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Goddard Space Flight Center

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Early COBE Results In Accord With Predictions of Big Bang Theory

A major advance in cosmology was revealed last month as early results from the Cosmic Background Explorer (COBE), launched last fall, were presented at the American Astronomical Society meeting held at Crystal City, VA.

Preliminary results are in accord with the predictions of the Big Bang theory, which traces the origin of the universe to a primordial explosion some 15 billion years ago. The universe today shows that sometime after the Big Bang, additional releases of energy must have occurred. COBE's new results severely limit the magnitude and character of such a release.

Preliminary COBE data based on limited observations now indicate a smooth, uniform Big Bang. However, small deviations from a blackbody spectrum—the characteristic signature of radiation from an opaque object of uniform temperature—would reveal energetic processes in the early universe.

COBE scientists reported that the instruments onboard the spacecraft are performing flawlessly with precision never before achieved. Such precision puts new constraints on theories to explain the present universe.

Over the two-year mission, COBE will continue to collect much more data. Scientists expect the final data to be ten times

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PHOTO: D. McCALLUM

PROUD COBE SCIENTISTS—The four scientists for the COBE mission were understandably proud as they posed before the press conference to announce their unprecedented results at the American Astronomical Society meetings held at Crystal City, VA on January 13. From left to right are: Dr. John Mather (Code 685), principal investigator for the Far Infrared Absolute Spectrophotometer (FIRAS) and Project Scientist for the COBE mission; Dr. Michael Hauser (Code 680), principal investigator for the Diffuse Infrared Background Experiment (DIRBE); Dr. Nancy W. Boggess (Code 685), Deputy Project Scientist; and Dr. George Smoot (UC-Berkeley), principal investigator for the Differential Microwave Radiometer (DMR).

EARLY MORNING LAUNCH—The spectacular photo shows the launch of the Goddard-managed Cosmic Background Explorer spacecraft, onboard the last Goddard-managed Delta expendable launch vehicle, into the crystal-clear dawn sky above Vandenberg Air Force Base, CA, Nov. 18, 1989.

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Talk from the Top

John W. Townsend Jr.

Q: The lack of proper overhead lighting at the Parkway Gate, with two floodlights directed into the faces of incoming drivers, presents a serious safety hazard for both drivers and the guard on duty. When is adequate lighting going to be installed?
A: The gatehouse floodlights have recently been re-adjusted to reduce the blinding effect on incoming drivers and increase guard visibility. New technology bulbs have been identified to complement the existing overhead lighting and will be installed at both the Parkway and East Gates upon receipt from the supplier. We also anticipate installing additional lighting at the Main Gate later in the year.

Q: I recently saw an article...on IRS [Internal Revenue Service] approved Flexible Spending Accounts (FSA). One estimates...family health-care and/or dependent-care expenses and a "pool of untaxed money" is set aside in special accounts to pay these expenses. These are available in about a third of the major corporations. What about government?
A: Changes in federal employee fringe benefits...require legislative action by the Congress. However, with health benefit premiums skyrocketing, Federal Employees Health Benefits (FEHB) reform is beginning to garner increased attention, and Congress has begun to look at ways to reform the FEHB system. According to a recent article in the Weekly Federal Employees News Digest, an item that may make it onto the Congressional agenda this year is a legislative proposal being drafted by Senator Ted Stevens. This proposal would make health premiums tax-free for federal workers. Employees would contribute to an account to cover items such as health insurance premiums, co-payments or even dependent care. There is no way at this time to predict the success of the Stevens proposal or other FEHB reform proposals which may come before Congress.

Center Director John W. Townsend, Jr. wants to hear from you! Send your questions to: TALK FROM THE TOP, Code 130.

Advanced TDRS Phase B RFP Released

by Carter Dove

NASA recently released the request for proposal (RFP) for the Advanced Tracking and Data Relay Satellite System (ATDRSS). The RFP requests that companies demonstrate their ability and capacity to design, manage, integrate and test large, modern communications spacecraft and associated ground facilities.

In the recently completed study phase, Goddard had awarded contracts in September 1987 totaling approximately $9.3 million to five contractors—Ford Aerospace and Communication Corp.; General Electric Astrospace; Hughes Space and Communications Group; Lockheed Missiles and Space Company, Inc.; and TRW Space and Technology Group—for an 18-month design feasibility study of the ATDRSS.

The first ATDRSS spacecraft tentatively is scheduled for delivery in July 1997, when it could be used to replace one of the Tracking and Data Relay Satellites (TDRS) currently in use.

