foster education, and stimulate economic growth. We partner with others to achieve NASA's goals, and we create technologies that support and advance these endeavors to take full advantage of doing research in space. We accomplish this through innovation in all that we do.

Centerwide Goals

Six Centerwide goals and supporting strategies guide Goddard and are linked with the NASA Strategic Plan, Enterprise Plans, and the Agency Performance Plan to form the framework for the Center's annual goals, performance targets, and actions.

Goal 1: To serve as a national resource for discovery in Earth and space science and technology development.

Goal 2: To be an international Center of Excellence for research in Earth science, space science, and technology.

Goal 3: To enhance the Nation's technological and scientific literacy by sharing the information and knowledge that result from the performance of Goddard's mission.

Goal 4: To accomplish the Center's mission through a vital and effective workforce.

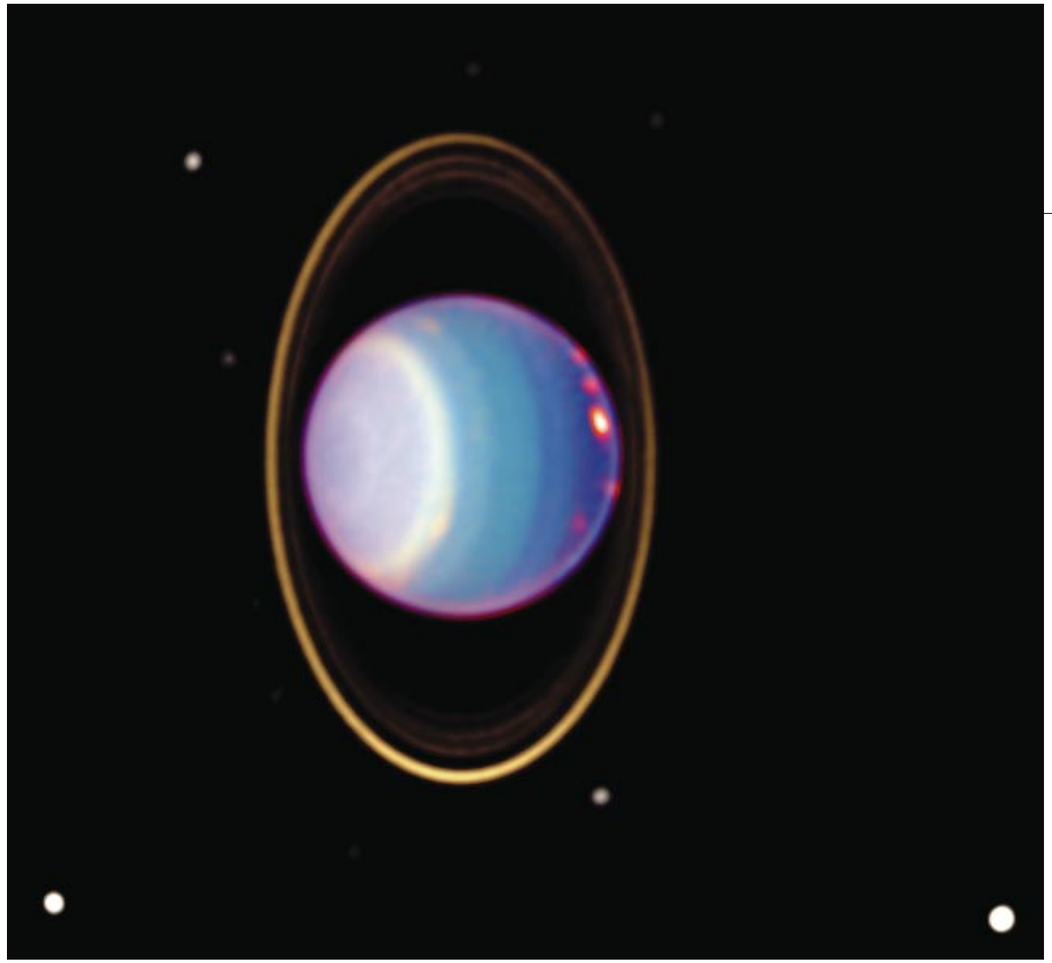
Goal 5: To maintain and upgrade Goddard's core infrastructure, laboratory facilities, and equipment to preserve the Center's preeminence as a national resource and Center of Excellence.

Goal 6: To organize science, technology, flight mission, and business processes to achieve greater productivity.

Organizational Structure

The Goddard Space Flight Center started 1998 under a reorganization structure that took effect in later December of the previous year. This reorganization was undertaken to better align the Center's organizational structure with the objectives of the Goddard Strategic Implementation Plan and to facilitate the transition to an enabling organization with increased emphasis on technology and advanced system development. The organizational changes are outlined below.

Key changes include the establishment of the Systems, Technology, and Advanced Concepts Directorate and the Applied Engineering and Technology Directorate. The Mission Operations and Data Systems Directorate and Engineering Directorate were disestablished in their entirety, along with the Assurance Technologies Division within the Office of Flight Assurance, and the Engineering and Safety Division, and Program and Mission Management Division within the Suborbital Projects and Operations Division. The employees and functional responsibilities of these former Directorates and Divisions were assigned to the Systems, Technology, and Advanced Concepts Directorate; Applied Engineering and Technology Directorate;



ABOVE:
A recent Hubble Space Telescope view using data taken with the Near Infrared Camera and Multi-Object Spectrometer reveals Uranus surrounded by its four major rings and by 10 of its 17 known satellites.

Employee Facts and Figures

Our workforce represents one of the country's finest resources to enable discovery, either by researcher or student, an interested citizen or casual web surfer. The following offers some background data.

GSFC Civil Servants - 3,227 GSFC Contractors - 8,332

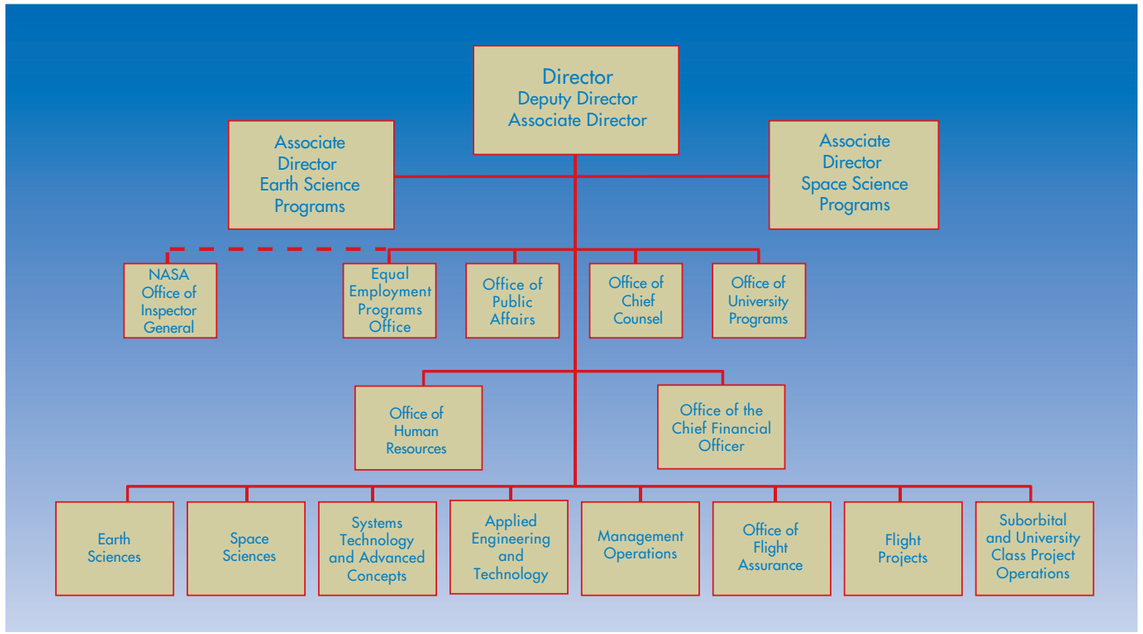
Civil Service Workforce Educational Mix:

Highest Degree Earned

Degree		#	% of workforce
PHD	-	436	13.5%
Masters	-	601	18.6%
Bachelors	-	1,293	40.1%
Associates	-	117	3.6%
No Degree	-	780	24.2%

Civil Servants by Skill Groups:

Skill		#	% of workforce
Clerical	-	247	7.6%
Prof. Admin.	-	783	24.3%
Sci. & Eng.	-	1,893	58.7%
Technicians	-	241	7.5%
Wage Grade	-	63	1.9%



Flight Projects Directorate; the Management Operations Directorate; or new organizational elements within the Suborbital Projects and Operations Directorate.

Project Goddard

Goddard has begun to make a number of changes that are necessary for the Center to realize its goals and to fulfill its mission and responsibilities. Project Goddard was initiated to respond to the Goddard Employee Survey and the recommendations provided by Goddard's supervisory management team. Its goals are to:

- *Provide unified leadership to steer Goddard through the current period of change.*
- *Translate the Goddard Strategic Implementation Plan into lower level plans.*
- *Align the Center's resources with its core business base.*
- *Communicate these efforts so employees can understand why change is happening and how they can participate.*

When completed in the Spring of 1999, Project Goddard will describe a well understood future that fulfills Enterprise strategic plans and is endorsed by our customers and sponsors. Project Goddard will provide a clear understanding of what must change to achieve that future state and will offer an agreed upon set of actions to ensure the needed changes occur.

ISO 9001

To help Goddard pull together mission, goals, procedures, and processes and ensure its competitive edge, the Center is building a Quality Management System for a Spring 1999 ISO 9001 certification. The Quality Management System is a value-added approach to Goddard's work and an effective approach to continuous improvement of its processes. This effort is not simply to meet a requirement for the Center to have an ISO 9001 certificate but for the continuing health and vibrancy of Goddard as an organization and as a place to work.

Impact to Communities

Results of Goddard's space and Earth science investigations and technological advances reach around the globe, impacting the research community, policy makers, consumers of information, educators, and our neighbors. Our work is customer-focused across a variety of disciplines and interests, seeking answers to age old puzzles about the universe and the Earth.

Earth Science Community

The Earth's dynamic system and all of its interrelated elements are the subject of important scientific exploration at Goddard. Goddard scientists combine comprehensive views from Earth-observing satellites with scientific exploration on the Earth's surface. This combination helps scientists understand the complex inter-workings of the Earth's hydrosphere, biosphere, and atmosphere; the solid Earth; and its interior. With increasing understanding of the Earth's system, Goddard scientists are able to evaluate many important phenomena affecting our planet. Research underway by Goddard scientists includes:

Land Cover Change and Land Use Change

Seasonal-to-Interannual Climate Variability and Prediction

Natural Hazards Research and Applications

Long-Term Climate Variability

Atmospheric Ozone

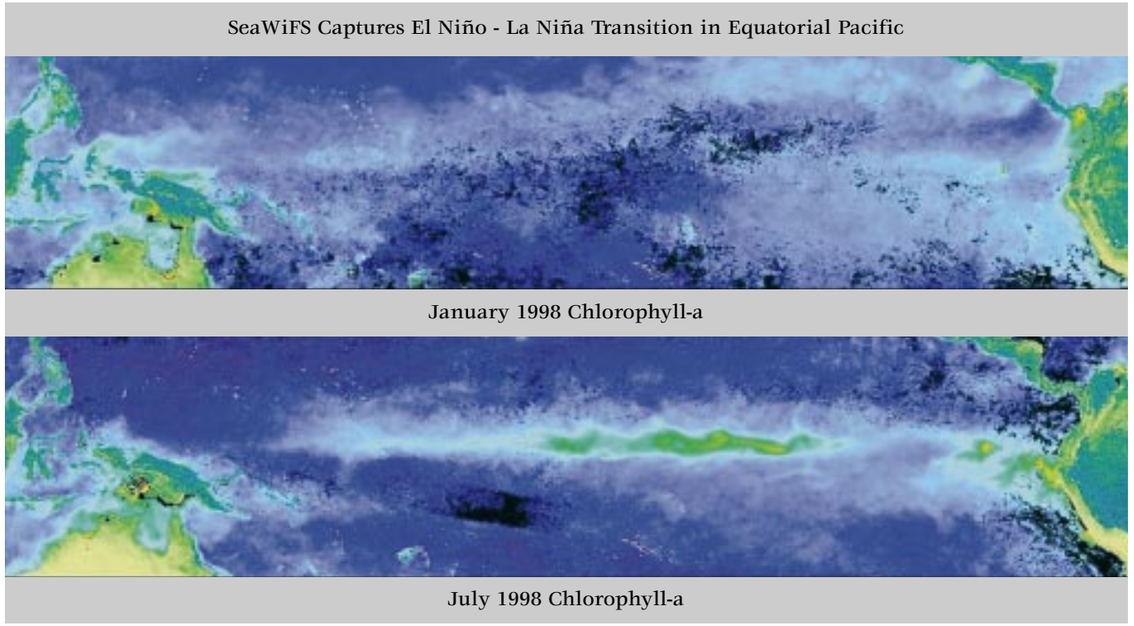
The ongoing goal of Goddard's Earth Science Enterprise is to merge these studies into an integrated model of the Earth as a system. NASA works with university, government, and industry scientists to identify areas of Earth science research that will have substantial societal benefits.

The Earth Observing System (EOS) is the centerpiece of NASA's Earth Science Enterprise. It consists of a science component and a data system component supporting a coordinated series of polar-orbiting and low-inclination satellites for long-term global observations of the land surface, biosphere, solid Earth, atmosphere, and oceans. Major Earth science missions will be launched in each of the next four years: Landsat–7 and the first EOS morning satellite (AM–1) in 1999; the first EOS afternoon satellite (PM–1) in 2000; the Ice, Cloud and Land Elevation Satellite (ICEsat–1) in 2001; and the atmospheric chemistry mission (CHEM–1) in 2002. These new missions will provide for the first time a comprehensive set of data for understanding the Earth as an integrated system, for implementing practical applications of satellite measurements, and for improving predictive models of our weather and climate.

