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Goddard Space Flight Center

Goddard News

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Sampex Scientists Locate Radiation Belt Around Earth

by Michael Finneran

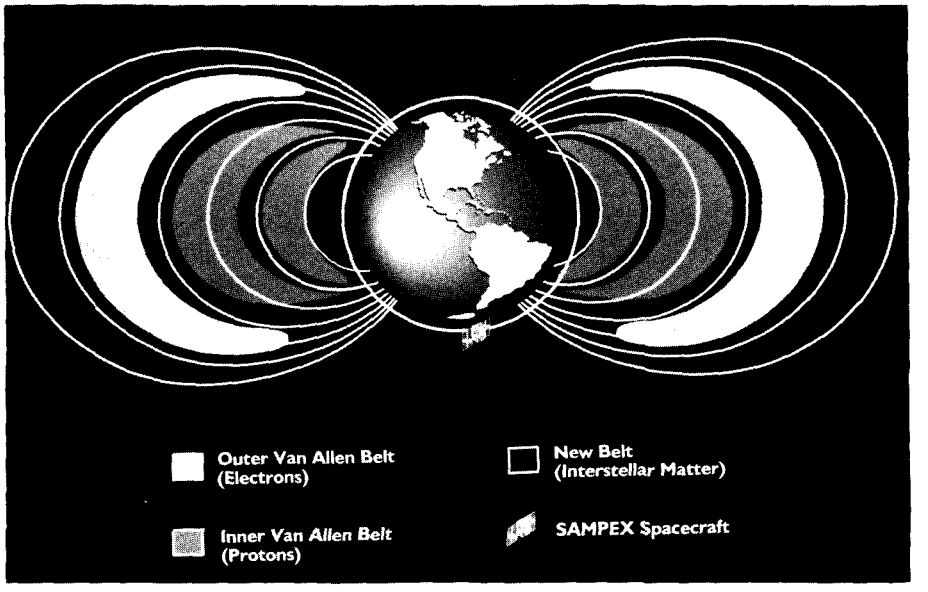


Illustration by Jay O'Leary

This illustration shows the location of a newly discovered radiation belt around the Earth.

The location of a radiation belt of cosmic rays — particles from beyond the solar system — has been pinpointed several hundred miles above the Earth, according to scientists from the California Institute of Technology in Pasadena and Goddard.

The radiation belt was located by Goddard's recently launched Solar, Anomalous, and Magnetospheric Particle Explorer (SAMPEX) using the onboard Mass Spectrometer Telescope (MAST). SAMPEX was orbiting 375 miles (600 kilometers) above the Earth when it measured the belt.

The belt is most intense above a 5,000-mile (8,050-kilometer) strip of Atlantic Ocean between the southern tips of South America and Africa, Caltech and Goddard scientists said.

The belt is composed of particles known as anomalous cosmic rays, which are the result of the sun's interaction with tenuous gas that exists between the stars in our Milky Way galaxy.

"We were pretty sure the belt was there, and now we've pinned it down along with its location, which we didn't know," said Goddard's Dr. Tycho von Rosenvinge, Code 661, a member of the SAMPEX team.

The first clear evidence for such a radiation belt was discovered by a team of Russian and U.S. scientists in 1991 using information from a series of Russian COSMOS spacecraft. But they were unable to determine directly the location of the belt, which is composed of different high-energy particles than another region of radiation, the well-known Van Allen radiation belts that were discovered by James A. Van Allen in 1958 using data from NASA's Explorer 1 satellite.

The belt, in which the anomalous cosmic rays collect, is embedded within the inner of the two Van Allen belts. The geometry of these belts is determined by the Earth's magnetic field lines, which connect the North and South magnetic poles.

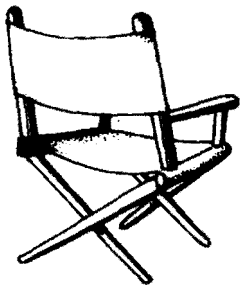
"The cosmic rays become trapped in this field, where they bounce back and forth between the poles of Earth's magnetic field," said Caltech's Dr. Richard Mewaldt, a member of the SAMPEX team along with Caltech colleagues Drs. Jay Cummings, Alan Cummings, Richard Selesnick and Edward Stone.

