Special Edition

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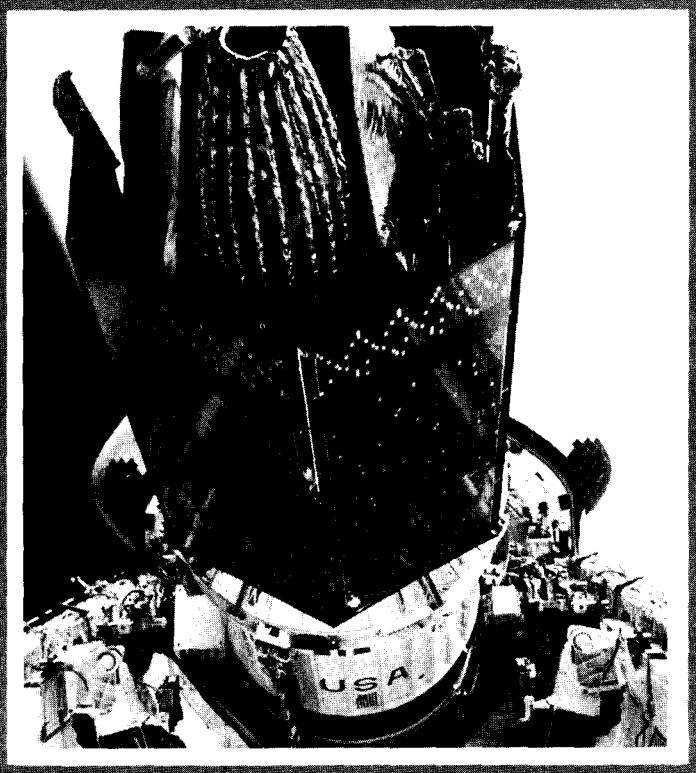
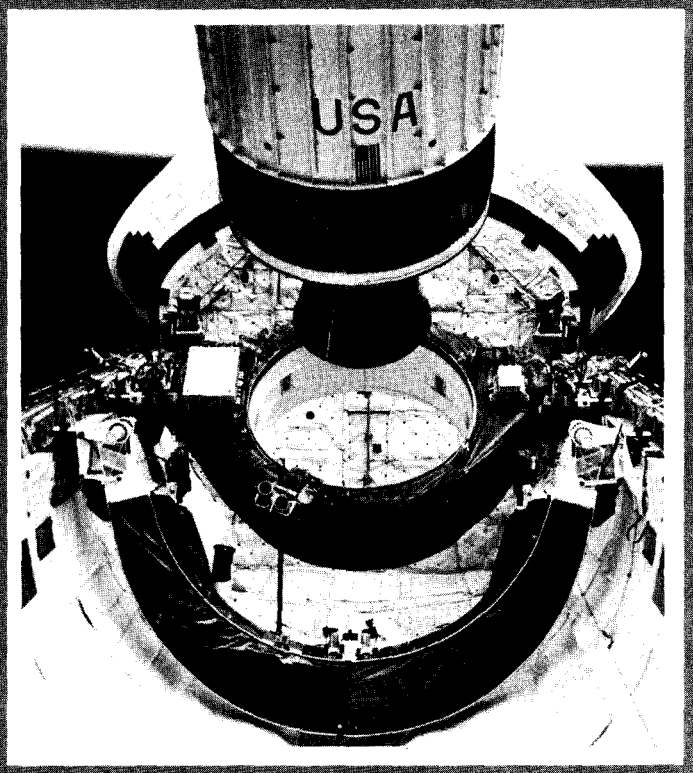
Goddard Space Flight Center

