Seasons Greetings

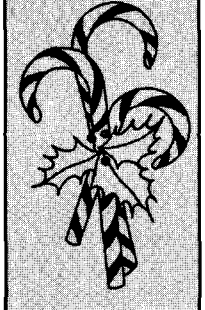
NASA
National Aeronautics and Space Administration
Goddard Space Flight Center

Goddard News

Greenbelt, Maryland / Wallops Island, Virginia

December 1993 Vol. 40 No. 12

INSIDE



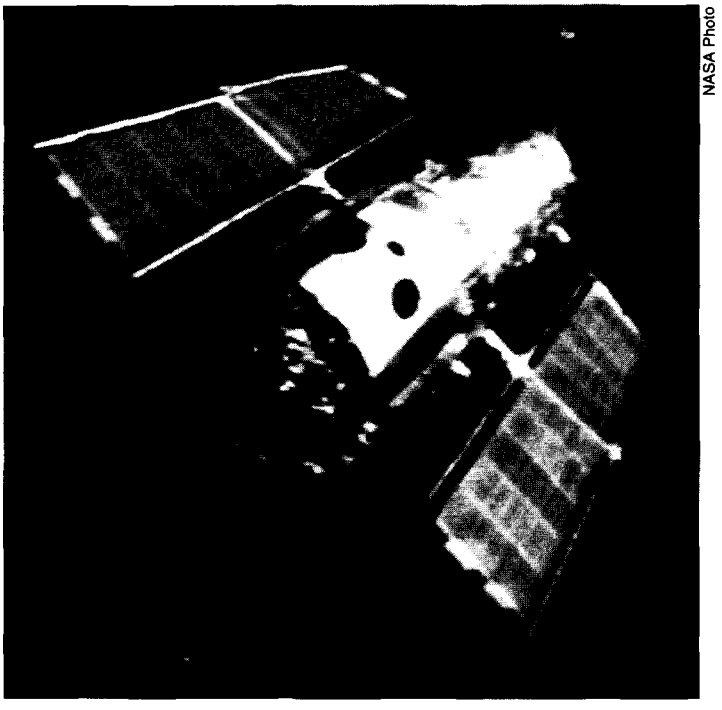
Hubble success hinged on practice making perfect

by Michael Finneran
and Jim Elliott

No one ever thought servicing the Hubble Space Telescope (HST) would be easy. And while in fact it was not, NASA made the 11-day mission look that way thanks to a development test program, integration and testing and, most importantly, extensive training and simulation by not only the astronaut crew but hundreds of ground support personnel.

Goddard employees involved with the project are looking back on the servicing with a mix of surprise that it went so smoothly and elation that the work was accomplished almost exactly as planned.

"The mission and the success thus far certainly can be interpreted as a Goddard success," said an exhausted but happy Joe Rothenberg, associate director of flight projects for HST, Code 440. "The support and encouragement of the entire center, from the director down, civil servants and contractors, were key ingredients in making things happen."



NASA Photo

The Hubble Space Telescope moments after being redeployed by the Space Shuttle Endeavour's robot arm.

Rothenberg, who averaged only three hours sleep a night throughout the mission, said he probably was most relieved when the spacecraft was deployed. "At that point," he explained, "the risk was over. The Goddard team had done its job — the hardware it had installed checked out and it had demonstrated that HST could be restored."

His biggest concern came on the day HST was to be deployed. "Here we thought we were ready to release and that any problems were behind us," he said, "and we discover a data system problem, which raised our anxieties for about six hours."

On that day and the day before, activity focused on Goddard's Space Telescope Operations Control Center (STOCC).

"The team in the STOCC was as well trained as the astronauts," Rothenberg observed. "Having come from an operations background myself, I knew the heroic efforts that were going on to ensure that all operations were fault-free and executed on time. The team also responded admirably to a timeline that was changing all the time."

Dennis McCarthy, Code 442, deputy project manager for flight systems and servicing, who served as day shift manager for the Goddard project team at Johnson, echoed Rothenberg's endorsement.

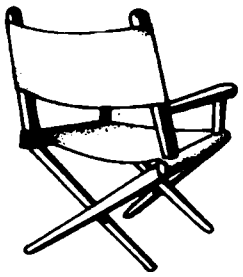
"With the DIU (Data Interface Unit), we were getting erroneous data," he explained, "and we were reacting to bad data without knowing it. The people in the STOCC meticulously and carefully diagnosed the situation."

McCarthy, Code 442, also had high praise for the Johnson flight directors with whom he worked. "They were a big help to me," he said. We were under a lot of pressure to reach decisions, but they always urged us to take our time, expressing their willingness to change the shuttle timeline to facilitate us. They were a big help to me."

"All in all, a smashing good show," said Dr. David Leckrone, Code 600, senior project scientist for Hubble, who viewed the launch at Kennedy Space Center in Florida and then worked the spacewalk shift at Johnson Space Center in Texas. "This is something that we all — NASA, Goddard, Johnson, Kennedy, Marshall, all the contractors and the American people — should be incredibly proud of up to this point."

