NASA
National Aeronautics and Space Administration
Goddard Space Flight Center

Goddard News

Greenbelt, Maryland and Wallops Island, Virginia

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Goddard's "Eye in the Sky" Turns Ten

by Randee Exler

NASA's only operating spaceborne telescope celebrates a decade of scientific discovery, engineering ingenuity and international cooperation this month. The International Ultraviolet Explorer (IUE) turns 10 on January 26.

NASA originally designed the IUE to "live" for three years, and optimistically hoped for five. Ten years, and much science later, the IUE continues studying stars, planets, galaxies and interstellar gas 24 hours a day.

INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) SCIENCES OPERATIONS—**Pictured (clockwise from front): Dr. Don West, IUE Operations Scientist; Matthew Garhart, Computer Sciences Corporation (CSC) telescope operator; Dr. Yoji Kondo, IUE Project Scientist; and Dr. George Sonneborn, CSC resident astronomer, analyze a real-time image in the IUE Science Operations Center in Building 21. The IUE celebrates its tenth birthday this month.**

Super Science

The IUE is credited with the discovery of galactic halos—hot gas which surrounds our galaxy; with monitoring volcanic activities on Io, a moon of Jupiter; and with beaming the first images of Halley's Comet ever recorded from space.

Since February 24, 1987 this "eye in the sky" has been monitoring the intense emissions of ultraviolet radiation from an exploding star, Supernova 1987A, approximately 163,000 light years from Earth. Not bad for a satellite given a "life expectancy" of three years!

Dr. Yoji Kondo, IUE Project Scientist at Goddard, maintains, "The IUE is the most productive telescope on or off the planet." Kondo backs his statement with statistics.

"One measure of the productivity of a scientific instrument is the number of papers published in refereed journals about work using that instrument," he said. "As the IUE completed its tenth year in orbit, more than 1,400 articles based on IUE observations have been published in refereed journals. This far exceeds the number of articles based on data from other telescopes in similar journals during the same time period."

International Cooperation

The papers are based on research of astronomers from around the world who conduct their studies in real-time on both sides of the Atlantic. The IUE was placed in a geosynchronous orbit over the Atlantic Ocean which enables operations around the clock. The satellite telescope is controlled from the science operations center in the U.S. at Goddard for 16 hours a day, and in Spain—with the Villafranca Ground Station near Madrid—for eight hours a day. IUE staff astronomers at Goddard, under contract by the Computer Sciences Corporation, assist visiting astronomers with their work. The Bendix Field Engineering Corporation performs spacecraft maintainance 24 hours a day from Goddard.

The IUE is a joint effort of NASA, the European Space Agency (ESA) and the British Science and Engineering Research Council (SERC). These organizations select observers and programs through annual proposal competitions. In January 1987, the total number of U.S. guest proposals for the 10th year of operation reached 320, the highest number for any year. Over the years, the total number of IUE guest observers at Goddard comes to more than 800 different astronomers; the number for the control center in Spain totals more than 750.

"These figures indicate that a very substantial number of the world's astronomers have used the IUE for their work at one time or another," said Kondo.

Goddard scientists, engineers and tech-

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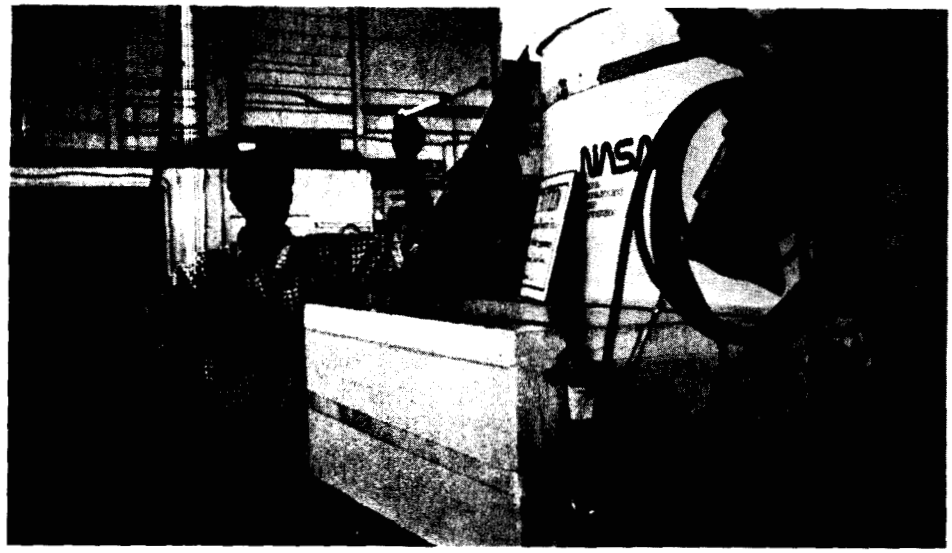
Astromag Joins Search for Antimatter

by Carolynne White

The word antimatter, for most of us, conjures up visions of Star Trek. But for Goddard astrophysicist Jonathan Ormes, project scientist for a superconducting magnet facility known as Astromag, antimatter is exciting—and elusive—stuff.

