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Goddard Space Flight Center

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1st U.S. robotics system in space

by Fred A. Brown

When Space Shuttle Discovery lifted off from the Kennedy Space Center in Florida, at 6:22:35:042 p.m. EST, Sept. 9, it carried three Goddard-managed projects: the Get Away Special (GAS), Spartan-201 and the Robot Operated Materials Processing System (ROMPS).

A first-time shuttle flyer, ROMPS was designed to advance microgravity processing. It is the first U.S. robotics system used in space.

ROMPS was designed and built at Goddard to demonstrate commercial methods of processing semiconductor materials in a microgravity environment, and, in so doing, project officials believe that ROMPS will improve the properties of materials within space processing.

To complete its tasks, ROMPS uses a robot to transport each of a large variety of semiconductors from storage racks to

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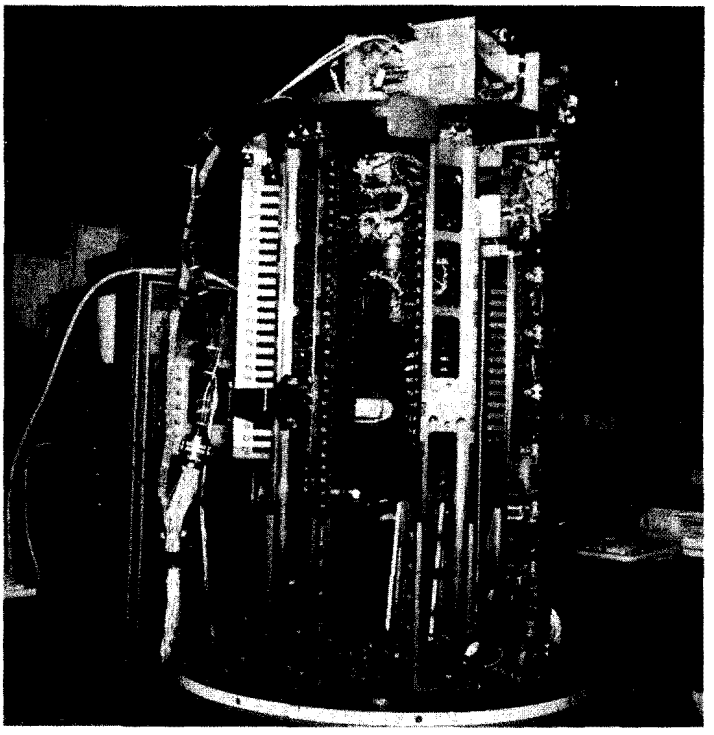

NASA

Robot Operated Materials Processing System (ROMPS)

X-Ray Timing Explorer to complete integration

by Michael Finneran

A Goddard-developed satellite that will be used to gather data about X-ray emitting stars and other celestial systems is nearing achievement of a major milestone in October with the expected completion of spacecraft integration.

Once integration is complete, the X-Ray Timing Explorer (XTE) satellite will begin a Comprehensive

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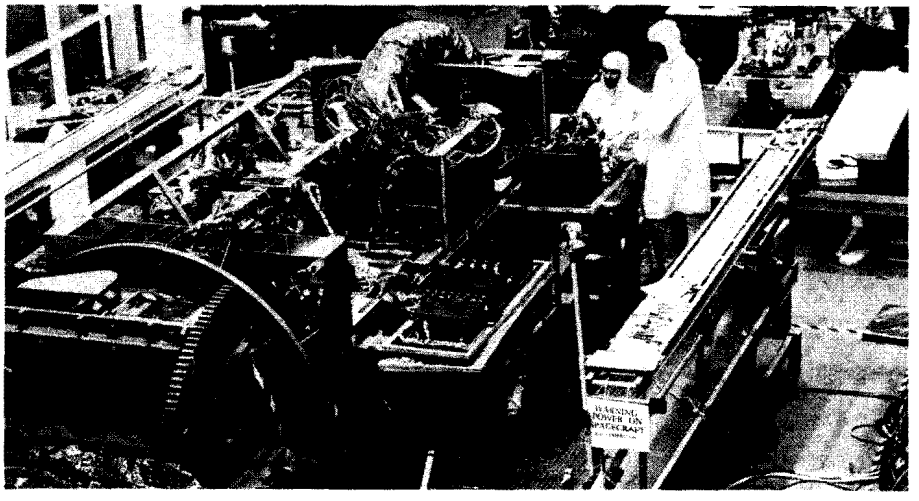
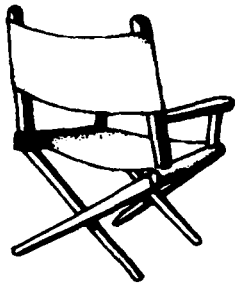


NASA

The X-Ray Timing Explorer (XTE) during integration in Building 29.