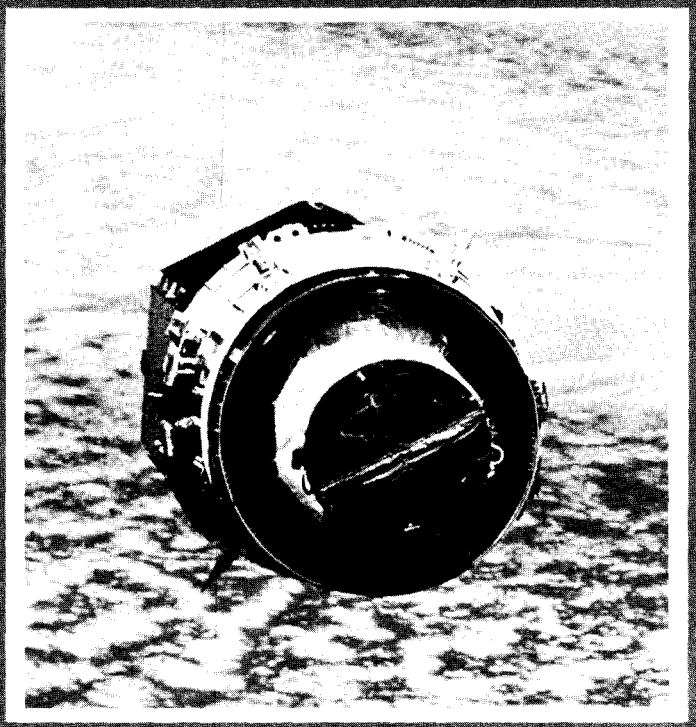
Goddard News

Greenbelt, Maryland and Wallops Island, Virginia Vol. 34 No. 12 Winter 1988–89

1988 Year In Review







TDRS-C Highlights U.S. Return to Space

Goddard had a lot to cheer about on September 29, 1988. Not only did America return to space, but the Center's 5,000-pound (2,270 kg) communications Tracking and Data Relay Satellite (TDRS)-C was the STS-26 primary payload on board.

Pictured (upper left) is a close-up scene of the TDRS as it is about to be released into space. The deployment of the TDRS and the Inertial Upper Stage (IUS) solid rocket motor that inserted the spacecraft into orbit was the highlight of the mission's first day. The upper right photograph shows the IUS moments after deployment from the Shuttle Discovery's cargo bay.

As TDRS separates following deployment from Discovery's payload bay, this straight-on view (bottom left) shows the IUS. TDRS, attached to the IUS, is partially visible.

Astronaut crew members snapped these 70mm photographs with a handheld Hasselblad camera aimed through Discovery's aft flight deck windows. These images were among the first set of photos released by NASA following the successful STS-26 mission.

Goddard Space Flight Center 1988: One of NASA's Most Versatile Centers

by Carter Dove

Goddard continued in 1988 to strengthen its role as one of NASA's most versatile centers, providing scientifically significant insights into the troublesome topic of ozone; conducting sounding rocket and balloon missions in Australia for the study of Supernova 1987A, the exploding star discovered in 1987; and managing satellites in the fields of communications, meteorology and astronomy. The Center's highlights for 1988 tell the story:

Launch Operations

Supernova 1987A (SN 1987A). NASA's sounding rocket and balloon program enjoyed the most successful operation in its history in 1988, recording 78 flights without a failure in any of the existing balloon or sounding rocket launch systems.

Goddard's Wallops Flight Facility flight program completed six sounding rocket and 15 scientific balloon missions to study Supernova 1987A from Australia.

NASA's fall Supernova campaign, the fifth campaign conducted in the past two years, included an experiment by Principal Investigator Dr. Bonnard J. Teegarden, Code 661. Teegarden's payload was carried by a heavy-lift balloon launched October 28. The experiment conducted high resolution spectroscopy of SN 1987A and other gamma-ray sources.

Delta. The Goddard-managed Delta 181 expendable launch vehicle lifted off from Cape Canaveral Air Force Station, FL, on February 8 with a Department of Defense Strategic Defense Initiative (SDI) experiment. For the Delta model 3910 launch vehicle, the 5550-pound SDI payload was the heaviest ever. Delta 181 was the last fully Goddard-managed mission from the East Coast.

Project Canada. Personnel from Wallops and the National Scientific Balloon Facility, Palestine, TX, managed the launch and operational flight support of scientific balloons from Prince Albert (Saskatchewan) Airport to search for cosmic rays, including those that could provide evidence of galaxies made of antimatter.

The month-long campaign began August 2 and continued through the launches of three scientific balloons, each with a cosmic ray experiment.

Project Management

TDRS-C. The Tracking and Data Relay Satellite-C (TDRS-C) was deployed by the Space Shuttle Discovery following its launch from Kennedy Space Center, FL, on September 29.

Known as TDRS-3 on attaining geosynchronous orbit, the satellite soon was placed by its on-board thrusters at 150° west longitude for testing and support of STS-27.

Following STS-27, TDRS-3 took up its operational position of 171° west longitude, over the Pacific Ocean southwest of the Hawaiian Islands and just east of the Gilbert Islands.