Scheduled to be launched by the Shuttle for operation aboard Space Station in 1995, the Particle Astrophysics Magnet Facility (Astromag) will, among other things, examine cosmological models by searching for antimatter.

The main component of the Astromag experiment will be its superconducting magnet. Cooled by liquid helium to a temperature of 2 degrees above absolute zero (brr!), the magnet will deflect particles of cosmic rays into detectors which will measure various characteristics of the particles and radio this information back to Earth.



SUPERCONDUCTING MAGNET—Steve Stochaj, a University of MD graduate student working in Code 661, demonstrates the strength of the Low Energy Antiproton Experiment's (LEAP) superconducting magnetic field with two wrenches. LEAP was flown from Canada in July and August.

Antimatter

Antimatter is the same as regular matter, but its atoms have an opposite electrical charge. Atoms in regular matter have protons; atoms in antimatter have antiprotons, or "p-bars" in physics jargon. When matter and antimatter collide, both are annihilated in a flash of pure energy.

Possible applications of this energy include rocket engines, weapons, and power generation. Spacecraft fueled by matter/antimatter reactions could facilitate extragalactic travel.

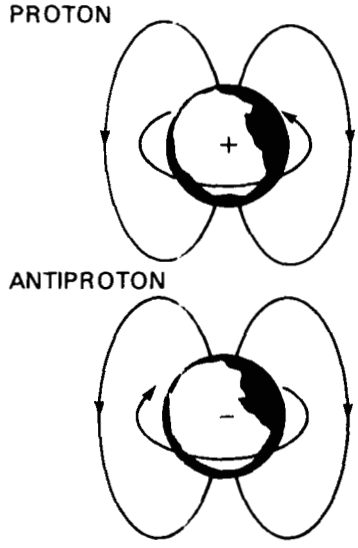
Measuring 30 feet by 13 feet, the $80 million experiment will be bolted to the outside of the Space Station superstructure.

From this position on the Space Station, Astromag will not only search for antimatter, but also study the origin and evolution of matter in the galaxy by directly sampling the galactic material.

Astromag will measure the isotopic composition and energy spectra of cosmic rays (super-high-energy charged particles —protons, nuclei, and electrons—zooming around in outer space at very high velocities) in our galaxy with unprecedented sensitivity. These measurements will answer questions about the origin, storage, and propagation of cosmic rays in our galaxy.

Carrying the search for antiprotons a step further, Astromag also will search for anti-nuclei of helium and heavier elements. While antiprotons, the most common form of antimatter, can be created by the "normal" process in which galactic cosmic rays collide with interstellar matter, heavier anti-elements, such as helium, could only have been formed in the Big Bang. Thus, evidence of anti-helium, or a heavier anti-element, would indicate that the universe contains regions of antimatter—perhaps whole anti-stars, or anti-galaxies—left over from the Big Bang.

Cosmic rays could originate from such regions of antimatter, or from more conventionally accepted sources, such as black holes, or other stars and galaxies.



OPPOSITE CHARGE— Antimatter is the same as regular matter but its atoms have an opposite electrical charge. Atoms in regular matter have protons; atoms in antimatter have antiprotons, or "p-bars" in physics jargon.

ALICE Experiment

The National Scientific Balloon Facility (NSBF) launched A Large Isotopic Composition Experiment (ALICE) for the Wallops Flight Facility on a balloon from Canada in August 1987, in conjunction with the University of Siegen in West Germany, to measure the isotopic composition of cosmic rays entering the upper atmosphere. ALICE's measurements will give an indication of dominant types of cosmic rays bombarding the Earth's upper atmosphere, which will, in turn, provide background for Astromag's research in the larger area of our local supercluster of galaxies.

LEAP Experiment

A related project, the Low Energy Antiproton Experiment (LEAP), launched from Canada in July and August 1987 by NSBF for WFF, in conjunction with scientists at New Mexico State University and the University of Arizona, measured the ratio of antiprotons to protons in Earth's upper atmosphere in an effort to verify earlier experiments postulating a higher-than-expected abundance of antiprotons in the universe.

