

Versatile Delta Has Busy Year

Twelve spacecraft were successfully launched by Goddard's Delta rocket in 1975 with half of them as NASA/Goddard missions and the other half evenly split among commercial companies, foreign countries and other government agencies, two each.

For '76 the Delta is scheduled to place 11 spacecraft in orbit with none carrying a Goddard payload; one, LAGEOS, carrying a NASA payload; and one, CTS, a joint Canadian-NASA spacecraft. Meanwhile, three Goddard experiments will be carried into solar orbit on board a Titan/Centaur/TE-364-4 rocket with the U.S. paying for the Titan and U.S. experiments and West Germany funding the spacecraft.

NASA expects to be paid some 92 million dollars next year by foreign and domestic users to provide Delta launch services with 69 percent coming from foreign users and 18 percent from U.S. government agencies.

Major milestones for Goddard last year included the marking of the 15th anniversary of the weather satellite era on April 1 and the launch of the 100th successful mission by the Delta, Telesat-C, May 7.

The second LANDSAT satellite was launched in January. Another geodetic satellite, GEOS-C, was launched in April, followed by Telesat-C, Nimbus-F, and Orbiting Solar Observatory-8 in the next two months. The second LANDSAT satellite was launched in January. Another geodetic satellite, GEOS-C, was launched in April, followed by Telesat-C

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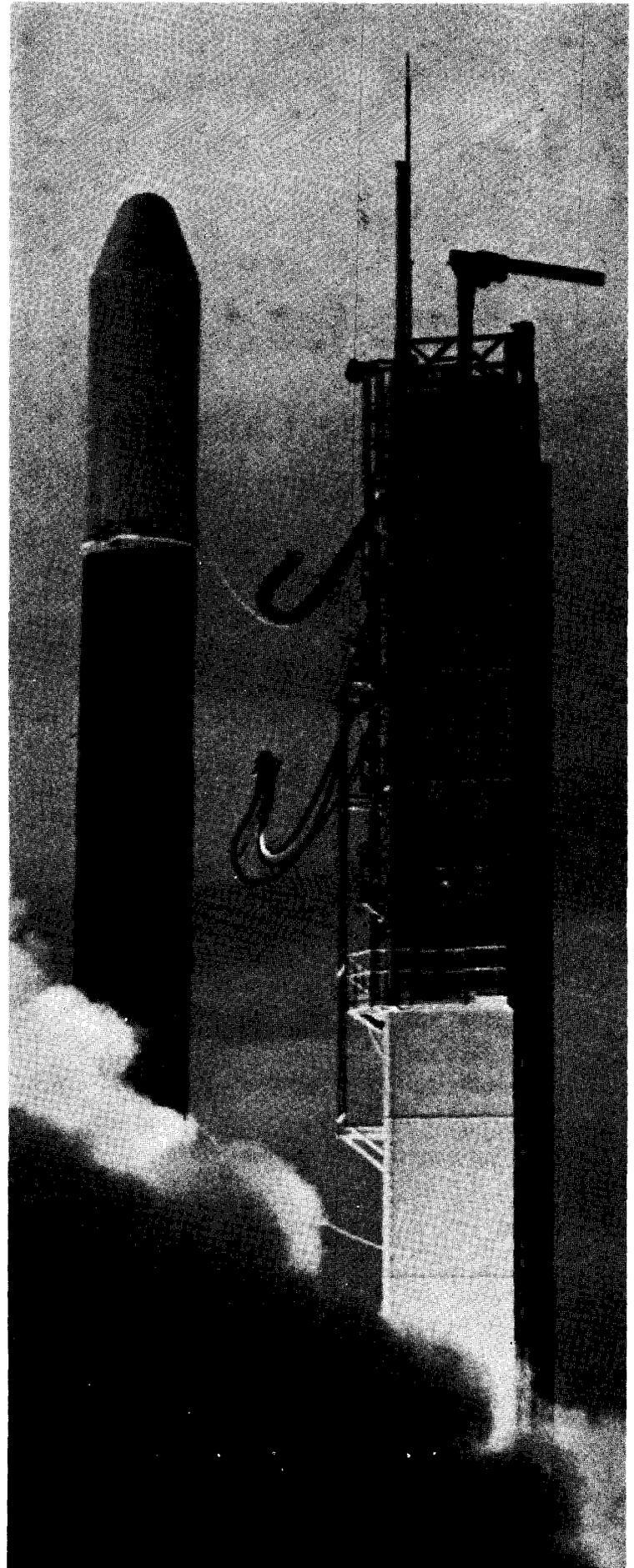
The second Synchronous Meteorological Satellite was placed into orbit in February and was joined by the National Oceanic and Atmospheric Administration's first operational synchronous orbit satellite in October. Called GOES, for Geosynchronous Orbit Environmental Satellite, it will ultimately be part of a world-wide system of U.S., European, Russian and Japanese weather satellites. RCA/Satcom-1 was placed in orbit in December to finish the year.