EOS satellites and complementary international missions will fly over most of the Earth's surface gathering data for a wide range of global and regional studies, such as global changes in the atmosphere and land surfaces and regional assessments of pollution and water resources. What were once studied as isolated events will be examined as interconnected processes forming a comprehensive description of Earth system dynamics.

SeaWiFS and TRMM — Watching the Earth's Climate Unfold

For the first time, NASA scientists and researchers around the world were able to predict and to watch unfold, a huge climatic event in full color and real time from a global perspective. For a continuous year, the Sea-viewing Wide Field-of-view Sensor



(SeaWiFS) collected dramatic images documenting the Earth's dynamic biosphere and the amazing response of life to a very powerful El Niño.

Launched on August 1, 1997, SeaWiFS is shedding light on the ebb and flow of life as it thrives and dies with the Earth's changing seasons. SeaWiFS provides a unique capability to study both land and oceans by using a single sensor to monitor biological changes globally.

Among the highlights of SeaWiFS' first year were new insights into the impact that El Niño climate events have on ocean life. While the 1997–98 El Niño essentially shut down the highly productive ecosystem in the equatorial Pacific Ocean, the following La Niña event resulted in unprecedented phytoplankton blooms that spread across the entire equatorial Pacific Ocean.

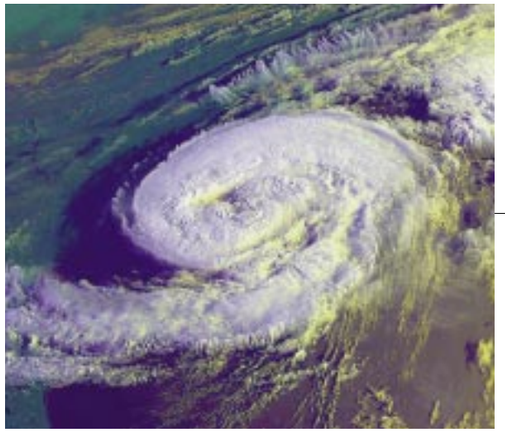
Adding to the mission's value, SeaWiFS was able to monitor a variety of natural disasters including fires in Florida, Mexico, Canada, Indonesia, and Russia; floods in China; dust storms in the Sahara and Gobi Deserts; and the progress of hurricanes Bonnie and Danielle.

Unique approaches to calibrating the SeaWiFS sensor have made possible the generation of superior quality data products in near-real time. Researchers around the world easily can access this wealth of information through the EOS Distributed Active Archive Center at Goddard where on-line systems facilitate rapid and cost-effective data distribution.

The Tropical Rainfall Measuring Mission (TRMM), a joint U.S.–Japanese mission, was launched by the Japanese National Space Development Agency in 1997. TRMM's first year in orbit has been highly successful, producing data in quality and quantity even better than anticipated by Goddard scientists and Japanese colleagues. TRMM includes the first space-borne rain radar and is the first satellite mission dedicated to measuring tropical and subtropical rainfall through microwave and visible and infrared sensors.

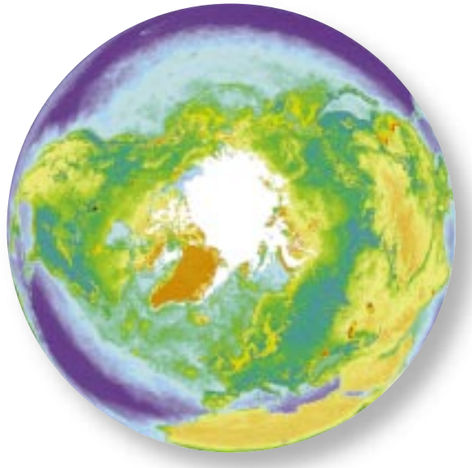
In August 1998, TRMM obtained compelling images of Hurricane Bonnie showing a storm cloud towering like a sky-scraper, 18 km (11 miles) into the sky. Many scientists believe that towering cloud

ABOVE:
The Sea-viewing Wide Field-of-view Sensor, the first ocean color mission to observe an El Niño-La Niña cycle on a global scale, shows the dramatic ecological transition in the equatorial Pacific from El Niño to La Niña.



Data derived from NOAA–12 was used to generate this image of sunlight glinting off Hurricane Bonnie as it approaches the North Carolina coast.

BELOW:
SeaWiFS color maps can map subtle differences in Earth's ocean color. The "color" of the North Pole projection strongly depends on how sunlight is reflected by free-floating organisms that contain chlorophyll.

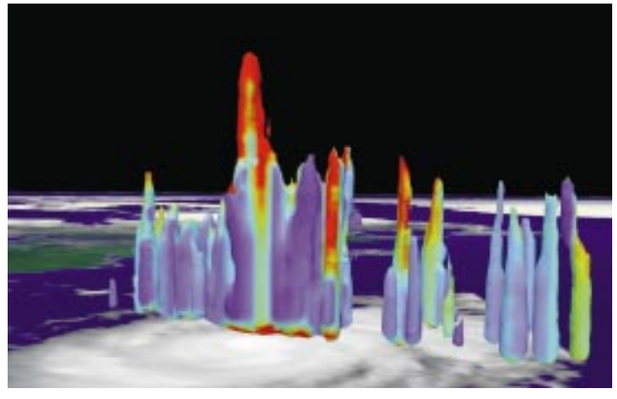


structures are probably precursors to hurricane intensification. TRMM has observed more than one hundred tropical cyclones since its launch, enhancing scientists' knowledge of cloud structures within tropical storms as the storms develop and recede. By studying differences in the patterns of ocean and land-based storms, TRMM is providing scientists the most detailed information to date on the processes of powerful storms, leading to new insights on how cyclones and hurricanes affect global climate patterns.

TRMM's complement of state-of-the-art instruments includes a precipitation radar, microwave scanner, visible imager, an Earth radiation sensor, and a lightning imager. Together, the instruments provide extremely accurate measurements of tropical rain and lightning variability and distribution and the balance of solar-absorbed and Earth-emitted radiation. Ultimately, data from TRMM will enhance our knowledge of the vertical distribution of heating in the atmosphere and improve our understanding of worldwide atmospheric circulation.

Atmospheric Ozone Research

NASA and National Oceanic and Atmospheric Administration (NOAA) satellites showed the Antarctic ozone hole covered the largest expanse of territory since its discovery in the early 1980s, reaching a record size of 27.3 million square kilometers (10.5 million square miles). The measurements were obtained using the Total Ozone Mapping Spectrometer (TOMS) instrument aboard NASA's Earth Probe satellite and the Solar Backscatter Ultraviolet Instrument aboard the NOAA–14 satellite.



Tropical Rainfall Measuring Mission obtained this image of Hurricane Bonnie. It shows a (cumulonimbus) storm cloud, towering like a sky scraper, 18 km (59,000 feet) into the sky from the eyewall.

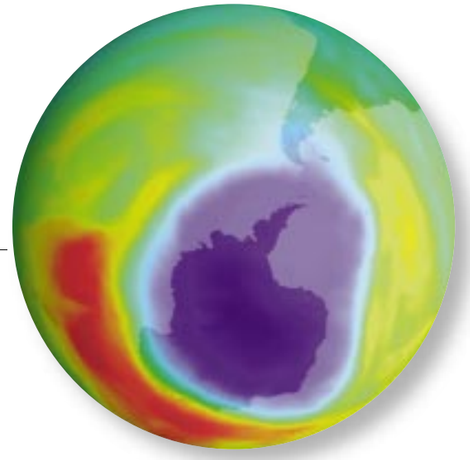
Scientists found that the increased size of the ozone hole is a direct result of unusually cold stratospheric temperatures. However, scientists can not explain the low temperatures. The decrease in ozone could result in increased ultraviolet radiation exposure in southern Chile and Argentina. Another concern with an ozone hole of this size is that ozone-depleted air will migrate into mid-latitudes in the Southern Hemisphere.

The Goddard Institute for Space Studies (GISS) and Columbia University, New York, reported that larger levels of ozone depletion were observed over the Arctic than in any previous year on record. Models suggest that increasing greenhouse gases in the atmosphere are one possible cause of the Arctic ozone losses. This is the first time that the interaction between ozone chemistry and the gradual buildup of greenhouse gases has been studied in a climate model.

Although ozone levels around the globe are expected to continue to decline over the next several years, NASA is now finding that the growth rates of ozone-depleting compounds in the upper part of the atmosphere is decreasing, indicating that international treaties to protect the ozone layer are working.

Airborne Laser Assessment of Coastal Erosion

The periodic El Niño events have caused devastating effects, and NASA has worked with other Government agencies to assess the damage. Several years ago, Goddard's Wallops Flight Facility, NOAA's Coastal Services Center, and USGS's Coastal and Marine Program jointly formulated a plan to address the following questions:



Data from the TOMS instrument show the size of the region of depleted Antarctic ozone (shown in blue) extended to a record 27.1 million sq. km (10.5 million-sq. mi.). Regions with higher levels of ozone are shown in red.

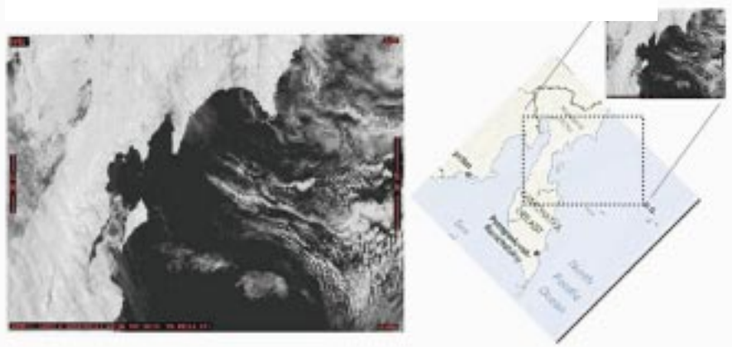
What were the magnitudes and spatial patterns of beach and coastal cliff erosion along representative beaches characteristic of the entire West Coast of the United States?

How do these changes differ from what occurs during non-El Niño winters?

To what extent were elevated sea level and changes in wave climate responsible for coastal change?

A key element of the plan was to survey 1,200 km (745 miles) of the West Coast both prior to and following the El Niño periods using NASA's Airborne Topographic Mapper, a scanning airborne laser. Initial results following this year's El Niño show patterns of erosion along the coast that are likely caused by changes in wave action during El Niño years.

First NOAA–15 Image taken 13 May 1998 - 20:50 UTC



AVHRR Image of a Portion of the Kamchatka Peninsula

The NOAA–K (15) satellite was launched successfully May 13 from Vandenberg Air Force Base, Calif. NOAA–K is the latest in the advanced TIROS–N series. The spacecraft will continue the provision of a polar-orbiting platform to support the environmental monitoring instruments for imaging and measurement of the Earth's atmosphere, its surface, and cloud cover. Additionally, NOAA–K is the first in the series to support dedicated microwave instruments for the generation of temperature, moisture, surface, and hydrological products in cloudy regions where visible and infrared instruments have decreased capability.

Regional Applications Center Project

The goal of the Regional Applications Center (RAC) program is to foster the self-supporting use of environmental and Earth resource data from satellites and other sources by regional institutions including federal, state and local government, universities, consortia, and commercial companies. This involves collaboration with these centers to transfer technology, science results, and data from Goddard to the RAC in support of their own user base.

Each RAC has a specific remote sensing applications focus that serves one or more particular needs for their geographic region. Goddard provides technology, government software, and data as well as scientific and technology implementation expertise. RACs in turn provide feedback on the use of the technology and data to NASA as input to further research and technology development efforts. RACs also act as commercialization agents. Several RACs currently are active in establishing new companies and products.

Regional Applications Centers

University of Southwestern Louisiana
Florida International University
Eastern Shore of Maryland Technical Center of Excellence
Cayuga County
University of Kansas
University of Maryland, Baltimore Campus
University of Nebraska, Lincoln
Rutgers University
Clemson University
James Madison University
University of Puerto Rico
University of Hawaii
Bowling Green State University
U.S. Naval Academy
Goddard Space Flight Center

Space Science Community

The Origins Initiative, a set of missions and enhancements to current programs, emerged from NASA's Space Science Enterprise strategic planning that included hundreds of scientists, engineers, educators, and communicators of science. They developed science and technology "Roadmaps" for each of the four science "themes,": Sun–Earth Connection, Structure and Evolution of the Universe, Astronomical Search for Origins, and Solar System Exploration, around which the Agency's Office of Space Science is organized.

To support NASA's Space Science Enterprise, Goddard leads the space science community in space-based physics and astronomy.

The Microwave Anisotropy Probe (MAP) will measure temperature variations in microwave radiation from the Big Bang to

Elements of the Microwave Anisotropy Probe undergo checkout at Goddard. MAP is a MIDEX class mission that will measure temperature differences, "anisotropy", in the cosmic microwave background radiation.

obtain a wealth of information on the fundamental nature of the cosmos. For the MAP project, 1998 was a very productive year of turning designs into flight hardware; nearly all flight hardware will be ready for integration at Goddard by year's end. The full MAP Observatory integration will occur in 1999 and launch will be in 2000.

Constellation–X is a proposed mission to study a variety of powerful objects and events, such as supermassive black holes and exploding stars, by making detailed observations of the X-rays from them. The Constellation–X program began funding a technology program to develop the optics and detectors required to enable the mission.

The Gamma Ray Large Area Space Telescope (GLAST) will observe the most violent events in the universe with unprecedented detail. GLAST is in the NASA Office of Space Science Strategic Plan for a launch in 2005. This year the project selected three teams to develop technology needed for the mission.

Sun–Earth Connection

The thrust of space physics, the Sun–Earth Connection, is to observe and interpret the variable radiations in the Earth's space environment. Three "quests," that shape the efforts to understand the workings of the Sun and the nature and extent of its influence on the Earth and other solar system bodies are:

How and why does the Sun vary?

How do the Earth and planets respond?