Many different theories have been formulated to account for these "extra" antiprotons. Some scientists believe they

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Astromag

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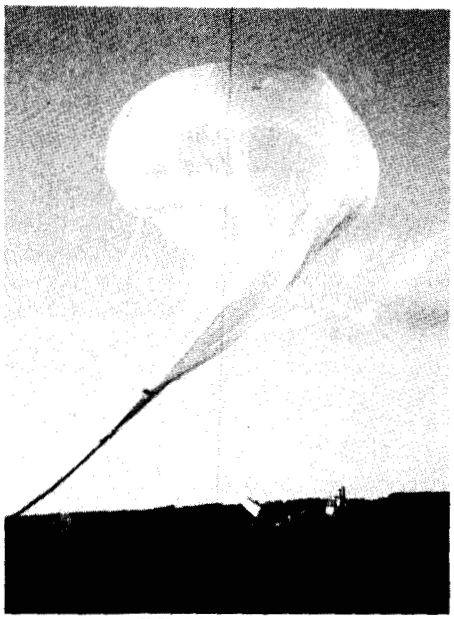


***BALLOON TAKES LEAP*—Pictured is the balloon that carried the Low Energy Antiproton Experiment (LEAP) to the top of the atmosphere from Prince Albert, Canada in August 1987.**

come from primordial black holes, formed during the Big Bang; others believe in a fundamental symmetry, which says that, just as matter came together to form the nearby stars and our galaxy, antimatter formed "anti-stars" and "anti-galaxies" elsewhere in the universe. A random few antimatter particles from these "antimatter galaxies" could enter our galaxy and be detected as antimatter cosmic rays.

By sampling directly these particles and other components of galactic cosmic ray matter, Astromag will help resolve such fundamental cosmological issues as the symmetry, origin, and evolution of matter in our galaxy.

Late arrival or no arrival?

Operation Snowflake

Dial 286-NEWS

Dial in for up-to-the-minute information on Goddard's status during winter storms.

NASA Pipeline

AMES RESEARCH CENTER, Mountain View, CA — The world's two largest wind tunnels became fully operational on Friday, December 11, 1987, at Ames. The tunnels are housed in the National Full-Scale Aerodynamics Complex (NFAC), a major resource for aeronautical research and development for the United States. The two tunnels provide unique facilities for full scale and large scale testing of advanced aircraft, closely simulating actual flight conditions. The two wind tunnels operate in the low speed range, up to 115 mph for the 80-by-120 foot and to 345 mph for the 40-by-80 foot. This is the speed range essential for the investigation of the critical takeoff and landing phases of flight, not only for rotorcraft and low speed aircraft, but also for high speed vehicles such as the Space Shuttle and the National Aero-Space Plane.

JET PROPULSION LABORATORY, Pasadena, CA — NASA's Galileo Project is being enhanced with inner-planet scientific observations and the first asteroid flybys while on its way to the planet Jupiter. Primarily, Galileo will provide the first direct sampling of the atmosphere of Jupiter and the first extended observations of the planet, its moons, and the intense magnetospheric environment. Galileo will be launched from the Space Shuttle no earlier than October 1989. A new trajectory will be used to send the spacecraft to the planet. Dubbed VEEGA, for Venus-Earth-Earth Gravity Assist, the flight path will permit Galileo to fly close by two asteroids, Gaspra and Ida. Scientists will be able to perform the kind of analysis of asteroids planned for the satellites of Jupiter, as well as similar observations of Venus and the Earth-Moon system. The Galileo project is managed by JPL. JPL built the orbiter; Ames is responsible for the probe craft.

LANGLEY RESEARCH CENTER, Hampton, VA — The first two images from a Space Shuttle experiment which measures temperatures on the top surface of the Shuttle orbiter during atmospheric reentry have been released by NASA. The high-resolution images were taken during Shuttle flight 61-C of Orbiter Columbia in January 1986. Columbia was modified for the experiment with the addition of an infrared camera mounted in the tip of the vertical tail. The experiment, called Shuttle Infrared Leeside Temperature Sensing (SILTS), was developed by Langley as part of the Agency's Orbiter Experiments (OEX) Program. The information from the images will be used in advancing the technology for predicting how much thermal protection is required on the upper surfaces of advanced entry vehicles during the reentry flight phase.