Director's Dialogue

Q: In a time when budget cuts are a common occurrence, is there a logical justification in tearing down existing, usable buildings? The latest proposition is to tear down buildings on the other side of Soil Conservation Road, near Building 25, so that a new road can go through the complex. Why can't the road be constructed so that it runs around the complex to meet the existing road leading to Building 25?

Logical thinking has obviously gone out the window. Cuts in budgets and contracts are taken seriously at GSFC, yet to waste money in tearing down usable, existing buildings are not. It is a shame that the government is not run like a business; entirely too much is wasted as is, and, now, more money is going to be wasted.

If these buildings are considered eyesores, why not build a 45-foot hill of dirt, hydro-seed it and plant some pine tree to hide the complex? Surely, this would cost less than the current proposition.

A: The current plan to demolish small buildings necessary for construction of a new road on Goddard's Eastern Campus maximizes facilities usage and employs the most direct and safe route for vehicular access through the campus. The plan offers the least expensive means of traffic flow by avoiding piecemeal construction such as building and demolishing a new roadway within a short period of time. Therefore, the current design is the optimum plan because it causes the least disruption to the Center and its mission, as well as the least impact to the environment.

Two major facilities, the Earth Observing System Data and Information System (EOSDIS) Building and the Earth Systems Building (ESSB), are being constructed on Goddard's property east of Soil Conservation Service Road. Roads are required to connect new and existing facilities on the East Campus were initially designed by the Facilities Management Division (FMD) to bypass Building 80, a small structure housing our custodial support personnel, and Building 82, a steel shed protecting our maintenance equipment. In early 1994, NASA and another local federal agency began negotiations to construct a third facility adjacent to EOSDIS and ESSB facilities. Because of the required size and location of this third building, it became apparent to FMD that the original design of the road connecting EOSDIS and ESSB would not accommodate this new facility in terms of route and traffic capacity.

Therefore, the decision was made to redesign the roadway. The new design will avoid the proposed building site, as well as the site adjacent to the existing power plant, that will eventually serve all three buildings. The plant will require expansion in order to accommodate future operations requirements resulting from the third facility, if approved. The redesigned roadway must also meet traffic curve standards for safe vehicle transport. The location that best meets all these criteria is the area where Buildings 80 and 82 are located.

Although the loss of these two facilities is of some impact to the Center, it is offset by the positive benefits to the new road location: 1) The actual amount of new paving needed is substantially reduced; 2) Locating the road through an existing developed area allows us to avoid removing additional tress; 3) The necessity for stormwater control structures is reduced; and, 4) The focus for world-class Earth science facilities on the Eastern Campus is maintained.

Sherry Foster, director
Management Operations Directorate, Code 200

Goddard marks Hispanic Heritage Month

by Dan Krieger

photo by: GHHC

Flamenco dance group Danza del Rio

Each year, September 15 to October 15 is designated as Hispanic Heritage Month. During that time, the principal Hispanic-service groups on Center, the Hispanic Heritage Advisory Committee for Employees, and the Goddard Hispanic Heritage Club schedule a variety of activities that are open to all employees.

This year, the month of activity began with a workforce diversity seminar in the Building 3 auditorium conducted by Dora Alcala, director of Civilian Equal Employment Opportunity Training at Patrick Air Force Base, Fla. The next event will take place Tuesday, October 4 when a Latin-American opera duo performs at 11:30 a.m. in the Building 3 auditorium.

The second annual Paella Night will be held at 5 p.m. October 5 at the Goddard Recreation Center. Paella, a saffron rice dish with seafood, poultry and vegetables simmered together, is the national dish of Spain.

The final event of the month-long celebration is the annual keynote luncheon on Tuesday, October 11, at 11:30 a.m. in the Building 8 auditorium. The keynote address will be given by Air Force Lt. Col. Pedro Rustan, project manager for the Department of Defense Clementine Project.

For more information, call Dan Krieger at (301) 286-7913 or Gilberto Colon at (301) 286-2113.