The rays are the most intense in the strip between South America and Africa, Mewaldt said, because the Earth's magnetic field is not centered perfectly, and this is where it allows the trapped particles to get closest to the planet's surface.

SAMPEX scientists said trapped cosmic rays can be stored in the belt for weeks or more, so the intensity can build up over time as more arrive. More of the cosmic rays collect in the belt during periods of minimum solar activity, which follows an 11-year cycle. The trapped radiation has doubled between August and November 1992, according to SAMPEX measurements, and now is about 100 times the intensity of the anomalous cosmic rays in interplanetary space.

"This long-term storage will give the SAMPEX team a unique opportunity to study the properties of interstellar matter right in Earth's back yard," Mewaldt said.

SAMPEX was launched in July 1992 on a Scout rocket from Vandenberg Air Force Base, Calif. The satellite is managed by Goddard for the Office of Space Sciences at NASA Headquarters in Washington, D.C.



Directors' Dialogue

Q. The Annual Report of the Space Directorate recently was distributed to the civil servants and contractors in Code 600. Among other items, it contains a listing of the Decision Considerations for Space Allocation, which prioritizes office and lab space for those working in instrument development and various data activities. While the priorities described appear to be reasonable, there exists a curious omission for contractors who are engaged in the operation and data acquisition of scientific spacecraft, such as SOHO, IUE, and others. Personnel working on these missions transmit commands to the spacecraft and ground system anomalies as they arise. Additionally, much of this may occur outside the standard office day The activities of these missions are inherently different from the traditional instrument development and data analysis. Yet, there seems to exist a lack of recognition among various groups that the office requirements for these missions are different as well. What considerations may these missions expect in the space allocation decision process?

A. I wish that we had sufficient space on-campus for all our staff. Code 600, like the rest of the Center, has more than twice as many contractor employees as civil servants, but not enough on-site space to house most of them on-campus. As part of our strategic planning exercises, we have set up some guidelines to determine how on-site space should be allocated, and we specifically have exhibited how priorities should be assigned in two areas where there are large numbers of staff members: instrument development and data management. The basic strategy that we applied in these two examples is the same in other discipline areas as well: priority for space on campus is proportional to the extent to which there is necessary face-to-face interaction with personnel who must be on-site. Note that this is not a ranking of the relative importance of jobs!

Steve Holt, director
Space Sciences Directorate,
Code 600

Questions for Directors Dialogue may be sent in to Directors' Dialogue, Code 130, with or without identification. Due to space limitations, not all questions can be answered. Questions are sent to the appropriate directorate office as written but may be edited for space and clarity before being printed. Some questions may be answered outside of this forum.

Goddard's Scientific Impact On The Rise

Photo by P. Battezzi

Dr. Elizabeth Aversa of the Institute for Scientific Information (ISI) addresses attendees at a recent library colloguium.

Following a decline several years ago, the impact of Goddard's scientific publications is back on the rise, according to Dr. Elizabeth Aversa, of the Institute for Scientific Information (ISI) and keynote speaker at a recent colloquium held at the Goddard library.

A New York Times article in 1990 concluded that the overall impact of NASA's research was declining. Data for the article was drawn from a study in Science Watch, which showed that GSFC's research impact was on the decline as well.

Aversa's presentation to GSFC scientists, representatives from the NASA headquarters library and several local science and technology libraries included an update to the 1990 data.

Her update showed that GSFC's citation impact is high, with 83 percent of articles written by Goddard scientists cited within the first five years following publication. The average five-year citation rate for GSFC papers in astronomy/astrophysics is 68 percent, geosciences 61 percent, and aerospace engineering 23 percent.

According to Aversa, Goddard has produced a number of high-impact papers—those cited most frequently across all disciplines—following recent successful missions/experiments, such as the Cosmic Background Explorer and the Total Ozone Mapping Spectrometer.

Aversa noted that the number of GSFC articles in journals scanned by ISI is increasing, having risen from 445 in 1989 to 603 in 1992.

The full data relating to Goddard is located in the GSFC library Building 21.

Photo Credit: Ron Moltere

Runners and Walkers on Your Mark!

More than 700 Goddard civil servants and contractors jockey for position at the start of the annual center-wide, two-mile Fun Run on April 28.