HEADQUARTERS, Washington, DC — NASA announced recently that White Sands Space Harbor, NM has been designated as an alternate end-of-mission landing site for Space Shuttle missions STS-26 through STS-28. The alternate site would be used for a Shuttle landing, if conditions were present that precluded a nominal end-of-mission recovery on lakebed Runway 17 at Edwards Air Force Base, CA, the primary landing site. The White Sands site was previously used on STS-3, the third orbital test flight, at its conclusion on March 30, 1982. That site was selected before launch because of continuing rain at Edwards which created a muddy lakebed unacceptable for landing.

MARSHALL SPACE FLIGHT CENTER, Huntsville, AL — Marshall released recently a two-part request for proposal to select a prime contractor for a long-duration, human-tended scientific satellite called the Advanced X-Ray Astrophysics Facility (AXAF). AXAF will be designed to observe some of the more violent processes in the Universe and reveal their hidden mysteries. AXAF will be an important new tool for basic research in plasma physics, the fundamental properties of matter, and the laws of physics. AXAF may even provide data from which astronomers can deduce the exact age of the Universe. Steve Holt, a Goddard scientist, is the principal investigator for the X-Ray Calorimeter, one of AXAF's four scientific instruments. AXAF also will be operated from GSFC. Once in orbit, AXAF will join the Hubble Space Telescope and the Goddard-managed Gamma Ray Observatory in returning images of the Universe to astronomers on Earth.

Gamma-Rays From Supernova Detected

The first direct observational detection of gamma-ray emissions from radioactive cobalt produced in the Supernova 1987A explosion was made by Goddard's Solar Maximum Mission (SMM) satellite, NASA officials announced recently. Two balloon experiments launched from Alice Springs, Australia by the Wallops Flight Facility, as part of NASA's Fall Supernova Observation Campaign, also confirmed this finding.

Supernova 1987A occurred in the Large Magellanic Cloud, a satellite galaxy to our own Milky Way which appears in the southern sky.

SMM began observing the Supernova in August. The detections were made by SMM's gamma-ray spectrometer, one of seven instruments on the spacecraft. The spectrometer was designed and built by both U.S. and Federal Republic of Germany scientists. Dr. Edward L. Chupp, University of New Hampshire, Durham, NH is the principal investigator.

The balloon instruments are the most sensitive gamma-ray detectors ever flown. The balloon experiments were able to identify the source of the gamma-ray emission to be the supernova rather than another nearby star because of their high spatial resolution. Also, the improved energy resolution of the balloon experiments allowed identification of the gamma-ray emissions from the radioactive cobalt produced in the supernova.

These three observations (the SMM and two balloon experiments) confirm and extend earlier evidence from the Japanese Ginga X-ray satellite and the Soviet Mir observations of hard X-rays. The U.S. observations are the first at the higher gamma-ray energy wavelengths.

In the tremendous energy released in a supernova, heavier elements are created from the lighter elements of the exploding star. The energy causes nuclear reactions where silicon is changed into radioactive nickel and cobalt and other heavy elements. Because this is the closest supernova to Earth to be visually observed in close detail in nearly 400 years, the detection of gamma rays was crucial to confirming the theory of nucleosynthesis—the creation of heavier elements out of lighter elements in the explosion of the supernova. Although there are supernovas detected every year by astronomers, these stars are too far away for gamma-ray emissions to be observed.

The SMM satellite is managed by Goddard and includes investigators from the University of New Hampshire, the Naval Research Laboratory (NRL), Washington, DC, and the Max Planck Institute of Extraterrestrial Physics in Germany. The spacecraft was launched from Florida on February 14, 1980 and is the first satellite to be repaired in space.

The SMM results were reported to the scientific community on December 11 in an International Astronomical Union telegram by Dr. Steve Matz, NRL and the SMM co-investigators. Both the SMM and balloon experiment results were reported in Washington on December 14 at a nuclear spectroscopy symposium.

The balloon experiments were a combined high-resolution gamma-ray and hard X-ray instrument from Lockheed's Palo Alto Research Laboratory, Palo Alto, CA, and the Marshall Space Flight Center (MSFC), Huntsville, AL; and an imaging gamma-ray telescope from the California Institute of Technology, Pasadena, CA.

Launch Update: Delta 181

by Carter Dove

A Goddard-managed Delta expendable launch vehicle will be launched from Cape Canaveral Air Force Station, FL, in the first quarter of 1988 for the deployment into low Earth orbit of a classified Department of Defense Strategic Defense Initiative (SDI) space vehicle to gather data for a "layered" defense system.