NASA's continual improvement plan published

by Gary Steinberg and Chris Williams

NASA's first "corporate" Continual Improvement (CI) Plan has been issued. The plan, produced by the Quality Steering Team (QST), is based on contributions from a large and diverse group of people from within the agency. The plan is important because it provides the foundation that allows NASA to integrate its goal of "faster, better, cheaper and safer" into every program and project throughout the agency by using a systems approach. Equally important, it incorporates the principles and goals of President Clinton's initiative to reinvent government.

A CI systems approach is not revolution, but an evolution. It builds on our past accomplishments by integrating new tools and techniques into our operations and processes. This approach allows us to save what is best in our agency while building on it, thereby allowing us to become more efficient, cost effective, flexible and competitive.

The CI plan demonstrates NASA's constancy of purpose for improvement—and an enduring vision of our agency as a worldwide leader in top-quality science, technology and management practices. The CI plan provides both our long-range road map, in the form of guidance, and our beginning steps, in the form of first-year actions or objectives for improvement. The plan also provides the strategies needed to cascade these goals and objectives throughout our agency. Most importantly, it gives everyone at NASA the guidance needed to improve their own programs and projects and continue to create excellent organizations.

Continual Improvment

Continual Improvement, or Total Quality Management (TQM), is a collection of sound management and business practices that focuses on process and common causes of process failure, rather than on problems and symptoms. Customers needs and expectations drive the system in which processes are systematically analyzed and continually improved. NASA's CI approach is defined by the U.S. National Quality Award framework, known as the Baldridge Award. The approach encompasses both "Kaizen," which are gradual incremental improvements (sometimes referred to as Continual Process Improvement), and breakthrough improvements, such as quantum leaps through innovation and reengineering. Chapter 5 of the CI plan shows this as a contiuum of approaches. Under NASA's CI approach, different CI tools are selected for use by individuals or process improvement teams based on the state of the process being addressed, and/or changed in the external environment.

Approach to plan development

NASA's CI plan is based on the Malcolm Baldrige National Quality Award criteria, the standard by which all goverment agencies eventually will be judged. These criteria are divided into seven areas: leadership, information and analysis, straegic planning, human resource development and management, management of process quality, quality and operational results and customer focus and satisfaction. Because we need to focus on our suppliers, an eighth category of "supplier quality" was added to our plan. The implementation of the goals in each of the chapters is designed to move NASA to an overall state of excellence.

CI training and development

NASA has used successfully the full continuum of CI tools and techniques. The vice president, Al Gore, in his June

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What's Up? September 1994

International Ultraviolet Explorer (IUE)
Days in orbit: 6,063

On August 20, IUE began nearly daily monitoring of the binary star system UX Aries. UX Aries is a close binary star system whose larger member is a star somewhat larger and cooler than our own Sun in a 6.4-day orbit around a smaller, dimmer star. Tidal forces between the two stars force them to rotate with the same 6.4-day period. This forced rotation causes greatly enhanced magnetic activity which, in turn, generates X-rays and ultraviolet emission in localized regions.

The intensity of this emission varies both because the brightness of individual active regions fluctuates and because the rotation of the star can cause these active regions to be hidden as they move to the star's far side.

By monitoring the intensity of the ultraviolet emission every day for nearly a month, scientists hope that the short-term intrinsic brightness fluctuations of individual active regions can be disentangled from this periodic rotational blocking. This, in turn, may give clues about the nature, location and size of these active regions. This information cannot be obtained by just taking a picture of the star, as it is about 160 light-years away, and appears as an unresolved point to any telescope.

Hubble Space Telescope (HST)
Days in orbit: 1,498

Through the first six months of this calendar year, HST completed 9,921 observations—2,698 for calibration and 7,223 astronomical. In July, HST devoted considerable observation time to Comet Shoemaker/Levy 9, the fragments of which crashed into Jupiter during the period July 16-22. Analysis of those impacts is continuing.

Compton Gamma-Ray Observatory (CGRO)
Days in orbit: 1,214

The Burst and Transit Source Experiment (BATSE) on the CGRO discovered a new transient gamma-ray source in the sky last July. It is called GRO J1655-40 and has characteristics similar to those of previous X-ray novae. These are binary star systems (two stars circling each other) with a black hole and a star of mass about that of our Sun. For unknown reasons, sometimes these systems become extremely bright in X-rays and gamma-rays every few tens of years when something causes gas from the star to suddenly fall into the black hole. These sources are usually bright for several weeks. In response to the discovery, GRO was reoriented in August to allow observations by CGRO's two other science instruments. At its peak, the source was one of the brightest gamma-ray objects in the sky.

Milestone

Continued from page 1.