Meanwhile, other activity continued.

The GSFC Magnetometer Experiment on Mariner 10 of Dr. Norman Ness and his colleagues established conclusively that Mercury has its own magnetic field and a significant magnetosphere.

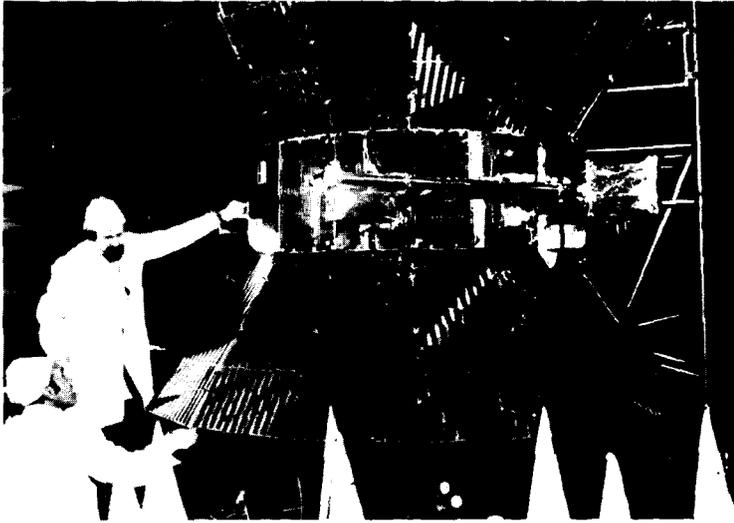
Larry W. Brown reported the first detection of low frequency radio emission from Saturn observed with the radio astronomy experiment on IMP 6.

Dr. Floyd W. Stecker believes that a 77-year-old astrophysical mystery, the origin of cosmic rays, has been solved. He published a scientific paper last summer which gave further strong support to the idea that cosmic rays come from supernovas in our own galaxy.



Continued on Page 4

Goddard's Delta rocket successfully launched 12 spacecraft in 1975.



Helios-B

Solar Probe Launched

Helios-B, the second of two spacecraft designed to fly closer to the Sun than any previous man-made object, was launched successfully from Kennedy Space Center, Florida, aboard a Titan Centaur rocket at 12:34 a.m. EST on January 15.

The spacecraft will be placed into a highly elliptical orbit around the Sun at distances ranging from 149,599,000 kilometers (89,700,000 miles) to 43,400,000 km (26,900,000 mi.). It will reach the closest point every 93 days.

Named after the Sun god of ancient Greece, Helios was built by West Germany as part of a joint venture with the United States. Three of the 10 experiments on board are American. The United States also supplies the launch vehicle, tracking and data acquisition and technical support. Goddard has overall project responsibility for U.S. participation. The U.S. project scientist is Dr. James Trainor of the Instrumentation Branch of Goddard's Laboratory for High Energy Astrophysics.

Helios B will fly nearly 3 million km (2 million mi.) closer to the Sun than its predecessor, Helios 1, which was launched a year ago. And it will experience about 10 percent more heat than Helios 1, whose parts already have shown they can take temperatures of 370 degrees Centigrade (700 degrees Fahrenheit)—the melting point of lead—and continue to function well.

Instruments aboard the spacecraft will measure the solar wind (ionized particles given off by the Sun), magnetic fields, solar and galactic cosmic rays, electromagnetic waves, micrometeoroids and the zodiacal light (a diffuse glow seen in the east and west before sunrise and after sunset).

Information returned by Helios B is expected to shed more light on the unexpected micrometeorite results observed on Helios 1.

Dr. Trainor explains, "Helios 1 detected about 15 times more micrometeorites close to the Sun 53 million km (33 million mi.) than observed near the Earth. They come from sharply defined but many different directions at different times.