TDRS-3, also known as TDRS-West, is the second in the projected operational three-satellite constellation of NASA communications satellites.

NOAA-H. A meteorological satellite, developed, launched and checked out under the supervision of Goddard for the National Oceanic and Atmospheric Administration (NOAA), NOAA-H was launched on an Air Force Atlas E expendable launch vehicle from Vandenberg Air Force Base, CA, on September 24.

NOAA-H, which became NOAA-11 on orbit, joined the orbiting NOAA-9 and NOAA-10 spacecraft in collecting meteorological and ocean data for transmission directly to users around the world.

Among the scientific instruments and equipment on board NOAA-H were an experiment for mapping Earth's ozone layer and another for an international search and rescue program, known as COSPAS/SARSAT. Goddard manages the U.S. research effort for the project.

San Marco. With a payload of five scientific instruments on board, the international San Marco satellite — managed jointly by Goddard and the University of Rome, Italy — was launched on March 25 from Italy's San Marco Equatorial Range in Kenya, East Africa, by a U.S. Scout expendable launch vehicle.

As planned, the spacecraft reentered the Earth's atmosphere December 5.

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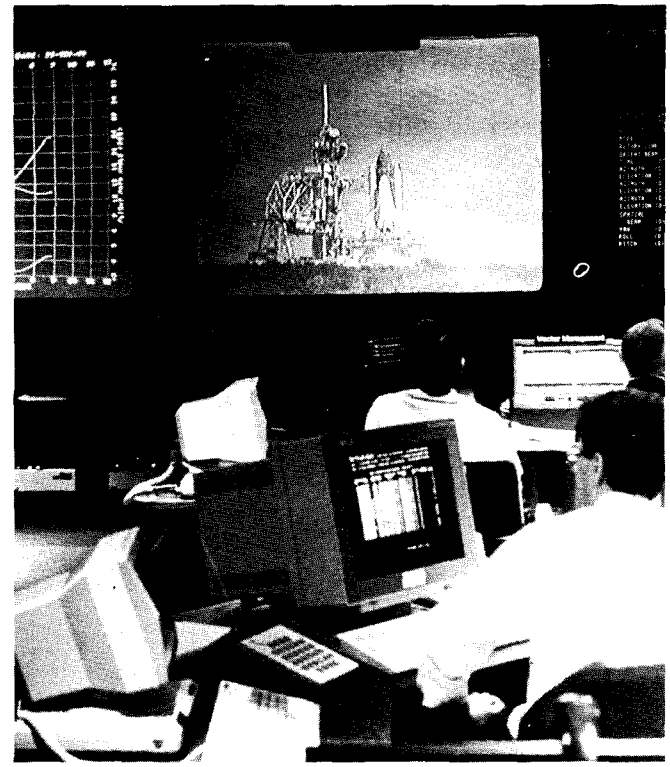
***NATIONAL SPACE CLUB RECEPTION*—The National Space Club honored Goddard's Flight Projects Directorate at a reception held at the Visitor Center in October. The Directorate was recognized for "excellence in management of complex space systems which contribute to NASA's leadership role in expanding human knowledge of the Earth and the universe." Pictured with award are (left to right) Center Director Dr. John W. Townsend, Jr., National Space Club President John L. Herre, Flight Projects Director Gerald Longanecker and Associate Center Director for Programs William C. Keathley.**

STS-26: Flight Dynamics Was The Place To Be!



EMPLOYEE VIEWING—Many employees watched the launch of the Shuttle Discovery in the comfort and quiet of the Building 8 Auditorium. Other employees joined the public and press and watched the launch from the Visitor Center. The employees pictured (left), however, chose a more crowded viewing site. The hallway outside Goddard's Flight Dynamics Facility (FDF) was jammed with viewers as America returned to space. Through the glass (right), screens with NASA Closed Circuit TV, spacecraft statistics and spacecraft trajectory kept the crowd close to the action.

ASTRONAUT IN WAITING—Janet Boyd, Christian Broadcasting Network, Virginia Beach, VA (center), discusses the pending launch with Astronaut Ron Parise (left) shortly before lift-off. Parise, a Computer Sciences Corporation employee working in Code 684.9, is the payload specialist for Astro-1, slated for STS-35, March 1990.