Performance Test (CPT), and then undergo environmental testing on its way to an Aug. 31, 1995 launch.

"The Engineering Directorate stepped up to this project with a commitment to develop a new spaceraft halfway into the program and has managed to maintain a very challenging schedule," said XTE Project Manager Dale F. Schulz, Code 410. "It set a pace that everybody fell in line with and, as a result, one year before launch we have affirmed our earliest possible launch date. Everyone has done a great job."

Richard Day, head of the Spacecraft Programs Office, Code 701.2, echoed Schulz's comments. "This has been a tremendous team effort from everyone involved," Day said. "Goddard personnel and local aerospace contractors have formed an extraordinary team that has worked extremely hard and successfully on this project."

The integration program was laid out in the summer of 1991 and began last October. The integration plan, Schulz said, was followed "very closely." Development of the current XTE spacecraft began Jan. 1, 1992.

The Comprehensive Performance Test (CPT) will follow completion of integration. These tests are designed to verify that all elements of the observatory perform as required for the mission in the integrated configuration.

"The first CPT establishes not only that everything works together, but it establishes a datum of performance to compare to after major portions of the environmental test program are completed," Schulz said.

A companion milestone that was accomplished successfully this month was the first end-to-end data flow test. The spacecraft in the integration area was linked to the Mission Operations Center and the Science Operations Center, both at Goddard, via the Tracking and Data Relay Satellite System (TDRSS) space network, just as it will do after launch. A ground antenna aimed at TDRS East was used to close the loop with the XTE spacecraft.

"The X-ray science community is very excited about the XTE mission operations concept," said Dr. Jean Swank, project scientist, Code 600. "A very robust ground and spacecraft control system has emerged from a close working relationship between the Engineering Directorate, the Mission Operations and Data Systems Directorate and the XTE science team. It should result in very exciting science."

XTE is scheduled for launch on a Delta II rocket from the Cape Canaveral Air Force Station in Florida. The spacecraft will be sent into a low-Earth circular orbit no higher than 375 miles (600 kilometers).

The spacecraft weighs almost 7,000 pounds (3,180 kilograms). Stowed dimensions are about 7.5 x 8 x 20 feet (236 x 241 x 608 centimeters). The spacecraft will carry three science instruments that will work together to add to the understanding of X-rays and other objects.

Two of these instruments – the Proportional Counter Array (PCA) and the High-Energy X-ray Timing Experiment (HEXTE) – will work in concert as the largest X-ray "telescope" yet flown, sensitive to X-rays from 2 to 200 keV. The third instrument, the All Sky Monitor (ASM), will observe the long-term behavior of X-ray sources and also serve as a sentinel that will monitor the sky and enable the spacecraft to swing rapidly to targets of opportunity for the PCA and the HEXTE.

The science instruments are:

Proportional Counter Array (PCA): This instrument consists of five large detectors that will measure X-rays in the 2-60 keV region. Provided by Goddard, the PCA science team is led by Jean Swank, principal investigator; and the PCA development team is led by Lois Workman, Code 701.1

High-Energy X-ray Timing Experiment (HEXTE): This instrument consists of two clusters of four detectors each that cover the energy range 20-200 keV. Provided by the University of California at San Diego, the HEXTE team is led by Richard Rothschild, principal investigator.

All Sky Monitor (ASM): This instrument consists of three scanning shadow cameras that will scan 70 percent of the sky every 100 minutes. The rotating ASM will monitor the intensity and long-term behavior of the brightest X-ray sources. It also will provide an alert if a source changes state or brightens suddenly, allowing the spacecraft to be maneuvered quickly – within a few hours – so the other two instruments can study the event. Provided by the Massachusetts Institute of Technology in Cambridge, Mass., the ASM team is led by Hale Bradt, principal investigator.

See related story on page 5

Testing of new shuttle remote arm at GSFC

by Jim Elliott

The Hubble Space Telescope (HST) Flight Systems and Servicing Project will conduct a demonstration of the Remote Manipulator System (RMS) Simulator/Servicing Aid Tool (SAT) here Sept. 29 and 30, according to Frank Cepollina, project manager, Code 442.

Astronauts from Johnson Space Center, including Swiss Astronaut Claude Nicollier, are expected to participate in the demonstration. Nicollier operated the RMS during last December's successful HST First Servicing Mission.

The demonstration, to be held in Building 10, will evaluate the ability of the RMS to maneuver in and around a deployed HST solar array and to access HST locations with an astronaut on its end effector.