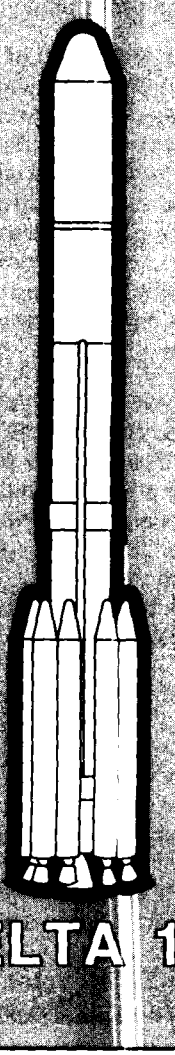
The mission, Delta 181, will be the most ambitious flight test to date for America's SDI program.

The space vehicle will contain multiple sensors and space objects, including four rockets that will be fired in space to simulate Soviet ballistic missile plumes.

This Delta 181 payload will, at 5,550 pounds, be the heaviest ever launched into orbit by the Delta 3910 model. The current record for the 3910 was the 5,105 pound Solar Maximum Mission satellite—managed by Goddard—which was launched into circular orbit at an altitude of 357 statute miles on February 14, 1980.

The most recent Delta launches were Delta 180, September 5, 1986, which successfully boosted into orbit a classified SDI payload; and Delta 182 which on March 20, 1987 successfully placed the PALAPA B2-P, an Indonesian communications satellite, into geosynchronous orbit.

The Delta project manager is William A. Russell, Jr.



See your name in print!

Mail your story to the Goddard News (Code 130), or call the Editor at 286-7277.

Magnesium-Rich Coating Proposed to Imprison Nuclear Wastes in Glass

by David Thomas

Goddard scientists, the Department of Energy (DOE) and two universities have discovered a way to further fortify high-level nuclear waste containers, virtually ensuring the safe storage of radioactive material for thousands of years.

The key is magnesium. Magnesium protects the glass components of nuclear waste containers from corrosion by factors of 100 or more. Scientists made the discovery after tests showed that natural glass found in the sea corroded considerably slower than that found on land. The tests further showed that seawater's magnesium constituent was the cause.

Glass Component

"We seem to have taken an important step toward developing an effective way to reinforce the glass component of nuclear waste containers," said Dr. Sidney Alterescu, from Goddard's Office of Commercial Programs. "This reinforcement will prevent the glass from corroding for at least 25,000 years."

Scientists say radioactivity will no longer pose a threat after that time lapse.

Currently, much of the Nation's harmful nuclear wastes are stored in large, steel tanks in government-operated nuclear facilities in Idaho, Colorado, Washington, and South Carolina, to name a few sites. The wastes partly are dissolved in nitric acid, and partly are in the form of sludge.

A new treatment for containing nuclear wastes is being considered for the U.S. This treatment, now used in France and Belgium, mixes the wastes with glass-forming materials, which are heated to produce a homogenous glass liquid. Then the mixture is poured into hollow stainless steel cylinders, where it solidifies, according to Dr. John A. O'Keefe, a Goddard geophysicist. The cylinder then is buried deep in the ground, and a special material, such as a clay, backfilled around the cylinder.

O'Keefe has studied tektites (ancient natural glasses which, he thinks, come from the moon) for nearly 30 years. He and others are studying tektites for hints on how to protect nuclear waste glass from corrosion.

Corrosion Problem

The objective is to contain the nuclear wastes and prevent them from contaminating the environment. The problem is that water eventually will corrode the layers of protection. The steel cylinders are expected to keep water out for about 300 years. After that, the glass will be the primary retainer of the wastes. The primary question being addressed in this research is: "What can be done to protect glass from corrosion?"

PHOTO BY G.H.R. VON KOENIGSWALD

NUCLEAR WASTE CONTAINER—**The edges of this 16mm land tektite show how water has corroded this natural glass. Microtektites from the sea have been found to corrode more slowly than land tektites. This discovery could lead to a safer means for containing high-level nuclear wastes.**

Professor B. P. Glass, at the University of Delaware's Department of Geology, is making field studies on the rate of tektite corrosion by water over long periods of time. DOE is funding the research.

Dr. Aaron Barkatt, in the Viscous State Laboratory at the Catholic University of America (CUA), Washington, DC, is correlating laboratory studies on the short-term corrosion rate of tektites with Glass's work on the longer times. Test results at CUA showed that microtektites from marine deposits take at least 100 times longer to corrode than do land tektites, even when allowance is made for the difference in temperature.