LIVE AT FIVE—WRC-TV Channel 4 Anchor Peter Ford (right) brought the Washington area the 5:00 p.m. news live from Goddard's Flight Dynamics Facility. Astronaut Story Musgrave (left), a veteran of STS-6 and 51-F, explained the mission progress to Ford and his viewers.

Looking Ahead... Mixed Fleet Manifest — January 1989

Space Shuttle

Flight	Date/ Orbiter	Primary Payload
29	2/89 *Discovery*	TDRS-D
30	4/28/89 *Atlantis*	MAGELLAN
28	7/1/89 *Columbia*	DOD
33	8/10/89 *Discovery*	DOD
34	10/12/89 *Atlantis*	Galileo
32	11/13/89 *Columbia*	SYNCOM IV-5 LDEF-1R
31	12/11/89 *Discovery*	HST
36	*2/1/90* *Atlantis*	*DOD*
35	3/1/90 *Columbia*	ASTRO-1 BBXRT-1
37	4/5/90 *Discovery*	GRO
38	5/10/90 *Atlantis*	DOD
40	6/7/90 *Columbia*	SLS-1
39	7/19/90 *Discovery*	CIRRIS (DOD) IBSS (DOD) STP-01 (DOD)
41	10/5/90 *Atlantis*	ULYSSES
42	*11/1/90* *Columbia*	*STARLAB (DOD)*
43	12/10/90 *Discovery*	TDRS-E
44	1/31/91 *Atlantis*	TSS-01 GPS-01 (DOD)
45	2/21/91 *Columbia*	IML-01
46	3/28/91 *Discovery*	DOD
47	5/2/91 *Altantis*	ATLAS-01
48	7/1/91 *Discovery*	S/L-J
49	8/1/91 *Atlantis*	GPS-02 (DOD) EURECA-1L LAGEOS-02
50	10/10/91 *Discovery*	UARS
51	*11/14/91* *Atlantis*	*SPACEHAB-01* INMARSAT-01 WAMDII
52	12/14/91 *Columbia*	S/L-D2
53	3/2/92 *Orbiter Vehicle (OV) 105*	GEOSTAR-01 EURECA-1R
54	3/30/92 *Columbia*	USML-01
55	5/7/92 *Discovery*	SRL-01
56	5/28/92 *Atlantis*	PUR-1 USMP-01
57	6/11/92 *OV 105*	ATLAS-02
58	*7/16/92* *Columbia*	*SLS-02*
59	8/13/92 *Discovery*	ASTRO-02
60	9/3/92 *Atlantis*	SHEAL ORFEUS SATCOM
61	9/24/92 *OV 105*	SPACEHAB-02 GEOSTART-02 DOD
62	10/22/92 *Columbia*	IML-02
63	11/10/92 *Discovery*	DOD
64	12/14/92 *Atlantis*	TDRS-F
65	1/11/93 *OV 105*	ISF-01
66	2/11/93 *Discovery*	SRL-02
67	3/22/93 *Atlantis*	EURECA-2L USMP-02
68	4/12/93 *OV 105*	INMARSAT-02
69	5/6/93 *Columbia*	ATLAS-03 CRISTA
70	6/3/93 *Discovery*	SFU-RETR GEOSTAR-03

Flight	Date/ Orbiter	Primary Payload
71	6/24/93 *Atlantis*	SPACEHAB-03 GP-B1
72	7/15/93 *OV 105*	ISF-02
73	8/12/93 *Columbia*	USML-02
74	9/2/93 *Discovery*	DOD
75	9/30/93 *Atlantis*	AAFE EURECA-2R USMP-03
76	10/21/93 *OV 105*	SLS-03
77	11/11/93 *Columbia*	OMV-01 (WISP) SPARTAN-T
78	12/9/93 *Discovery*	DOD
79	1/13/94 *Atlantis*	SPACEHAB-04 XTE
80	2/3/94 *OV 105*	ISF-03
81	2/24/94 *Columbia*	IML-03
82	3/24/94 *Discovery*	HST-REV
83	4/14/94 *Atlantis*	ATLAS-04
84	5/12/94 *OV 105*	TDRS-G
85	6/9/94 *Columbia*	S/L-D3
86	7/14/94 *Atlantis*	SPACEHAB-05
87	8/25/94 *OV 105*	DOD
88	9/22/94 *Columbia*	SRL-03