Other evaluations to be made include the feasibility of the SAT assisting Extra Vehicular Activity (EVA) astronauts with tasks they will be performing on the second HST servicing mission, now planned for early 1997; the ability of two Intra Vehicular Activity (IVA) crewmembers working side-by-side on the aft flight deck while operating both the RMS and the SAT, and the effectiveness of the RMS and the SAT operating in parallel to maximize the workload and minimize EVA time.

The EVA-intensive HST First Servicing Mission proved the value of astronaut servicing, according to Cepollina, but because of the unprecedented amount of EVA, it also strained the resources of the shuttle systems. A study by the project concluded that a telerobotic tool could reduce EVA timelines, increase the probability of mission success, increase mission flexibility and reduce mission risk.

The SAT is a teleoperated robotic manipulator designed to assist the astronauts but not take away any of their functions.

Following the Building 10 demonstration, the astronauts will participate in a robotic execution of typical HST servicing tasks in the Building 11 Robotics Lab.

X-ray astronomy is a new window on the cosmos

by Michael Finneran

Mention X-rays and some people think of the diagnostic devices used by physicians to detect broken bones and tumors. But to astrophysicists, X-rays are a recently opened window on the cosmos. Until the last half of this century, astronomers were restricted to looking at the universe with optical telescopes gathering images based on visible light, much like those that create a photograph.

But there is much more to the universe than visible light. Visible light is only a narrow band in the electromagnetic spectrum. Most of the radiation cannot be seen with the naked eye. In the last 50 or so years, however, major strides in astronomy have opened a whole new realm of sight.

With sophisticated instruments, researchers now have a new set of eyes to view radio, infrared, ultraviolet, X-rays and gamma rays. With the exception of radio and parts of the infrared spectrum, though, the Earth's atmosphere blocks most of these rays. Thus, the only way to gather the information astrophysicists require for determining what lies beyond is to send satellites aloft, laden with special instruments to detect what human eyes cannot. The Goddard-managed X-Ray Timing Explorer (XTE) will be such a satellite.

XTE will gather data about X-ray-emitting objects both within our Milky Way galaxy and beyond. It will concentrate on the X-ray sources called "compact objects." The XTE will perform two basic kinds of studies: timing and spectral. Typically, X-ray emitting sources vary in the "timing," or intensity, of their X-ray emissions, from sub-milliseconds to years. XTE will measure these variations, which tell of natural oscillations of the sources.

Additionally, studies of the spectra, or number of X-rays emitted as a function of their wavelength, will reveal the X-ray emission processes of the objects under study and, indirectly, the locations of regions emitting X-rays, such as the surface of a neutron star or next door to a black hole.

PAST AND FUTURE X-RAY MISSIONS

With its ability to study more than a thousand of the brightest X-ray sources in the sky, XTE will help to solve some of the mysteries about these exotic systems. For example, scientists still do not know the origin of the cosmic X-ray background, the pervasive all-sky glow at X-ray wavelengths. They also do not know if, as predicted, a fast, rotating pulsar – the dense remnant of an exploding star – was the result of the February 1987 supernova known as SN1987A. The interior regions of AGNs remain an enigma, as do the internal structure of neutron stars.

XTE will be the next in a series of missions exploring the X-ray universe. Currently, the Soviet/European GRANAT mission, the German Roentgen Satellite and the Japan/U.S. ASCA are operating.

Future missions will include NASA's Advanced X-ray Astrophysics Facility (AXAF) as well as European, Russian, Italian and Japanese missions. Each of these missions concentrates on a different aspect of the X-ray universe.

COMPACT OBJECTS

A glance at the night sky reveals countless stars in the heavens. To the average person, these stars appear more or less alike. In fact, however, what seem to be stars may instead be galaxies so distant they appear as a single point of light. And individual stars themselves can be quite different than each other. The compact objects that XTE will study are individual stars, stellar systems and galaxy cores with gravitational and magnetic fields much more powerful than any known on Earth. Nearly all stars, as they use up their energy, ultimately collapse to become compact objects. The compact objects that XTE will examine include:

White dwarfs: Originally about the diameter of the Sun, these are collapsed stars that have burned all of their nuclear fuel. White dwarfs have collapsed to about the diameter of the Earth, but because they contain the mass of the Sun, they are 300,000 times more dense. Nearby young white dwarfs are among the hottest stars known.