Crucial to mission success were the many hours of extensive training that ground personnel underwent prior to the mission. In one such training session, called a Joint Integrated Simulation, some 60 hours were spent

Continued on page 8.



Directors' Dialogue

Q: Cafeterias at other NASA Centers seem to provide more variety, tastier food, and lower prices. I believe these other Centers subsidize their cafeteria, thereby improving the quality of daily life. It is my understanding that GEWA opts to subsidize Christmas parties, picnics and other special occasions, at the expense of quality cafeteria service. Making it necessary to go off center for lunch is neither good for productivity nor lunch-time traffic congestion. Can someone explain the logic behind this choice?

A: While all NASA Centers provide cafeteria services, they are for the most part run very differently. Some are managed by the Center, some by the Center along with a contractor, and some are run by their Exchanges. None, however, subsidize their cafeterias. The GEWA Cafeteria Chairman and Co-Chairman work together with Canteen to provide a wide variety menu at the lowest possible prices. We are continually working with Canteen management to improve the quality and cost of food. Our two cafeterias serve approximately 1900 employees daily. Obviously, we are not equipped to provide cafeteria services to all Goddard employees.

Each year, based on the population of each directorate, GEWA provides a fixed dollar amount for each employee. Directorates may choose to subsidize their holiday parties, picnics or other special events with these funds, as long as these functions are open to everyone in the directorate.

Goddard's GEWA Council is made up of representatives from each directorate, who on a voluntary basis work very hard behind the scenes to improve the quality of life at Goddard. These individuals are listed in the back of the GSFC telephone directory; feel free to contact them if you have a specific problem. They will be glad to help you.

Fran Bolster,
Code 200,
GEWA Council

Questions for Directors Dialogue may be sent in to Directors' Dialogue, Code 130, with or without identification. Due to space limitations, not all questions can be answered. Questions are sent to the appropriate directorate office as written but may be edited for space and clarity before being printed. Some questions may be answered outside of this forum.

Goddard year in review: reflections on 1993

Editor's note: This is part one of a two part article.

Goddard and Wallops made great strides in 1993. The year was filled with scientific wonder and engineering achievement. The year began with the launch of a Tracking and Data Relay Satellite and ended with the historic Hubble Space Telescope (HST) First Servicing Mission. Throughout 1993, GSFC and Wallops demonstrated gains in science, engineering, mission operations and institutional growth. To list all of the varied accomplishments would fill much more than an eight page newsletter. Following is a sampling of Goddard's accomplishments:

January

Goddard kicked off the new year with the successful deployment of the Tracking and Data Relay Satellite (TDRS-6). TDRS-6 joined four other TDRS spacecraft in geosynchronous orbit approximately 22,300 miles (35405.64 km) above the Earth.

In science, results from the international Roentgen (ROSAT) satellite, the Goddard-managed Cosmic Background Explorer, and the Hubble Space Telescope were released at the annual American Astronomical Society meeting in Phoenix, Ariz. Several Goddard scientists presented their project's latest results.

Astronomers discovered a huge concentration of mysterious "dark matter" using the international ROSAT X-ray observatory. The discovery appears to confirm previous suggestions of where most of the dark matter in the universe may be concentrated, namely in and around small groups and galaxies, according to astronomers.

The Big Bang theory passed its toughest test yet with results reported from COBE. Precise measurements made by COBE's Far Infrared Absolute Spectrophotometer (FIRAS) of the afterglow from the Big Bang — the primeval explosion that began the Universe — showed that 99.97% of the radiant energy of the universe was released within the first year after the Big Bang itself. Meanwhile, back in Greenbelt, COBE Road was officially named in a ceremony on January 26.

Astronomers announced the discovery of a double nucleus in the active galaxy Markian 315. The discovery made by the HST may solve a decade-old mystery about the nature of a jet-like feature in the Markian 315, a so-called Seyfert galaxy, and appears to confirm one mechanism for producing an active galactic nucleus.

The first, and so far the only, Supreme Court justice to visit Goddard toured the Center in January. Justice Sandra Day O'Conner and four of her law clerks paid Goddard a visit this month.

Continued on page 3.

Goddard year in review

Continued from page 2.

February

Astro-D launched into a near-nominal orbit on February 19 from the Kagoshima Space Center, Japan. The satellite was renamed ASCA, which means "flying bird" in Japanese. Goddard designed mirrors are flying on this satellite. The mirrors use technology developed for an earlier Goddard x-ray endeavor, the Broad Band X-Ray Telescope.

Ninety-seven GSFC and 21 Wallops engineers visited area middle and high schools this month in support of National Engineers Week. Through their combined efforts, the engineers communicated with thousands of students.