The tests showed that artificial seawater also corrodes glass very slowly. By subtracting one constituent after another from the artificial water, scientists found that the protective property is associated with the presence of magnesium at a level of approximately one gram per liter. The magnesium causes the formation of a protective coating about 2 tenthousandths of an inch thick.

Magnesium Salts

If glass can be protected from corrosion by putting small quantities of magnesium into whatever water reaches the glass (for example, by putting magnesium into the backfill), then, according to the scientists,

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American Institute of Aeronautics and Astronautics (AIAA)

LUNCH AND LEARN

Thursday, February 16, 1988

11:30 a.m.

Goddard Recreation Center

DR. FRANK McDONALD
Associate Director
Goddard Space Flight Center

SPACE RESEARCH — GATEWAY TO THE FUTURE

Dr. McDonald will discuss the future of space research. He will speak, particularly, on contrasts between the U.S., Russian, Japanese, and European space research programs as well as expectations for cooperation or competition in the future.

Tickets cost $6.00 and can be purchased from Janet Paquin (286-7297) or Alberta Moran (595-4177).

Goddard Space Flight Center

"Eye in the Sky"

Continued from page 1

nicians designed, integrated, and tested the IUE. An ESA team built the solar array and the ground facilities near Madrid, Spain. SERC, in collaboration with University College, London, provided the four TV camera detectors for transforming the spectral displays into video signals.

Engineering Ingenuity

More than luck has kept the IUE running for a decade. A dedicated team of Goddard engineers, astronomers and analysts breathed new life into the IUE when one of its remaining three gyros failed and the spacecraft lost its pointing capability in 1985. Of the IUE's original six gyros (three had previously failed in 1979, 1982, and 1983). The 1985 gyro failure left only two working gyros.

Spacecraft traditionally need a minimum of three gyros—to determine the spacecraft's roll, pitch and yaw references—to point at targets and maintain stabilization during observations. The problem of maintaining three-axis stabilization with only two gyros is considered nearly impossible to achieve.

Thanks to a highly unconventional plan devised and implemented by Goddard's guidance and control team, led by Henry Hoffman, Code 712, the IUE made what engineers have called a "miraculous repair." The team substituted one axis of the IUE's Sun sensor for the lost gyro, thus maintaining three-axis control on only two gyros. Not only did using the Sun sensor stabilize the ailing spacecraft, but pointing accuracies and stability have remained virtually unchanged.

"The IUE has an entirely new set of control laws which bear no resemblance to what was there before," explained Hoffman.

And there's more.

"We have a one-gyro system sitting in our hip pocket," he added. This software has been fully checked out on the ground and will be uplinked to the IUE if and when one of the remaining two gyros fails. The one gyro system uses the second axis of the Sun sensor in lieu of one of the remaining two gyros.

"We have a concept and plans for developing a zero-gyro system," Hoffman claimed. "Two reference axes will be derived from the Sun sensor, and the third reference by carefully managing the speed of the spacecraft's reaction wheels." The zero-gyro concept is being studied and appears feasible at this time.

Small Giant

There are many ground-based telescopes much larger and more powerful than the IUE—a 17.7-inch (45-centimeter), f/15 Cassegrain (reflecting) instrument—but being space-borne has its advantages: there are no clouds or atmosphere to obscure its vision.

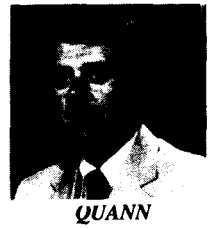
The IUE's success has paved the way for more ambitious NASA projects such as the Hubble Space Telescope (HST), scheduled to be launched on mission STS-31 when the Space Shuttle resumes operations. HST, as large as a railroad boxcar, will view the universe in visible and ultraviolet light unobscured by Earth's atmosphere.

Goddard is responsible for development of the telescope's four American-contributed scientific instruments, the development of the ground system, and HST operations. James Moore is Goddard's HST project manager.

When HST flies, the IUE will have a partner in the sky. But for now, the science community looks solely to this small giant for ultraviolet astronomical answers.

John Quann Leaves Goddard

by Michael Braukus



QUANN

John J. Quann, Deputy Director of Goddard, retired January 15 after a 29-year career of Federal service to accept a position as Vice President, Information Systems, with NYMA, Inc., Greenbelt, MD, a computer software company.

Since joining NASA in 1959, Quann has held many key positions at Goddard. Prior to being named Deputy Director in September 1982, he served as the Center's Director of the Mission and Data Operations Directorate.