Neutron stars: When stars larger than the Sun have burned their nuclear fuel and start to collapse, a supernova explosion goes off, leaving a remnant collapsed core while the outer layers are blown off. Often this remaining core is a neutron star. Instead of atoms, these stars contain mostly neutrons, which are one of the constituents of the nuclei of atoms. Neutron stars contain the magnetic field of the original star; thus, a neutron star is a magnet with a field 12 orders of magnitude stronger than the Earth's. Neutron stars also are born rotating very fast — up to a thousand revolutions per second.

Suspected black holes: If the remnant core of a collapsed star is massive enough, the gravitational field is so strong that even light cannot escape it. Such a collapsed star is called a black hole. It is known that some collapsed stars are massive enough for this to happen, but it has not been proved that their properties are like the theoretical black holes that Einstein's theory of gravity predicts.

Binary star systems: A binary star system is two stars orbiting each other. When one of the stars is a compact object, the gaseous surface of the normal star is pulled toward the compact object. This gas accelerates to speeds near the speed of light and becomes very hot — 10 million to 100 million degrees — and emits X-rays. These X-rays carry out to us information about the compact object, such as its size, mass, rate of rotation, magnetic field and even the interior structure.

XTE also will study larger systems the formation of which is still a scientific mystery. These include:

Active Galactic Nuclei (AGNs): These are the intensely bright cores of distant galaxies. Such cores are thought to be super-massive black holes that are 10- to 100-million times the size of our Sun, generating X-rays from their innermost and hottest regions.

Quasars: These are a type of AGN that emit more light than all the stars in the galaxies where they reside. Quasars often show rapid variations of light, indicating they are very small, possibly the size of our solar system. Galaxies of this type also often eject extensive jets of particles and energy from their cores.

Working to balance budget

by Karen W. Davis

He comes from a family of Goddard employees; his father, brother and sister-in-law work on center. David Jacintho, with an MBA in marketing from the University of Maryland, College Park, joined the members of his clan at Goddard in 1989 when he came aboard as a lead financial resource analyst in the Flight Dynamics Division, Code 550.

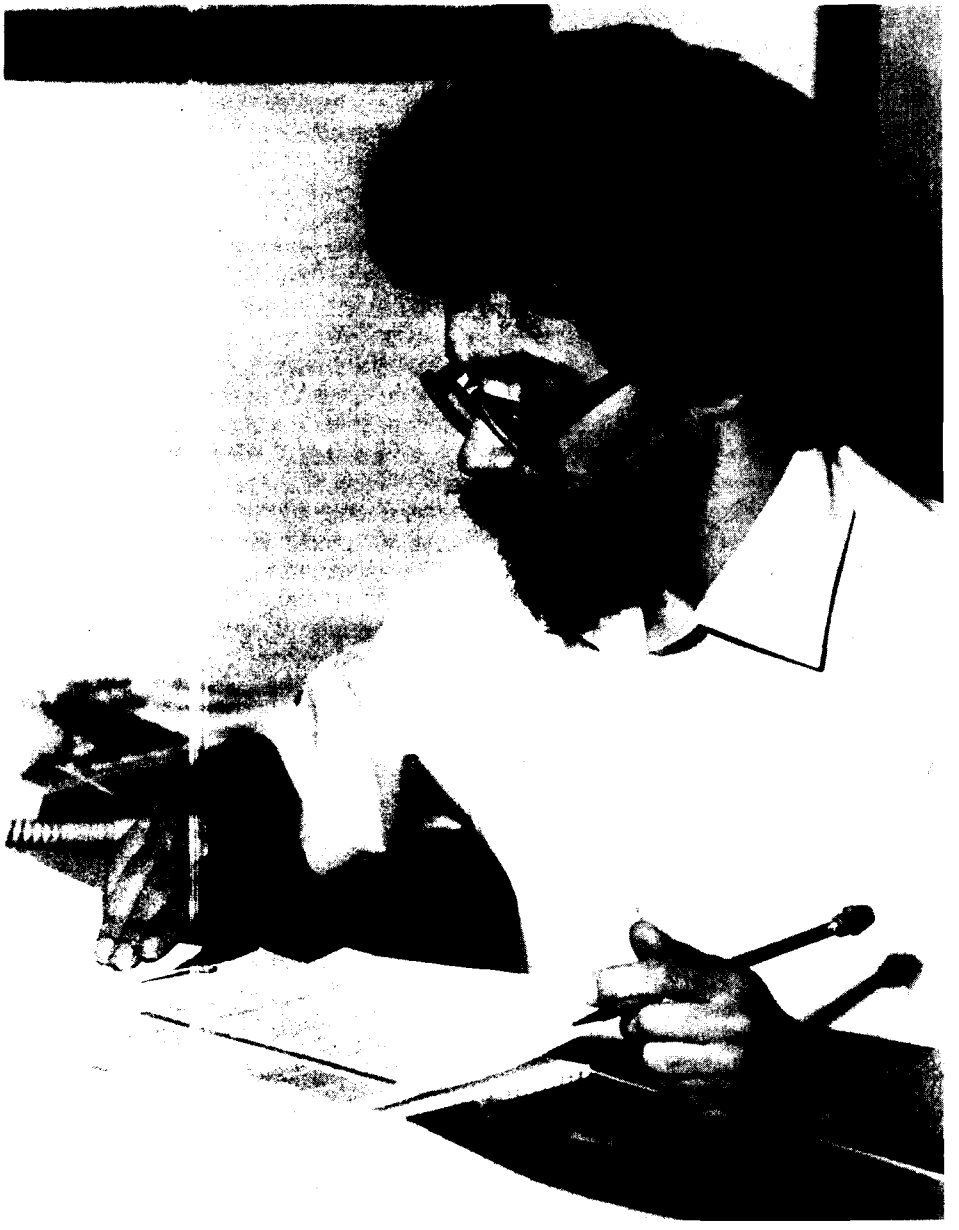
Despite having family members in the GSFC workforce, Jacintho says he still experienced cultural shock. "I didn't know a lot about the Center, and what really stood out was how everyone spoke in acronyms. I think that once you have been here for a while, you find yourself doing the same thing to others. I guess it's all part of Goddard's charm," said Jacintho.