"We don't know whether they are transported by the Sun's corona after being pulled into the Sun from elsewhere in space—which would have an important impact on solar energy theory—or whether they may be following the path of starlight directly in towards the Sun."

Other Goddard personnel managing the Helios-B project are Gilbert W. Ousley, Project Manager, International Projects Office; Charles B. White, Assistant Project Manager; and William R. Witt, Jr., Assistant Project Manager. Goddard investigators and their experiments are N. F. Ness (Principal Investigator) and L. F. Burlaga, Flux-Gate Magnetometer; S. J. Bauer and R. G. Stone, Plasma and Radio Wave Experiment; and J. H. Trainor (Principal Investigator), F. B. McDonald and B. J. Teegarden, Cosmic Ray Experiment.

AID Improves Status of Women

In response to Congressional mandate and in recognition of the International Women's Year, the State Department's Agency for International Development (AID) is concentrating on ways to improve women's participation in its technical and social projects. Various recent AID publications outline the efforts.

Though legal and social barriers to women's equality are generally falling around the world, lack of education and access to credit still hold many women back from participation in a technical society. In the 42 nations where annual per capita income is less than \$500, women work largely outside the money economy. Half a billion women make up 60 percent of the world's illiterate adults.

The agency is responding in a variety of ways. More women are being brought to the United States for training—13.1 percent of such trainees in the first half of 1975 were women, compared to only 4.5 percent two years earlier. Others are receiving training in their own countries—as paramedics in Guatemala, as midwives in Afghanistan, as family planning instructors in Pakistan (where such services now reach 75 percent of the population, according to AID). In other areas, trading cooperatives and credit institutions aimed at women are helping make new markets available for their crafts and produce. A by-product of the work is new statistics showing the importance of women to the work force of many developing countries.

SAS Observes Pulsars

New and unexpected behavior on the part of pulsars (pulsing stars) has been observed by NASA's Small Astronomy Satellite-2 (SAS-2) which is equipped with a single gamma ray experiment. The 195-kilogram (430-pound) spacecraft was launched from the San Marco Equatorial Range in the Indian Ocean offshore from the Republic of Kenya on November 15, 1972.

According to GSFC's Dr. Carl E. Fichtel, a pulsar in the Vela constellation has been observed generating two bursts of gamma rays for every burst of radio waves. Neither the gamma ray nor the radio bursts occur at the same time.

"No other pulsar has ever been found to exhibit such properties. These new results imply that pulsars are probably much more complex objects than had previously been believed," said Dr. Fichtel.

Scientists generally agree that pulsars are small, extremely dense, rapidly spinning stars which represent the remains of a huge stellar explo-

sion, or supernova. Considerable disagreement exists about how these stars produce their radiation pulses, and whether the pulses occur at the surface of the star or above it.

"Our new gamma ray results suggest that radiation may come from both the pulsar's surface and above it. This would explain why the radio waves and gamma rays do not arrive at the Earth simultaneously," added Dr. David Thompson, a member of the SAS-2 experiment group.

According to Dr. Fichtel, the detection of gamma rays from the Vela pulsar also means that pulsars are a likely source of cosmic rays. These are high-energy charged particles which are found in interstellar space and are needed to produce gamma rays.

Many astrophysicists have believed that only very young pulsars, with ages 1000 ages or less, could produce particles with cosmic ray energies. The SAS-2 results cast some doubt on this conclusion since the Vela pulsar is thought to be more than 10,000 years old.



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

OFFICE OF THE ADMINISTRATOR

Dr. John F. Clark
Director
Goddard Space Flight Center
National Aeronautics and
Space Administration
Greenbelt, MD 20771

Dear John:

It was wonderful to receive the report this week that you and your fellow employees at Goddard achieved your fair-share goal of \$165,000 in the Combined Federal Campaign for the National Capital Area. Congratulations are more than ever deserved in view of the problems raised by the Prince George's Community Fund.

Your participation in the Baltimore CFC with contributions and pledges totaling about \$13,000 is also commendable.

You have again demonstrated in a generous way a concern for the less fortunate and the quality of life in your community. Please accept my personal thanks for all you have done to assure the success of the campaign, and I would appreciate your extending my thanks to your employees, particularly to Ms. Nina Chaney, who served as your campaign coordinator.