Expendables

Date	Launch Vehicle	Payload
7/89	Delta 186	COBE
7/89	Scout	MACSAT (DOD)
9/89	Atlas Centaur 68	FLTSATCOM-F8 (DOD)
9/89	Scout	SALT (DOD)
12/89	Atlas 50E	NOAA-D
2/90	Delta	ROSAT
6/90	Atlas Centaur	CRRES
7/90	Atlas I	GOES-I
3/91	Scout	USAF-I (DOD)
5/91	Atlas 34E	NOAA-I
8/91	Delta	EUVE
11/91	Atlas I	GOES-J
12/91	Scout	SMALL EXPLORER-01
5/92	Atlas I	GOES-K
5/92	Scout S-215C	CRRES-01
6/92	Scout	SMALL EXPLORER-02
7/92	Atlas IIE	NOAA-J
7/92	To be determined (TBD)	GEOTAIL
9/92	Titan III	MARS OBSERVER
*12/92	TBD	SMALL EXPLORER-03
12/92	TBD	WIND
* 3/93	TBD	MSAT
* 6/93	TBD	SMALL EXPLORER-04
6/93	TBD	POLAR
11/93	Titan II	NOAA-K
*12/93	TBD	SMALL EXPLORER-05

Glossary

AAFE	Aeroassist Flight Experiment
ACTS	Advanced Communications Technology Satellite
ASTRO	Astronomy
ATLAS	Atmospheric Laboratory for Applications and Science
BBXRT	Broad Band X-ray Telescope
CIRRIS	Cryogenic Infrared Radiance Instrument for Shuttle
COBE	Cosmic Background Explorer
CRRES	Combined Release and Radiation Effects Satellite
CRISTA	Cryogenic Infrared Spectrometer Telescope for Atmosphere
DOD	Department of Defense
EURECA	European Retrievable Carrier
EUVE	Extreme Ultraviolet Explorer
FLTSATCOM	Fleet Communications Satellite
GOES	Geostationary Operational Environmental Satellite

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Goddard 1988

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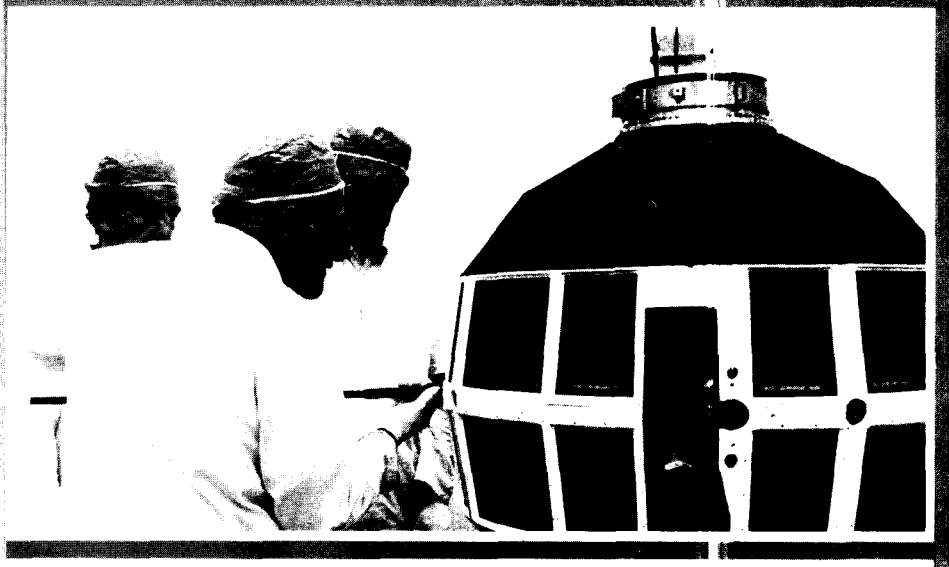


PREPARING SAN MARCO—**Don Rider (foreground) and Tom Harbach (right), both of Goddard, install one of the booms on the San Marco D/L satellite, as a technician looks on. Preparation of the spacecraft was carried out in the "clean room" on the San Marco platform, three miles off the coast of Kenya. The satellite, an Italian-American project, was launched successfully from the platform on March 25. It reentered the Earth's atmosphere, as planned, in early December. Ron Adkins was the Goddard project manager.**

Burning up on its reentry over Zaire, it posed no danger to people on Earth.

The San Marco satellite studied the lower atmosphere and explored the possible relationship between solar activity and meteorological phenomena.