At work, Jacintho has many responsibilities. Chief among them is to help ensure the division manages its resources efficiently. He also provides cost and rate information to the division so that the level and cost of technical services needed can be established.

Jacintho says a balancing act is what comes to mind when describing his job. "My division must support various mission requirements and, at the same time, provide support for institutional requirements. These are skills, like in any job, that require time and experience. Often, the institutional requirements help develop cutting edge technology in software, computer systems and many other technical areas," said Jacintho.

According to Jacintho, he presents solid facts and figures to the directorate to justify money needed for missions and internal projects (based on priority) it is asked to support. The job is rewarding, Jacintho says, but there are lot of pressures during a budget cycle to make decisions on cutbacks. "The decision process has grown more difficult because of Goddard's shrinking budget. Everyone is trying their best to get cheaper, better and faster — doing a lot more with less," said Jacintho.

Although his job keeps him extremely busy, Jacintho finds time to participate in other areas in which he has a personal interest. He is involved with the Advisory Committee for People with Disabilities and is a former chairman of that group. He also is a strong supporter of Goddard's Multicultural Diversity Team, which is geared toward advancing multicultural issues on Center.



David Jacintho

"Providing the same opportunities for multicultural groups on Center is essential, especially in terms of the top level management positions. There are still some barriers towards upward mobility at Goddard and it is important that they continue to fall," Jacintho said.

"Multicultural advancement is a long process, but it remains my hope for the future. I think that Goddard has done well in addressing the issue in terms of programs and recruiting efforts, but I personally do not feel that the Center has done enough to promote growth and provide career opportunities for recruits once they are in the system. I want to see more opportunities for upward mobility for all cultural groups," he said.

In looking to the future, Jacintho concluded: "I want to do my part to help diversify the Center on every level, in management as well as the labor force. It is important to show future employees that opportunities do exist at all levels at Goddard. This will be my greatest contribution to myself and Goddard."

Goddard Engineering Colloquia

During October, four engineering colloquiums will be held in the Building 3 auditorium. The sessions begin at 3:30 p.m.

October 3: Dr. Stanley Williams, of the Department of Geology at Arizona State University, presents "Volcano!"

October 17: Milo Medin, Ames Research Center, presents the "Information Superhighway."

October 24: Jon Kusler, executive director of the Association of State Wetlands Managers, presents "Wetlands Management."

October 31: Francis Reynolds, consulting engineer, presents "Crackpot or Genius — The Uncommon Art of Inventing."

Blood drive

On August 3, the Bloodmobile was held in the Building 8 auditorium. The number of pints collected was 161. We exceeded the goal, which was 155. Following is a list of employees who reached the gallon mark on August 3:

Name	*Code*	*# of Gallons*
Mark Allen		6
Jeffrey Blythe	205.9	4
Robert Frederickson	421	4
Charles Freeman	442	6
Mark Hubbard	442	2
Edward Kaita		1
Stephen Leete	704.2	1
John Mattox	668.1	3
William McKenzie	519.7	2
W.L. Ramsey	205	3
Robert Savage	312	1
William St. Clair	300.1	1
David Thompson	662	6
Mark Walther	250	5

The next Bloodmobile will be held on October 5. Watch DATELINE for details.

