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Goddard Space Flight Center

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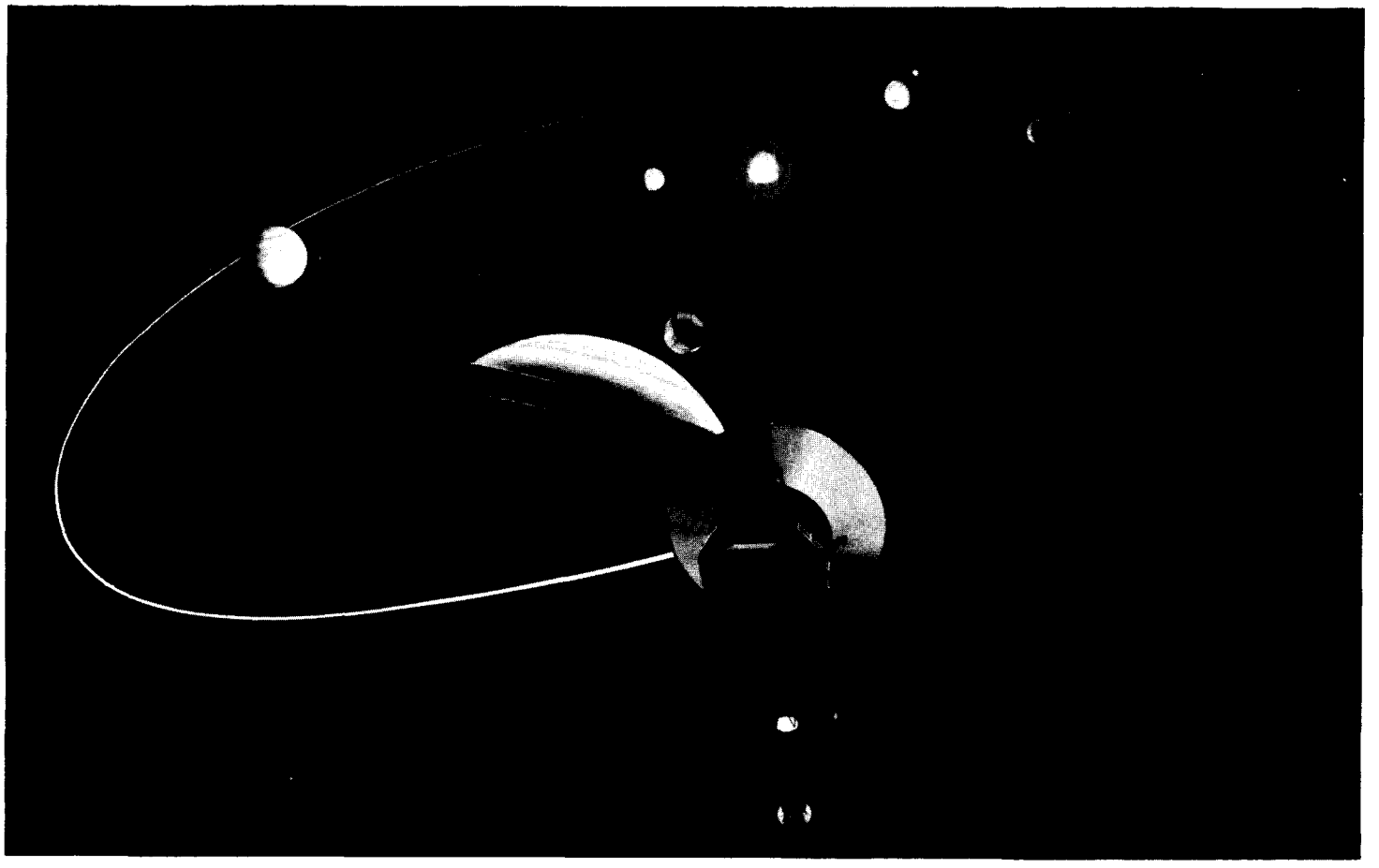
Goddard Scientists Prepare for Encounter of the Closest Kind



GRAND TOUR—An artist's concept of the Voyager spacecraft and its grand tour of the outer planets—Jupiter, Saturn, Uranus, and coming up on August 24, the closest encounter yet, with the planet Neptune.

by Carolynne White

When the Voyager 2 spacecraft makes its closest encounter yet on its Grand Tour of the solar system—passing within 3,000 miles of the planet Neptune—19 Goddard scientists involved with five of the spacecraft's 11 instruments will be anxiously awaiting the information it sends back.

Goddard scientist Dr. Barney Conrath, Code 690, is the principal investigator for the Infrared Interferometer Spectrometer and Radiometer (IRIS), a two-part instrument on Voyager which will gather information about the temperature and composition of the planet's atmosphere and the total amount of energy emitted by the planet.

Other Goddard scientists and their instruments also play an important role in this encounter. The Magnetometer Instrument (MAG) is actually four magnetometers—two high-sensitivity instruments on their own 43-foot boom and two medium-sensitivity magnetometers near the body of the spacecraft. They will measure Neptune's magnetic field—if it has one—and the magnetic field of the solar wind. The Plasma Subsystem (PLS), located on the fixed support structure of the scan platform, will measure properties of the solar wind in three different states—when it is between planets, when it interacts with their magnetospheres, and when solar wind plasmas are within the magnetospheres of planets. A Planetary Radio Astronomy Experiment (PRA) will measure radio emissions from the planet to determine its intrinsic rotation period. Finally, the Cosmic Ray Subsystem (CRS), which consists of seven telescopes, will measure the energy and chemical composition of charged particles between the

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INSIDE
New Code 500 Director Dale Fahnestock: Proud of His "Team" Page 6

Talk from the Top

Q: I understand that Space Station is to be the cornerstone of NASA's future, yet, there seems to be a lack of enthusiasm that borders on disgust.... I have been in numerous meetings where those of significantly high rank have groaned openly, rolled their eyes and talked about Space Station as if it were a fiasco. If Space Station is something the Center should be excited about, why is that not being communicated down through the ranks... why are we supporting it?