Two of its five instruments were from Goddard: the Wind and Temperature Spectrometer to measure neutral winds, neutral particle temperatures and concentrations of selected gases in the atmosphere; and the Three-Axis Electric Field Experiment, to measure the electric field surrounding the spacecraft in orbit.

The Scout launch vehicle program is managed by NASA/Langley Research Center, VA.

Cosmic Background Explorer (COBE). Big progress was made on the construction and testing of Goddard's in-house satellite project, COBE, in 1988. Construction of the Cryogenic Optical Assembly (COA) was completed in July. The COA houses a vacuum insulated cooling tank known as the dewar. A major milestone occurred in October when two of the spacecraft's three instruments operated for the first time inside this "thermos bottle"-like device.

The COBE is scheduled for launch aboard a Goddard-managed Delta expendable launch vehicle from Vandenberg Air Force Base, CA, in the summer of 1989.

From its 560-mile (900-km) orbit, the spacecraft will circle the Earth 14 times a day in its exploration of the remnants of the Big Bang — the primeval explosion that is thought to have started the expansion of the universe about 14 billion years ago.

Space Station Freedom. On November 1, Goddard issued a Request for Proposal which will lead to the award of prime contract for the design, development, testing and fabrication of Space Station Freedom's flight telerobotic servicer (FTS).

The FTS will be a space robot with automated features that will assist crews in the assembly, maintenance and servicing of the Freedom station and visiting spacecraft.

Science

Ozone. Atmospheric scientists at Goddard reported on October 7 to a concerned world scientific community and public at large that the stratospheric ozone above the Antarctic in September decreased only 15 percent, in contrast to a 50 percent loss in September 1987.

The data for this observation came from the Total Ozone Mapping Spectrometer (TOMS) on board the Goddard-managed NIMBUS 7 satellite and field measurements from balloon-borne instrumentation.

Researchers had expected ozone losses of about 25 to 30 percent and reasoned that the smaller losses may have been due to unusually dynamic weather patterns in the stratosphere.

Meteorology. Dr. Joanne Simpson, a pioneer in cloud and storm research and head of Goddard's Severe Storms Branch at the time, was elected president of the American Meteorological Society. Since then, she has been named Chief Scientist for Meteorology at Goddard.

One of the first persons to use an instrumented aircraft in meteorological research, Dr. Simpson won the Meisinger Award for her "outstanding experimental work in cumulus investigations by means of aircraft and for her imaginative use of these observations for deductions about the dynamics and energetics of cumulus clouds. . . ."

Dr. William K.M. Lau of Goddard's Climate and Radiation Branch was awarded the 1988 Meisinger Award as the Nation's most outstanding young scientist.

Lau was recognized for his outstanding contributions to the basic understanding of the global climate system, particularly his use of satellite observations to study the phenomenon known as the El Nino/Southern Oscillation, which impacts long-range weather forecasting.

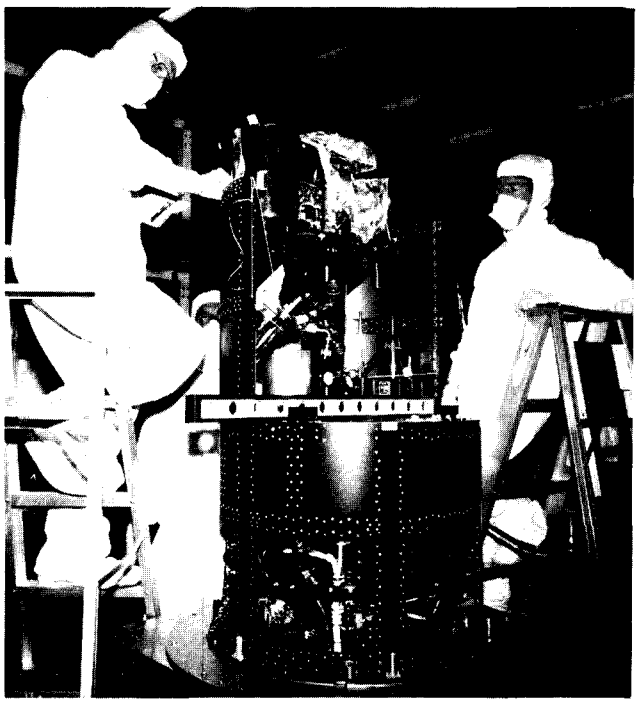
Washington Technology honored him as one of the Top Ten Science Talents in the Washington area for his research contributions in climate dynamics.