What's UP? June 1993

Compton Gamma Ray Observatory — *Days in orbit: 787*
The observatory is functioning normally. As of May 26, the mean orbital altitude was 219 miles (353.51 kilometers). A series of two 16-minute thruster burns is planned each day beginning June 15 and continuing for about two weeks to boost the observatory's orbit from 217 to 280 miles (from 350 to 450 kilometers).

Cosmic Background Explorer (COBE)— *Days in orbit: 1,289*
COBE continued to acquire all science and engineering data without any major problems or operational errors. The spacecraft is being monitored closely while it is in its shadow season. The shadows, which are 14 minutes long, will reach a maximum of 17 minutes at the end of June.

Extreme Ultraviolet Explorer (EUVE) — *Days in orbit: 358*
Recent discoveries from EUVE were presented at the 182nd National Meeting of the American Astronomical Society (AAS), University of California at Berkeley, following the one-year anniversary of EUVE's launch on June 7. The new results include the discovery of elements that blanket the light from white dwarf stars, the detection of ionized helium in the local interstellar gas, the detection of an extreme ultraviolet shadow in the local interstellar medium and new findings on the mysteries of rare extragalactic objects.

Hubble Space Telescope (HST) — *Days in orbit: 1,040*
All science instruments and spacecraft subsystems operated nominally in May. Preparation for the HST First Servicing Mission (FSM) included the seventh in a series of training simulations. Both the wide Field Planetary Camera (WF/PC) II and the Solar Array II successfully completed preship reviews and arrived at Goddard the first week in June to begin integration and test activities. The Corrective Optics Space Telescope Axial Replacement (COSTAR) had some schedule setbacks in May. Vibration tests uncovered interference problems between the mechanisms and the optical bench housing. Design corrections and cleaning of the optics to remove particulate contamination generated by the interference was required. Delivery to Goddard is now planned for early July. This is later than originally scheduled but still supports the December 2, 1993 launch date.

International Ultraviolet Explorer (IUE) — *Days in orbit: 5,635*
IUE periodically observed a set of solar-type stars over a 16-day interval in May to monitor the spectral line emission from active regions on these stars. The IUE activities were coordinated with ground-based observations used to infer the strengths of the magnetic fields associated with the regions. By analyzing the change in the ultraviolet emission and the magnetic fields as the stars rotate, the IUE guest investigators can map the spatial distribution of the active regions and correlate their emission and magnetic field properties. When combined with similar relations observed for the Sun, these results provide a test of proposed mechanisms responsible for heating the chromospheres of solar-type stars.

Upper Atmosphere Research Satellite (UARS) — *Days in orbit: 625*
The Halogen Occultation Experiment (HALOE) instrument, which measures trace gas concentrations by atmospheric infrared absorption, is making very good measurements. The Microwave Limb Sounder (MLS) instrument, which measures chlorine monoxide (one of the main ingredients causing ozone depletion) continues to gather excellent data. UARS data are becoming more available and being used for geophysical studies. Five special UARS sessions were held at the European Society meeting in Weisbaden, Germany and at the American Geophysical Union meeting in May. A special UARS issue of geophysical research letters is scheduled to be released this month. Interesting results to date indicate that dynamical transport of trace gases may play a much larger role in polar ozone morphology than previously believed. UARS battery performance has remained stable and plans are being made to conduct reconditioning procedures during the mid-June full sun period. In response to last month's safehold situation, meeting was held May 26 to review proposed changes to the failure detection logic by the contractor. This revised logic would replace the patched logic currently onboard and provide a more rugged safehold protection system.

The Wide Field/Planetry Camera II Arrives At Goddard

The new Wide Field/Planetary Camera-II (WF/PC-II), designed to replace the camera on NASA's orbiting Hubble Space Telescope (HST), arrived at Goddard on June 4 from the Jet Propulsion Laboratory, Pasadena, Calif.