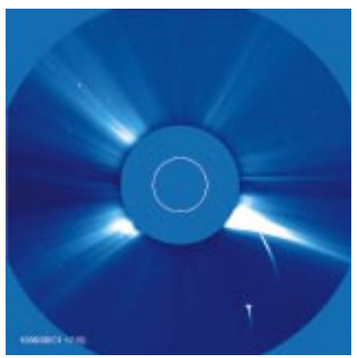
What are the implications for humanity?

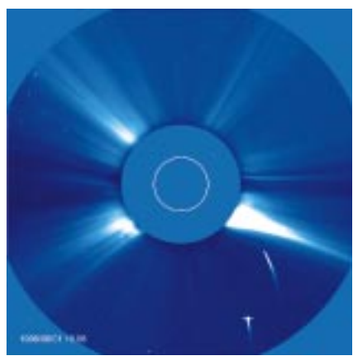
Goddard spacecraft provide a powerful network for investigating many of the physical processes that link the Sun and the Earth. The continuation of these missions represents an efficient and cost-effective means of providing important new data on the Sun's influence on the Earth's magnetosphere and upper atmosphere.

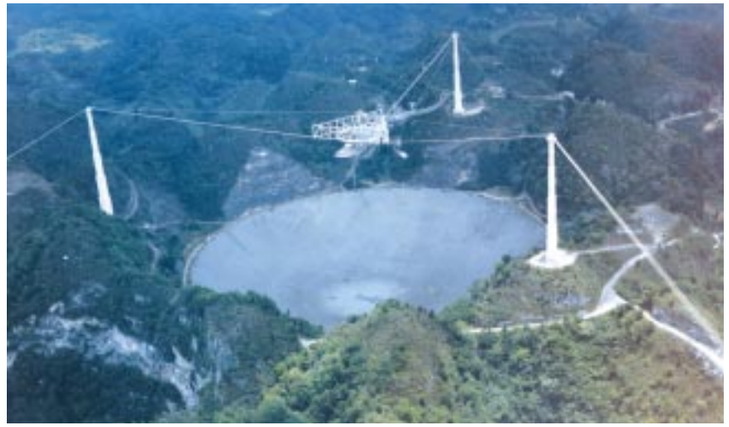
Solar and Heliospheric Observatory

In April 1998, NASA and European Space Agency scientists celebrated two years of successful operations of the Solar and Heliospheric Observatory (SOHO), and the two agencies decided to extend the mission to 2003. The extension would enable SOHO to observe intense solar activity, expected when the count of sunspots rises to a maximum around the year 2000. It would remain the flagship of a multinational fleet of solar spacecraft.

BELOW:
An instrument on board the SOHO solar observatory captures an image of two comets arcing toward a fatal fiery encounter with the Sun. The Sungrazer comets approach from below and have visible tails.







ABOVE: Researchers at the U.S. National Astronomy and Ionosphere Center in Arecibo, Puerto Rico, used the facility's radio telescope to transmit a signal toward SOHO, while NASA's Deep Space Network in Goldstone, CA, acted as a receiver, locating the spacecraft's echo and tracking it using radar techniques.

However, the celebration was short lived. On June 24, ground controllers lost contact with SOHO during maintenance operations. In one of the most dramatic space rescue efforts in NASA's history, the spacecraft was located using radar techniques with the 305-meter (990 ft) Arecibo, Puerto Rico, radio telescope of the U.S. National Astronomy and Ionosphere Center as a transmitter and a 70-meter (228 ft) dish of the NASA Deep Space Network as a receiver.

The Solar and Heliospheric Observatory first responded to radio transmissions on August 3, and telemetry was received on August 8, telling controllers the condition of the spacecraft and its instruments.

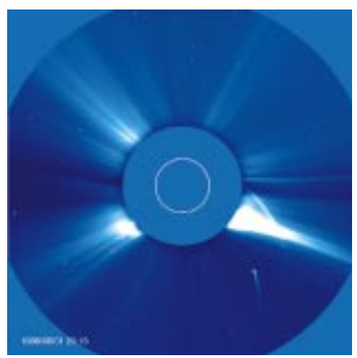
New, high-quality pictures of the Sun taken in October raised hopes that the mission would soon be returned to scientific operations and were the latest success for the team during a complex, challenging recovery sequence.

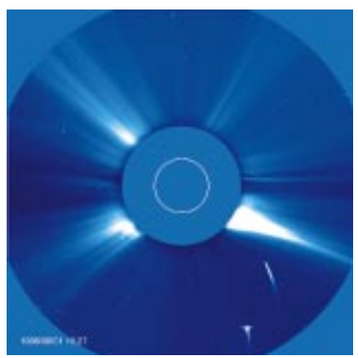
Since then, engineers have successfully brought all 12 scientific instruments back into operation on the joint mission.

Prior to the interruption, instruments on SOHO had taken about two million images of the Sun, an activity representing over a terabyte (a trillion bytes) of data. The joint mission of the European Space Agency and NASA revolutionized solar science by its special ability to observe simultaneously the interior and atmosphere of the Sun and particles in the solar wind and the Sun's outer atmosphere.

SOHO observations have been the subject of more than 200 papers submitted to refereed, scientific journals. Apart from discoveries about flows of gas inside the Sun, giant "tornadoes" of hot, electrically charged gas and clashing magnetic fieldlines, SOHO also proved its worth as the chief watchdog for the Sun, giving early warning of eruptions that could affect the Earth.

Images from SOHO showed investigators for the first time that solar flares produce seismic waves in the Sun's interior that resemble those created by earthquakes; captured a unique image of two comets plunging into the Sun's atmosphere followed by a probably unrelated, but dramatic ejection of hot gas and magnetic energy known as a coronal mass ejection; and assisted eclipse expeditions from





around the world in making key observations of the Sun in ways impossible with ground-based telescopes.

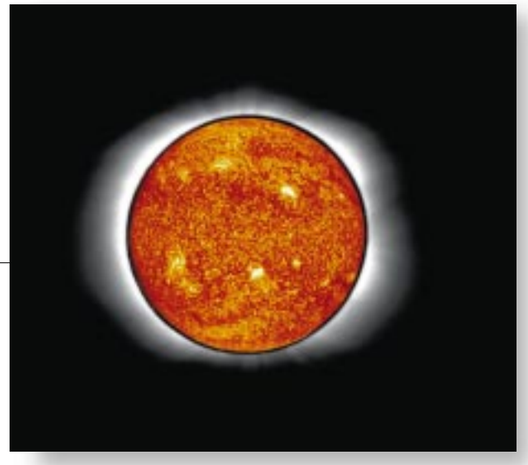
Advanced Composition Explorer

The first results from the Goddard-managed Advanced Composition Explorer (ACE) spacecraft are challenging the current understanding of the acceleration of particles by explosions on the Sun. Researchers are using ACE to sample matter from explosive solar events, called flares. By comparing the amounts of different elements found in solar cosmic rays, scientists can learn what events on the Sun are likely to have produced them, and how those events accelerate cosmic ray particles. Because the majority of the material in the solar system is contained in the Sun, studying the solar composition can tell researchers about the history and evolution of the solar system.

Transition Region and Coronal Explorer

The first images from the Goddard built and managed Transition Region and Coronal Explorer (TRACE) spacecraft revealed activity in the solar atmosphere in stunning clarity and included the first detailed observations of a magnetic energy release, called a magnetic reconnection. This explosive release of vast amounts of energy is responsible for similar events on the Sun, such as flares, that can cause communication and power system disruptions on Earth.

TRACE's observations of solar flares in extreme ultraviolet light are yielding new data on active phenomena on the Sun. The findings show that large-scale events can happen very rapidly on the Sun. One flare, less than 320 km (200 mi) wide, was about 88,500 km (55,000 mi) long. It appeared and vanished in just a few minutes. TRACE was able to obtain unprecedented information on such explosions because it takes highly detailed pictures at rapid rates over long intervals.



ABOVE: This image is a composite view of the total solar eclipse using the Extreme Ultraviolet Imaging Telescope on board the Solar and Heliospheric Observatory spacecraft and a telescope on the island of Aruba.

ACE

RIGHT: The high resolution of the Transition Region and Coronal Explorer spacecraft reveals the fine structure in loops of plasma (hot, electrically charged gas) contained by strong magnetic fields. TRACE was launched into orbit on Apr. 1, 1998 from Vandenberg AFB, Calif.

Structure and Evolution of the Universe

The Structure and Evolution of the Universe theme embraces three fundamental scientific quests:

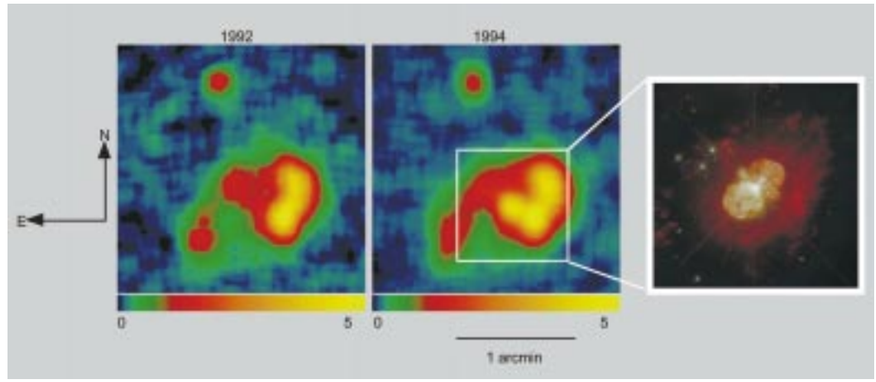
To explain the structure of the universe and forecast our cosmic destiny.

To explore the cycles of matter and energy in the evolving universe.

To examine the ultimate limits of gravity and energy in the universe.

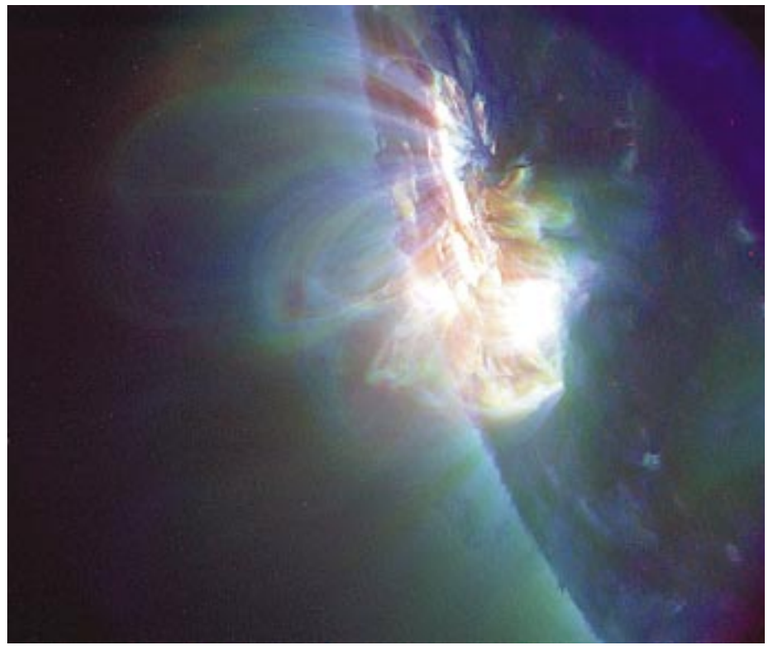
Some Goddard missions are beginning to address these campaigns.

Recent optical and near IR observations suggest that Eta Carinae may be two stars, not one! Scientists using these images and data from NASA's Rossi X-ray Timing Explorer spacecraft surmise that the changes are because of the presence of a massive "companion" star in orbit around Eta Carinae.



Rossi X-ray Timing Explorer

The Rossi X-ray Timing Explorer (RXTE) discovered a super-dense star spinning at more than 60 times per second. This exceptionally fast pulsar, investigators believe, could have been spinning as fast as 150 times per second or more when it formed some 4,000 years ago. Faster pulsars were previously known, but all are thought to have rotated much more slowly when formed.



One of the Milky Way Galaxy's largest stars may in fact be a double star system, according to research by a team of astronomers using RXTE. Unusual variations in the intensity of X-rays emitted by hot gas near Eta Carinae are thought to be caused by the presence of a massive companion star in orbit around it. Eta Carinae is an estimated 7,500 light years from Earth in the southern sky.

RXTE scientists reported that a newly discovered star that is emitting rapid pulses of X-rays may be the long-sought missing link between old neutron stars that emit powerful flashes of X-rays, and older, rapidly spinning neutron stars that emit mainly radio waves. The new-found star, a type of so-called X-ray pulsar, has accelerated its own rotation at the expense of a nearby "companion" star by pulling gas from the companion onto its surface in a process called accretion.

The Next Generation Space Telescope Project conducts an engineering model test deployment of an inflatable sunshield. Inflatable and rigidizable structures potentially offer distinct advantages over existing mechanical structures.

Compton Gamma Ray Observatory

Scientists assisted by the Compton Gamma Ray Observatory and the Hubble Space Telescope reported that a recently detected cosmic gamma ray burst released several hundred times more energy than a supernova or exploding star. This immense energy release means that the observed gamma ray burst, and probably many others, are the most powerful explosions that have occurred in the universe since its creation as a result of the Big Bang. For a few seconds, the burst was as luminous in gamma rays as the rest of the universe as seen from Earth. The burst took place in a faint galaxy about 12 billion light years from the Earth. The new discovery challenges theories of the gamma ray burst process to account for such a great energy release in such a short time.

Search for Origins Program

Goddard Space Flight Center is directing the study effort for the Next Generation Space Telescope project and is responsible for the operation of the Hubble Space Telescope, an operating mission within the Search for Origins theme. The intent of the "Origins" program is to search for clues to help scientists find our cosmic roots, from the formulation of galaxies, stars and planets, to how did life originate on Earth, and is there life outside our solar system.