March

This month, five satellites in NASA's suite of orbiting astronomical observatories — the International Ultraviolet Explorer, the ROSAT, the ASCA, the Compton Gamma Ray-Observatory and the HST—turned towards a young supernova that is one of the brightest in decades. Through IUE observations, scientists now have evidence that red supergiants — the largest stars known — end their existence as supernovae.

More than 100 scientists participated in an Upper Atmosphere Research Satellite workshop this month in Virginia Beach, Virginia. Many of the talks illustrated new understanding of the development and distributions of important gaseous species impacting ozone, and a newly-perceived role of dynamics and transport from high altitudes in the formation and maintenance of the Antarctic "ozone hole."

In a move designed to streamline management and provide greater overall mission integration of Earth Observing System (EOS) activities, Goddard established a Mission to Planet Earth office this month. The new office is responsible for all program planning and coordination, systems engineering, integration and management efforts.

April

April marked the 10th anniversary of Goddard's Tracking and Data Relay Satellite System (TDRSS). The TDRSS replaced a nearly 25-year-old, worldwide, ground-based tracking and communications network. The TDRSS began with the launch of the first satellite on April 3, 1983. Since then, four other satellites have been put into orbit, the latest in January of this year.

Two Goddard projects were in the spotlight during STS-56 this month. Goddard's Shuttle Solar Backscatter Ultraviolet (SSBUV) and Spartan-201 flew in the cargo bay of the Space Shuttle Discovery. SSBUV measured ozone concentrations by comparing solar ultraviolet radiation with that scattered back from the Earth's atmosphere. Spartan-201 studied the acceleration and velocity of the solar wind and measured aspects of the Sun's corona.

Goddard's spring Community Day at the Visitor Center was a huge success. Volunteers contributed their time, energy and talents to help educate, enlighten and entertain more than 4,000 visitors.

May

Data from Goddard's Compton Gamma-Ray Observatory suggest that gamma-ray bursts may be more powerful than most scientist thought. The discovery challenged long-standing theories about these bursts and raised the possibility that they are created by some unknown object or phenomenon in the universe. One of the instruments that gathered the data is the Energetic Gamma-Ray Experiment Telescope, built at Goddard.

PHOTO CREDIT:Nina Desmond

Goddard opens for to the community

GSFC joined with Prince George's Community College (PGCC) to form the Goddard-PGCC Space Technology Institute to help students gain the skills necessary to prepare them for potential employment in the aerospace industry. Many of the courses within the program are so specialized that they are not offered by other local colleges.

June

The first three days of work in space for the Space Shuttle Endeavour crew during STS-57 concentrated on Goddard's Superfluid Helium On-Orbit Transfer (SHOOT) flight demonstration. The SHOOT experiment demonstrated the technology required to refill superfluid helium dewars in space. SHOOT was conceived, developed and managed by Goddard. SHOOT accomplished a number of first time achievements, including the lowest temperature ever in orbit — 1.1 K (-457 F. 1.1 degrees above absolute). Endeavour also flew 12 Goddard-managed Get Away Special payloads in its cargo bay.

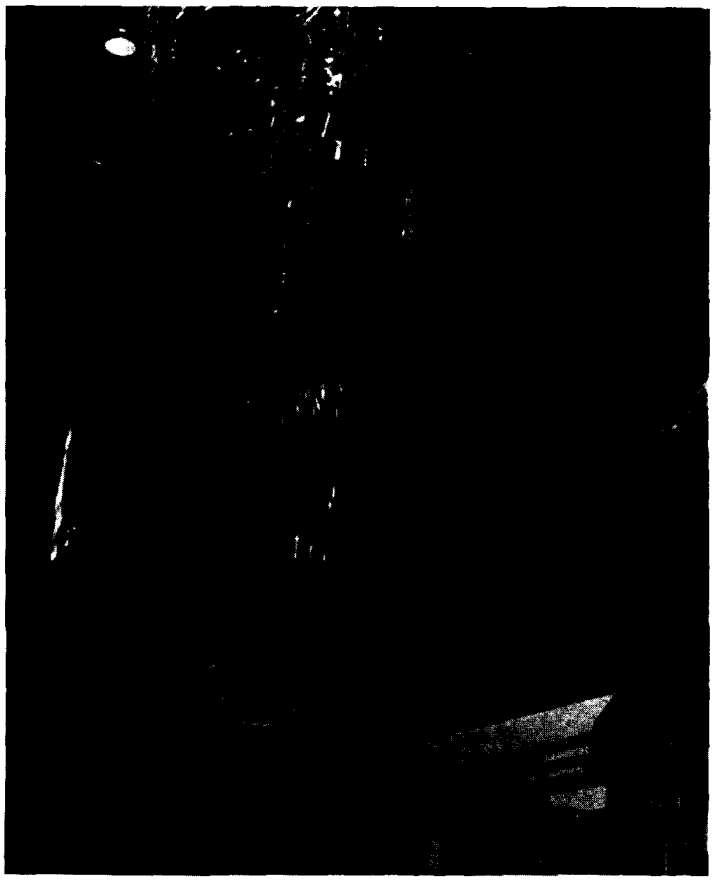
The location of a radiation belt of cosmic rays — particles from beyond the solar system — was pinpointed to several hundred miles above the Earth. The belt was located by Goddard's Solar, Anomalous, and Magnetospheric Particle Explorer (SAMPEX) this month.