A: Space Station Freedom is no fiasco, but rather a program of first priority at GSFC. The polar platform is a key element of Eos and "Mission to Planet Earth," which is near and dear to our hearts. What you may be seeing is concern over the fact that the Center has not received the necessary resources to implement the project and that the level of Congressional funding is a major problem at this moment.

Q: When are the branch secretaries at Goddard going to be raised to a grade GS-6? The division secretaries (and associate division secretaries) already have been raised to a higher grade; it's only fair that the branch secretaries, who make up the majority of secretaries at Goddard, be able to keep up with the cost of living.

A: Shortly after coming back to Goddard I asked for a full review of all secretarial grades at Goddard, intentionally concentrating on the grade of the branch secretary positions, I asked for, a received, data on grade patterns at Goddard and at a number of similar Federal institutions in the Washington area. Based on a classification review and based on what other governmental laboratories are doing, I am unable to justify higher than a grade GS-5, unless significant other higher level duties are assigned to the position. This is not the case in almost all branch secretary positions at GSFC.

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

Guaymas Tracking Site Provides Long-Distance Antenna for Amateur Radio Users

by Carolynne White

Amateur Radio Operator John Sullivan of Cottonwood, AZ was vacationing in Mexico last December when he discovered an abandoned NASA tracking station at Guaymas, Mexico.

Turned over to the Mexican government in January 1971, the station was in disrepair, and a big Rhombic antenna used for air-to-ground transmission during the early days of the Manned Space Flight Program had been damaged by lightning.

But this ham radio operator, not to be discouraged, obtained approval from the Delgado Administrativo for radio communications in the Mexican state of Sonora to repair the 70-foot antenna and began using it to transmit to other amateur radio operators. With the help of the Delgado Administrativeo, Manuel Aquino Vazquez, also an amateur radio enthusiast, Sullivan and other ham radio operators found that they could load the antenna with all the ham radio frequencies and transmit around the world, using only 100 watts of power.

Built in 1963, the Guaymas tracking station was part of the Goddard's Manned Space Flight Network (MSFN), which handled all voice, data, and video communications throughout the Mercury, Gemini and Apollo missions. The antenna John Sullivan repaired used about 500 watts of power to transmit to and from Mission Control in Houston and the Syncom I communications satellite used for those missions, via Goddard NASA Communications (NASCOM) and Network Control Center (NCC).

The Guaymas tracking station received transmissions from Houston on 269 MHz, and received transmissions on 258 MHz.

Antenna Enthusiasm

"I'm kind of an antenna freak," said Sullivan. "When I saw that huge antenna not being used, I just had to work it."

But the antenna's balan—the part that balances the antenna—had been damaged by lightning, and had to be repaired before he could use it. Also, the antenna's terminating resistor, the mechanism that makes the antenna directional, was gone.

"We had to attach our own line to the antenna," said Sullivan, "but when we had it fixed and finally tied on with our transmitter/tuner, we could tune all bands. We talked to practically every country in Europe—Germany, Spain, Italy."

Sullivan has talked to other radio operators as far away as central Russia using the antenna—with a signal strength of 599, the strongest signal possible.

An Amateur's Dream

"This antenna is a dream for an amateur," he said. "I wish I had one in my back yard [in Arizona]."

Ham radio operator Dr. Roger C. Broyles, a friend of discoverer John Sullivan, now helps Sullivan spread the word about this new resource available to amateur radio operators.

"Most amateur radio operators can only dream of using such an antenna, but can ill afford one," said Broyles, "So we think quite a few will want to visit this site."

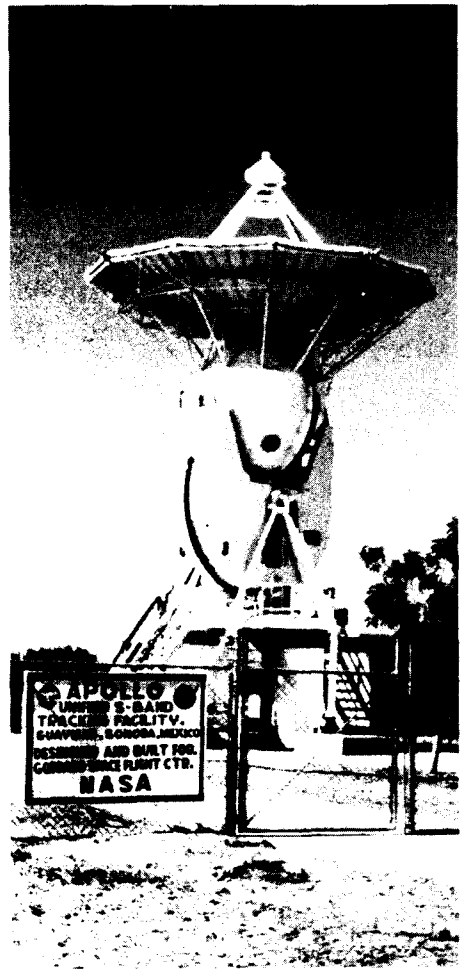


PHOTO: ED DANKO

GUAYMAS ANTENNA—**The satellite dish at the Guaymas site used for tracking spacecraft during the early days of the Manned Space Flight Program. Amateur radio operators use another antenna at this now-abandoned site to talk to ham radio operators as far away as central Russia.**

Launch Update: Shuttle to Launch German Spacelabs

A Memorandum of Understanding (MOU) recently signed between NASA and the Federal Republic of Germany provides for the launch of German payloads on the Space Shuttle. Under the MOU, specific launch services agreements or other agreements will be signed for each activity.