In an interview before his retirement, Quann was asked to reflect upon his career with NASA. "In the beginning, I never thought of working at Goddard as a career," he said. "In 1959, NASA was a brand new organization—one that held great potential and promise. Well, the promise paid off. My career has been thoroughly rewarding and extremely enjoyable."

When asked to make a prediction about Goddard's future, Quann responded. "It is not so much a prediction but an observation that the Center is at a crossroad," he said.

"Up until now," Quann said, "the Goddard Space Flight Center has had its emphasis on flight and well it should. We have been balanced over the years with very good science, engineering and operations groups.

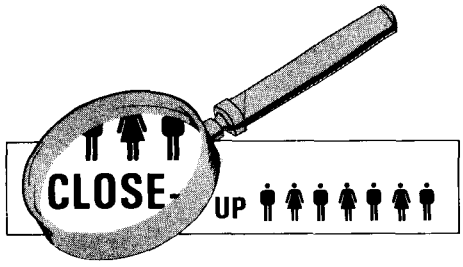
"But now Headquarters seems to be looking to Goddard to operate the big observatories, such as the Hubble Space Telescope and the Advanced X-ray Astrophysics Facility. Yet, Goddard is not developing these long-lived observatories. Aside from the Gamma Ray Observatory, the development responsibility is at the Marshall Space Flight Center. This, in my opinion, is cause for concern," said Quann.

Quann explained that spacecraft development and operations should go hand-in-hand, that they should not be separated. "I think it would be a bad situation to have Marshall become the developer of spacecraft and have Goddard become the operator," he said. "Among other things, this will tie up a significant number of Goddard people for operations which, in turn, will give us less opportunity to do development. Whereas, for Marshall it will be just the reverse. That is one issue. A second issue is the split of responsibility between two centers and the problems this can cause."

"We have to be somewhat careful of operations because it can be consuming. Although it is something Goddard does well, there is a danger that a significant portion of the Center could be swept into it. And that would not be in the best interest of the Center or NASA," Quann said.

Quann was not sure what his sentiments would be about leaving Goddard. "You are asking me almost too soon," he said. "I really have not dwelt on it. But I have a feeling that it is going to be a gut-wrenching experience. This is a hell of a good organization, with tremendous people.

"There truly is not another organization like NASA. Its people are superb. They understand what has to be done and—come hell or high water—they are going to accomplish it. You just do not find that attribute in most people these days. I think NASA still has that drive, that dedication and I hope it does not lose it," said Quann.



HOGAN

Explorer Missions Project Manager, **GEORGE D. HOGAN**, will be leaving Goddard on January 30, for a position as Director of Flight Programs at the Perkin-Elmer Corporation, Danbury, CT. Hogan joined Goddard in 1960 as a communications expert in the engineering directorate, working on such projects as the Television Infrared Observation Satellite (TIROS) and the Nimbus remote sensing satellite series. He joined the Nimbus Project Office as Systems Engineer and then became Spacecraft Manager for the project, going on to become the Explorer Project Manager in 1977. "It'll be hard to leave," said Hogan.

KEEGAN

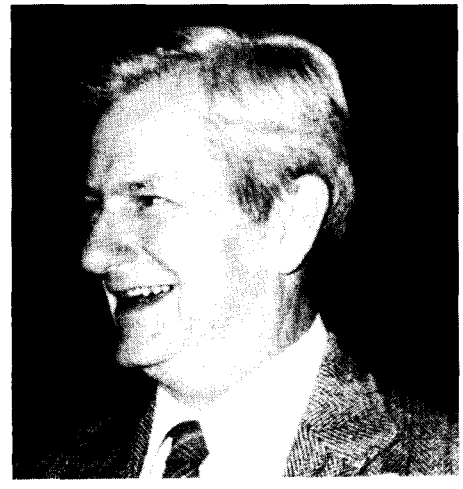
BRIAN KEEGAN, Deputy, Code 300, was the chairman for the Quality Up-Front Panel at the recent 4th Annual NASA Contractors Conference conducted at the Johnson Space Center, Houston, TX recently. The panel's discussion was the "common key" to achieving quality up-front. The keys are meaningful organizational commitment, continual improvement of development and the production process, and customer support and cooperation. The keynote speaker at the conference was James M. Beggs, past NASA Administrator. Proceedings from the Conference are available by calling Gene Guerny, x6548.

Director of Engineering Retires

JOHN H. BOECKEL retired this month, after 11 years as Goddard's Director of Engineering (Code 700). Best known among Goddard employees for his "can do" attitude, Boeckel's numerous contributions to NASA's space program range from his pioneering work with simulated environment testing of GSFC-built spacecraft in the early 1960's to his competent management of the Systems Reliability/Engineering Directorate merge in 1976.