Tropical deforestation and adverse effects on tropical forest habitat have increased in the Brazilian Amazon Basin since the late 1970s, a Goddard-University of New Hampshire study revealed this month. Data from the Landsat 4 and 5 satellites covering 1978-88 indicated that although the extent of deforestation is less than expected, it has increased substantially and created adverse "edge effects" that pose a threat to the habitat of plant and animal species.

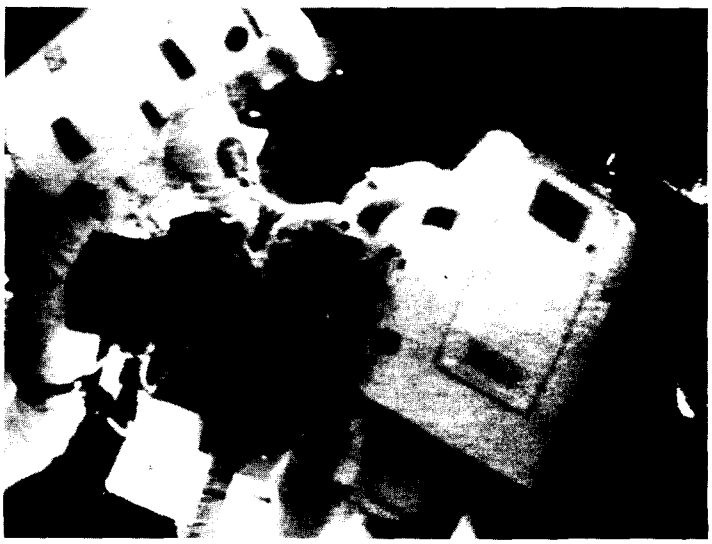
Watch for the continuation of this article in the January 94 issue.

Hubble Space Telescope First Servicing Mission called a success

STS-61 crew completes a record five EVA's



Mission Specialist Jeff Hoffman, tethered (left), and Payload Commander/Mission Specialist Story Musgrave, on the shuttle's robot arm (right), are pictured here replacing the Solar Array Drive Electronics (SADE) during the fifth spacewalk of the servicing mission. The SADE controls the array's ability to point toward the Sun and generate electricity to power the telescope.



During the Hubble First Servicing Mission Senator Barbara Milkulski (D-Md.) visited the Test and Evaluation Facility where a full size space shuttle bay holds a berthed model of the Hubble Space Telescope.

Mission Specialist Kathy Thornton is seen here preparing to jettison the right solar array during the second spacewalk of the HST first servicing mission. The solar array had to be jettisoned after it failed to retract completely because of a kink in its bi-stem framework.

What's Next?

While the servicing mission appears to have been a success, the big question now is, did it work?

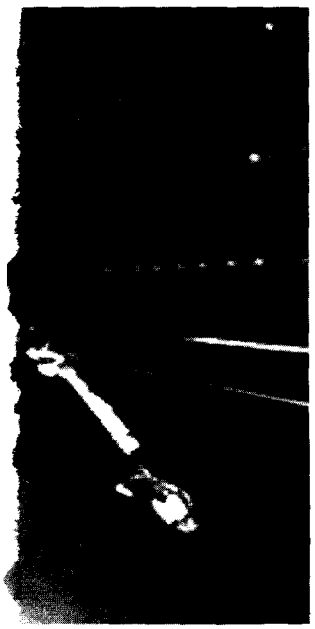
The next few weeks will tell, as NASA managers methodically check out the space telescope's new equipment. The so-called Servicing Mission Observatory Verification phase, now underway, will take 13 to 14 weeks to complete, with the first corrected astronomical images scheduled to be available in six to eight weeks.