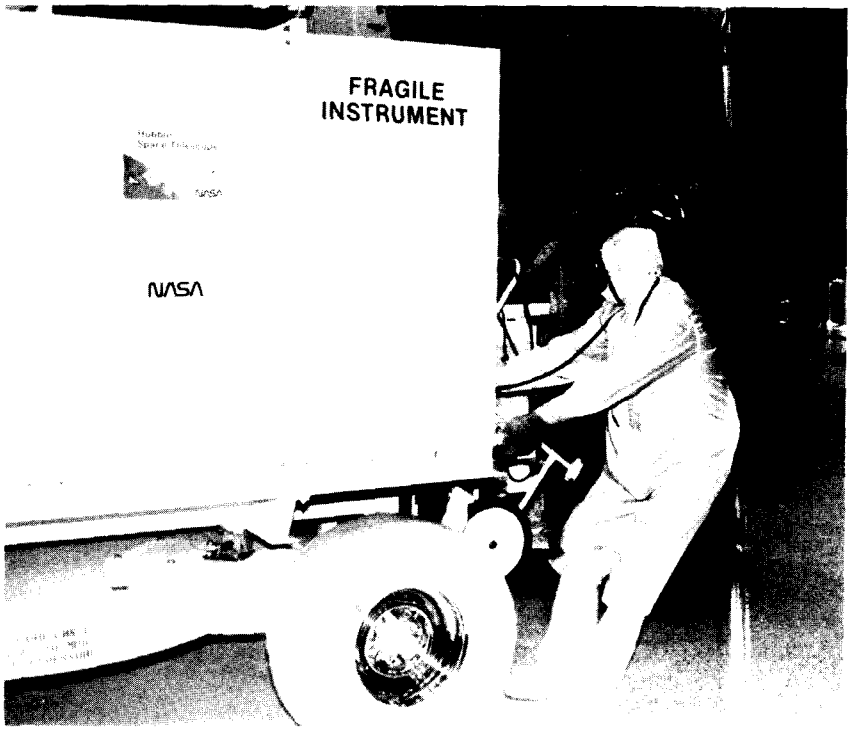


Photo by Ron Moltere

The Wide Field/ Planetary Camera-II arrives at Goddard for testing.

The camera was delivered to Goddard for testing with spacecraft and ground simulators before being shipped to the Kennedy Space Center, Fla., for integration with the space shuttle.

The Wide Field/Planetary Camera-II is designed to restore nearly all of the original imaging capability lost when an optical flaw was discovered in the Hubble telescope's primary mirror.

Four small relay mirrors inside the camera's four optical trains have been polished to a new prescription that will cancel the error in the curvature of the Hubble Space Telescope's primary mirror by creating an error of equal and opposite magnitude.

Small actuators will fine-tune the alignment of these mirrors on orbit, assuring the optical quality that will be required to image fine detail in star clusters, distant galaxies and objects in the ultraviolet.

After testing at GSFC is complete, the camera will be delivered to Kennedy in mid-September, where it will be readied for a planned December 2 launch aboard the Space Shuttle Endeavour.

The camera is scheduled to be installed on the orbiting telescope as part of the astronauts' extravehicular activities during STS-61, the first of several HST servicing missions designed to replace major components of the space telescope and science instruments.

About seven to eight weeks after installation, the new camera will be ready to begin imaging science targets with its three wide-field camera systems and one planetary camera system. The wide-field camera will provide extraordinary sensitivity for detection of star clusters and distant galaxies, while the planetary camera will perform high-resolution studies of individual objects, including planets and their satellites, nearby galaxies and other stellar objects.

The Wide Field/Planetary Camera-II will be able to detect objects 100 times fainter than those visible from the Earth-based telescopes, with about 10 times greater spatial resolution. The camera also has the unique capability of imaging in the far ultraviolet, a capacity that is impossible from ground-based telescopes and limited, at best, from space.

Dr. Ellen Ochoa, mission specialist on STS-56 and the first Hispanic female in space, is recognized formally for her accomplishments in a ceremony at the House of Representatives Office Building. Ochoa is seen here receiving a plaque from the Honorable Jose Serrano (D-N.Y.) Chairman of the Congressional Hispanic Caucus.

Goddard Scientists and Engineers Show D.C. High School Students Science Can Be Fun

By Mary Odell

Goddard Scientists and engineers from the Earth Science and Space Science Directorates joined Dunbar Senior High School, Washington, D.C., faculty and students on June 3 to celebrate Space Day, the school's annual event to promote excellence in science, math and technology education.

The celebration marked the successful completion of this year's Enterprise Mission Program, a unique educational program at Dunbar that uses NASA missions as a "hook" to interest students in math, science and engineering.