"A four-satellite constellation of ATDRSS is expected to be in orbit and operational by 2001," according to Thomas C. Underwood, Assistant Chief for the TDRS System. ATDRSS is intended to maintain the present NASA track and data relay system through the first decade of the 21st Century.

The current TDRS system, which includes geostationary satellites and one operational ground facility and a second ground facility to become operational in 1993, has replaced most of the ground network of tracking stations used by NASA to track and communicate with its low Earth-orbiting spacecraft. The TDRS system provides improved communications coverage for the Space Shuttle. Future missions that will use the system include the Hubble Space Telescope, Space Station Freedom and the Earth Observing Systems.

NASA currently has three TDRS satellites in orbit and three more in various phases of construction. By the end of the next decade, these satellites are expected to reach the end of their useful life and will require replacement. The ATDRSS satellite sought by NASA will provide the necessary continuation to meet user needs.

"The advanced satellites," explained William S. Guion of the Tracking and Data Relay project office, "will differ from the existing TDRS spacecraft in two important respects: a new frequency band with a high-data capability of 650 million bits per second; and an enhanced multiple access system which will increase the data rate provided each of several simultaneous users from the current 50 thousand bits per second to 3 million bits per second."

PHOTO: D. McCALLUM

SPACE CLUB AWARD—**Code 400 Director Peter Burr (left) and Delta Project Manager John Beckham (center), along with Center Director Dr. John W. Townsend, Jr. (not shown), received the National Space Club's Nelson P. Jackson Award for Engineering Excellence on behalf of the MDAC/DOD/NASA/Johns Hopkins Applied Physics Laboratory Delta 181 Mission Project Team in a ceremony held on Thursday, February 1. The Club's Third Vice President and Awards Chairman Jerry Iler (far right) presented the award for "successful, innovative, and imaginative management of the most complex unmanned Space Defense Initiative space mission accomplished to date." This is the twelfth such award NASA or a NASA Field Center has received from the National Space Club. A memorial to the late Nelson P. (Pete) Jackson, one of the founders of the club, the award is presented to a firm or agency responsible for an outstanding contribution to the missile, aircraft, and space fields during the award year.**

PEGSAT Launch Set For March 2

March 2 has been set for the launch of Goddard's Pegasus Satellite (Pegsat) from a NASA B-52 research aircraft, according to Project Manager Bob Pincus.

The new launch date was set following a third flight test of the air-launched space booster, conducted at the Ames-Dryden Flight Facility in California.

Pegsat, built jointly by Orbital Sciences Corp. (OSC) of Fairfax, VA and the Hercules Aerospace Co., of Wilmington, DE, is a small delta-wing rocket that will be launched from the B-52 at an altitude of 43,000 feet.

Three captive flights using inert motors have been conducted, Pincus said, one on November 9 and another on December 15. The third mission was conducted on January 30.

On the first test flight at Dryden, the rocket's thermal coating began to shed, resulting in one broken running light on the B-52 and a broken porthole covering the plane's tail camera. The plane also reached an altitude of 36,000 feet, 4,000 feet below the desired altitude necessary for launch. During the second flight, the B-52 reached an altitude of 42,700 feet.

Pegsat has two barium canisters, which will be deployed over Central Canada 15 to 30 days after launch; a small Navy experimental communications satellite, which will be deployed from Pegsat's 94 degree orbit; and equipment for measuring the environment during the runway and launch phases of the mission.

NASA Pipeline

NASA HEADQUARTERS, Washington, D.C.—In the largest NASA/Japan international cooperative space science mission to date, NASA and Japan have completed an agreement for the launch of Japan's GEOTAIL spacecraft on a Delta II launch vehicle, from the Kennedy Space Center, Fla., in July 1992. Richard H. Truly, NASA Administrator, and Professor Jun Nishimura, Director-General of Japan's Institute of Space and Astronautical Science (ISAS), signed the agreement on behalf of the U.S. and Japanese agencies implementing this cooperative activity. The GEOTAIL spacecraft is a bilateral cooperative mission between NASA and ISAS which will investigate the stored energy in the geomagnetic tail of the Earth. GEOTAIL will use a double lunar-swingby orbit to take measurements in the region from 8 to 220 Earth radii (Re). These data will be compared with other NASA missions in the Global Geospace Science (GGS) Program. GGS will investigate cause and effect relationships in the global flow of energy in the Earth's magnetosphere.