Over the course of the next two decades, the Origins program will use the best minds in academia, industry, and NASA to develop the technologies that will enable putting in space a succession of sophisticated telescopes each building on scientific and technological achievements of the prior missions. Augmented with ground-based observatories and research and analysis, NASA's Origins program will give our civilization a better sense of the universe around us and our place in it.

Next Generation Space Telescope

The Next Generation Space Telescope (NGST) will observe the first stars and galaxies that formed after the Big Bang. The NGST partnership now includes ESA, the Canadian Space Agency, the Space Telescope Science Institute, and five NASA centers. The first phase, mission concept procurement, will start in January 1999. NGST has started studies of four telescope mirror technologies, six instrument concepts, and five cryogenic actuators. Prospects are excellent for a launch in 2007 or 2008. This grand effort is embedded in fundamental questions that have been posed:

What is the shape of the universe?

How do galaxies evolve?

How do stars and planetary systems form and interact?

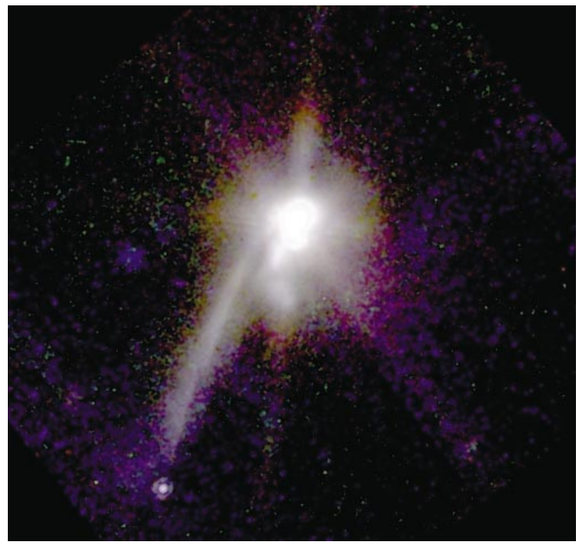
What are the life cycles of matter in the universe?

What is dark matter?

Answers to most of these questions involve objects formed extremely early in the history of the universe. Such objects have their radiation greatly redshifted when observed in the current epoch, meaning that observations are best performed in the infrared portion of the spectrum. The NGST will be capable of detecting radiation whose wavelength lies in the range 0.6 to 20 microns. Furthermore, the NGST must be able to see objects 400 times fainter than those currently studied with large ground-based infrared telescopes or the current generation of space-based infrared telescopes, and it must do so with the image sharpness comparable to the Hubble Space Telescope.

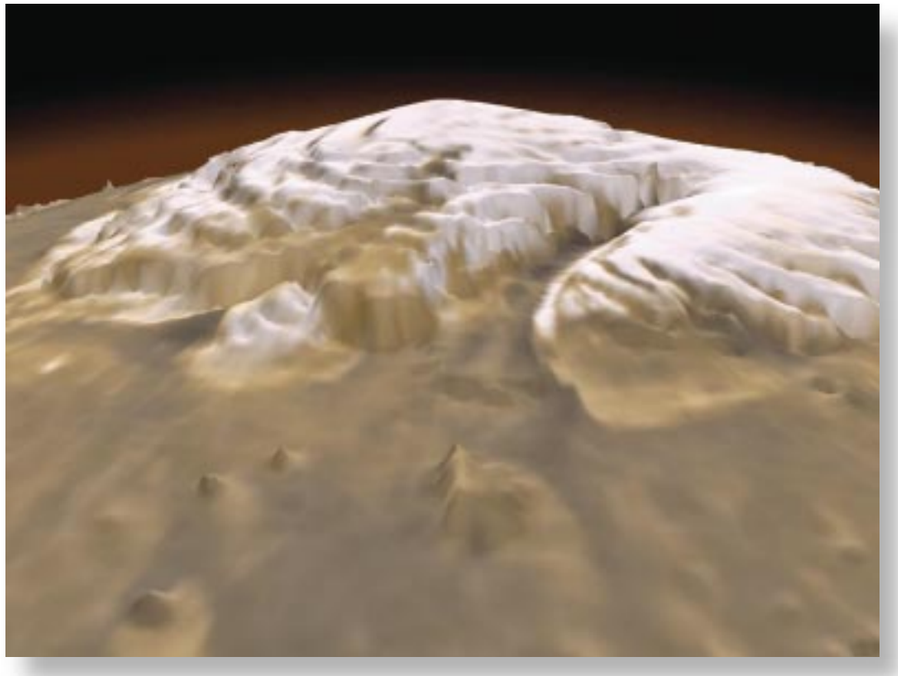
NASA announced in 1998 that duties of the Space Telescope Science Institute in Baltimore, Md., would be expanded to include the management of science operations for the Next Generation Space Telescope. The Space Telescope Science Institute, located at the Johns Hopkins University, has been operating the science program for the Hubble telescope since 1983.

BELOW: This Hubble Space Telescope near-infrared image of newborn binary stars (image center) reveals a long thin nebula pointing toward a faint companion object (bottom left) which could be the first extrasolar planet to be imaged directly. The candidate protoplanet appears at a distance of 130 billion miles from the binary (1400 times the Earth's distance from the Sun). The image was taken with the Near Infrared Camera and Multi-Object Spectrometer.



Hubble Space Telescope

The Hubble Space Telescope (HST) continues to rewrite the astronomy book. This year it has given astronomers their first direct look at what may be a protoplanet outside our solar system—one apparently that has been ejected into deep space by its parent stars. A protoplanet is a newborn planet, which may still be hot from its formation. If the discovery, using Hubble's Near Infrared Camera and Multi-Object Spectrometer, is confirmed, it will challenge conventional theories about the birth and evolution of planets. Located within a star-forming region in the constellation Taurus, the object appears to lie at the end of a strange filament of light that suggests it was flung away from the vicinity of a newly forming pair of stars. At a distance of 450 light years, the same distance as the newly formed stars, the candidate protoplanet would be ten thousand times less luminous than the Sun. If the object is a few hundred thousand years old, the same age as the newly formed star system in its vicinity, then it is estimated to be 2–3 times the mass of Jupiter.



"Picket fence" rendition of surface topography in the Northern Hemisphere of Mars from the Mars Orbiter Laser Altimeter. The MOLA profile is approximately 5000 km (3000 miles) long.

Hubble also gave astronomers a ringside seat to the beginning of a titanic collision of an onrushing stellar shock wave with an eerie, glowing gas ring. The ring encircles the place where a stellar explosion, supernova, was seen to occur in 1987. Though the star's self-destruction was first seen nearly 12 years ago, astronomers are just beginning to witness the shock wave from the eruption plowing into the light-year wide ring. Activated by the 64-million km per hour (40-million mile per hour) collision, a 160-billion km diameter (100-billion mile diameter) knot of gas in a piece of the ring has already begun to "light up" as its temperature surges from a few thousand degrees to 556,000 degrees Kelvin (1-million degrees Fahrenheit). The observations where made with Goddard's Space Telescope Imaging Spectrograph, installed on Hubble in February 1997.

Solar System Exploration Program

Why do we explore our solar system? The answer lies in the three "quests" that represent the fundamental goals of the Solar System Exploration program.

To explain the formation and evolution of the solar system and the Earth within it.

To seek the origins of life and its existence beyond Earth.

To chart our destiny in the solar system.

Goddard is contributing to this program with sophisticated instruments aboard spacecraft bound for distant planets.

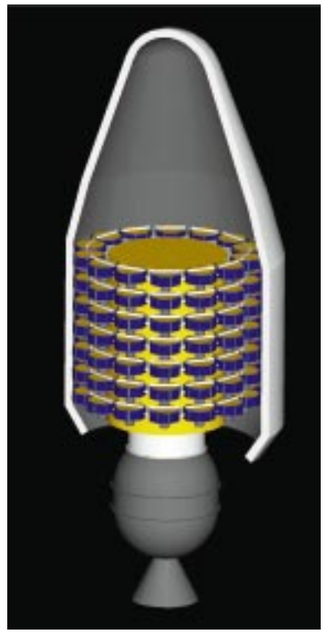
Mars Global Surveyor

Goddard's Mars Orbiter Laser Altimeter (MOLA) instrument, a key experiment on the Mars Global Surveyor spacecraft, collected profiles of the Red Planet's topography that contained unprecedented new information about the relief of the north polar cap of Mars, as well as its surrounding features, including the expansive north polar sand seas.

These initial profiles have revealed an often striking surface topology of canyons and spiral troughs in the water and carbon dioxide ice that can reach depths as great as 3,600 feet below the surface.

In addition, MOLA obtained the first direct measurements of cloud heights on Mars,

This deployer ship concept shows how dozens of nano-satellites could be placed into space using a single launch vehicle. This cross-sectional view illustrates the small satellites stacked inside the payload fairing of a Delta II launch vehicle.



with clustered cloud features appearing most prominently near the edge of the north polar cap. The clouds were detected up to heights of 15 km (9.3 miles) above the surface and as low as a few hundred meters (1,000 feet).

Another Goddard instrument on Mars Global Surveyor returned the first definitive information on the properties of Mars' magnetic field. Measurements from the spacecraft's Magnetometer and Electron Reflectometer showed that Mars has strong, localized magnetic fields. These magnetic fields would cause a compass needle on Mars to point in wildly different directions as an explorer traversed the surface from the location of one magnetized concentration to another. The magnetized areas on Mars could not form without the presence of an overall global magnetic field that was perhaps as strong as Earth's is today. Because the internal dynamo that powered the global field is extinct, these local magnetic fields act as fossils, preserving a record of the geologic history and thermal evolution of Mars.

The Goddard-built Neutral Mass Spectrometer was successfully launched to Mars on board the Japanese Planet–B spacecraft. The spectrometer will enable scientists to measure the chemical composition in the upper atmosphere on Mars on a global scale, which has never been done before. The spacecraft is scheduled to arrive at the Red Planet in October 1999.

Enabling the Science Community

For Goddard to be recognized as a Center of Excellence in Scientific Research, carefully selected technologies for development and use on board spacecraft or for informational systems is critical. Key technologies include: lightweight, adaptive, deployable and distributed optics; cryogenics; solid state detectors; precision deployable structures; formation flying and constellation management; hyperspectral and passive microwave instruments; active laser systems; automation; intelligent synthesis environment; ultrastable electro mechanical systems; extension of the Internet to space; and advanced information systems.

Global Positioning System Advances

The Global Position System (GPS) is revolutionizing and revitalizing the space business from guidance systems of the sounding rocket tracking systems to the International Space Station crew return vehicle. Goddard is creating the specialized GPS software and systems that are fueling this revolution and setting the course for the next millennium's space navigation solutions.

Using spaceborne GPS and specialized algorithms developed at Goddard, a satellite will soon be capable of navigating itself and making ground stations simpler and requiring fewer operators. And, by incorporating other GPS-anchored features like onboard maneuver planning and autonomous constellation control, a single ground station operator will eventually manage fleets of satellites in constellations around the Earth.

Nano-satellite Technology Development

Goddard's nano-satellite technology development effort will revolutionize the scientific investigations of key physical processes explored by the space science and Earth science communities. Nano-satellites are disks, 304 mm (12 in) wide

Providing cheaper access to space, the Ultra-Long Duration Balloon is being developed to fly one-ton payloads at the edge of Earth's atmosphere up to 100 days. Material tests measured the durability of candidate composite films for the Ultra-Long Duration Balloon.

and 101 mm (4 in) thick, and weigh less than 10 kg (22 lbs), including the propellant mass. Each satellite will generate about 5–10 watts total power for its operations. On future NASA science missions, it is envisioned that tens to hundreds of nano-satellites will fly in formation in order to make simultaneous measurements of an area of the sky. This approach gives scientists more precise data than a single satellite taking a single measurement. For the first time scientifically, simultaneous measurements in both space and time will be resolved.

To maximize the number of satellites delivered to space with one launch vehicle, Goddard plans to develop advanced technology components to make future spacecraft and their onboard instruments compact, lightweight, low power, low cost, and survivable in a space radiation environment over a 2-year mission lifetime. These technology components will be matured to a level from which they can be readily adapted to specific science and mission objectives in the onset of the next century.

Ultra-Long Duration Balloon

Goddard's Wallops Flight Facility has begun preparation of a new unpiloted scientific balloon that will fly around the world in the year 2000. The new super-pressure Ultra-Long Duration Balloon is designed to stay afloat at altitudes reaching 36,000 meters (120,000 feet) for up to 100 days with over a ton of scientific and support equipment. This new technology presents significant opportunity to perform many types of research in space and Earth science effectively and inexpensively.

University Class Explorers

NASA selected the first university Explorer Missions, designed to provide frequent flight opportunities for highly focused and relatively inexpensive science missions whose total cost to NASA is limited to $13 million. Goddard's Wallops Flight Facility manages this program, which is targeted towards space science missions.

Wallops Partnership

The Wallops Flight Facility took a major step in 1998 in its efforts to become a multiagency national resource with the establishment of a Partnership Charter. The

A major milestone for supporting commercial orbital rocket activity at Wallops Island was reached this year with the ribbon cutting for a Virginia Space Flight Center launch pad. The commercial launch pad was created as a result of cooperation between the public and private sectors – including NASA, the Commonwealth of Virginia, Old Dominion University, the Center for Innovative Technology, the Virginia Commercial Space Flight Authority and private industry. The launch pad will support a wide variety of Expendable Launch Vehicles. The commercial spaceport, according to the Commonwealth, is expected to bring a capital investment of $60 million and 300 new jobs to the Eastern Shore. (From L to R) U.S. Sen. Charles Robb (D-Va.), NASA Administrator Dan Goldin, U.S. Sen. John Warner (R-Va.), U.S. Rep. Wayne T. Gilchrest (R-Md.-1st), Virginia Gov. James Gilmore, U.S. Rep. Tom Davis (R-Va.-11th), and Virginia Center for Innovative Technology President Dr. Robert Templin, Jr.