Goddard's Joe Alexander, associate director of the Space Sciences Directorate, Code 600, and several colleagues provided an array of interactive displays ranging from photographs showing the difference in light from different parts of the electromagnetic spectrum to an interactive that took students on a tour of the planets.

Photo by Mary Odell

Dr. Gene Feldman, Code 902.3, shows Dunbar Senior High School students a visualization of Jason the Submersible during Space Day Celebrations.

Students involved in the Enterprise program were given the opportunity to show how technology has been integrated into their main classroom, the Space Lab. The students demonstrated how they access NASA via Spacelink to obtain information on space-related topics.

Each year students in the space studies program carry out a specific mission. This year they worked in multi-disciplinary teams on a Space Station mission. On this day, the students displayed the result of their year-long effort, a 15-foot scale model of a Space Station called the USS Dunbar, which was built by an engineering team using a computer-aided design. The model was built to the specifications of the science and communication teams. The highlight of the student exhibits was the launch of model rockets designed and built by students from the flight dynamics team of the Enterprise program.

In Memoriam

William (Bill) Shenk

SHENK

Goddard mourns the loss of William (Bill) E. Shenk, a research meteorologist in the Laboratory for Atmospheres, mesoscale Dynamics Precipitation Branch, Code 912, Shenk, who bicycled 44 miles to and from work virtually every day for 14 years, was struck by a car on Wednesday morning, May 26, on Route 216 in Laurel, Md., as he biked to work.

Shenk's career at GSFC spanned more than two decades. He was the founder of the Severe Storms Research Program at Goddard, was an active participant in the scientific design of the Geostationary Operational Environmental Satellites (GOES) and served as GOES project scientist for 22 years. He made major contributions to Goddard's understanding of satellite observations of tropical storms and severe weather.

Dr. Robert Adler, branch head, Code 912, remembers Shenk as "an enthusiastic member of the scientific and Goddard communities. He always will be remembered as the initiator of the program that evolved into our branch and as a strong advocate for new and improved satellite observations and analysis techniques. He will perhaps be missed most during exciting weather events, when the branch gathers around weather maps. Bill's animated discussion and forecasts will be silent. Our organization has lost a close friend and colleague."

Shenk is survived by his wife, Ginny; son, Steve; and daughter, Linda, as well as his friends and colleagues at Goddard and the meteorological community at large.

Goddard Engineer Is Recognized for Innovative Invention

by Tammy Jones

At six-years old, James Kerley picked up a hammer and saw and built his first model of a battleship. Now, at 72, Kerley is still building. For the past 29 years, Kerley has worked at Goddard in Code 754 as a structural engineer. Engineering has been Kerley's life—his dad was a traveling civil engineer—so for Kerley becoming an engineer was imminent. "I consider myself a multi-cultural engineer. I've been to every state and most countries," said Kerley.

James Kerley, engineer in Code 754, seated in his office holds a drawing of the walker, one of his 50 inventions. The walker is designed to assist the physically disadvantaged. Kerley and his co-workers recently were recognized for their climbing/crawling robot.

Kerley's inventions are as numerous as the amount of years he has worked as an engineer. His name is associated with some 50 inventions. He has received many accolades, most recently for inventing a "climbing robot." Kerley, along with senior technician Wayne Eklund and project engineer Edward May, both of NSI Technology Services Corp., built the climbing/crawling machine.

It was quite a timely invention considering the Tennessee Valley Authority (TVA) was in search of a new robot to replace its workers who climbed towers. Design News named the climbing robot one of the top three inventions of the year in 1992. Kerley, Eklund and May split a $5,000 cash award and received a plaque and other prizes.

The climbing/crawling robot can go places no other robot had been able to go before. It is a giant step in robotics. Its concept addresses some of the major problems that have plagued robotics design. Robots have very high centers of gravity and, therefore, have difficulty climbing straight up. Kerley's robot, however, has a center of gravity just a few inches high, which makes for easier climbing. Robots typically have a problem working on flat surfaces. The robot can be outfitted with magnets, suction cups and grippers that seize and release the surface it is crawling over. It is lightweight, only 45 pounds (20.41 kilograms), which means it can handle quite heavy weights.