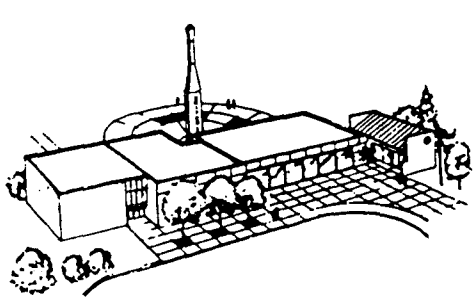
JOHNSON SPACE CENTER, Houston, TX—In the first of what will become standard biennial selections, 23 new astronaut candidates have been named for the Space Shuttle program. The candidates were chosen from among 1,945 qualified applicants, 106 of whom received interviews and medical examinations between September and November 1989. They will report to the Johnson Space Center, Houston, in July to begin a year of training and evaluation, after which they will receive technical assignments leading to selection for Shuttle flight crews. The 1990 group consists of 7 pilot candidates and 16 mission specialist candidates, including 11 civilians and 12 military officers. Among the 5 women selected are 3 military officers, including the first woman to be named as a pilot candidate, and the first Hispanic woman to be chosen. A listing of the candidates and short biographical sketches are available from all NASA newsrooms. Call 6-8955 (Goddard Public Affairs Office) to obtain copies.

KENNEDY SPACE CENTER, FL—NASA Administrator Richard H. Truly recently named Thomas E. Utsman as the Deputy Associate Administrator for Space Flight (Management) and James A. "Gene" Thomas as the Deputy Director of the John F. Kennedy Space Center, FL. In his new capacity, Utsman will have overall responsibility for assisting William B. Lenoir, Associate Administrator for Space Flight, in the day-to-day oversight management of the Space Flight programs. Specific responsibilities will include overseeing procurement activities, assessing program management performance and conducting long-range operational planning. George Abbey continues in his capacity as Deputy Associate Administrator.

March Visitor Center Events

Launch Site Goddard—Sunday, March 4 and 18, 1:00 p.m.—Be a part of the launch team or just watch the fun!

Saturday Video—Saturday, March 10, 1:00 p.m.—This month's feature, "Supernova" uses computer graphics, photos and interviews to explain this phenomenon. The "true star" of the program, however, is "Supernova 1987A," which occurred in a neighboring galaxy.



Visit a neighboring galaxy in March and witness an exploding star, a supernova! All events are free. For more information call 286-8981.

Know and Tell—Sunday, February 25, 1:00 p.m.—Join Dr. Eli Dwek on a journey to the Large Magellanic Cloud where Supernova 1987A was discovered!

Star Watch—Saturday evening, March 10, 7:00 p.m.—View the night sky through a telescope! Bring your own or use one of ours!

COBE Results

more sensitive than these early results.

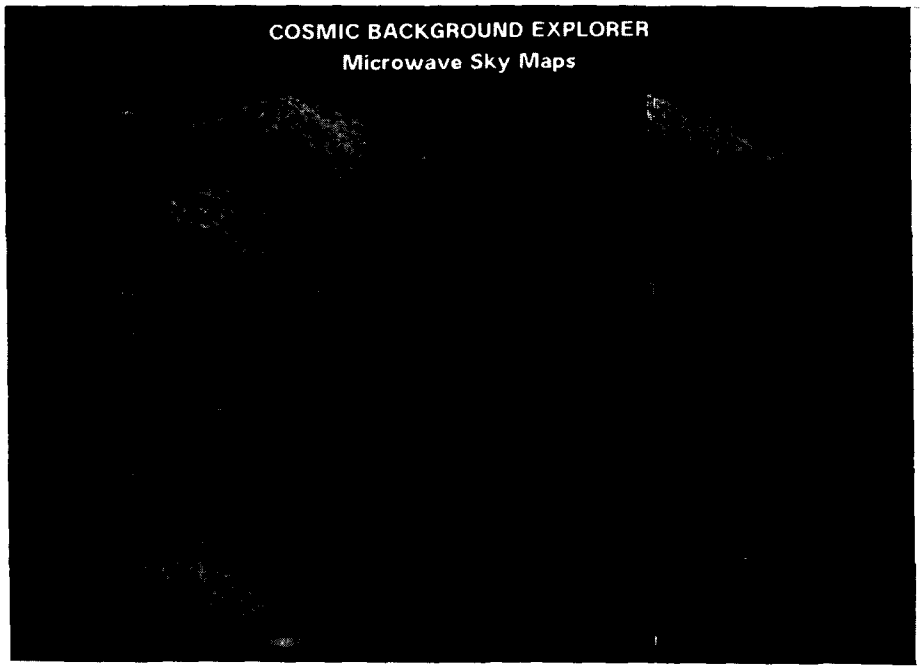
Dr. John Mather (Code 685), principal investigator for the Far Infrared Absolute Spectrophotometer (FIRAS) and Project Scientist for the COBE mission, reported that the spectrum measurement of the cosmic background (a relic of the Big Bang) is highly accurate and heralds a major advance in observational cosmology. Based on a small sample of data, FIRAS measurements show no deviation from a blackbody spectrum as large as one percent of the peak brightness of the cosmic microwave background over the wavelength range 500 microns to 10 millimeters.