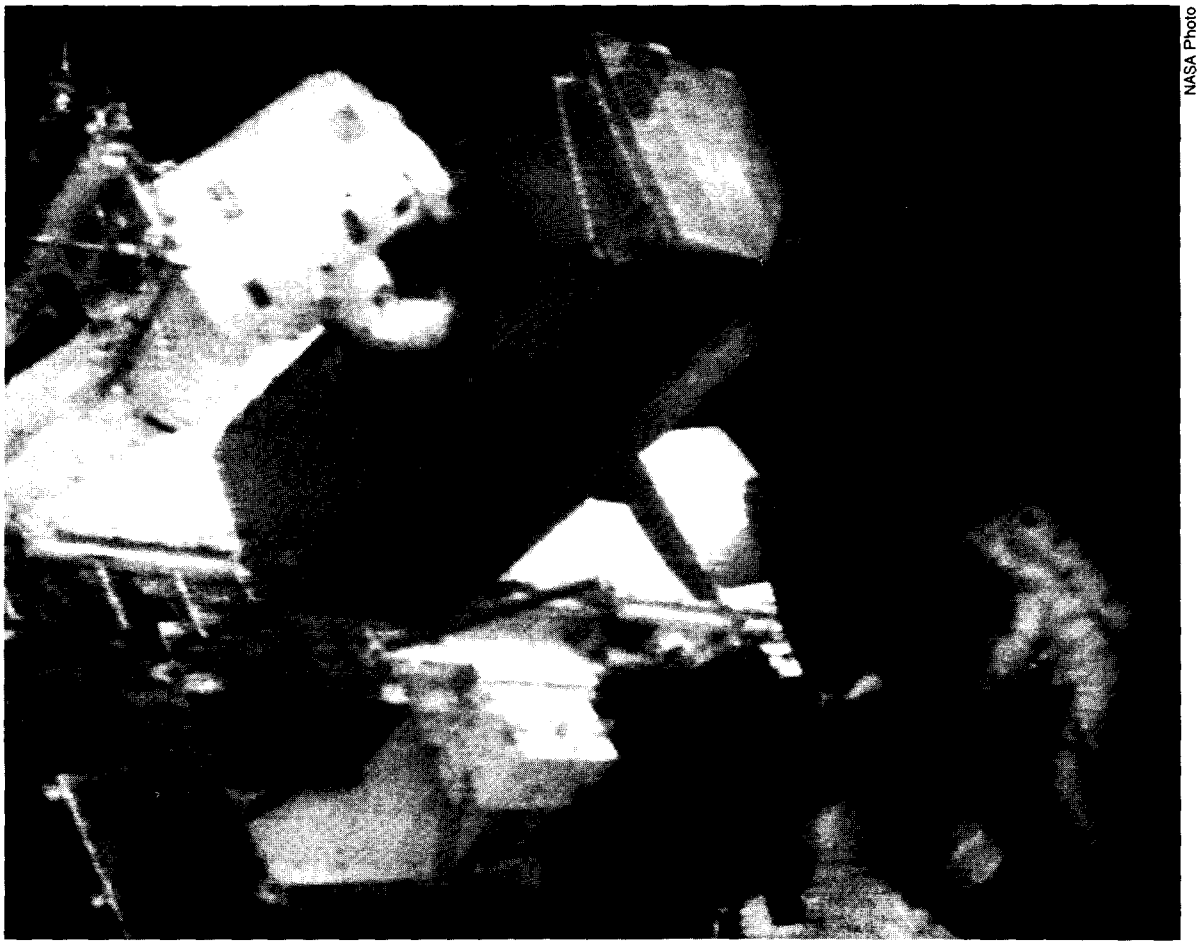
"This is a sort of a trial-and-error process," said Dr. David Leckrone, senior project scientist for Hubble, Code 600. "It will take as long as it takes...one will just have to be a little patient, because in the end we would like, really, to be judged on the best we can do. And I think that's only fair, after all the work people have put into this, that in the end the wine is judged after it's had a chance to age and not straight out of the barrel."

Key activities during verification include:

- Activation and engineering checkout of the science instruments.
- Optical alignment and focusing of WF/PC II and COSTAR.
- Initial calibration of WF/PC II and the COSTAR-corrected science instruments.
- Early science observations.

Engineering checkout activities include:





NASA Photo

Removal of the High Speed Photometer (HSP) and installation of the Corrective Optics Space Telescope Axial Replacement (COSTAR) highlighted the fourth EVA. The HSP, a first generation instrument, was replaced by COSTAR. COSTAR uses a series of 10 corrective mirrors for the remaining Hubble instruments: the Faint Object Camera (FOC), the Faint Object Spectrograph (FOS) and the Goddard High Resolution Spectrograph (GHRS). COSTAR will compensate for the spherical abberation in the Hubble's primary mirror.