The first flight will be the D-2 Spacelab mission, currently scheduled for launch in February 1992. It will carry German materials processing and life sciences experiments and a small number of NASA experiments. The crew will include two German payload specialists. The Federal Republic of Germany (FRG) has paid NASA for an additional mission, the D-3 Spacelab, currently scheduled for launch in November 1993.

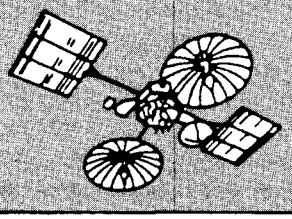
Under a similar agreement signed in April 1981, the FRG's D-1 Spacelab mission was completed successfully in November 1985. The D-1 mission carried materials processing and life sciences experiments. The crew included two German and one Dutch payload specialists.

FRG has long been a supporter of the Space Transportation System and has contributed 40 percent to the European Space Agency development of the Spacelab. FRG, as a member of the European Space Agency, also will contribute significantly to the development of the Space Station Freedom.

NEWSFLASH!!!!

TDRS System Fully Operational

The Tracking and Data Relay Satellite System is now fully operational. This milestone was reached with the successful completion of system acceptance testing on July 26, at 1 p.m. PST. The three satellites are all in their operational positions and functioning perfectly, according to Goddard officials.



NASA Pipeline

LANGLEY RESEARCH CENTER, Hampton, VA—Preliminary results from a series of high-speed ground tests indicate that heavy rain may reduce aircraft wing performance when it is most needed, during landing approach or take-off in the presence of a microburst storm, an important factor for pilots to consider while flying through severe storms, according to researchers at Langley Research Center. The heavy rain research is part of a broad NASA-Federal Aviation Administration airborne wind shear detection and avoidance program begun in 1986.

LEWIS RESEARCH CENTER, Cleveland, OH—Scientists at Lewis Research Center have established a new benchmark in the application of high-temperature superconductors to high-frequency electronic circuits. They have produced the first electronic circuit able to operate at 33 to 37 Gigahertz, a frequency range more than three times higher than attainable with previously developed circuits. (A Gigahertz is one billion cycles per second). Attaining these higher frequencies is important because advanced communications satellites will operate at 20-30 Gigahertz and above. These frequencies will allow satellites to process data at much faster rates, resulting in a three-fold increase in the number of communications linkups they can handle.

NASA HEADQUARTERS, Washington, DC—The U.S./USSR Joint Working Group on Earth Sciences held its second meeting in Washington, D.C., July 17-21. The group agreed to cooperate in two sub-satellite experiments related to land-atmosphere interactions, outlined plans for a joint research program in volcanology and agreed to cooperate in studies of changes in the Earth's cryosphere in response to global climate warming. Both sides noted with satisfaction the progress achieved in the preparation of the U.S. Total Ozone Mapping Spectrometer to be flown on the Soviet Meteor 3 spacecraft in the second half of 1991. Both sides expressed support for continued interaction between the U.S. and USSR in oceanographic research related to understanding ocean processes of importance in global change.

Goddard Studies How Weather and Climate are Influenced by Vegetation

by Carter Dove

Goddard scientists—joined by others from the U.S., Soviet Union, Canada, England and France—has have set up camp on a prairie grassland site in Central Kansas to learn how land surface vegetation regulates the rate of soil moisture return to the atmosphere, ultimately influencing local weather and regional climate.

The NASA-managed effort—led by scientists from Goddard's Laboratory for Terrestrial Physics—is an element of the International Satellite Land Surface Climatology Project (ISLSCP) and is known as FIFE, the First ISLSCP Field Experiment.

FIFE '89—with data from five Earth remote-sensing satellites, six research aircraft and dozens of high-tech surface and airborne measurement devices—is being conducted on and over a nine-by-nine square mile (15×15 sq km) area in the Konza Prairie Natural Area, just north of Interstate 70, near Manhattan, central Kansas.

A period of intensive, simultaneous observations were conducted from July 23 until August 12.

According to Dr. Forrest Hall, the FIFE science coordinator, with Goddard's Earth Resources Branch, data from the ground, aircraft and satellite-generated observations will be placed on a computer data base at Goddard for access by all FIFE investigators.

Additionally, results of the FIFE investigation will be made available, Hall said, to the scientific community through publication in journals and other established channels.

One of the many users of the results generated by the project will be Dr. Piers Sellers of the University of Maryland, the FIFE staff scientist. Instrumental in the design of FIFE, Sellers will combine computer models of vegetation with global weather to improve the understanding of how vegetation interacts with the atmospheric circulation.

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Closest Encounter

Continued from page 1

planets and within the magnetosphere itself.