When FIRAS captured these data, it was pointed toward the North Galactic Pole, where emissions from our own galaxy, the Milky Way, are expected to be low. Using only 9 minutes of sky observations, FIRAS has already produced the most precise cosmic microwave background spectrum measurement ever made. Much more exposure time will be obtained during the mission.

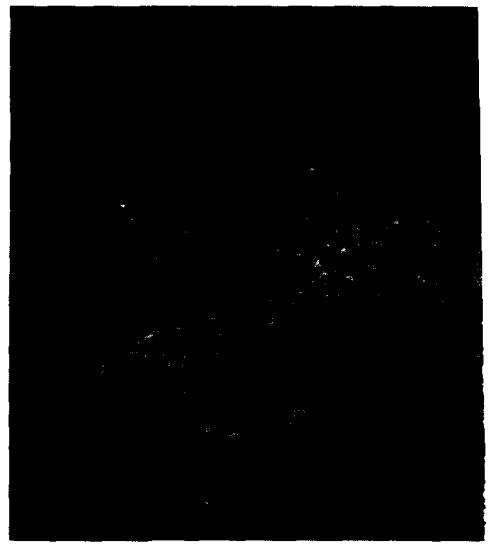
Dr. George Smoot (UC-Berkeley), principal investigator for the Differential Microwave Radiometer (DMR), presented the first COBE maps of the variation in brightness of the cosmic background radiation over the sky. The maps, taken at frequencies of 31, 53, and 90 GHz, indicate that the cosmic background radiation is equally bright in all directions. The question of what and where are the progenitors of galaxies and large clusters of galaxies is still open

The preliminary results from the DMR are based on only about 20 days of data and also indicate the extraordinary smoothness of the universe. This instrument will continue to take data for two years, which will improve its sensitivity to search for anisotropies, or "lumpiness," in the early universe well beyond the present limits.

Dr. Michael Hauser (Code 680), principal investigator for the Diffuse Infrared Background Experiment (DIRBE), showed maps of half the sky taken at wavelengths of 1.2, 12, and 240 microns (never before achieved for the 1.2 and 240 micron wavelengths). Final maps from this experiment will enable COBE scientists to search for radiation from the first stars and galaxies.



PRELIMINARY DMR SKY MAPS (31.5, 53, and 90 GHz)—**These are the preliminary sky maps of the cosmic microwave radiation obtained from the Differential Microwave Radiometer (DMR), which clearly show the first-order anisotropy at the 0.1% level. This previously measured anisotropy is because of the Doppler shift resulting from the Solar System motion, relative to the distant matter in the universe. The fact that there are no other features prominent in the maps indicates the extraordinary smoothness of the early universe, but still leaves open the question: Where are the progenitors of galaxies and large clusters of galaxies? The COBE maps are the first at 53 GHz. The data are shown as full sky maps in galactic coordinates (the plane of the galaxy is horizontal across the map and the galactic center is at the center of the map.) The black areas are regions of the sky not yet observed by the instrument. Galactic emission can be seen in the 31 and 53 GHz maps. The 90 GHz channel A map contains much less data than the other maps because all the data from this channel are not yet processed.**