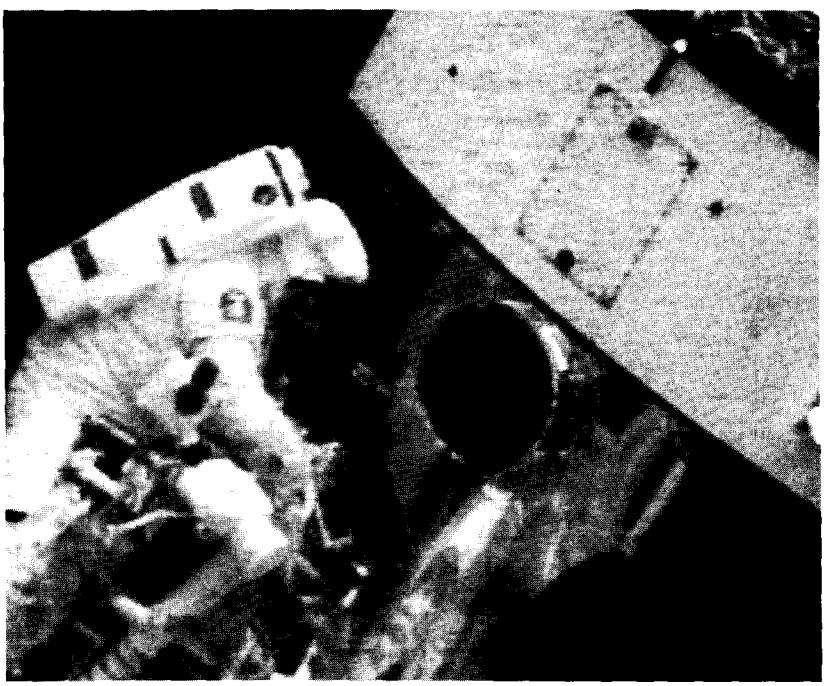
- Decontaminate the WF/PC II detectors (charge-coupled devices, or CCDs) of foreign substances by heating the detectors to drive off contaminants.
- Establish proper operating temperature of WF/PC II CCDs by monitoring ultraviolet (UV) light from a calibration star.
- Monitor pressure drop, due to out-gassing, until it is safe to turn on high voltage to the COSTAR-corrected science instruments.
- Determine the effects of the servicing mission on basic, or pre-COSTAR, optical performance of the science instruments.

Steps in focusing the science instruments include:

- Check out the first-generation instruments and conduct pre-focusing tests.
- Adjust the secondary mirror in Hubble's optical telescope assembly to set focus for WF/PC II and correct for residual coma in the assembly.
- Deploy COSTAR arms.
- Adjust COSTAR and WF/PC II optics and mirrors, including mirror kit, coarse adjustment, fine alignment and focus.

Science instrument calibration includes a series of tests and measurements to establish the actual performance of the science instruments in the areas of sensitivity, resolution and detector-response characteristics.

STS-61 Mission Specialist Jeffrey Hoffman prepares to install a new Rate Sensing Unit during the first spacewalk.



Making A Difference

by Karen W. Davis

The Goddard Equal Opportunity Programs Office (EEO), Code 120, is made up of a team dedicated to helping minority groups, disabled and physically challenged individuals. Terri Patterson, the executive secretary, is a part of that team. Patterson was born in Washington, D.C., and is the proud parent of two sons. She attended D.C. Teachers College, where she studied Physical Education. Her desire to help others influenced her career choices and eventually led her to EEO.

Terri Patterson

She began her career with NASA in 1986 at Marshall Space Flight Center, Huntsville Ala., where she worked in the Photographic Lab. She relocated to Maryland with her family and began a career at Goddard in the Public Affairs Office. She joined EEO in 1991.

Patterson says that there is a difference that is hard to express when working with diverse groups of people. "It takes a lot of heart, but it is especially rewarding because people have certain needs which must be addressed. I used to feel sorry for people because they were a minority or physically disabled. Now, when I talk to them I know that they deserve the same treatment as everyone else. We talk about both personal and professional things. They have taught me never to prejudge."

According to Patterson, her office is like a family; "our office is a tightly-knit group that respects each other and the job that we do. My bosses are tough, but determined advocates for the disabled. They are dedicated to them and will do whatever it takes to help solve their problems or complaints," she said.

Patterson's job is to listen to employee complaints or problems and direct them to a counselor. Most of the complaints are of a discrimination matter. She works in conjunction with the counselors to insure that they meet their deadlines for hearing and resolving the cases. Patterson sees to it that all procedures are documented and adhered to in a timely fashion for each case.

Her team is responsible for making sure that all public places on Center are handicapped accessible. "My job is very important because I am the first person that is contacted when a problem arises," Patterson said. She must determine the appropriate way to proceed and ensure the client that their concerns are important and will be addressed in a professional manner.

Patterson's job is extremely rewarding but it has its drawbacks. "Sometimes I get frustrated because I know that the callers have legitimate complaints, but we can't help everyone. Sometimes there is only so much we can do, but in your heart you always want to do more," she said.

Patterson assigns interpreters for the hearing impaired and works with advisory groups for Hispanics, African Americans and Asians as well as the disabled. She also helps with summer programs for minority students and universities. Participating universities have included Lincoln, Florida A&M, Mississippi State, Spellman and Morehouse.

Most of the students are engineering majors who work with Goddard engineers selected by the Equal Opportunities Office for a six week period. Patterson believes in her job, because she believes the desire to succeed is in everyone.

She helps people realize that they are important and deserve a fair chance to find success. "In our office, everybody is linked by a common goal. No one is more important than the other, we all need each other to survive and the goal is to help everyone until we have exhausted all possible means to solve their concerns or problems."