The point of closest approach will occur at approximately six minutes after midnight, EDT, on Thursday, August 24—but because of the four-hour, six-minute lag time in receiving the signals, we will not see the images and data from closest approach until about 4 o'clock in the morning (EDT) on Friday the 25th.

The Jet Propulsion Laboratory's (JPL) Deep Space Network (DSN), which routinely receives data from the Voyager spacecraft, will be augmented around the time of the encounter by the Very Large Array (VLA) of 27 radio telescopes in Socorro, New Mexico, and the 64-meter antenna at Usuda, Japan, thus providing an increased data rate and quality of data, while decreasing radio "noise" in the transmissions.

Internal Energy Spectra

"Every celestial body gives off two types of thermal radiation," according to Dr. Rudolph A. Hanel, a co-investigator (and formerly principal investigator) for the IRIS experiment. "One is reflected sunlight, and the other is thermal emissions."

The infrared radiometer on IRIS measures the amount of reflected sunlight, and the Michelson Interferometer measures the thermal emission spectrum

"This is an especially difficult task in relation to the other planets," said Dr. Hanel, "because the temperatures at Neptune are extremely low, in the range of 50 to 60 degrees Kelvin (10 to 15 degrees Fahrenheit)—the atmosphere of Earth would be liquid at that temperature!"

One goal of the IRIS instrument is to determine the total amount of energy emitted by the planet Neptune. When a planet emits the same amount of heat that it receives from the Sun, it is said to be in thermal energy balance. But if the thermal emission is greater than can be accounted for by the amount of heat the planet absorbs from the Sun, then the planet must have an internal heat source.

Similar measurements taken by Voyager on Jupiter and Saturn indicate that both these gas giants, as they are called, have a large internal heat source. Voyager revealed that Uranus, however, is nearly in energy balance with solar radiation and has, at most, only a small internal heat source.

"Ground-based measurements indicate that Neptune may have an internal energy source which is quite large," said Dr. Hanel, "but we will need the precise numbers that this close encounter will provide to validate any theories."

Other Goddard co-investigators include Dr. Michael Flasar, Dr. Virgil G. Kunde, Dr. William C. Maguire, Dr. John Pearl, Dr. Joseph Pirraglia, and Dr. Robert Samuelson (all of Code 693.2).

Magnetic Field?

Most bodies in the solar system—including the Sun—have a magnetic field. In fact, the Sun's magnetic field permeates the solar system. But scientists as yet have no idea whether or not Neptune has one.

"We have not yet had a hint from our instrument or any others on the Voyager spacecraft," said Dr. Ron Lepping, Code 695, who is a co-investigator for the Magnetometer Instrument (MAG). "It's still a mystery to us whether or not Neptune has a magnetic field, although there are reasons to expect one."

Dr. Lepping and his colleagues, including principal investigator for the MAG, Dr. Norman Ness, now at the Bartol Research Institute of the University of Delaware, will be able to detect possible signs of a planetary magnetic field slightly before closest approach, depending on whether the spacecraft encounters a bow shock or signals in the solar wind associated with it.

A bow shock is formed when the solar wind, a low-density plasma which travels throughout the solar system, encounters the magnetosphere of a planet—the teardrop-shaped envelope of magnetic influence surrounding a planet. The magnetosphere is defined by the planet's magnetic field, and the outer boundary of this envelope is called the magnetopause.

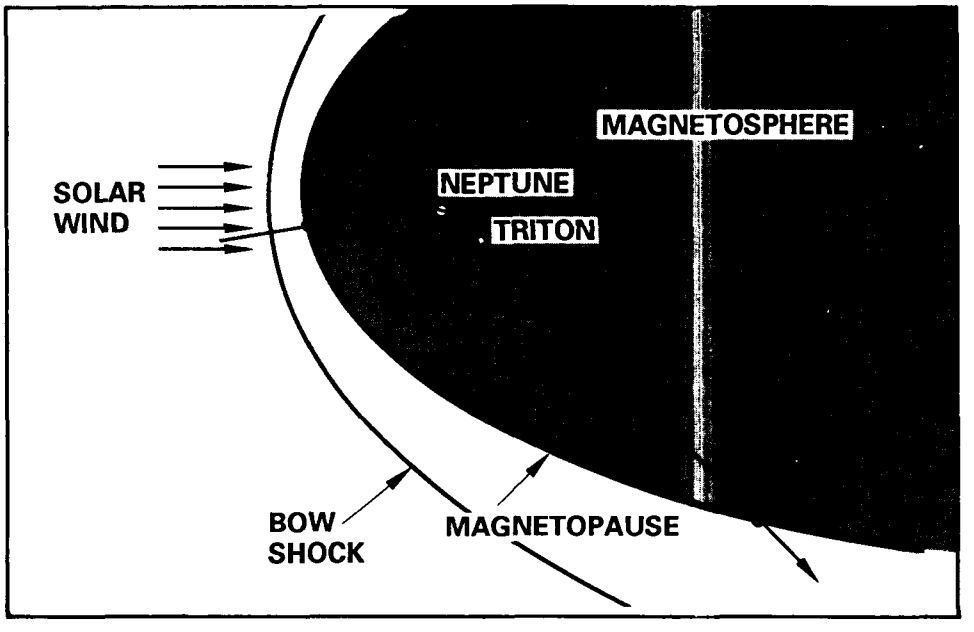
If a shock wave is formed relatively far away from the planet, it's a good indication that the planet has a strong magnetic field, and thus, a magnetosphere, according to the scientists. If the planet has no discernible magnetic field, they believe, a shock wave could still form from the interaction of the solar wind with the planet's atmosphere—but the shock would be much closer to the planet.