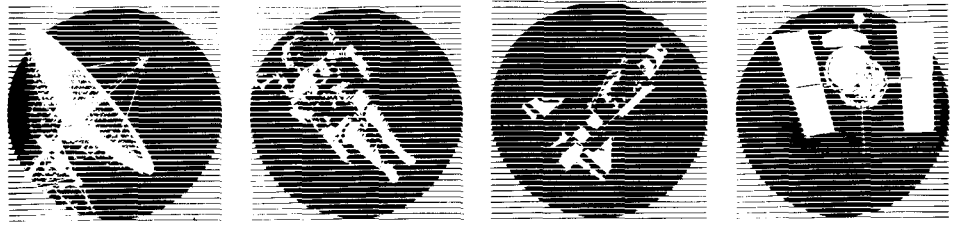
The former provided the Center with the most advanced spacecraft environmental test facilities in the Nation at that time (early 1960's), while the latter produced a rapid, smooth transition affecting nearly 1,000 people in the two directorates during a period of peak demands of in-house projects.

Colleagues refer to Boeckel as "a really great guy" and an "ambassador of goodwill for the engineering profession." His knack for approaching very complex technical and management problems served him well during his stint as Assistant Director for Operations of the newly-established Applications Directorate in 1974. Later, in his role as Acting Director of Project Management, concurrent with his Director of Engineering position, Boeckel personally led the critical initial efforts which resulted in rebaselining the nationally and internationally important Landsat-D project.



BOECKEL

A recipient of the NASA Exceptional Service Medal and a member of several distinguished professional societies, Boeckel will be missed at Goddard, not only for his invaluable contributions to the Agency's programs, but also for the compassion and enthusiasm he showed to his colleagues throughout his career.



Visitor Center—February Calendar

February 7—
Model Rocket Launch—1:00 p.m.

February 13—
Star Watch—7:00 p.m. to 9:00 p.m.

February 13 & 14—
NASA Film Series—1:00 p.m.
"FRIENDSHIP 7"

February 21—
Model Rocket Launch—1:00 p.m.

February 28—
Public Lecture—1:00 p.m.
"Spacecraft Sensors: Our Eyes in the Skies"

For more information, call the Visitor Center at 286-8981.

Forth Computer Language Goes Standard

Two Goddard employees will represent NASA in an effort to standardize a computer language used on Center for, among other purposes, image processing and artificial intelligence.

James Rash, Code 531, has been selected as the NASA representative to the American National Standards Institute's (ANSI) X3J14 Technical Committee to draft a proposed standard for the computer language Forth. Dr. John Dorband, Code 635, is the alternate representative to the committee.

Forth, a language developed in the early seventies, runs on computers of nearly every size and type, from embedded microcontrollers found in automobiles and microwave ovens, to large mainframes. Forth is reputed to be the first high-level language implemented in silicon as the machine language of a single-chip processor. The widespread use of the language and the growing number of different dialects brought the standardization issue to a critical point in the past year or so, and resulted in the formation of the technical committee.

Several groups at Goddard currently use Forth on various applications, including image processing (Code 684), signal blocking and deblocking (Code 515), dual-channel telemetry simulator (Code 515), data capture (Code 541), airborne laser experiment control (Code 723), and artificial intelligence (Codes 514 and 531).

Dorband developed a version of Forth for parallel processing on Code 600's Massively Parallel Processor (MPP), giving the MPP an interactive programming capability. Rash is developing expert systems capabilities in Forth for Code 531's Communications Link Analysis and Simulation System.

FORTH APPLICATION—**Dr. John Dorband (left) and Jim Rash view an image generated on the Massively Parallel Processor, which uses an application of Forth, a computer language that Rash and Dorband are helping to standardize.**

ANSI established the X3J14 Technical Committee in August 1987 under the auspices of the Computer and Business Machine Manufacturers Association (CBEMA) in Washington, DC. Under ANSI rules, the language standardization process is expected to take two to four years. The technical committee itself will continue beyond the official adoption of ANSI Forth, and will consider any future technical proposals for revising the standard.

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Nuclear Waste

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solving the problem of protecting nuclear waste glass from corrosion might be easier than previously thought.

Magnesium salts that are inexpensive and non-poisonous are easy to find, according to Dr. Alterescu. "I think we've made a breakthrough in developing an inexpensive, safe and very effective way to protect nuclear waste glass from corrosion over hundreds of thousands of years, without resorting to glasses that are difficult to make and to use."