Planetary sciences. Dr. Rudolf A. Hanel, senior scientist at the Laboratory for Extraterrestrial Physics at Goddard, received the 1988 Gerard P. Kuiper Prize by the Division for Planetary Sciences of the American Astronomical Society.

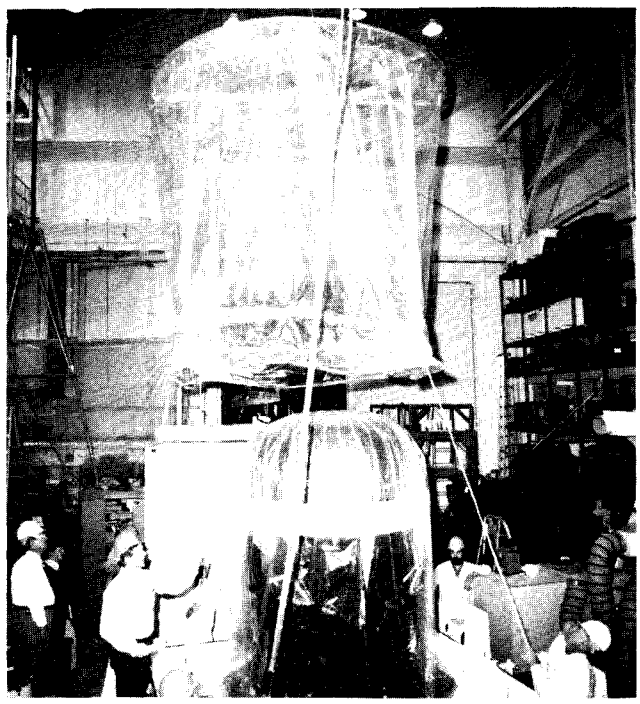
Hanel's recognition resulted from his role in the development of sensitive infrared spectrometers to determine the structure, composition, and thermal characteristics of planetary atmospheres.

Earth System. Goddard conducted a NASA-wide pre-proposal briefing in March on the Announcement of Opportunity for the Earth Observing System (Eos) — a 15-year mission to advance the understanding of the entire Earth system on a global scale.

The teleconference event served



COA COMPLETED—The final assembly of the Cosmic Background Explorer's Cryogenic Optical Assembly (COA) was completed in July. Pictured are Mantec/NSI technicians Tom Harbach (left), Ron Greer (right), and Keith Brenza (center). COBE's COA houses a helium cryostat (vacuum insulated tank) known as a dewar (after Scotsman Sir James Dewar, the inventor of the insulated vacuum container). A major milestone occured in October when two of the spacecraft's three instruments operated for the first time inside this "thermos bottle"-like device. The COBE is scheduled for launch aboard a Goddard-managed Delta expendable launch vehnicle from Vandenberg Air Force Base, CA, in the summer of 1989.



IN THE BAG—The Energetic Gamma Ray Experiment Telescope (EGRET), a joint effort by scientists at GSFC, Stanford University and West Germany, was double bagged for protection before leaving Greenbelt on December 3 for a 10-day trailer ride to TRW's Redondo Beach, CA, facility. The EGRET, a familiar sight in the building 7/10 cleanroom, is an instrument built for the Gamma Ray Observatory, scheduled for a 1990 Shuttle launch.

primarily to answer preliminary questions from prospective investigators in the Eos program.

Eos will be a long-term mission, providing systematic, continuing observations from low Earth orbit by four polar-orbiting platforms — enabling multidisciplinary study of the Earth, including the atmosphere, the oceans, the land surface and the solid Earth.

Goddard has overall responsibility for one of the polar platforms, which may carry up to 20 instruments.

Oceanography. On four airborne missions this spring, the Wallops Airborne Oceanographic Lidar (AOL) participated in the Department of Energy Shelf Edge Exchange Processes (SEEP II) field experiment. This is a multidisciplinary study aimed at resolving the biological, chemical, and physical processes of the Atlantic shelf water.

Engineering

AIAA Award. Frank Cepollina, Goddard's satellite servicing project manager, received the American Institute of Aeronautics and Astronautics (AIAA) 1988 Aerospace Maintenance Award.

Cepollina was selected for the award because of his unique contribution to the development and implementation of the concepts, designs and techniques for on-orbit maintenance and servicing of spacecraft.