"We know Neptune has a thick atmosphere," said Dr. Lepping, "so we know we'll see some kind of bow shock. But *when* we see the shock will tell us whether or not it is caused by a magnetic field. At closest approach to the planet we'll measure *in-situ* any existing planetary field which is, in fact, our **main** interest at encounter."

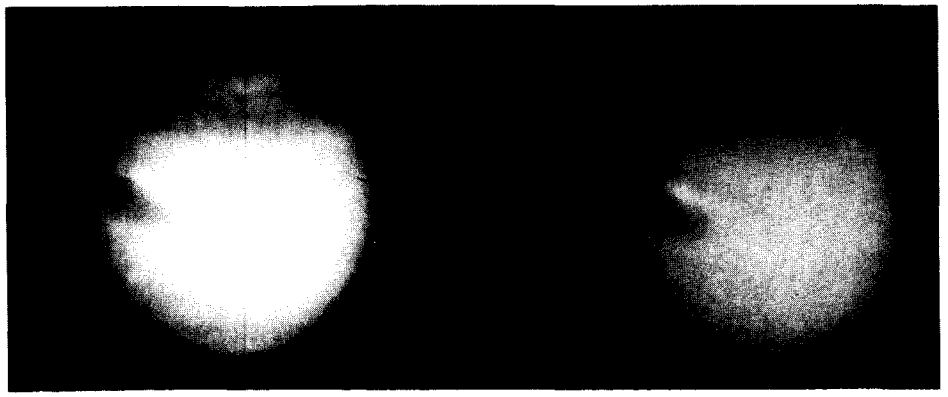
Other Goddard scientists on the magnetometer team include Dr. Mario Acuna (Code 695), Dr. Leonard Burlaga (Code 692), and Dr. Jack Connerney, Code 695.

Plasma and the Solar Wind

The Plasma Subsystem (PLS) onboard the Voyager spacecraft is an instrument specially designed to study properties of the solar wind and the plasma within planetary magnetospheres. The solar wind prevails throughout the solar system in between the planets, but is has different properties when it interacts with atmospheres and magnetospheres of planets.



***CLOSEST ENCOUNTER*—This schematic representation shows the path of the Voyager spacecraft as it approaches Neptune, passes by, and is deflected by Neptune's gravity to also pass near Triton, a moon of Neptune. A possible magnetosphere for the planet is also shown here, illustrating the bow shock formed when the solar wind slams into the outer edge of the magnetosphere, the magnetopause.**



NEPTUNE—ENHANCED VIEW—**These photographs of the planet Neptune were obtained by the Voyager spacecraft on June 22, at a distance of 92.2 million kilometers (57.1 million miles). The view on the left is how the planet would appear to the naked eye; the right view has been enhanced to show details more clearly. Scientists are especially interested in the dark oval cloud system which is bigger than the entire planet Mars, and a dusky collar—actually a double ring—which is visible around the south pole.**

Dr. John Belcher is the PLS principal investigator; Dr. Keith Ogilvie, Code 695, is a co-investigator.

"Our plasma team is also interested in the shock wave formed when the solar wind hits the magnetosphere—or atmosphere—of Neptune," said Dr. Ogilvie.

"If Voyager enters a magnetosphere at Neptune, the PLS will measure the characteristics (density, temperature, composition and flow speed) of the plasma inside," he said. "From these measurements, we will be able to deduce information about the magnetosphere, its structure, and how its parts interact with one another."

Other Goddard scientists on the plasma team include Dr. Jack Scudder and Dr. Ed Sittler (both Code 692).

Neptune's Beacon

Two Goddard scientists will be awaiting the results of this closest encounter in the dark, so to speak. Michael Desch and Michael Kaiser, Code 695, are co-investigators of the Planetary Radio Astronomy Experiment (PRA), an instrument that will use Neptune's radio emissions to determine the rotation period of the planet.

"The radio emissions will sweep across the spacecraft much like a lighthouse beacon," said Desch. "Measuring the time between emissions will give us the rotation period of the planet."

The rotation period of Neptune is still unknown, according to Desch. "We have figures for Jupiter, Saturn, and Uranus, but the PRA has not yet detected radio emissions from Neptune."

The principal investigator for the PRA is Dr. Jim Warwick, at the University of Colorado.

Cosmic Ray Experiment

Although Goddard co-investigators for the Cosmic Ray Subsystem (CRS) Dr. Frank B. McDonald (Code 100), Dr. James H. Trainor (Code 600), and Dr. Nand Lal (Code 660) are just as excited as other scientists about Voyager's upcoming encounter, they are interested primarily in scientific results their instrument returns when Voyager is between the planets, in "cruise mode."

"We certainly look forward to going to Neptune," said Dr. McDonald, "but we were selected mainly to do interplanetary studies. Our Cosmic Ray Subsystem performs most of its scientific analysis during the long pauses in between planets—in 'cruise mode,'"

Although the CRS was designed to study cosmic rays in the interplanetary medium, it is also useful during planetary encounters, according to Dr. McDonald.

"The CRS is really to study cosmic rays," he said, "But we do magnetospheres as a sideline. Because we pass through the magnetospheres anyway, we do analyze the data in detail, and we made some important contributions during encounters with Jupiter, Saturn, and Uranus. At Jupiter our instrument detected sulphur and other gases in the atmosphere, indicating that these were particles which originated in Io [one of Jupiter's moons]."