Sincerely,

James C. Fletcher
Administrator

GSFC Exceeds Goal

Goddard has exceeded its Combined Federal Campaign (CFC) goal for the fourth consecutive year. Through the CFC, Goddard contributed \$167,047 to the United Way of the National Capital Area, the National Health Agencies, and the International Service Agencies. This represents 101% of GSFC's goal of \$165,000. Also, \$13,389 was contributed to the CFC of Central Maryland, which includes Baltimore.

The key people who conducted the successful campaign were: Dr. John F. Clark, Chairman; Dr. Robert S. Cooper, Vice-chairman; Mr. Herbert J. Fivehouse, Campaign Manager; and Nina Chaney, Campaign Coordinator.

Directorate Coordinators were: Ann Snow, 100; Lynn Murphy, 200; Clay Magee, 300; Eileen Mowle, 400; Frank Ferrell, 500; George Abid, 600; Frank Martin, 700; Tom Ramos, 800; and Marie Stubbs, 900.

Dr. James Fletcher expressed his appreciation to all who were involved in this significant accomplishment in the accompanying letter.

Hearth Receives Top NASA Honor

Donald P. Hearth, Director of the Langley Research Center, was recently awarded the NASA Distinguished Service Medal, NASA's highest award, "in recognition of his outstanding contributions while serving as director and chairman of the 'Outlook for Space' study."

Hearth served as Deputy Director of Goddard for five years until his appointment to Langley last summer. He spent much of his last year at Goddard directing the "Outlook for Space" study, an agency-wide examination of opportunities for future space activities. In 1969, Hearth was awarded NASA's Exceptional Service Medal.

Unemployment Rises for Engineers

John Alden, executive secretary of the Engineering Manpower Commission (EMC) of the Engineers Joint Council, reviews the latest job statistics in the November NEW ENGINEER. The article title, "The Bottom Falls Out," tells it all.

Overall unemployment for engineers, as compiled by the Bureau of Labor Statistics (which does not limit the designation to graduate engineers), rose from 0.9 percent in 1974 to 3.0 percent in 1975. As for new graduates seeking their first job, the market was "in many ways as depressed as in 1971-72, with its massive aerospace layoffs," writes Alden. The proportion of graduates without job offers or other plans rose to 12 percent, highest since EMC started taking data.

Petroleum engineers were most successful in getting jobs; industrial, civil and architectural engineers were hardest hit. Lowest starting salary was for civil engineers, \$12,888—still \$1,836 above nontechnical graduates.

Volunteers Needed

Volunteer opportunities are available with the Mental Health Association of Montgomery County, a United Way Agency. Each placement offers supervised experience and an opportunity to explore mental health concerns in the county.

The Volunteer Corps has openings for men and women interested in working with hospitalized mental and day care patients and with former patients returning to the community. There are no educational requirements, however, all applicants must be at least 18 years of age. Daytime training will be held March '76 and periodic evening training will be available if numbers warrant. Application deadline is February 23. Prospective volunteers should call the Mental Health Association offices at 949-1255.

ing writing, technical report preparation, and editing and configuration management support. The work will reflect the status, progress, results and accomplishments of GSFC research and engineering programs and support services.

Wood Retains Strength

A thick block of wood burns at the rate of only about 1 inch every 40 minutes. Hence, a wooden beam or post several inches thick will retain most of its strength during the initial stages of fire. On the other hand, materials that may melt or conduct heat quickly sag very early in the fire, and allow the structure to collapse much sooner than do wood timbers of the same initial strength.

The national demand for wood products rose by 70 percent over the past three decades and is expected to double from present levels by the turn of the century.

The conversion of wood into usable products requires six times less energy than for steel and 39 times less than for aluminum.

Wood pilings have been discovered intact after being under the streets of Venice for more than 1000 years.

During World War II the U.S. armed forces consumed enough lumber to build 9.5 million average-sized homes.

Raytheon Selected

On December 17 Goddard chose Raytheon Service Co., Hyattsville, Md. to provide technical writing and editing support for a two-year period beginning January 1, 1976.

The competitive contract, when finally negotiated by the end of the year, is expected to be about \$1 million.

Raytheon services will include scientific and engineer-

Delta . . . from Page 1

Dr. Jack C. Brandt and a team of NASA/University astronomers deciphered a number of ancient Indian "rock art" paintings in the southwestern United States as probably commemorating the explosive creation of the Crab Nebula, in 1054 A.D.