Patterson is a strong supporter of the D.C. Public School System. She involved with a program called "D.C. Partnership", that began in March 1993. "I wanted to help children in the D.C. area as well as those in Maryland." The focus of the program is to stimulate self-esteem and educational growth.

"We choose engineers who are graduates from D.C. public schools and assign them a school to work," Patterson explained. Each engineer works closely with a teacher from their assigned school to address the needs of the students and teachers. EEO provides equipment for the schools, and counsel students on the importance of having goals and dreams for the future. We encourage students to keep a positive attitude in themselves and their ability to succeed," Patterson said.

Patterson's goal is to see this program succeed. "It's a wonderful feeling to see your dreams unfold and know that you are truly helping others. I love my job because I love helping people. This is what I do best," she said. Her dedication and service is making a difference in peoples lives and their hopes for a better future.

Retirees

Congratulations to the following employees who recently retired!

Name	Code	Years
Geaorge Bishop IV	833.3	36
William Jackson Jr.	832.2	36
George Stonesifer	30	32
Thomas Lavelle	470	32
Raymond Westcott	735.4	31
Thomas Dennis Jr.	260	31
Barbra Glasser	600	30
Salvatore Costa	500	30
Leroy Scriba	271.4	29
Levina Carlson	541	27
Jerome Teles	553	27
Howard Shultz	291.3	27
Wesley McDonald	752.3	26
Carollyn Colley	285	25
David Cristofalo	400	24
Helen Burritt	560	24
Carole Boudrot	235.1	22

Colloquium Schedule

All colloquiums begin at 3:30 p.m. and are held in the Building 3 auditorium:

Scientific Colloquium

Jan. 7: Warren Washington of the National Center for Atmospheric Research will present "New findings from Computer Simulations of the Greenhouse Effect."

Jan. 14: Tom Poremra of John Hopkins University/Applied Physics Lab presents "Space Science and 19th century Polar Explorers."

Jan. 21: Caroll Ann Hodges of the U.S. Geological Survey will present "Minerals and World Affairs: Cause for Conflict?"

Jan. 28: Jack Wisdom of the Massachuetts Institute of Technology presents "Chaos and the Solar System."

Engineering Colloquium

Jan. 10: "Severe Storm Observations from Satellite Images" by Dr. Fritz Hasler of Goddard.

Jan. 24: "Space Medicine" by Dr. Patricia S. Cowings, Ames Research Center.

Goddard winners of excellence award for quality and productivity named

Dr. John Klineberg recently announced the 1993 winners of the Sixth Annual Goddard Excellence Award for Quality and Productivity. The two winners are the Computer Sciences Corporation (CSC), Systems Science Division, SEAS Center of Beltsville, Md., in the large business category; and the Hernandez Engineering Incorporated of Greenbelt, Md., in the small business category.

The two Goddard contractors were chosen from five finalists for the awards. The three finalists for the large business award were the Hercules Aerospace Company, Missiles, Ordnance and Space Group of Magna, Utah; Unisys Corporation Government Systems Group, Systems Services, Goddard Facility of Lanham, Md., and the winner, CSC's System Sciences Division. In the small business category there were two finalists, the Hernandez engineering, Incorporated, the winner; and EER Systems Corporation, Space Applications Group of Seabrook, Md.

The GSFC Excellence Award for Quality and Productivity is offered annually to current GSFC prime contractors, subcontractors, and suppliers who meet the eligibility requirements. Those companies that contribute significantly to the mission of GSFC, regardless of the product or service provided, and that have a continuous improvement program in place that has achieved demonstrable results over a multyear are encouraged to apply. In March 1994, the eligible Goddard contractors must prepare a written application addressing the criteria.

Based on the review of the written applications, those companies considered to be potential winners are selected as finalists. Finalists receive a plaque indicating their status during a ceremony at Goddard.

A site visit is then made to the facility of each finalist to assess those facets of the application that require further explanation, to validate the data and impressions drawn from the application, and to observe the effects of continuous improvement on the work environment. Once all site visits are completed, the evaluation committee completes its assessments of all finalists and presents its recommendations to Dr. Klineberg, who then selects the award recipients. The cycle for the next Goddard Excellence Award contest will begin with the application received by June 15, 1994.

Appointment

DENVER W. HERR recently was appointed Project Manager for the Second Tracking and Data Relay Satellite System Ground Terminal (STGT) Project.

Herr was the Deputy Project Manager of the STGT Project since May 1988. Herr acquired extensive experience in positions supporting the development of satellite communications systems. Herr received a bachelor of science degree in Electrical Engineering from Lehigh University in 1964 and a master of science degree in Telecommunications from George Washington University in 1975.

Hubble success

Continued from page 1.

practicing the mission and preparing for the unexpected.

"That training served us in very, very good stead at Johnson," said Leckrone. "First of all, the real mission was much less severe in terms of the kinds of problems that arose and the numbers of problems that arose than came up in our training. So we were very well prepared for the small number of things that did arise, and the training was very evident in the way everybody responded."