A Grand Tour Indeed

For Dr. Lepping, this encounter with Neptune will mark not only the closest Voyager encounter yet, but also his 20th anniversary with Goddard—and Voyager.

Said Lepping, "It's just incredible to be part of a project of this scope: Voyager's Grand Tour includes four planets—two of them for the first time ever!"

And 19 Goddard scientists will be anxiously awaiting the results of Voyager's last planetary encounter—the closest yet—with the planet Neptune.

Neptune Fast Facts

Neptune, the eighth planet from the Sun, is the fourth largest planet in our solar system. Neptune receives so little light from the Sun that it is invisible to the naked eye, but appears as a star of the eighth magnitude when viewed through a telescope. This distant planet is believed to be a twin of the planet Uranus.

The effect that Neptune has on the motion of Uranus puzzled early astronomers and led to its eventual discovery. In 1842, F.W. Bessel expressed the conviction that Uranus was influenced by an unknown planet, but he died before proving his theory. In 1843 the Royal Society of Sciences of Gottingen, Germany, offered a prize of 50 ducats for a satisfactory theory on the eccentricity of Uranus.

John Couch Adams, then a student of St. John's College, Cambridge, England, seriously attacked the problem in 1843. So did U.J.J. Leverrier, who had published some work on theoretical astronomy. The elements that they individually developed were so similar that the heavens were closely reexamined and new star charts drawn up. Comparing the stars on the chart closely with the sky revealed a previously unknown eighth magnitude star. Some wanted to name the newly discovered planet Leverrier but it was debated whether he should receive sole credit for the discovery, so the planet was named Neptune, instead.

Following are some other facts about the planet Neptune:

- distance from Sun:2,796,700,000 miles (4,497,000,000 km)
- period of revolution around Sun: 164.8 years
- rotation period: 18 hours 30 min. (estimated)
- mass: 17.2 times that of Earth
- diameter: 27,600 miles (44,417 km.)
- temperature: −200 C
- satellites: Triton, Nereid
- rings: ?
- main components of atmosphere: hydrogen, helium, methane

INSIDE

New Code 500 Director Dale Fahnestock: Proud of His "Team"

If you didn't already know that Dale Fahnestock was proud of his 26 years with Code 500—both the old and the new Code 500—you could certainly tell from the many photographs of controllers, Goddard facilities, spacecraft, and tracking stations decorating his walls.

Fahnestock is the new Director of the Mission Operations and Data Systems Directorate, created in 1983 when Code 800—the Networks—was combined with Code 500, then the Mission and Data Operations Directorate. At the time, Fahnestock was Deputy Director of Code 500—and he remained as Deputy Director of the "new" Code 500.

Six years later, he is the Director.

"One of the benefits of becoming 'Director of' after being a Deputy for six years" said Fahnestock, "is that I have had a chance to become familiar with the people, the projects, and the routines."

But his involvement with Code 500 really began when Fahnestock first came to Goddard, in January 1963. Armed with a Bachelor of Science in Electrical Engineering from New Jersey Institute of Technology and three-and-a-half years of experience in research and development of radio frequency and digital systems with the Department of Defense (DoD), Fahnestock came to Goddard as an engineer in the Radio Frequency (RF) Systems Branch.

"The interesting part of that story," said Fahnestock, "is that I was only in that organization for about one day! One of my old supervisors from DoD was in the directorate staff office, and he came down and recruited me."

Fahnestock remained in the directorate office—first as the Assistant Tracking and Data Systems Manager for the NIMBUS Project—and, within a year, as the Tracking and Data System Manager.

Goal for the Future

Seven years as a Head of the Project Operations Branch, two years as Chief of the Ground Systems Management Office, and a year as Chief of the Information Processing Division, plus six years as Deputy Director, adds up to a wealth of experience in mission operations and data systems for the new Director.

Based on that experience, Fahnestock has a clear idea of what he wants Code 500 to accomplish in the coming years.

"The maior goal we have, now that we've put the Space Network into operation, is to support all the major upcoming projects, like HST [Hubble Space Telescope], and COBE [Cosmic Background Explorer], GRO [Gamma Ray Observatory], and UARS [Upper Atmosphere Research Satellite]," he said. "The big challenge is to have all the procedures, systems capabilities, and personnel in place to support the launch and flight operation of these missions."

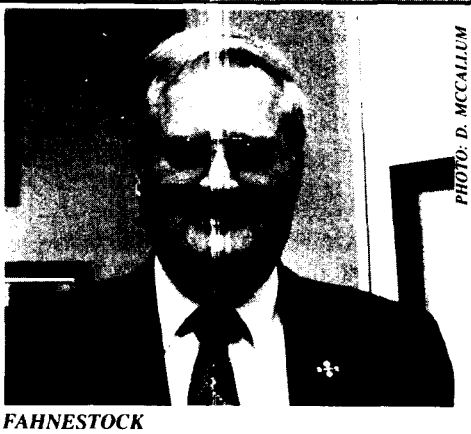


PHOTO: D. MCCALLUM

FAHNESTOCK

Interesting Opportunities

Out of all these job titles, Fahnestock's favorite so far has been that of Deputy Director.

"As Deputy Director, I had an opportunity to become involved in some interesting projects," he said. "For example, I've been the NASA Chairman for the Space Network Interoperability Panel, which is looking into achieving compatibility of the planned European and Japanese data relay networks with NASA's Space Network. It has been an excellent opportunity to interface with people in foreign space communities."