Sounding rockets provide scientists with an inexpensive means to gather data and conduct tests in a variety of disciplines including plasma physics, galactic astronomy, high energy astrophysics, solar physics, and microgravity. The Suborbital Flight Program was highly successful for the year. The Sounding Rocket Program achieved a success rate of 100% conducting flights from Puerto Rico; Norway; White Sands Missile Range, NM; and Wallops Island. The Puerto Rico Campaign – Coqui Dos – included the establishment of a temporary range and the successful launching of eight rockets to study "space weather" in the equatorial region. Meanwhile, the Scientific Balloon Program chalked up an impressive 96% success rate with flights from Brazil; Canada; Antarctica; Fairbanks, AK.; Ft. Sumner, NM; Palestine, TX.; and Wallops Island. The two programs conducted five flights dedicated to experiments designed and built by high school or undergraduate students.

senior partners include NASA, the U.S. Navy, and the Virginia Space Flight Center. Other agencies at Wallops include the National Oceanic and Atmospheric Administration and the U.S. Coast Guard. The mission of the Partnership is to facilitate execution of individual agency missions; jointly establish shared services; ensure equitable distribution of business costs; and develop new business at Wallops.

Transfer of Technology

Goddard facilitates the transfer of NASA's research and technology into practical applications to benefit the American public and to strengthen the American economy through new product opportunities.

In 1998, NASA announced the award of cooperative agreements to establish high-technology business incubators at three NASA Centers. Goddard's incubator, the Emerging Technology Center of the Baltimore Development Corporation, was established in Canton, Md. The Technology Commercialization Office (TCO) participated in an array of prominent industry events that created promising and productive relationships with external organizations. The TCO held Goddard's Second Technology Showcase, open to the public, and the first Small Business Innovative Research showcase.

Goddard and the Houston Advanced Research Center developed jointly the Airborne Lidar Topographic Mapping System through a partnership with TerraPoint LLC, a spinoff of the Fortune 500 company Transamerica Corporation.

QuickRide

Goddard awarded an indefinite delivery/indefinite quantity contract known as "Quick Ride" to Final Analysis, Incorporated of Lanham, Md. The contract allows any NASA Center, along with other government agencies, to procure excess space onboard commercial satellites for the purpose of accommodating various Earth science, space science, and technology instrumentation payloads.

Communications

Goddard cut the ribbon on the Guam Island tracking station that effectively completes NASA's vital communications and data-gathering support for NASA Earth-orbiting missions. The Guam station provides global, full-time and real-time communications support for NASA's Space Network customers, including the Space Shuttle, International Space Station, and Hubble Space Telescope.

Institute for Advanced Aerospace Concepts

Goddard established, through the Universities Space Research Association, the NASA Institute for Advanced Aerospace Concepts. The Institute will provide an independent, open forum for the analysis and definition of space and

aeronautics advanced concepts. It will focus on revolutionary concepts, in particular, such as systems and architectures that can have a major impact on the future missions of the NASA enterprises.

Outsourcing Desktop Initiative

Goddard led an Agencywide effort to fulfill a multibillion dollar contract to obtain desktop computers and local communications services. The contract, called the Outsourcing Desktop Initiative for NASA (ODIN), will deliver comprehensive desktop computer, server, and intra-center communications services to NASA and NASA contractors. Other government agencies will be able to buy from the ODIN contractors through the General Services Administration. Long-term savings over the life of the contract could approach 25 percent compared to existing procurement procedures.

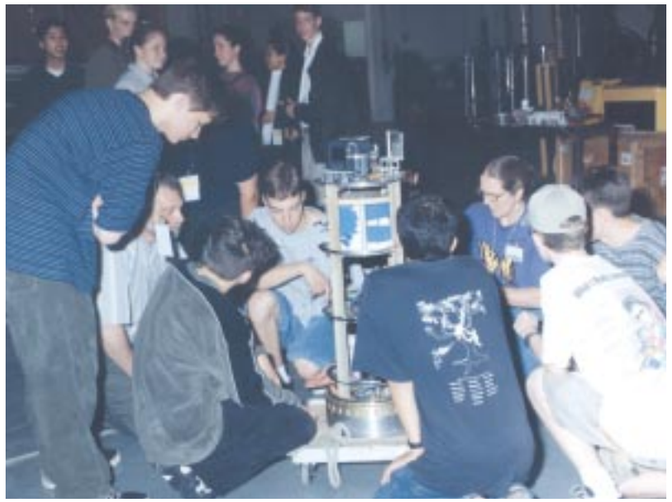
Center Education and Outreach

Formal Education

Goddard offered extensive experiences for teachers, students, schools, districts, and state education agencies throughout the past year. Approximately 300,000 individuals were served.

Most significant were efforts to develop follow-up programs to sustain the short-term impact of Goddard programs, and to develop systemic efforts that would move beyond the individual who attended a NASA program and relate these experiences to the reform efforts of a school, district, or state.

Highlights to build a sustaining impact include:



Students and teachers examine their experiments prior to the first flight of the Suborbital Student Experiment Module in May 1998 at the Wallops Flight Facility. Students from four states participated in the program to fly high school experiments on a NASA sub-orbital rocket.

- *The Stevens Institute Distance Mentoring Program: this a joint initiative between Goddard and the Stevens Institute of Technology in Hoboken, New Jersey used distance mentoring to pair Goddard Hispanic engineers with science teachers. The goal of the program is to promote interaction between the students and role models from within the Goddard professional community.*
- *Laboratory for Atmospheres: a joint research and academic program with Howard University's Center for the Study of Terrestrial and Extraterrestrial Atmospheres, it is the first and only interdisciplinary program at a Historically Black Colleges and Universities institution offering M.S. and Ph.D. degrees in the atmospheric sciences.*
- *Hubble Challenge: an engineering competition for teachers and students to develop a qualifying round submission based on an engineering project. Ten qualifying teams competed at Goddard to solve a problem related to the Hubble Space Telescope. Judges were the engineers who solved the second servicing mission Hubble challenge.*
- *American Academy for the Advancement of Science training effort: NASA employees from across the Agency reviewed and developed materials that are responsive to the national science standards.*
- *The Maryland Ambassadors Program: teamed with Marshall Space Flight Center and developed Earth and space sciences investigations now available on the Internet.*
- *Urban teams education action plans: developed an aerospace curriculum plan followed by an action plan supported by the Goddard education resources.*
- *Anne Beers Elementary School astronomy program: featured contact between this Washington, D.C. school and staff at Goddard, culminating in an onsite summer program for school faculty members.*
- *Mentoring relationships: for teachers and students, to encourage stronger relationships between education facilities and Goddard, both at Greenbelt and Wallops.*

Highlights to develop systemic impact include:

- *The Connecticut/NASA Education Collaborative: to bring together NASA resources in the state of Connecticut with the State Department of Education, Talcott Planetarium, Connecticut Discovery Museum, Eastern Connecticut State University, and the Science Center of Connecticut. Statewide training sessions were related to NASA enterprise-related topics.*
- *The Wallops Saturday Youth Program: to provide hands-on science activities to high-risk, economically disadvantaged students one day each month. The goal is to motivate and introduce children to the sciences and enhance their academic focus. Activities have included science experiments, motivational lectures, field trips, and long-term projects. Some of the science experiments consisted of electroplating, telegraphy, magnetism, and energy sources.*
- *Maine Educator Team: to develop an action plan with Goddard for Earth sciences.*
- *Material network: to disseminate NASA education materials and to train teachers on the use of the curriculum support materials in their classrooms through the Eisenhower National Clearinghouse Access Centers throughout Pennsylvania.*
- *The SUNBEAMS program: a collaboration with D.C. middle schools and Goddard to bring teachers, students, and scientists together with the goal to enhance classroom instruction and learning outcomes.*

Higher Education

NASA Academy

The NASA Academy, now in its 6th year, brought 23 senior undergraduate and graduate students from across the nation to Goddard to conduct cutting-edge research and to gain exposure to NASA management and industry leaders. This program has been replicated at three other NASA Field Centers and has approximately 240 worldwide alumni.

National Research Council Resident Research Associateship Program

The National Research Council Resident Research Associateship Program provides recent doctoral scientists and engineers of unusual promise and ability, or senior scientists and engineers, with temporary full-time residence at Goddard to perform

independent research in collaboration with scientists and engineers to contribute to the Center's missions. There are over 50 associates in residence at Goddard.

Graduate Student Researchers Program

The Graduate Student Researchers Program reaches a diverse group of U.S. graduate students whose research interests are compatible with NASA's programs in space science and aerospace technology. Goddard sponsored over 40 students.

Informal Education and Outreach

National Park Service Partnership

Goddard and the National Park Service (NPS) successfully achieved its first year's plans to reach closer towards a mutual goal to improve public awareness and appreciation of science. Goddard and the NPS shared expertise in data visualization and displays and potential use of remote sensing data for natural resource management, linked similar web site topics from each organization, developed interpretive styles for technical and scientific information, participated in professional association and community events, and shared training and experience opportunities to communicate to broad and diverse audiences.

This partnership strengthened and made richer each organization's efforts in an elegant and powerful manner with visible results in the majority of the 370 National Parks within 1 year. Visitors to the Parks benefit from a fresh source of information that support Park Ranger interpretive programs and, likewise, Goddard employees have learned from the NPS new communication styles.

Flight Opportunities for Students

Goddard established a flight opportunity component to NASA's National Student Involvement Program. The flight opportunities include the Space Experiment Module, a Space Shuttle based program, and the Suborbital Student Experiment Module, a sounding rocket effort through Wallops. Students across the country will compete and winners will be afforded a summer for flight readiness, followed by actual flight of their projects on either the Space Shuttle or sounding rocket.

The first in a new class of inexpensive, student-built space missions funded by NASA, called the Student Nitric Oxide Explorer, is investigating the effects of energy from both the Sun and the magnetosphere on nitric oxide densities in the Earth's upper atmosphere. This mission allows universities and graduate students to plan, build, and fly science satellites for low-Earth orbit applications. The Student Nitric Oxide Explorer is the first of a program that is a precursor to the University Explorer program.

Kids in Science and Technology Collaborative Forum

The Kids in Space Collaborative Forum is designed to create partnerships between both public and private organizations with the goal of inspiring children in science and math. The Collaborative Forum brings service providers and school officials in the area together to give teachers access to educational resources they do not have. Its purpose is to create a regional alliance between children, educators, NASA, high-tech industry, and other federal agencies. The Collaborative will be a permanent group that will provide a list of mentors, a guide to available resources, assistance in writing grant proposals, and connections to the donors of equipment to teachers.

Achieving Competence in Computing, Engineering, and Space Science

The Achieving Competence in Computing, Engineering, and Space Science Program, jointly sponsored by NASA and the American Association for the Advancement of Science, continues to serve as a model program for students with disabilities studying technical disciplines. Goddard manages the program for the Agency, and placed 23 college students with disabilities at five NASA Centers. This is the only program in the Agency targeted toward students with disabilities in technical disciplines.

University of Maryland Eastern Shore/Wallops Flight Facility Bridge Program

The goal of this program is to improve the retention rate of engineering students in the post-secondary school environment. Minority- and female-entering freshmen couple classroom work with Wallops work experiences to strengthen their skills in pursuit of a career in science, mathematics, or engineering.

Minority University-SPace Interdisciplinary Network

The Minority University-SPace Interdisciplinary Network (MU-SPIN) transfers advanced computer networking technologies to institutions predominantly attended by racial or ethnic minorities at the graduate, undergraduate, and pre-college levels who traditionally have been underrepresented in mathematics, science, engineering, and technology areas related to NASA's mission.

MU-SPIN strengthens the science and engineering capabilities of MU-SPIN institutions to participate in competitive research and education processes via computer networks; and it develops training and education mechanisms to support, sustain and evolve the institutional network infrastructure, generating a better prepared pool of candidates to contribute to NASA's workforce diversity efforts.

Students from a middle school in Prince George's County present their solution to resolve an actual problem with some of the Hubble's thermal blankets as part of the Hubble Engineering Competition.

Business Community

Our colleagues in industry and neighbors in the community have stepped up inclusion of more members and activities in support of Goddard's goals. These groups become our customers as well.

Goddard Alliance

The Alliance was formed in 1996 as a non-profit, civic organization to illustrate Goddard Space Flight Center as a positive economic and technology contributor to the Greenbelt community. Members come from state and local government, local businesses, educational institutions, and the Goddard contractor community. The Alliance strives to achieve community-wide support infrastructure, provides a focal point for local industry, and encourages contractor-based centers of excellence. First and foremost, the Alliance networks with constituents and partner organizations with mutual interests to increase exposure of the Center's achievements within the community.

The Goddard Contractors' Association

This group provides a forum for the exchange of information between Center management and the contractor community. During the past year, the Agency selected the Goddard Contractors' Association (GCA) as a model and recognized the role of the GCA to share reports and recommendations that are useful to similar organizations. In addition, the GCA, with Goddard personnel, developed a set of guidelines to facilitate and speed the process to reach resolution regarding onsite harassment and discrimination complaints. The GCA also hosted an annual quality and continuous improvement symposium to educate industry and government on approaches to overcome challenges. This year's session featured the innovative Rapid Spacecraft Development contract and the Next Generation Space Telescope project. With guidance from its sister Greenbelt organization, a similar effort is underway at the Wallops Flight Facility.

A subgroup of the GCA is the Public Affairs Consortium. This group shares the goals of the GCA, comes from the same organizations, and focuses on public information and communication to ensure consistency and coordination of activities to target audiences.

Economic Impact

Goddard directly impacts local and national economic health. The Center spends its resources for required goods and services and contributes directly to the area's economy by creating jobs, leading to salaries that are re-spent in the community. Dollars are spent on people, our Nation's most important asset.