The mission got off to an auspicious start with a flawless Dec. 2 liftoff, only one day behind schedule despite a launch pad switch prompted by sandblasting contamination at pad 39A.

After the berthing of Hubble on Flight Day Three, a tense mood eased at Johnson, said Leckrone. The shuttle Endeavour crew pulled off the first of five Extra Vehicular Activities (EVAs) with only a minor hitch closing a door on the space telescope. Astronauts Jeff Hoffman and Story Musgrave changed out two rate sensor units, prepared the solar array carrier for the next day's EVA and installed two new electronics control units and a set of fuses.

"After the first day we were all elated, because that was the first demonstration that what we had planned could work," said Leckrone.

Meanwhile at Goddard, personnel in the STOCC worked in concert with Mission Control and the Goddard contingent at Johnson.

"We had a very close handshake with JSC," said Ann Merwarth, manager of the HST Operations and Ground Systems Project. Merwarth, Code 441, and hundreds of personnel at Goddard provided invisible but indispensable support for the mission through the many commands sent to the space telescope from the control center.

A key to the process was a software program called the Servicing Mission Planning and Replanning Tool that permitted the mission timeline to be quickly refigured.

"We had a timeline to execute, and whenever anything went wrong we had contingency procedures to pick from," said Merwarth. "All of the tasks were packaged up as units that could be moved around. So when we saw that we were getting ahead of the timeline, we'd start to think about replanning to add something. The main thing was to look ahead and have work ready for the crew when it was ready to do it. And I don't think we really ever had the crew sitting around with nothing to do."

Said Merwarth: "The one thing that we did really well was interaction and communication. We were able to keep each other informed and yet had the opportunity to work the problems. So we were really pleased."

Spacewalking astronauts encountered few glitches as they sped through the tasks on one of NASA's most challenging missions.

On EVA Day Two, astronauts Kathy Thornton and Tom Akers changed out the solar arrays, jettisoning one that was too bent to be rolled up and returned to Earth. Although the European Space Agency (ESA), which provided the arrays, had hoped for the return of both, the jettisoning of one had been anticipated during simulations of the mission.

On EVA Day Three, Hoffman and Musgrave effortlessly installed the Wide Field/Planetary Camera II, which contains its own corrective optics to compensate for the flaw in the space telescope's primary mirror. While later installing two new magnetometers, however, the astronauts discovered that the casing on one of the existing components was disintegrating. Because the old magnetometers were to be left in place, with the new ones snapping over them, the disintegrating casing posed a contamination hazard to the telescope's optics. In the only unanticipated task added on the servicing mission, NASA decided to seal the casings on the old magnetometers with a mylar shroud that astronauts would later fashion onboard Endeavour and install on EVA Day Five.

On EVA Day Four, Thornton and Akers removed the High Speed Photometer and installed in its place the Corrective Optics Space Telescope Axial Replacement (COSTAR), whose 10 dime- to quarter-size mirrors are designed to correct the light entering the Faint Object Camera, Faint Object Spectrograph and Goddard High Resolution Spectrograph. After completing the task flawlessly, the two astronauts installed a co-processor to augment the telescope's onboard computer.

A test of the co-processor provided the first real scare, with NASA managers fearing the new device or perhaps the computer itself — the telescope's "brain" — was in peril. An orbital internal data link, however, is suspected of having been the problem.

On EVA Day Five, Hoffman and Musgrave installed new solar array drive electronics, a repair kit for the Goddard High Resolution Spectrograph and capped the old magnetometers with shrouds they had built while inside the space shuttle. The shuttle also boosted the space telescope to a higher altitude. Meanwhile, the second big scare of the mission occurred when one of four data interface units, which is part of the telescope's data management system, showed a problem on one of its two sides. That crisis passed when NASA managers determined that the other side of the unit could be used.

The next day, Flight Day Nine, the Hubble Space Telescope was released from the shuttle. In the customer support room next to Mission Control at Johnson, Leckrone and the rest of the Goddard contingent celebrated with champagne.

"Needless to say, things went way beyond our expectations in a positive sense," said Leckrone. "It seems we were just touched with good fortune."

Said Merwarth: "We all feel like we have our baby back now."

Goddard News

NASA National Aeronautics and Space Administration
Goddard Space Flight Center

The GODDARD NEWS is published monthly by the Office of Public Affairs, Goddard Space Flight Center, Greenbelt, MD 20771.

Deadline for submitted material is the tenth of each month. For additional information contact Fred Brown (301) 286-7277, TDD (301) 286-8955.

The GODDARD NEWS Staff is:
Executive Editor: Randee Exler
Chief Editor: Jim Elliott
Managing Editor: Fred Brown
Contributing Editors: Michael Finneran, Tammy Jones, W. Allen Kenitzer, Keith Koehler
Production Assistants: William Brown, Michelle Mangum, Tony May