Other parts of the job have required travel to White Sands, to the TDRS Ground Station there, and other NASA tracking stations—Guam; Hawaii; Madrid; and Alaska.

During STS-26, the resumption of Shuttle flights after a two-year hiatus, Fahnestock traveled to the tracking stations at Guam and Hawaii with Astronaut Lacy Veach to present Silver Snoopy medals to the personnel there.

"The airport at Guam is decorated with a model of the shuttle, a huge photograph of the shuttle in flight, and a plaque, all made out of wood by the station personnel," said Fahnestock. "It says: 'Guam Tracking Station,' with the NASA Logo, and a big satellite dish, carved out of wood."

"Next month I'll be going to Santiago to be the NASA representative for the closing of the ground station there," said Fahnestock.

The Home Team

And what does a man who has such interesting work do for recreation? He stays at home.

For the last 13 years, Fahnestock and his family have been restoring a 17-room English country-style house in Elkridge. Tutbury, as the house is called, built in 1845, was once featured in the now-defunct *Washington Star* newspaper.

"One day I saw these people walking around on the lawn [of which there are three and three-quarter acres], and I went outside to see what they were doing, and it was a reporter and photographer doing a story on new development in the area near these houses," said Fahnestock.

That was in 1978. Eleven years later, the house is still under renovation—"it's a big house!," said Fahnestock.

The house has ten bedrooms—a must if Fahnestock's eight children are all to have their own room!

And, out of eight children, ranging in age from 10 to 23, four were in college last year!

"It was hard to believe that we had four children all in college at the same time," said Fahnestock, "but I think that will be the peak."

Derick, the oldest at 23, who recently graduated from Virginia Polytechnic Institute in aerospace engineering, and his sister Medora, 22, whose degree is in computer science, from the University of Maryland Baltimore Campus (UMBC), are currently traveling around Europe—by bicycle!

Evelyn, 20, is in her third year of Business Administration at UMBC; and Dale Jr. is a sophomore in Electrical Engineering at the University of Maryland.

Fahnestock has two children in high school: Becky, 16, a junior, and Ruth, 14, a sophomore. Elizabeth, 12, has a little while before high school, and David is the youngest at 10.

Fahnestock also plays softball in Goddard's league, with a team called the Charlie Browns. He said his team is doing "fairly well" so far—eight wins and one loss for the first half of the season.

Not a bad record. And for Dale Fahnestock, perhaps, a good omen for the success of his other team—the Mission Operations and Data Systems Directorate.

CLOSE UP

Goddard's Associate Director for Programs, **WILLIAM C. KEATHLEY,** has retired, leaving the Associate Director's Office vacant, for now. A multiple recipient of NASA awards such as the NASA Medal for Outstanding Leadership and the NASA Exceptional Service Award, Keathley's specialities included fluid dynamics, lubricants, explosive forming, cryogenics, and solar physics. Keathley served Goddard for 9 years, including 8 years as the Director of Flight Projects...Goddard waves farewell to **GERALD W. LONGANECKER,** Director of the Flight Projects Directorate (Code 400), who is retiring as of August. Longanecker was the recipient of the NASA Medal for Exceptional Service (1972), the GSFC Exceptional Performance Award (1978) and the NASA Outstanding Leadership Medal (1982). Longanecker is honored for his many contributions to the space program, and to Goddard. **PETER BURR** will replace Longanecker as Director of Code 400 (Acting)....also departing is Mission Operations and Data Systems (Code 500) Director **ROBERT E. SPEARING,** whose position will be filled by **DALE FAHNESTOCK** (see story page 6)...

KEATHLEY

LONGANECKER

...The new Disabled Veterans Program Coordinator for Goddard is **COLMAN BEULAH,** Code 751.1. In this capacity, Beulah will assist the Equal Opportunity Programs Manager in implementing an Affirmative Action Plan to assure the rights of individuals with military service-connected disabilities are protected with regard to hiring and career advancement opportunities....**DR. H. RICHARD FREEMAN** has been appointed to the position of Chief Engineer, Flight Projects Directorate (Code 400). In this role, Dr. Freeman will provide technical leadership and managerial direction, while focusing on improving engineering design and developing new concepts and approaches.

Summer Program Students at Goddard are More Than "SHARP"

***1989 SHARP STUDENTS*—Front Row (Left to Right): Tiffany Hodge, Andrea Dennis, Ericka Gordon, Kyschia Patton, Sabrina Wilson, Sena Pringle, Alana Sharpes, Veronica Villanueva, Tiombe Jenkins, Melissa Sheow, Julie Perez, Annissa Sheow, Janine Smith, Valerie Flower. Back Row: Cyn Gosier, Kyle Hair, Anthony Hill, David Mitchell, Kevin Stephen, DeVaughn Williams, James Pickett Jr., Terrence Taylor, Ricardo Benn, Arden Phillips, William Brown, Reginald Adkins, Tarziah Brewington, Tanya Jones.**

If you've seen some Goddard employees in the cafeteria that look younger than most, you may have encountered some of the 27 students participating in the 1989 Summer High School Apprenticeship Research Program (SHARP). And if you've said to yourself, "They recruit them younger and younger every year!"—you are partially correct.