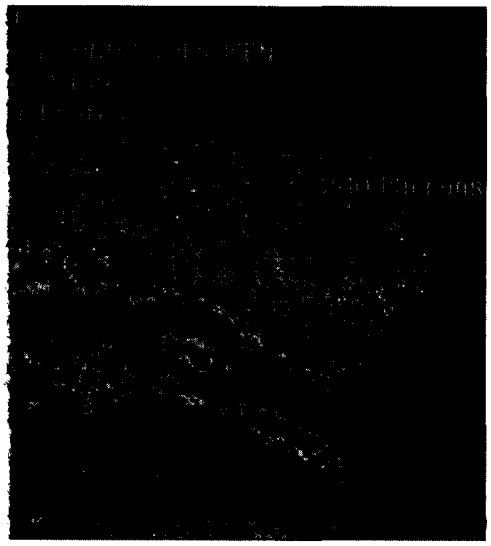


PRELIMINARY DIRBE SKY MAP (240 Microns)– **celestial emission in part of the Milky Way Galaxy (Dec. 11-18, 1989) by the Diffuse Infrared Backgro Explorer (COBE) spacecraft. These data, along wit will permit determination of the mass and tempera into the character of the dust. These data clearly s in our Galaxy, including the patchy 'infrared cirrus' Satellite, launched in 1983. As the COBE progress DIRBE will produce the first all-sky map of the i microns. Different colors in the map denote region to encompass the large brightness range observed the map are parts of the sky not yet scanned by t map is thermal emission from cold (typically abo**

These initial maps, taken over a one-week period, clearly reveal bright foreground radiations from stars, dust in our own Solar System, and interstellar dust. DIRBE maps half the entire sky every day at 10 different wavelengths, and it covers the entire sky in 6 months.

At the AAS Meeting, Dr. Nancy W. Boggess (Code 685), Deputy Project Scientist, gave an overview of the mission, reporting that COBE has met or exceeded all design goals. At launch, all systems deployed as planned. The RF/Thermal Shield, which protects all three instruments from Solar and Terrestrial radiation, is more specular than hoped.

This efficient shield results in a lower than anticipated temperature in the dewar, the giant thermos bottle that maintains the FIRAS and DIRBE at operating temperatures below 2 degrees K. The dewar now operates at 1.4 degrees K, though designed for 1.6 degrees K less. The lower temperature will enable the detectors of the COBE instruments to be more sensitive. It also makes the lifetime of the liquid helium, which keeps the dewar cryogenically cooled, longer than the original 12 to 14 months. It is now expected to last 430 days.



-This figure is a preliminary map of the intensity of at 240 microns wavelength as measured in one week und Experiment (DIRBE) on the Cosmic Background h those at other wavelengths measured by the DIRBE, ture of the material being observed, as well as insight how the complex distribution of interstellar material clouds noted in data taken by the Infrared Astronomy es throughout its first six months of data-taking, the ntensity of celestial emission at a wavelength of 240 s of different sky brightnesses (on a logarithmic scale). The red zones at the lower right and lower left of he DIRBE instrument. Most of the emission in this ut 30 degrees Kelvin) interstellar dust.

COBE was launched November 18, 1989, aboard the last NASA-owned Delta rocket, from Vandenberg Air Force Base, CA. COBE is managed by Goddard for NASA's Office of Space Science and Applications. GSFC is responsible for the design, development, and flight operations, as well as for the development of the analysis software and for the production of the final mission data sets.

The COBE Science Team consists of Drs. Charles L. Bennett, Nancy W. Boggess, Edward S. Cheng, Eli Dwek, Michael G. Hauser, Thomas Kelsall, John C. Mather, S. Harvey Moseley, Jr., Richard A. Shafer, and Robert F. Silverberg, all of Goddard's Laboratory for Astronomy and Solar Physics; Samuel Gulkis and Michael A. Janssen of the Jet Propulsion Laboratory; Dr. Philip M. Lubin of the University of California at Santa Barbara; Drs. Stephan S. Meyer and Rainer Weiss of the Massachusetts Institute of Technology; Dr. Thomas L. Murdock of the General Research Corporation; Dr. George F. Smoot of the University of California, Berkeley; Dr. David T. Wilkinson of Princeton University; and Dr. Edward L. Wright of the University of California at Los Angeles.

New Supercomputer Will Give GSFC Tenfold Power Increase

by Carolynne White

Goddard's Space Data and Computing Division will increase its computing power by more than ten times with a new Cray YMP supercomputer it will buy as part of a $59 million joint procurement with Lewis Research Center. This first ever multicenter, multi-discipline procurement will provide each center with a state-of-the-art system that can do the same amount of work in one-tenth the time.

"Current projections indicate that the science research for the Earth Observing System (EOS) will require at least a tenfold increase in computing power over what we can deliver today," said Dr. Milton Halem, Chief, Space Data and Computing Division.

The reason such increased computing power is needed is not necessarily to accommodate more users, or more data, although this will add to the requirement, according to Halem, but because scientists will be asking more complex questions and studying more intricate relationships among data sets than ever before in the context of EOS.