Contract Obligations

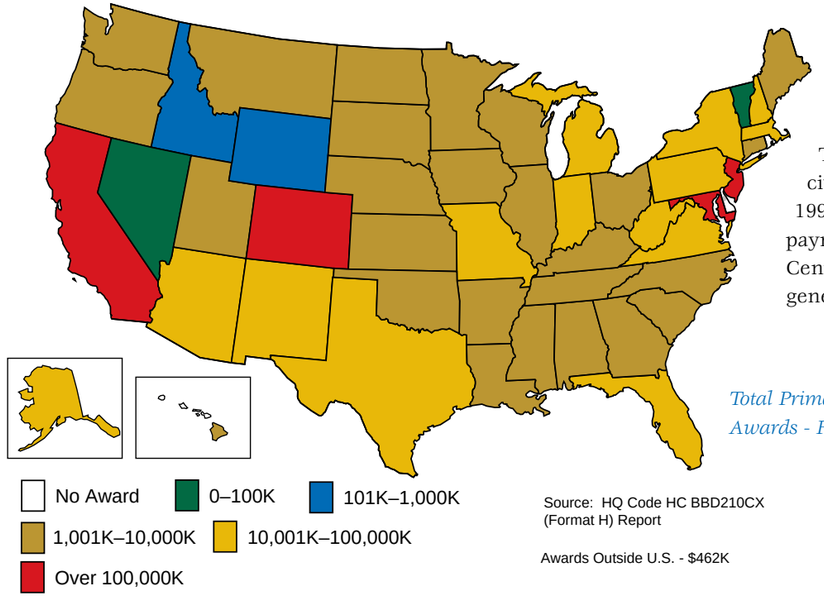
In accomplishing its mission, Goddard spends the greatest part of its resources through contracts acquiring various products and services. The dollars obligated by Goddard significantly enhance business development, job creation, and tax bases for both the state and local economies. In total, the Center obligated over $2.5 billion on new and existing contracts in FY 1998; 65% went to commercial firms, 22% to educational institutions, 7% to non-profit organizations, 5% to intragovernmental, and 1% outside the U.S. Geographically, these obligations and prime contract awards are issued to contractors nationwide. Overall, Goddard processes more than 40% of the agency's contractual actions and 30% of the contractual obligations.

Ultimately, the dollars obligated by the Center are returned to the local and national economies in the form of gross output, sales, the purchase of intermediate goods and services, and employee income. For every $1 that Goddard obligates, a total of $2.09 in gross output of sales are generated in the state of Maryland alone.[1]

Employment Impact

Goddard's mission is supported by civil servant employees and onsite, contractor employees. The Center has a highly technical skill base with the majority of the workforce comprised of scientists and engineers.

Total salaries and benefits for all civil servant employees for FY 1998 were $278 million. For every payroll dollar generated by the Center, $1.20 of additional income is generated statewide[2].



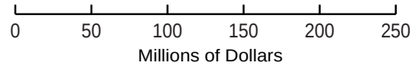
Total Prime Contract Awards - FY98

Support to Small and Disadvantaged Business

Goddard continues its strong support to small, disadvantaged, and women-owned business firms. During FY 1998, the Center obligated $236,377,000 on new awards and existing contracts with small, disadvantaged and women-owned business. Of these obligations, 32% were set-aside exclusively for small businesses and 26% were awarded to disadvantaged small businesses in the Small Business Administration's 8(a) program.

Top 25 Business Contractors - FY98

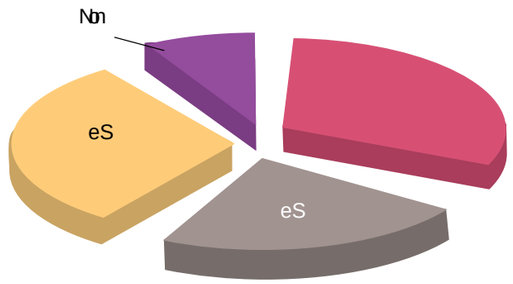
FY 98	FY 97	Company	Number of Contracts	Millions of Dollars Obligated
1	4	McDonnell Douglas Corporation	3	$236.6
2	1	AlliedSignal Technical Services	3	$233.7
3	3	Lockheed Martin Corp.	30	$230.5
4	7	TRW, Inc.	10	$132.7
5	4	Hughes Aircraft Company	4	$107.0
6	5	Hughes Information Technical Corporation	1	$91.9
7	12	Ball Aerospace & Tech. Corporation	10	$57.3
8	11	ITT Corporation	5	$57.0
9	8	Hughes STX Corporation	15	$51.8
10	7	Swales & Associates, Inc.	5	$37.7
11	9	Santa Barbara Research Corporation	6	$36.9
12	14	Space Systems Loral, Inc.	2	$30.9
*13	15	Jackson & Tull, Inc.	3	$27.4
14	10	Aerojet General Corporation	4	$26.3
15	28	Orbital Sciences Corporation	9	$20.9
16	18	NSI Technology Services Corporation	1	$20.6
17	17	Cortez III Service Corporation	1	$20.0
18	59	Computer Sciences Corporation	14	$20.0
19	23	Fairchild Space & Defense Corp.	1	$15.9
20	13	Raytheon Service Company	1	$15.1
*21	26	Science Systems Applications	6	$14.8
22	29	Unisys Corporation	1	$14.5
23	27	General Sciences Corporation	4	$14.4
24	22	Brown & Root Services Corporation	1	$12.9
*25	25	QSS Group, Inc.	3	$12.8



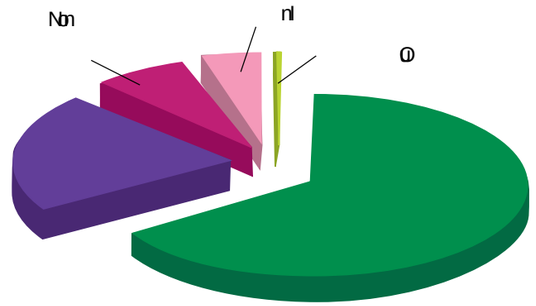
Source: BBD210CX (Format H) Report

*8(a) Minority

Distribution of awards to Small and Disadvantaged Businesses - FY98 obligations

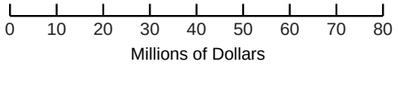


Distribution of procurements - FY98 obligations



Top 25 Nonprofit Institutions - FY98

FY 98	FY 97	Institutions	Number of Contracts	Millions of Dollars Obligated
1	2	Johns Hopkins University	67	$64.7
2	1	Assoc. of Universities for Res. in Astronomy	17	$48.8
3	3	University of Colorado – Boulder	152	$36.2
4	5	University of Maryland – College Park	137	$24.9
5	8	University of California – Berkeley	99	$20.9
6	4	Southwest Research Institute	33	$20
7	10	New Mexico State University – Las Cruces	18	$18.1
8	7	California Institute of Technology	71	$17.3
9	13	Massachusetts Institute of Technology	99	$15.8
10	12	Wheeling Jesuit College	3	$15.2
11	9	University of Arizona	100	$14.3
12	6	Universities Space Research	46	$13.3
13	11	Columbia University	63	$12.8
14	16	Smithsonian Institution	114	$11.5
15	11	University of Alaska – Fairbanks	29	$10.3
16	17	Stanford University	42	$10.0
17	19	University of Washington	65	$8.0
18	20	University of New Hampshire	53	$7.9
19	15	University of California – San Diego	66	$7.3
20	--	American Museum Natural History	4	$5.9
21	25	University of Texas – Austin	47	$5.8
22	21	University of California – Los Angeles	57	$5.4
23	19	University of Wisconsin – Madison	65	$5.3
24	29	University of Iowa	23	$5.3
25	31	University of Hawaii	49	$5.3



Source: BBD210CX (Format H) Report

Excludes Purchases <25K

Geographical distribution summary - FY98
Obligations by state - place of performance

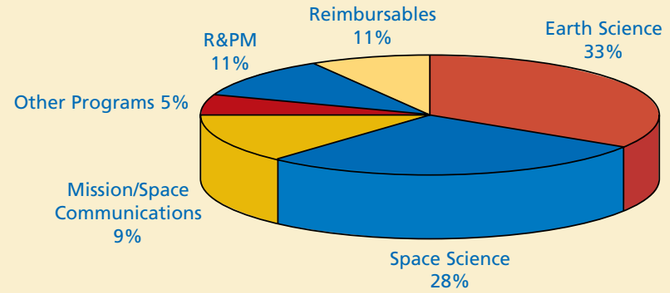
State	Total ($K)	State	Total ($K)
Alabama	$ 5,112	Montana	$ 2,520
Alaska	10,042	Nebraska	2,237
Arizona	19,883	Nevada	718
Arkansas	1,389	New Hampshire	14,373
California	663,077	New Jersey	112,726
Colorado	108,227	New Mexico	13,222
Connecticut	4,187	New York	36,159
Delaware	2,129	North Carolina	4,791
District of Columbia	17,078	North Dakota	3,049
Florida	20,608	Ohio	5,874
Georgia	6,069	Oklahoma	1,911
Hawaii	8,492	Oregon	5,845
Idaho	769	Pennsylvania	36,794
Illinois	8,072	Rhode Island	2,865
Indiana	59,290	South Carolina	1,871
Iowa	8,123	South Dakota	2,161
Kansas	2,314	Tennessee	1,960
Kentucky	1,497	Texas	66,352
Louisiana	2,638	Utah	4,032
Maine	1,982	Vermont	483
Maryland	1,050,615	Virginia	73,275
Massachusetts	46,570	Washington	11,882
Michigan	10,768	West Virginia	23,250
Minnesota	2,731	Wisconsin	7,671
Mississippi	1,404	Wyoming	565
Missouri	4,362	**TOTAL**	**$2,505,024**

Source: BBD140CX (Fortmat F) Report

Excludes Purchases <$25

Goddard FY98 Budget ($M)

	FY98	FY97	FY96
Earth Science	1,117.9	1,032.9	898.6
Space Science	869.2	836.8	722.7
Mission/Space Communications	265.0	396.2	431.7
Other Programs	150.4	171.7	174.1
R&PM	340.9	334.5	306.9
Subtotal Direct Appropriations	2,743.4	2,772.1	2,534.0
Reimbursables	336.0	265.2	278.9
Total	**3,079.4**	**3,037.3**	**2,812.9**



POP 98-1 — Total Center Summary *(Civil Service & Contractor Support FTEs)*

	FY98
Earth Science	2,477.0
Space Science	2,483.5
Mission/Space Communications	2,424.1
Other Direct Programs	567.8
Indirects	1,858.2
Total	**9,810.6**

OVERVIEW OF FINANCIAL STATEMENTS

The Fiscal Year (FY) 98 Financial Statements have been formulated to present the financial position and results of operations of NASA, Goddard Space Flight Center (GSFC), pursuant to the requirements of the Chief Financial Officers Act of 1990 and the Government Reform Act of 1994. These statements include Statement of Financial Position and Statement of Operations and Changes in Net Position. The statements have been prepared from the official accounting and budgetary records of GSFC (Basic Accounting System and Fiscal System) in accordance with the form and contents prescribed by the Office of Management and Budget (OMB) Bulletin 94-01.

The statements should be read with the realization that they reflect the component of a sovereign entity; that liabilities not covered by budgetary resources cannot be liquidated without the enactment of an appropriation; and that payment of all liabilities, other than contracts, can be abrogated by the sovereign entity.

There are nine appropriations included in GSFC's Financial Statements. The current appropriations are Human Space Flight (HSF), Science Aeronautics Technology (SAT), Mission Support (MS), Office of Inspector General (OIG), and Trust Fund Expense (TFE). Actual expenses for all appropriations including government and non-government reimbursable activities are reflected in the Financial Statements for FY98.

Statement of Financial Position
As of September 30, 1998

	1998	1997
Assets		
Intragovernmental Assets:	(In Thousands of $)	(In Thousands of $)
Fund Balance with Treasury (Note 2)	$ 1,611,787	$ 1,767,059
Accounts Receivable, Net (Note 3) – Federal Claims	71,989	58,698
Advances and Prepayments (Note 4)	3,435	3,142
Governmental Assets:		
Accounts Receivable, Net (Note 3) – Non-federal Claims	$ 7,994	$ 3,064
Advances and Prepayments	—	—
Operating Materials & Supplies, Net (Note 5)	206,425	4,900
Property, Plant and Equipment, Net (Note 6)	2,762,800	2,680,260
Other Assets (Note 7)	—	151,964
Total Assets	**$4,664,430**	**$4,669,087**
Liabilities		
Liabilities Covered by Budgetary Resources:		
Intragovernmental Liabilities		
Accounts Payable	$ 80,924	$ 102,056
Other Liabilities (Note 8)	21,469	(2,587)
Governmental Liabilities		
Accounts Payable	821,269	734,729
Lease Liabilities	678	1,089
Other Liabilities (Note 8)	6,632	12,683
Total Liabilities Covered by Budgetary Resources	**$ 930,972**	**$ 847,970**
Liabilities Not Covered by Budgetary Resources:		
Intragovernmental Liabilities		
Other Liabilities (Note 8)	$ 2,092	$ 166
Governmental Liabilities		
Other Liabilities (Note 8)	29,876	27,342
Total Liabilities Not Covered by Budgetary Resources	**31,968**	**27,508**
Total Liabilities	**$962,940**	**$875,478**
Net Position (Note 9):		
Balances:		
Unexpended Appropriation	$764,911	$985,318
Invested Capital (Note 10)	2,968,547	2,836,035
Cumulative Results of Operations	—	301
Future Funding Requirements	(31,968)	(28,045)
Total Net Position	**$3,701,490**	**$3,793,609**
Total Liabilities and Net Position	**$4,664,430**	**$4,669,087**

The accompanying notes are an integral part of these statements.