Presidential Award for Design Excellence. Goddard's International Ultraviolet Explorer (IUE) was among the ten winners of the 1988 Presidential Awards for Design Excellence honored in a White House Ceremony in November. Goddard originally designed the spacecraft to "live" for three years and optimistically hoped for five. The spacecraft celebrated a decade of scientific operation in January 1988 and continues studying stars, planets, galaxies and interstellar gas 24 hours a day.

The jury in its selection of this award-winning spacecraft wrote:

"This project utilizes the technical know-how and scientific capability of numerous countries and shows the achievements obtainable by multinational efforts once a unifying purpose is found that will benefit humanity and advance technical progress."

Systems Testing

Hubble Space Telescope (HST). The fourth in a series of ground systems test for NASA's HST — one of the most comprehensive tests ever undertaken — was conducted at Goddard during a five-and-one-half day period in June.

The extensive ground systems test from Goddard simulated almost a week of space flight operations and involved direct communication with the HST, located in a clean room at the Lockheed Space and Missile Company, Sunnyvale, CA.

Community Outreach

Greenbelt Visitor Center (VC) Renovation. The second half of the Greenbelt Visitor Center renovation was celebrated in May with a ribbon-cutting ceremony, employee open house and community day. Center Director Dr. John W. Townsend, Jr., Greenbelt

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Mixed Fleet Manifest

Continued from page 5

GP-B1	Gravity Probe-B1
GPS	Global Positioning System
GRO	Gamma Ray Observatory
HST	Hubble Space Telescope
HST-REV	HST Revisit
IBSS	Infrared Background Signature Survey
IML	International Microgravity Laboratory
INMARSAT	International Maritime Satellite Organization
ISF	Industrial Space Facility
LAGEOS	Laser Geodynamics Satellite
LDEF	Long Duration Exposure Facility
MACSAT	Multi-Access Communications Satellite
MSAT	Mobile Satellite
NOAA	National Oceanic and Atmospheric Administration
OMV	Orbital Maneuvering Vehicle
ORFEUS	Orbiting and Retrievable Far and Extreme Ultraviolet Spectrometer
PUR	Payload Under Review
ROSAT	Roentgen Satellite
SALT	Special (Purpose Inexpensive Satellite) Altimeter
SFU-RET	Space Flyer Unit-Retrieval
SHEAL-2	Shuttle High Energy Astrophysics Laboratory
S/L	Spacelab
SLS	Space Life Sciences Laboratory
SRL	Space Radar Laboratory
STP	Space Test Program
SYNCOM	Hughes Geosynchronous Communications Satellite
TDRS	Tracking and Data Relay Satellite
TSS	Tethered-Satellite System
UARS	Upper Atmosphere Research Satellite
ULYSSES	Formerly ISPM (International Solar Polar Mission)
USAF	United States Air Force
USML	United States Microgravity Laboratory
USMP	United States Microgravity Payload
WAMDII	Wide Angle Michelson Doppler Imaging Interferometer
WISP	Waves in Space Plasma
XTE	X-ray Timing Explorer

Mayor Gil Weidenfeld and Robert Goddard Middle School Principal Karl Taschenberger cut the ribbon in front of the newly-renovated facility as the children of Goddard's Child Development Center released balloons into the air. An employee reception and evening open house followed.

Community Day was chock full of activities inside and out. Inside, visitors checked out the exciting new exhibits. Outside, the U.S. Navy Band played as model rockets pierced the sky.

US/USSR Model Rocketry Competition. While top athletes competed for world honors in Seoul, South Korea, top world model rocketeers competed in the first dual meet between the US and the USSR at Goddard's Wallops Flight Facility Visitor Center September 30 – October 3. Sixteen Soviet "spacemodelers" visited Wallops for the event as guests of the National Association of Rocketry (NAR).

There were six different categories of competition for individual team members — bronze, silver and gold — and six team gold medals. The Soviets won 10 individual awards, and the U.S. won 14. The team competition was a tie, with each team winning three gold medals.

NASA

Special Edition Goddard News

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and Carolynne White

***FRIENDLY COMPETITION*—The US/USSR Model Rocketry Competition, conducted at the Wallops Flight Facility in September, marked the first dual international competition between the two nations. Pictured: A Soviet "spacemodeler," one of 16 who visited the Wallops Flight Facility in September, presents a fellow model rocket enthusiast with a commemorative pin.**