"We are moving into a new era where the scope of computer modeling is expanding across interfaces between different scientific disciplines; these complex models will be required to synthesize the massive amounts of space data, collected using different time scales and varying spatial resolutions," Halem said.

The new system will replace the Cyber 205 now used by about 1,400 scientists spread over 500 different computer accounts. Approximately 70% of that usage is in support of Goddard and other NASA investigators doing research in Earth science, astrophysics, and other topics under the authorization of NASA's Office of Space and Earth Sciences. The remaining 30% of computer resources in used by outside investigators at universities and research institutions, either remotely, through networks, or occasionally through on-center visits.

The initial purchase is for four processors, with 32 megawords of high-speed, direct-access memory, and 128 megawords electronic memory in a solid state device (SSD), for a total of 25 gigabytes (25 billion bytes) of disk space. This is eight times our current high-speed memory capacity and twice our current disk storage capacity on the Cyber 205, said Halem.

Lewis Research Center will receive the same initial system; both centers are included in seven years of upgrade options with a combined ceiling of $170 million. The procurement allows each system to more than double in capacity in 1991 by adding two processors and increasing capacity to 64 megawords high-speed memory, 256 megawords SSD memory, and 50 gigabytes of disk space. In 1992, Goddard and Lewis can again double the capacity by adding two more processors and completing the eight-processor Cray YMP system and increasing capacity to 128 megawords high-speed memory; 512 megawords SSD memory; and 100 gigabytes of disk space.

The contract also provides for an upgrade in 1993, which will be performed either by increasing the number of processors to 16, each twice the speed of the previous processors, or by delivery of a new machine now in development by Cray, known as the C-90, with equivalent power, Halem explained. The C-90 is also upgradeable under the contract.

By 1994, the Space Data and Computing Division expects to have 60 times the computing power available today.

This supercomputing power will arrive just in time to accommodate the more intensive demands posed by EOS scientists studying global change, as well as the complex processing needs of everyday scientific investigations.

"Spaceborne observations will provide data with increased spectral and spatial resolution, that will need to be assimilated and interpreted by new, more complex models," said Dr. Halem. "This purchase not only quarantees that we will be able to meet that demand, but also insures that we will maintain NASA and Goddard at the forefront of computing through the year 2,000."

INSIDE

NASA Dedicates Communications Terminal in White Sands, New Mexico

Goddard and New Mexico officials traveled to White Sands, NM last month to dedicate a new $14 million ground communications terminal which will serve as backup to the existing White Sands Ground Terminal (WSGT) in relaying commands to and receiving data from its Tracking and Data Relay Satellites (TDRS).

Known as the Second Tracking and Data Relay Satellite Ground Terminal (STGT), the new White Sands facility will house approximately $245 million in sophisticated computer and communications equipment.

The STGT is expected to be operational in 1993, according to Project Manager Donald P. Eckel, and will:

- Serve as a backup to the existing WSGT
- Eliminate WSGT as a single-point-of-failure
- Provide capability to operate more than two TDRS in orbit simultaneously, to meet increased communications demands of the Space Station era, and
- Permit WSGT to be taken out of service for modernization

The three-satellite TDRS constellation, in geosynchronous orbit 22,300 statute miles (35,800km) above the equator, is the heart of NASA's space communications network and has improved communications with and tracking of orbiting spacecraft, including the Space Shuttle.

DESERT RIBBON CUTTING—**NASA and New Mexico officials gathered at White Sands, NM to officially dedicate the new $14 million ground communications terminal known as the Second Tracking and Data Relay Satellite Ground Terminal (STGT). Cutting the ribbon, from left to right, are Astronaut Jim Buchli; New Mexico Congressman Joseph Skeen; Mrs. Truly and NASA Administrator Admiral Richard H. Truly; Dale Green from the office of the Governor of New Mexico, Gary Carruthers; Jerry Fitts, of NASA Headquarters, Code Z; Astronaut John Blaha; Henry R. Benevidez, of the Las Cruces City Council; and Goddard Space Flight Center Director Dr. John W. Townsend, Jr.**

BACKUP TERMINAL—**The Second TDRSS Ground Terminal, or STGT, will serve as backup to the existing White Sands Ground Terminal (WSGT) in relaying commands to and receiving data from its Tracking and Data Relay Satellites (TDRS). This new White Sands facility will house approximately $245 million in sophisticated computer and communications equipment.**

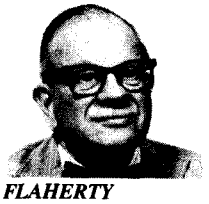
Present at the dedication ceremony were New Mexico Congressman Joseph Skeen; NASA Administrator Admiral Richard H. Truly and Mrs. Truly; Dale Green from the office of the Governor of New Mexico, Gary Carruthers; Jerry Fitts, of NASA Headquarters, Code Z; Henry R. Benevidez, of the Las Cruces City Council; and Goddard Center Director Dr. John W. Townsend, Jr. Astronauts John Blaha and Jim Buchli also participated in the ceremony, which included a ribbon cutting.