"It can move at speeds as high as 80 inches (2,032 millimeters) per minute and can exert 425 pounds (192.78 kilograms) of forward force to move sandblasting and painting equipment up a tall steel utility tower," Kerley said.

For maneuverability, the robot features Kerley's compliant joint, which he has used on numerous robotics co-inventions. The compliant joint "takes advantage of a cable's flexibility and strength in bending. These joints have six degrees of freedom and allow the robot to move in any direction. The cables give body to the robot, and it performs similar to a caterpillar." The robot not only performs like a caterpillar, it also looks like one.

Several of these robots can work together as a team to handle jobs that would be extremely difficult for single robots. Essentially, Kerley has created a robot that is much safer than having people scale high walls and dig through deep tunnels. It can crawl through 600-foot (182.88 meter) tunnels that are only 2 1/2 inches (63.50 millimeters) in diameter. It is capable of digging holes through streets and cleaning underneath ships. It also can be used in several ways in space, particularly on NASA's planned space station.

The robot is more flexible and definitely more affordable than those with similar designs. Kerley says that when TVA announced it was looking for a new robot, bids were coming in as high as $100,000.

"That was awfully high to me. We figured we could come up with something more affordable," said Kerley. And they did—the team built the climbing robot for roughly $25,000.

Kerley has been described as one of the more prolific inventors here at Goddard, but he has a modest demeanor. Defying the typical engineers' casual dress code, sporting a blue tie and blue sweater, Kerley emphasizes that the key to his success is teamwork. "I cannot work alone. I'm working with some very clever people (Eklund and May). These people know the business I don't know," said Kerley.

Dr. Dorothy J. Zukor Appointed Deputy Director Of Earth Sciences.

ZUKOR

Dr. Dorothy J. Zukor has been appointed deputy director of Earth Sciences recently. Zukor began her career at NASA in 1986 as the attached payloads project safety manager in the Office of Flight Assurance.

In 1988, she was selected as the assistant executive officer to the NASA administrator, where she was responsible for maintaining an overall view of the problems, issues, policies and program development that were of concern to NASA management.

Zukor returned to Goddard in 1990 when she was named associate director of project engineering.

Nine Goddard Executives Selected For SES Training Program

Nine Goddard career civil servants are among 58 NASA employees selected for the first class in NASA's new Senior Executive Service (SES) Candidate Development Program.

Chosen from Goddard were Nancy Abell, Code 603; Martin Donohoe, Code 422; Orlando Figueroa, Code 740.4; David Howell, 520; Dorothy Perkins, 510; H. K. Ramapriyan, Code 423; Michael Ryschkewitsch, Code 704; Christopher Scolese, Code 421 and Charles Woodyard, Code 550.

The program is designed to help NASA prepare for the anticipated large number of SES vacancies in fiscal year 1994, (particularly in the scientific and technical fields) by providing additional developmental opportunities for a cadre of highly trained men and women to potentially fill these vacancies.

Candidates will work with a designated SES mentor to prepare an individual development plan (IDP) designed to strengthen their executive management skills. NASA's Executive Resources Board (ERB) will approve each IDP. The candidates will spend approximately 120 days in a developmental work assignment gaining experience working at another NASA center or Federal agency.

Being selected for, and completing this training program does not guarantee appointment to the SES. NASA will continue to have multiple paths of entry into the SES, and all career SES entry positions will continue to be completed through the SES vacancy announcement process as they have in the past.

Two Goddard Scientists Honored For Geminga Discovery

by Michael Finneran

Drs. Stephen S. Holt and David L. Bertsch have received the John C. Lindsay Memorial Award for Science.

Awarded jointly this year, the honor is given annually to Goddard employees who make outstanding contributions to science or technology. Holt, director of space sciences, and Bertsch, of the Laboratory for High Energy Astrophysics, were recognized for their discovery of pulsations from a star known as Geminga.

The two scientists were presented their awards during a ceremony June 4 at Goddard.

Holt, Bertsch and co-workers solved a 20-year mystery, last year when they discovered that Geminga is a pulsar, which is the dense, rapidly spinning remnant of a star that has exploded. Not only did the discovery solve the puzzle of Geminga's nature, it has given astrophysicists the first example of an isolated pulsar without radio emission. Pulsars typically emit radio signals, but Geminga, instead, is one of the brightest gamma-ray sources in the sky.