Statement of Operations and Changes in Net Position
For the Year Ended September 30, 1998

	1998	1997
Revenues and Financing Resources:	(In Thousands of $)	(In Thousands of $)
Appropriated Capital Used	$2,935,655	$2,751,560
Revenues from Sales of Goods & Services		
To the Public	18,506	14,624
Intragovernmental	356,355	303,102
Other Revenues and Financing Resources	13,420	356
Less: Receipts Transferred to Treasury	(13,420)	(356)
Total Revenues and Financing Resources:	**$3,310,516**	**$3,069,286**
Expenses:		
Program or Operating Expenses:		
Current Appropriations:		
Science Aeronautics and Technology	$2,386,877	$2,108,756
Human Space Flight	16,572	17,930
Mission Support	534,017	603,797
Office of Inspector General	8	12
Trust Fund Expense	228	—
Noncurrent Appropriations:		
Space Flight Control and Data Communications	(7,655)	4,751
Research and Development	4,647	14,747
Research and Program Management	35	(14)
Construction of Facilities	1,227	1,295
Bad Debts and Writeoffs	—	36
Non-Government: Reimbursable Expenses	18,506	14,624
Government: Reimbursable Expenses	356,355	303,102
Total Expenses:	**$3,310,817**	**$3,069,036**
Excess, (Shortage) of Revenues & Financing Sources Over Total Expenses	**$ (301)**	**$ 250**
Changes in Net Position		
Nonoperation Changes:		
Invested Capital	$ 132,512	$ 77,011
Unexpended Appropriations	(220,407)	34,422
Future Funding Requirements	(3,923)	(1,757)
Total Nonoperation Changes	**$ (91,818)**	**$ 109,676**
Excess, (Shortage) of Revenues & Financing Sources Over Total Expenses	**(301)**	**250**
Net Position, Beginning Balance	**$3,793,609**	**$3,683,683**
Net Position, Ending Balance	**$3,701,490**	**$3,793,609**

The accompanying notes are an integral part of these statements.

Notes to the Financial Statements
For the Year Ended September 30, 1998

Summary of Accounting Policies and Operations – Note 1

Basis of Presentation

In accordance with NASA's Chief Financial Officer (CFO) directive that installations begin the process of fulfilling the requirements legislated by the Chief Financial Officers Act of 1990, regarding the preparation of subject to audit financial statements (beginning FY 1996), these statements were formulated from the books and records of GSFC in conformity with form and content procedures specified in OMB Bulletin 94-01.

Reporting Entity

GSFC is one of nine NASA field centers established to assist NASA in its mission to provide for aeronautical and space activities. The financial management of NASA's operations is the responsibility of Center officials at all organizational levels. Ultimately, the Financial Management Division, Code 151, within the office of the Center's CFO is responsible for synthesizing, aggregating, and reporting accounting events to NASA Headquarters Code B and the Department of Treasury (for cash transactions), in accordance with Agencywide financial management regulations.

The GSFC overall accounting system consists of numerous feeder systems. When combined, they provide the basic information necessary to meet internal and external financial reporting requirements in terms of funds control and accountability. Albeit, it is recognized that the current systems does not meet OMB Circular A-127 requirements for a single integrated financial system. NASA is moving to implementing a full-integrated financial system. NASA contracted KPMG Peat Marwick to identify and modify an off-the-shelf accounting package to accomplish this objective. Currently, Goddard is scheduled for deployment in FY 2000.

The following nine direct appropriations require individual treatment and are distinctly classified in GSFC combined accounting and control systems:

(1) **HSF** – supports human space flight research and development activities for space flight, spacecraft control, and communications actions. This includes research, development, operations, services, maintenance, and construction of facilities, which encompass the repair, rehabilitation, and modification of real and personal property.

(2) **SAT** – provides for the conduct and support of science, aeronautics, and technology. Research, development, operations, services, maintenance, and construction of facilities (repair, rehabilitation, and modification of real and personal property) also serve as by-products of this appropriation.

(3) **MS** – funds safety, reliability and quality assurance activities in support of Agency programs and space communication services for NASA programs. The appropriation also provides budgetary resources for salaries, fringe benefits, and related expenses, while supporting research and construction of facilities.

(4) **Space Flight Control and Data Communications (SFCDC)** – provides for space flight, expendable launch vehicles, spacecraft control, and communication activities,

including operations, production services, related institutional activities, minor construction, maintenance, repair, rehabilitation and modifications. This appropriation was restructured and replaced in the FY 1995 NASA budget.

(5) **Research and Development (R&D)** – includes research and development of the aeronautics and space research, related institutional activities. This appropriation was restructured and replaced in the FY 1995 NASA budget.

(6) **Research and Program Management (R&PM)** – funds civil servant salaries, fringe benefits, training, travel, and related expenses to manage and conduct NASA programs within GSFC. This appropriation was restructured and replaced in the FY 1995 NASA budget.

(7) **Construction of Facilities (Cof F)** – provides budgetary resources for construction, repair, rehabilitation and modification of facilities, minor construction of new facilities and additions to existing structures, and facility planning and design. This appropriation was restructured and replaced in the FY 1995 NASA budget.

(8) **OIG** – funds necessary OIG salary, travel and related expenses required to conduct audits and investigations of Center activities.

(9) **Trust Fund Expense (TFE)** – expenses of all property and services procured for the trust fund. This appropriation was new in FY 1998 NASA budget.

In addition to the direct appropriations, we receive funds from various federal and non-federal customers to perform aeronautical and space activities.

Basis of Accounting

GSFC accounts are maintained on an accrual basis (i.e., expenses are recorded when incurred and revenue when earned). Expenses are classified in the accounts by appropriation in accordance with the Agencywide coding structure, which sets forth a uniform classification of financial activity that is used for planning, budgeting, accounting, and reporting. The expenses are further categorized in the General Ledger as operating or capitalized expenditures.

Advances

GSFC distributes the majority of its funding used for the University Contracts and Grants Program by the method of Letter of Credit through the Health and Human Services (HHS) Payment Management System (PMS). HHS serves as an agent for the U.S. Treasury in processing the drawdown of funds (disbursements) from a pre-established balance set up by GSFC based on contract/grant awards. The established balance for each University constitute advance payments. A smaller number of university contract/grant recipients receive advance payments on a quarterly basis via check payments through the U.S. Treasury system. In accordance with OMB Circular A-110, quarterly financial reporting of transactions is provided by recipients on Federal Cash Transactions Reports (SF 272's). Detailed monitoring, funds control (against outstanding obligations), and accountability records are maintained. In addition, audits by the Defense Contract Audit Agency and NASA's OIG support this monitoring.

Property, Plant, and Equipment (PP&E)

GSFC-owned Property, Plant, and Equipment (PP&E) may be held by the Center or its contractors. Under the provisions of the Federal Acquisition Regulation (FAR), contractors are responsible for control over and accountability for such property in their possession. The GSFC General Ledger is capable of classifying Government-held PP&E from Contractor-held PP&E.

Government regulation does not make a provision for depreciating PP&E under appropriated funding authority. However, in accordance with the User Charge Act and OMB Circular A-25, NASA is permitted to assess depreciation charges for the use of facilities and equipment, under the "full cost" concept, to non-government reimbursable customers. In addition, automated data processing software is treated as operating cost rather than capitalized, in accordance with GAO Title II guidelines.

Equipment with a unit cost of $100,000 or more and a useful life of two years or more and will not be consumed in an experiment, is capitalized. Capitalized cost includes unit cost, transportation, installation, and handling and storage cost. Real property such as land, buildings, and other structures and facilities, is capitalized when the asset value is $100,000 or more. Effective in FY98, NASA raised the capitalization threshold for PP&E from $5,000 to $100,000.

Land values are recorded at original acquisition cost and do not reflect current market value or include cost of improvements. Buildings are also valued at acquisition cost, including the cost of capital improvements and fixed equipment required for functional use of the facility.

Government-owned/Contractor-held property includes GSFC real property, such as land, buildings, and structures, materials, plant equipment, space hardware, special tooling, and special test equipment. Contractors are directed to report annually (on NASA Form 1018) plant equipment costing $100,000 or more and having a useful life of two years and will not be consumed in an experiment. In addition, this reporting includes capturing the other property categories mentioned above, regardless of the value (although most exceed $100,000), and is included in the Statement of Financial Position. This reporting is certified by the contractor's representative and reviewed by a government property administrator. Space hardware work-in-progress represent the largest amount of assets owned by GSFC.

Revenues and Other Financing Sources

GSFC receives the majority of its funding through multiyear appropriations. These include three-year appropriations for construction activities, two-year appropriations for operational and space flight activities, and a single year appropriation for civil service payroll and travel. In addition to appropriated funds, the Center performs services for federal and non-federal customers upon receipt of customers funding authority.

Notes to the Statement of Financial Position
For the Year Ended September 30, 1998

FUND BALANCES WITH TREASURY – NOTE 2

	Obligated Available	Unobligated Available	Unobligated Restricted	Total
Appropriated Funds	$1,358,139	$243,155	$9,991	$1,611,285
Deposit Funds for Reimbursable Advances	502	—	—	502
Total Funds Balance with Treasury	**$1,358,641**	**$243,155**	**$9,991**	**$1,611,787**

GSFC cash receipts and disbursements are processed by the U.S. Treasury. The funds with the U.S. Treasury include appropriated funds, trust funds, and deposited funds for advances received for reimbursable services.

ACCOUNTS RECEIVABLE – NOTE 3

	Entity Accounts Receivable	Allowances for Losses on A/R & Int	Net Amount Due
Intragovernmental	$71,989	$ —	$71,989
Governmental	8,033	(39)	7,994
Total Accounts Receivable	**$80,022**	**$ (39)**	**$79,983**

Accounts Receivable consist of amounts owed to GSFC by other Federal Agencies and amounts owed by the public. NASA establishes an allowance amount for reporting purposes based on an analysis of outstanding receivable balances. Most receivables are due from other Federal Agencies for reimbursement of services. Non-federal customers provide advance payments which are placed on deposit with the U.S. Treasury until services are performed.

ADVANCES AND PREPAYMENTS – NOTE 4

	1998	1997	CHANGE
Intragovernmental	$3,435	$3,142	$293

See Note 1 for dissussion on Advances and Prepayments.

OPERATING MATERIALS AND SUPPLIES – NOTE 5

	1998	1997	CHANGE
Contractor-held Materials	$201,127	$ —	$201,127
Stores Stock	5,253	4,854	399
Standby Stock	45	45	—
Total Operating Materials and Supplies	**$206,425**	**$4,899**	**$201,526**

The variance shown above results from a change in the application of government accounting principles. The change requires classification of Contract-held Materials as Operating Materials and Supplies. Based on the correct application of goverment accounting principles, the amount resulted in an increase of $151,964 to Operating Materials and Supplies and a decrease in Other Assets.

In accordance with Federal Accounting Standards Advisory promulgation, materials held by GSFC, which are repetitively procured, stored, and issued on the basis of recurring demand are considered Operating Material and Supplies.

PROPERTY, PLANT, AND EQUIPMENT – NOTE 6

Government-owned/Government-held	1998	1997	Change
Land	$ 5,483	$ 3,351	$ 2,132
Structures, Facilities & Leasehold Improvements	513,930	506,718	7,212
Equipment	365,825	738,294	(372,469)
Assets Under Capital Lease	12,911	12,911	-
Work-in-Process	1,630,525	1,144,253	486,272
Total	**$2,528,674**	**$2,405,527**	**$123,147**

Government-owned/Contractor-held	1998	1997	Change
Structures, Facilities & Leasehold Improvements	$ 14,833	$ 14,427	406
Equipment	24,891	92,086	(67,195)
Special Tooling	6,667	16,371	(9,704)
Special Test Equipment	79,682	97,981	(18,299)
Space Hardware	108,053	53,868	54,185
Total	**$ 234,126**	**$ 274,733**	**$(40,607)**
Grand Total	**$2,762,800**	**$2,680,260**	**$ 82,540**

The variance amount of $2,132k in the land account resulted from sitework clearing. The variance amount of Equipment accounts resulted from the new change in the capitalization of PP&E from $5k to 100k.

The variance amount of $486,272k in the Work-in-Process account resulted from an increase in cost reporting from Goddard's contractors.

See Note 1 for dissussion on Property, Plant, and Equipment .

OTHER ASSETS – NOTE 7

	1998	1997	Change
Contractor-held Materials	$—	$151,964	$(151,964)

The variance shown above results from a change in the application of government accounting principles. The change requires classification of Contract-Held Materials as Operating Materials and Supplies. Based on the correct application of goverment accounting principles, the amount resulted in a decrease of $151,964 to other assets and an increase to Operating Materials and Supplies.

These assets include Government-owned/Contractor-held materials.

OTHER LIABILITIES – NOTE 8

Liabilities Covered by Budgetary Resources:	Current	Non-Current	Total
Intragovernmental Liabilities:			
Liabilities for Deposit and Suspense Funds	$21,231	$ —	$21,231
Liabilities for Statistical Reimbursable Cost	238	—	238
Total	**$21,469**	**—**	**$21,469**
Governmental Liabilities:			
Liabilities for Deposit and Suspense Funds	$ 6,627	—	$ 6,627
Liabilities for Statistical Reimbursable Cost	5	—	5
Total	**$ 6,632**	**—**	**$ 6,632**
Total Liabilities Covered by Budgetary Resources	**$28,101**	**—**	**$28,101**

OTHER LIABILITIES – NOTE 8 Continued:

Liabilities Not Covered by Budgetary Resources:	Current		Non-Current
Intragovernmental Liabilities			
Accounts Payable for Closed Appropriation	$ —	$2,092	$ 2,092
Liabilities for Receipts Accounts	—		—
Total	**$ —**	**$2,092**	**$ 2,092**
Governmental Liabilities:			
Accounts Payable for Closed Appropriation	$ —	$6,459	$ 6,459
Liabilities for Receipts Accounts			
Unfunded Annual Leave	23,414	3	23,417
Total	**$23,414**	**$6,462**	**$29,876**
Total Liabilities Not Covered by Budgetary Resources	**$23,414**	**$8,554**	**$31,968**
Grand Total	**$51,515**	**$8,554**	**$60,069**

Accounts payable include amounts recorded for receipt of goods or services furnished to the Center but not disbursed. Additionally, throughout GSFC, cost is recognized and accrued based on information provided monthly by contractors on cost and performance reports (NASA Form 533, Contractor Financial Management Report). The Defense Contract Audit Agency (DCAA) performs independent audits on reported cost to ensure reliability of estimates. Also, further assurance is provided by GSFC resource analysts as a result of examining cost accruals generated from the NF 533's.