In 1988, NASA awarded to the GE Military and Data System Operations (M&DSO), Valley Forge, PA, a contract to design and install the new terminal's hardware, develop command and control software and provide training to operating personnel.

The GE M&DSO design features a highly automated system designed to provide greater than .9999 availability by limiting downtime due to computer or equipment malfunctions to less than one hour per year.

CLOSE-UP

JOHN B. FLAHERTY, JR., formerly Chief Staff Engineer of the Instrument Division (Code 720) will be Head of the newly-established Instrument Concept Design Office (Code 720.2) within the Division. "Basically what we've done is separate out Phase A, Concept Design, of the instrument development process into its own office," said Flaherty. "This way we will concentrate on the needs of the scientists in Code 600, assisting with proposal writing and primary planning for new instruments."....In the Optics Branch (Code 717), **JOHN OSANTOWSKI** has been appointed to the newly-established position of Assistant Branch Head of the Optics Branch. "Our Branch is involved in developing instruments for Earth-sensing and astronomy missions," said Osantowski. "The sections of our branch follow instrument development from concept through fabrication, assembly, and testing: A project goes from the Optical Research Section to Optical Design, to the Optical Lab, and then to Optical Testing," he said. The Diffuse Infrared Background Experiment (DIRBE) on the Cosmic Background Explorer Spacecraft, featured in this issue, and making headlines in national news, began as a conceptual design in the Optical Research Section of this Branch....A scientist at Goddard has co-authored a report on a study that provided new evidence that pollution can modify clouds so that they help cool the Earth's climate. In a study published in the journal *Science,* **MICHAEL D. KING,** of Goddard's Laboratory for Atmospheres, and his colleagues observed the effects of pollution from ships burning fossil fuels on shallow layer clouds. The study, co-authored by Lawrence F. Radke, University of Washington, and James A. Coakley, Jr., Oregon State University, used simultaneous measurements from the NOAA-10 satellite and the University of Washington's C-131A research aircraft. The observations of these "ship track" clouds were conducted off the coast of California on July 10, 1987.



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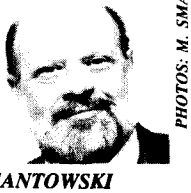


OSANTOWSKI

PHOTOS: M. SMALL

PHOTO: D. McCALLUM

***PECUNIARY PROGRAMMERS*—Four Goddard Space Flight Center employees and five Century Computing employees received a cash award from the NASA Space Act Awards Program Inventions and Contributions Board for their contribution "Transportable Applications Executive (TAE)" in a ceremony on February 1 in Center Director Dr. John W. Towsend, Jr's office. TAE is an advanced software management system that binds a set of application programs into a single, easily operated system used by end users, programmers, and systems analysts. This system lowers the cost of software system development, upgrades, and maintenance. TAE has been the system of choice in most image analysis systems developed by NASA. From left to right, awardees are: Dolly Perkins (Code 522); John Dalton (Code 520); Dharitri Misra (Century Computing), Norm Engelberg (Century), Center Director Dr. Townsend; Phil Miller (Century); John McBeth (Century); Paul Butterfield (Century); David Howell (Code 520); and Marti Szczur (Code 522).**

PHOTO: D. McCALLUM

***REMEMBERING MARTIN LUTHER KING, JR.*—O.H. Laster of the Martin Luther King, Jr. Commission speaks to approximately 125 employees and students in the Building 8 Auditorium on Friday, January 12. The lunchtime celebration of Dr. Martin Luther King, Jr.'s birthday was held in commemoration of the great civil rights leader and his dream of equality for all. Students from the Suitland High School University Program listened alongside Goddard employees as Laster spoke of many gains in civil rights that have been achieved both nationally, and locally, at Goddard. He noted, however, that recent law and policy changes have been a setback to the movement, and that much work remains to be done.**