The discovery was made using data from NASA's orbiting Compton Gamma-Ray Observatory and the German/NASA Roentgen Satellite (ROSAT). The Lindsay award also recognizes Holt and Bertsch for their central roles in developing the Compton and ROSAT missions.

RETIREES

Congratulations to the following employees who recently retired!

Name	Code	Years
Wesley J. Bodin	530	42
Nancy W. Boggess	685	25
Dora Carle	263.1	25
Robert T. Duffy	800	42
George G. Gerondakis	752	28
Mary T. Gladding	130	37
Vincent A. Guidice	534	25
Wade Hampton	290	31
Robert L. Herman	562.1	34
Jacques D. Knox	290	40
Louis A. Koschmeder	560	36
Jyri Kork	470	31
Charles S. Moutoux	754.1	32
Alton D. Payne	284	40
James H. Robinson Jr.	700	33
Lonnie J. Rogers	737.3	34
Guillermo Rodriguez	734	35
Elton R. Scott	244.1	37
Paul L. Snead	293	24
Robert G. Stepp	740.3	29
John C. Voelkel	530	25
William Watt	501	38

Goddard Supports Disabled Youth

by Fred A. Brown

For many youngsters with disabilities, high technology careers have appeared to be beyond reach. With the passage of the Americans with Disabilities Act (ADA) and the introduction of the High School/High Tech program, this is no longer the case. Opportunities have now become a reality as a result of the community-based partnership between Goddard, Prince George's Private Industry Council, Inc., and United Cerebral Palsy of Prince George's and Montgomery Counties, Inc. The program initially was funded by Goddard and designed to encourage students with disabilities to explore careers in science, engineering, computer programming and other high tech fields.

"The High School/High Tech program vividly exemplifies NASA's commitment to the successful future of students with disabilities in science and technology. Goddard and its supporting contractors will make every effort to provide these students an opportunity to explore technical subject fields and enhance their understanding of our planet and the universe," said Dillard Menchan, Chief, Equal Opportunity Program Office, Code 120.

"The potential contributions made by these students throughout their academic and professional careers will have an impact on the aerospace community in the 21st century," Menchan explained.

Students participating in the program will be engaged in a variety of learning experiences. These include corporate site visits, after school science and technology-related projects, summer employment at Goddard and experiences to encourage further education and training, said Charles McNelly, Executive Director of United Cerebral Palsy of Prince George's and Montgomery Counties, Inc.

"Both community and corporate participation will play a critical role in the success of the High School/High Tech program. It is anticipated that additional and ongoing funds and support will come from high technology firms," said McNelly.

An important element will be cooperation of local universities, colleges, and training schools, he explained. Education and training programs will help students understand how to prepare for admission to training programs leading to high technology careers, he said.

A cornerstone of the program will be six weeks of paid summer employment at Goddard. According to McNelly, "most youth with disabilities never have had the opportunity for summer employment. The six weeks spent at Goddard are anticipated to be an eye-opener and motivator on the road to making high technology careers a reality for youth with disabilities."

Global Change Symposium in Washington, DC

by Jim Elliott

Personnel from Goddard played a significant role in the Global Change Policy symposium, held at the National Press Club, Washington, DC, May 18.

The Goddard participants were Dr. Robert Price, director, Mission to Planet Earth Office; Dr. Michael King, senior scientist, Earth observing System project; and John Dalton, project manager, Earth Observing System Data and Information System (EOSDIS).

Price, who was chairman for the panel on Mission to Planet Earth, presented an overview of the Earth observing program, and King discussed key areas of scientific uncertainty in understanding climate and global change. Dalton explained how EOSDIS will provide a system of scientific, discipline-oriented data management centers for processing, archiving and distributing spacecraft interment data and geophysical information.

Also participating in the panel discussion were Dr. Shelby Tilford, acting associate administrator, Office of the Mission to Planet Earth, NASA Headquarters; Berrien Moore III, director, Institute for the Study of Earth, Oceans and Space, University of New Hampshire; Dr. John Eddy, EOSDIS, SocioEconomic Data and Applications Center (SEDAC), Saginaw, Mich.; and Arthur Booth, EOSDIS program manager for the National Oceanic and Atmospheric Administration (NOAA).

Several hundred people attended the one-day symposium.

Goddard News

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