Global monitoring of the ozone from space has been going on since 1970 with instrumentation on board Nimbus-4; the same Nimbus instrument is now being carried on AE-E to take a close look at the ozone in the equatorial region. GSFC's Dr. Donald F. Heath, the AE Ozone Experiment Investigator, expects enough information to be available by 1980 to help establish if there is a depletion of ozone.

The newest Orbiting Solar Observatory, OSO-8, was launched from Cape Canaveral to continue the series' solar observations and also look into deep space at several powerful emitters of X-rays in our galaxy which are likely to be neutron stars or even black holes.

In other areas, Goddard's Applications Technology Satellite-6, launched from Cape Canaveral, Florida, in May of 1974, was moved over Africa last summer to provide instructional television for several thousand villages in India. It also was the prime communications link during the historic Apollo/Soyuz flight last July.

The LANDSAT satellites continued to transmit back important Earth resources information. Pictures were used to guide a Navy icebreaker through cracks in sea ice to an area in Antarctica never before visited by a surface vessel. They were used in support of ocean explorer Jacques Cousteau in oceanographic activities near the Bahamas and with the state of Florida as part of a long-range GSFC-Florida Red Tide observation mission. U.S. crop inventory experiments began with LANDSAT-2.

Nimbus-6, launched in June from Cape Canaveral, was used in many balloon, sea and land data collection platform experiments, including one in which small platforms were dropped on sea ice north of Alaska to monitor ice movement in the Beaufort Sea. Such monitoring is expected to be important to oil drilling operations.

Meanwhile, modification of a four-unit building to utilize solar energy as part of a joint energy research project between a large housing cooperative at Greenbelt, Maryland and GSFC was nearing completion. A fuel oil savings of as much as fifty percent is expected to be demonstrated this winter.

On future projects, GSFC chose Boeing Company, Kent, Washington for award of a fixed-price incentive contract to provide base modules for the first two Applications Explorer missions—the Heat Capacity Mapping Mission and the Stratospheric Aerosol Gas Experiment.

Another selection was the Western Union Telegraph Co., Upper Saddle River, N.J., and RCA Global Communications, Inc., New York, N.Y., for negotiations leading to Phase I contract awards to provide a detailed system design proposal for a Tracking and Data Relay Satellite System (TDRSS) to be developed and operated by industry to meet NASA service requirements.

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James Lacy, Editor

Lorel Foged, Assistant Editor

Patricia Ratkewicz, Secretary, Phone Extension 4141



PTTI planning meeting coordinator Clark Wardrip welcomes attendees.

Goddard Hosts PTTI Meeting

The seventh Precise Time and Time Interval (PTTI) planning meeting was held at Goddard on December 2, 3 and 4, 1975. Over two hundred and fifty people attended the meeting which was sponsored jointly by NASA and the Department of Defense.

The purpose of the PTTI planning meetings was to disseminate, coordinate and exchange practical information at the user level; to review present and future precise time and frequency needs and to acquaint systems engineers, technical managers and program administrators with precise time and frequency technology and its problems.

The 36 papers presented covered PTTI needs related to navigation, communications, geodesy, interferometry, missile and satellite tracking systems, meteorology, collision avoidance, and frequency and time generation and synchronization.

Representatives from eight foreign countries presented papers: Australia, Canada, Chile, England, India, Japan, USSR and South Africa. Participating NASA personnel were Donald Kaufmann, John McKenna and Victor Reinhardt, Code 814; Andrew Chi, Code 810; F. O. Vonbun, P. E. Schmid, P. D. Argentiero and D. E. Smith, Code 900, and F. M. Boykin from Wallops Flight Center.

Vostok Carries U.S. Experiments

An unmanned Soviet Vostok spacecraft was launched November 25 carrying at least 11 biological experiments, four of them provided by NASA at Soviet invitation. The U.S. experiments include such life forms as plant cells and fish embryos. Each experiment has both a near-weightlessness version and a control counterpart to be conducted in a one-gravity centrifuge. Placed in an orbit initially ranging from 141 to 251 miles above Earth, the satellite is expected to remain aloft for about 22 days.

Another unmanned craft, Soyuz 20, docked with the Salyut 4 space station, suggesting that Soviet space officials are investigating the possibility of automatically resupplying the station to enable longer manned missions. Launched November 17, Soyuz 20 was the first unmanned craft to rendezvous and couple with a Salyut. There were no announcements of attempts at transferring consumables or other materials from spacecraft to space station, though Soviet officials have discussed the concept of automated orbital "tankers" in the past.