GSFC and Langley To Work With Maryland To Promote Technology Transfer

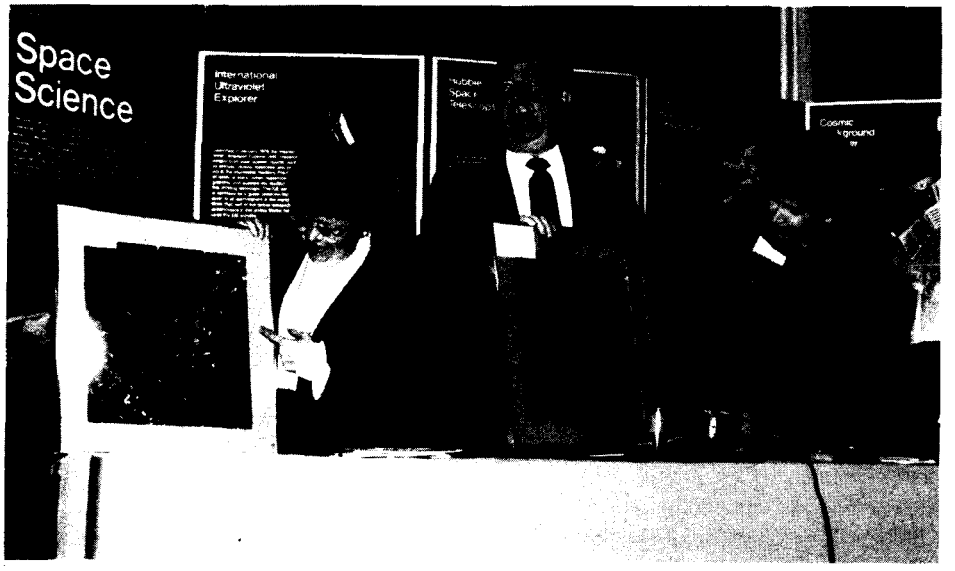
Maryland officials were at Goddard January 29 to sign a memorandum of agreement between Goddard Space Flight Center (GSFC), NASA's Langley Research Center (LaRC), and the State of Maryland to promote the transfer of NASA-derived technology to the state's businesses.

On hand for the signing of the agreement at Goddard were Senator Barbara A. Mikulski (D-Maryland); Representative Constance A. Morella (R-Maryland); Maryland Governor William Donald Schaefer; Center Director Dr. John W. Townsend, Jr.; and LaRC Director Dr. Richard H. Petersen. Also present were Maryland Secretary of Economic and Employment Development J. Randall Evans; and Selig Solomon, director of the Office of Technology Development.

GSFC and LaRC will work through the Maryland Office of Technology Development to foster the growth of the use of space by Maryland's private sector.

As part of the agreement, each NASA center named a representative to coordinate technology transfer activities and serve as an official point of contact. These representatives are Donald S. Friedman, GSFC, and John Samos, LaRC.

At the ceremony Center Director Townsend presented the participants with color photographs of the Chesapeake Bay area taken by the Landsat Earth-observing satellite. Governor Schaefer in turn presented both Center Directors with framed plaques bearing the State Seal of Maryland.



BIRD'S-EYE VIEWS—**Senator Barbara A. Mikulski (D-Maryland); Maryland Governor William Donald Schaefer; and Representative Constance A. Morella (R-Maryland) admire the Landsat photographs presented to them at the ceremonial signing of a Memorandum of Understanding for technology transfer between Goddard, Langley Research Center, and the state of Maryland.**

"This agreement will have exciting and far-reaching consequences," said Senator Mikulski, who chairs the Appropriations Subcommittee on HUD, VA and independent agencies, which oversees NASA funding. "It will promote the transfer of high-tech know-how from our public investment in America's space program into Maryland's private sector. It is a public-private partnership that will help keep Maryland's high-tech economy flying high and strong well into the 21st century," she added.

"This agreement is a very important agreement, the beginning of an exciting new partnership which will benefit Goddard, the State of Maryland, and the Maryland companies which will be the recipients of NASA's technologies. Everybody wins," said Governor Schaefer.

"Goddard is proud to be located in the state of Maryland," Dr. Townsend said. "As a part of both our government and civic responsibilities, we take very seriously the duty to transfer our space technology developments into the commercial sector as quickly as possible wherever appropriate."

Following the signing, Senator Mikuski, Congresswoman Morella, Governor Schaefer, Dr. Townsend, Secretary Evans and other dignitaries toured Goddard's robotics lab and the Space Telescope Operations Control Center. The Hubble Space Telescope will be controlled from Goddard following launch, scheduled no earlier than April 18.

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