NET POSITION – NOTE 9

	Appropriated Funds
Unexpended Appropriations	
Undelivered	$511,765
Unobligated:	
Available	243,155
Unavailable	9,991
Invested Capital (Note 10)	2,968,547
Cumulative Results of Operations	—
Future Funding Requirements	(31,968)
Total Net Position	**$3,701,490**

INVESTED CAPITAL – NOTE 10

PROPERTY, PLANT, AND EQUIPMENT	$2,762,800
OPERATING MATERIALS AND SUPPLIES	206,425
LESS LIABILITY FOR CAPITALIZED LEASES	(678)
INVESTED CAPITAL	**$2,968,547**

People At Work and In The Community

A popular program at Community Day is the puppet show that follows the exploits of two NASA astronauts on their first trip into space.

Goddard employees recognize the need to share their expertise with not only colleagues, but also with nontraditional audiences. Volunteerism, distinctive awards and recognition, and reaching towards others to enhance the quality of life represent the "beyond the gates" attitude that earns Goddard a leadership reputation.

Reaching the General Public

Community Day

The Goddard Visitor Center hosts two Community Days a year for our families, neighbors, and interested public. Over 10,000 visitors enjoy these special days; average annual attendance for Greenbelt and Wallops Visitor Centers is 100,000 guests. Community Days differ with each event because the Days are based on unique themes, such as Earth Week or Agency achievements.

Earth Science Gallery

"Build it and they will understand," were the words spoken at the ribbon cutting ceremony for the Goddard Visitor Center's new Earth Science Gallery. The gallery, built in partnership with the National Oceanic and Atmospheric Administration, was developed to promote the education of the public about how we affect our environment and how the environment affects us. The gallery includes a variety of interactive displays and integrated web sites with Earth science data.

Web Sites

Applying technology to deliver information, images, activities and interaction with scientists, Goddard built a Center web site that was accessed by millions of people over the year. Many Goddard-developed web sites have earned recognition and awards, citations, and glowing feedback from users.

Local Community Impact

Goddard and its employees are becoming more visible throughout the local community. The Center works with local businesses, state and federal agencies, chambers of commerce, and local elected officials. Goddard is committed to become the best community neighbor it can be by sharing our expertise, resources, and most importantly ourselves. Whether it is through the Visitor Center or a Speaker's Bureau experience, the Traveling Exhibits program, or everyday interaction with local citizens, good community relations is important to the Center.

Center Management worked with the Prince George's Economic Development Corporation (EDC) to establish stronger business ties for the purpose of commercializing NASA technology and expanding opportunities for disadvantaged businesses in Prince George's County. As a result, Goddard endorsed the EDC's application on behalf of Prince George's County to become a Federal Empowerment Zone. If successful, special tax incentives designed to encourage investment, business expansion, and job creation will become available to the County.

Small Business Innovation Research

Goddard sponsored the first Small Business Innovation Research (SBIR) Technology Exhibit. This event was held with Goddard's Twenty-fifth Annual Small and Small Disadvantaged Business Conference to provide counseling opportunities to small firms doing business with government and prime contractors. The SBIR exhibit showcased achievements by selected NASA SBIR companies currently doing business with Goddard.

Focus Groups

Center Director A.V. Diaz hosted a series of Community Relations Focus Groups with local elected officials, neighboring state and federal agencies, business organizations, chambers of commerce, and local homeowner's associations. These meetings allowed opportunities to share information on Goddard's missions and research and on new business ties and partnerships.

Technology on Capitol Hill

Goddard scientists and engineers displayed state-of-the-art technology at the 1998 Technology Showcase on Capitol Hill. Exhibits from each of NASA's four strategic enterprises were displayed at the invitation of Congressman Dana Rohrabacher, Chairman, Subcommittee on Space and Aeronautics, Committee on Science. Goddard exhibits included Hubble Space Telescope, Next Generation Space Telescope, Nanosat, Technology Commercialization, Distributed Active Archive Center, and visualization and analysis of Earth science data. Despite busy schedules, over 20 members of Congress and scores of Hill employees visited the demonstrations.

NASA Administrator Dan Goldin at the Technology Day on Capitol Hill.

The new Earth Science Gallery at the Visitor Center includes a variety of interactive displays; integrated web sites with Earth science data.

Earth Today

"Earth Today: A Digital View of our Dynamic Planet," a new exhibit at the National Air and Space Museum, is the first exhibit to display global-scale Earth science data sets collected daily by NASA, NOAA, the U.S. Navy, and the United States Geological Survey in near-real time. Current data of sea surface temperature, atmospheric clouds and water vapor concentrations, land and ocean biospheres, and earthquakes are updated continuously and projected onto a large screen. A state-of-the-art graphics supercomputer automatically retrieves and formats the data for the near real-time portion of the program.

Reaching Goddard Employees

Celebrate Goddard Day

Goddard celebrated its number one resource, its people, in a day designed to celebrate the diversity of people who make Goddard such a unique place to work. Celebrate Goddard Day consisted of directorate displays of the contribution of employee diversity to Goddard's mission. Dr. Edwin Nichols and Lee Mun Wah gave enlightening educational presentations on workforce diversity. Approximately 5,000 Goddard employees and their families took part in the day's festivities.

Celebrate Goddard Day

Technology Showcase

Goddard held its Technology Showcase to an expanded audience that included employees as well as members from industry, academia, and other government organizations. Entitled "Advancing Science Through Partnerships With Industry," the showcase was developed to illustrate the technology, expertise, and facilities that are of interest to other organizations. With over 135 exhibits focusing on Goddard's Earth and space science enterprises, this event was intended to exhibit our cutting-edge technologies.

Technology Showcase

GSFC Multi-Cultural Advisory Team

The GSFC Multi-Cultural Advisory Team is chartered to provide leadership in promoting the benefits of a multicultural work environment. Team members implement initiatives that help to ensure that employees feel valued, participate fully, and can develop to their full potential in achieving the Center's mission. The team:

- Advocated and helped to establish a new participative Center-level awards and recognition process, including the creation of a "Diversity Enhancement" Award.

- Analyzed Center Culture Survey variances between minorities and non-minorities and formulated recommendations for management consideration.

- Chaired a team to develop recommendations to raise awareness of diversity issues, effect organizational change, and institutionalize diversity as an integral part of Goddard's mission.

Center Director's Colloquium

The Center Director's Colloquia Series was initiated to afford opportunities to learn about a wide range of management and change-related issues. Prominent speakers from the public, private, and academic sectors spoke on topics, including how others enhance creativity, communications, and team effectiveness.

Goddard Employees Welfare Association

The Goddard Employees Welfare Association (GEWA) supports many Centerwide activities for employees throughout the year. Some events that GEWA supported in 1998 were:

Americans with Disabilities Week
Combined Federal Campaign
Atrium Teas and Posters
Safety Awareness Day
Take Your Daughters to Work Day
Women's Advisory Committee
Summer Student Reception
New Employees Welcome
Celebrate Goddard Day
Focus on the Future Day
Management, Scientific, and Engineering Colloquia

Goddard Awardees

The GSFC awards and recognition process underwent a complete reengineering process during 1998. The outcome was the development of an awards system that allows for more employee involvement and more agility and flexibility in recognizing outstanding achievement from the Center workforce.

In addition, many Goddard employees receive awards from prestigious organizations worldwide. However, is difficult to keep track of those employees who have received outside awards, so in order to avoid omissions, the following pages are those Goddard employees who received either Goddard or NASA awards during 1998.

1998 Federal Executive Board Excellence in Federal Career Award

Gold/Silver Finalists

Dr. David A. Content
James B. Heaney
Linda Treece

Bronze Award Winners

John F. Osantowski
Benjamin C. Harris, Sr.
Jacklyn C. Mattson
Katherine A. Richardson

1998 John C. Lindsay Memorial Award

Dr. Jean H. Swank

1997 William Nordberg Memorial Award

Dr. Robert A. Langel, Retired

1998 Moe I. Schneebaum Memorial Award

Dr. F. Landis Markley

1998 NASA Honor Awards

Distinguished Service Medal

Dr. John H. Campbell
Dr. Robert D. Price
Dr. Thomas Flatley

Distinguished Public Service Medal

Dr. Nobuyoshi Fugono
Donald A. Maclean (Retired)

Outstanding Leadership Medal

Richard D. Barney
Martin J. Donohoe
Thomas LaVigna
Donald L. Margolies
Dr. Charles R. McClain
Dr. Michael G. Ryschkewitsch
Dr. Joanne Simpson
James G. Watzin

Public Service Medal

Mary C. Chiu
Jose A. Gonzalez
J. Crane Simmons (Retired)
Dr. Hervey S. Stockman

Exceptional Achievement Medal

W. James Adams
Judith N. Bruner
Dr. John E. Connerney
Dr. Gene Feldman
Dr. John C. Gerlach
Dr. Barry E. Jacobs
Dr. Randy A. Kimble
M. Bruce Milam
Thomas Paprocki
Bruce T. Pham
Giulio Rosanova

Erich F. Stocker
Richard C. Tagler
Thomas E. Williams
Daniel D. Worth
Dr. Darrell F. Zimbelman

Exceptional Service Medal

LuAnn M. Bindschadler
Sandra K. Bowden
Sandra A. Buffalano
Valorie A. Burr
Michael A. Calabrese
Pedro I. Colon
Dr. John H. Day, Jr.
Dr. Richard R. Fisher
Martin E. Frederick
Mildred S. Garner
Abigail D. Harper
Benjamin C. Harris, Sr.
Phillip A. Holloway
Andre D. Jackson
Thomas Keating, Jr.
John T. Langmead, III
Carlos Lopez
Nancy Patton
Dr. Arthur Poland
Charles A. Renn, Jr.
Richard I. Weiss (Retired)
Paula L. Wood

Exceptional Scientific Achievement Medal

Dr. Bruce E. Woodgate

Exceptional Engineering Achievement Medal

John R. Kolasinski

Equal Employment Opportunity Medal

Dr. Theodore R. Gull

Group Achievement Award

Advanced Composition Explorer Team
Bowie State Outreach Team
Cassini Gas Chromatograph Mass Spectrometer and Ion and Neutral Mass Spectrometer Experiment Team
Cassini CIRS Instrument Development Team
Comet Hale-Bopp NASA Sounding Rocket Campaign Support Team
Global Geospace Science Investigations Team
GOES-10 Solar Array Drive Assembly Anomaly and Inverted Operation Group
Integrated Mission Design Center Development and Operations Team
Small Business Innovation Research Program Team
30-Day Spacecraft Team and Rapid Spacecraft Source Evaluation Board
Space Telescope Imaging Spectrograph Development Team
Travel Services Source Evaluation Board Team
Tropical Rainfall Measuring Mission Team
Wallops Mission 2000 Implementation Plan Development Team

Public Service Group Achievement Award

Ogden Logistics Services Mission Support Group
The Boeing Company – Space Transportation Division

1997 Presidential Rank Recipients Meritorious Executive In SES

Dr. James E. Hansen
Arthur F. Obenschain
Dr. Robert D. Price
Dr. David E. Smith

1998 Space Flight Awareness Silver Snoopy Recipients

Daniel J. Duffy, Jr.
Michael B. Feldman
Gregory J. Goulet
Gary Hendricks

Peggy Jester
Warren J. Mitchell
David S. Parker
Teresa Robshaw
Alan Selser
Thomas Shaffer
Sofia Stachel
Edward H. Venter

Space Flight Awareness Launch Honorees

STS-89 Launch Honorees

Douglas J. Bender
Stephen D. Hendry
John Kucel
Angela M. Manifold
Jimmie A. Martin
Mario Martins
Jean McCloskey
Robert McCutcheon
Mark Neumann
James L. Rattigan
Eve Rothenberg
Maria M. So
Hollice Toomer
Jane Whetzel
William R. Williams

STS-91 Launch Honorees

Melissa L. Blizzard
Kevin K. Carmack
Jo-Ann Chernega
Robert Courtney
Mary K. Faller
Craig J. Gray
Michael C. Hogan
Bruce G. Kamen
Charlton R. Hostetler
Ann M. Nicholson
Joel P. Smith
Richard A. Strafella
Marco A. Toral
Albert G. Vernacchio
Yaromyr A. Zinkewych

Annual Goddard Safety Awards

Safety Honorable Mention Award

In recognition of timely response to a burning ballast in Building 23.

Stephen E. Monk
Steven L. Trepanier
Sandra K. Vanderweit-Whit

In recognition of implementing their new program which significantly impacts the reduction of excess furniture that could result in safety hazards.

John W. Slagle, Jr.
Terrence K. Butler
Michael A. Wedge

Contractor Safety Award

Mike Miller
Elizabeth A. Allen
MILA Spaceflight Tracking & Data Network Station

Humanitarian Award

Phillip J. Nessler, Jr.
Tsabikos A. Papadimitris
Phillip Z. Tapper

Safety Award of Merit

Robert P. DeDalis

Safety Award of Honor

John H. Henninger

Facilities Operations Manager Award

Quinton E. Baker

Conclusion

During 1998, the Goddard Space Flight Center celebrated the achievements of the year and the opportunities of the future. Our science research remains an exciting and vibrant component of what we are. Our capabilities to enhance excellent science from business practices to advanced technologies mark our commitment to lead others into the next century. And the inclusion of many people with diverse backgrounds and interests brings a rich texture of perspectives and talents that we enjoy with every passing year.

Goddard employees and customers look forward to another year of busy activity in 1999, from flight projects to ISO certification, from the Goddard Safety Initiative to continued communications with our important communities in the sciences, education, neighborhood and with ourselves as a Center.

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