Designed to encourage student minorities to consider technical careers, the SHARP program actively recruits participants directly through school administrators, counselors, and teachers to produce successful students like these, who have demonstrated outstanding scholarship, good citizenship in school and community activities, and the reliability and dedication to complete the program and continue on to college.

This year's SHARP seniors will attend some of the most prestigious universities in the country, including Drexel University, Boston University, University of Maryland, Florida A & M University, University of Michigan at Ann Arbor, Yale University, the Naval Academy, West Point, Columbia University, and Brown University.

Throughout the summer, students perform laboratory research with an assigned mentor, attend career workshops, and visit other technical facilities. The students also keep a laboratory notebook and journal of their experiences at Goddard.

Retirees:

Best wishes to the following Goddard employees who retired recently!

Name	Years of Service	Name	Years of Service
Adams, May	26	Martin, Alfred	32
Barnes, Robert E.	43	McDonald, William F.	35
Carle, Clinton E.	28	Moran, Gerard F.	38
Chapman, Lois	22	Scott, James H.	30
Craig, Ronald E.	35	Simms, Celeste	37
Coady, Robert E.	30	Smith, Dean S.	35
Dukes, John T., Jr.	57	Sos, John Y.	31
Hunter, Charles M.	37	Tatum, Ray S.	20
Jones, Mary Lou	27	Wannemacher, Harry	33
Keathley, William C.	25	Wolfson, Afred	37
Longanecker, Gerald W.	33	Wright, Robert C.	30

Landscapers Name Goddard Employer of the Year

Melwood Horticultural Training Center, Inc., Goddard's landscaping contractor, named Goddard one of two employers of the year at a ceremony held June 13.

The award cites Goddard for providing outstanding employment opportunities to persons with developmental disabilities.

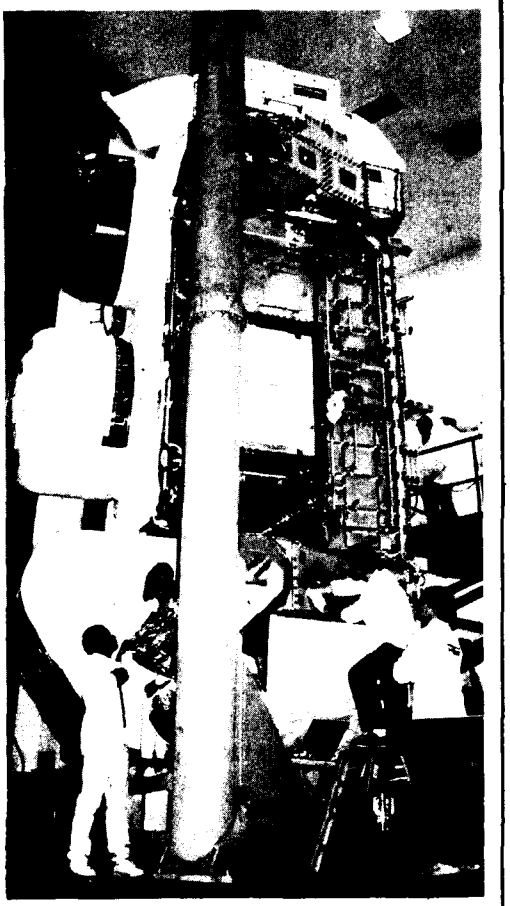
Goddard's contract with Melwood, a training center for developmentally disabled workers, employs eight workers—six of whom are developmentally disabled—to plant trees and flowers, weed and mulch flowerbeds, rake grass and clean up organic debris.

Frank Habas, Code 292, is the contractor monitor for the Melwood arrangement.

Rich Stewart (Code 290), technical officer for the Melwood contract, said he has noticed a significant improvement in Goddard's overall appearance since the contract began three years ago.

"Goddard's landscaping looks infinitely better now that Melwood's on the job," said Stewart. "Melwood's emphasis on quality of flowerbeds and general hard work has transformed Goddard into a manicured worksite."

And for the Melwood crew—Vernon Anderson, Tom Sliwiak, Joe Brooks, David Kasulke, Drew Bowie, E. Dorsey, Howard Curtis, and Crew Leader Stacy Parsons—Goddard's transformation is a realization of three years of effort.



GRO PREPARATIONS—**Gamma Ray Observatory (GRO) Project Manager John Madden and STS-37 Astronaut Steve Nagel visit the spacecraft at TRW's environmental test chambers in Redondo Beach, CA (left). Engineers (right) inspect the spacecraft after it has been turned on its end in a vertical fixture for in-plant transportation. Scheduled for launch in 1990, the 29,000-pound (13,150-kg) Gamma Ray Observatory is now essentially complete and undergoing final testing at TRW.**

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Goddard News

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The GODDARD NEWS staff is:

Executive Editor
Jim Elliott
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Vegetation Studies

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The data for the FIFE study will come from:

- Automatic meterological stations. Dozens of these will report on temperature, humidity, wind speed, several components of radiation flux, soil temperature and precipitation at 15-minute intervals.
- Aircraft. Five U.S. C-130 and one Canadian Twin Otter research aircraft will be deployed to measure fluxes of water and energy to the atmosphere or to remotely sense visible, near-infrared, thermal-infrared and active and passive microwave energy reflected from the Earth's surface.
- Satellites. Data sets will be compiled from five U.S. Earth remote sensing satellites: GOES (Geostationary Operational Environmental Satellite); NOAA (National Oceanic and Atmospheric Administration) 9 and 10; and LANDSATs 4 and 5. Data from the French SPOT satellite also will be used extensively.