STS-65 launch witnessed by honorees

by Roberta Valonis

Honorees of the Manned Flight Awareness (MFA) Program got to see the spectacular liftoff of STS-65 on July 8. This was the finale to four days of activity that included a VIP tour of KSC and a reception held in their honor. Astronaut Bill Readdy, a veteran of two shuttle flights, presented each Goddard honoree with a certificate and pin.

The MFA launch honoree award is the highest and most prestigious award available to employees of the NASA/industry space shuttle/payloads team. This NASA-sponsored award recognizes individuals for their exceptional dedication to quality work and flight safety.

Goddard's honorees (left to right):
First row: Daniel J. Smith, CTA Inc.; Beverly A. Reece, AlliedSignal Technical Services Corp. (ATSC); Joanne R. Myers, Computer Sciences Corp. (CSC); Valerie D. Ward, Code 55l; Michael A. Richter, III, Code 542. Second row: Nicholas Gray, Jackson and Tull; Michael J. Fillis, Code 832.3; Stephen V. DePalo, Hernandez Engineering, Inc.; Eugene C. Shackelford, ATSC; Gary W. Williamson, ATSC. Third row: Douglas P. Morgenstern, CSC; Keith B. Chapman, CSC; Jack E. Leibee, Code 441; Frederick C. Gross, Code 3l3; and Clifford R. Dickey, Code 284.

Retirees

Congratulations to the following employees who recently retired!

Name	*Code*	*Years*
Dennis McCarthy	440	32
Larry Line	737.3	31
James Trainor	100	30
Ann Derby	111.3	27
Mary Schronce	680	23
Clara Rubindoux	540	21
Gladys M. Evans	801	14

Robotics system flies

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halogen lamp furnaces where their crystal structures are reformed in heating and cooling cycles.

Microgravity processing can reduce semiconductor crystal irregularities caused by convection and sedimentation. The improved crystal structure that results from such processing will increase the performance of many types of semiconductors that can yield higher efficiency devices such as solar cells and computer chips.

According to Lloyd Purves, ROMPS mission manager, Code 714, ROMPS' design permits it to address a variety of commercial objectives in materials processing and automation technology. The immediate objective of using microgravity processing is to understand better the behavior of semiconductor crystal structures and from an increased understanding improve the quality of ground-processed semiconductors. A long-term ROMPS objective is to develop microgravity-processed semiconductor devices with sufficient performance advantages that they can be produced competitively in space.

Another objective of the ROMPS program is to advance automation and robotics for material processing in ways that can lower the costs of developing and manufacturing semiconductors.

To get the lowest possible microgravity levels, the samples were processed during crew rest periods when shuttle vibrations were at a minimum. The processing was extended over more than one crew rest period. As a result, the processing sequence was programmed to shut down ROMPS at the end of each crew rest period as necessary. Ground commands were given to restart the processing at the beginning of the next crew rest period. The processing otherwise was done automatically, with ground control used to monitor progress and intervene if unexpected situations develop.

The ROMPS flight hardware is contained in a pair of Getaway Special (GAS) cans mounted on the HH-G carrier in the shuttle's payload bay. The HH system provides the ROMPS GAS cans with power and ground links for telemetry and commands. This arrangement allows ground monitoring and control of in-space processing, return of the samples to ground and reflight of the ROMPS system with new samples and modified processing capabilities.

The ROMPS samples will be analyzed by project officials after completion of mission STS-64, and the results will be compared to samples that were processed on Earth. These results will also be used to define materials and processing for planned reflights of ROMPS on future shuttle missions. ROMPS is designed so that it can refly quickly and easily. Its first reflight is tentatively scheduled for 1995.

Goddard developed the ROMPS mechanisms and control electronics. ROMPS is sponsored by the NASA Office of Advanced Concepts and Technology (OACT) as part of its mission to develop commercially-relevant techniques for in-space materials processing. Two NASA-sponsored Centers for the Commercial Development of Space are involved in the project.

ROMPS mission manager is Lloyd Purves, Goddard. Principal investigators are Dr. Tim Anderson, University of Florida, and Dr. Eric Cole, George Mason University, Fairfax, Va. Co-principal investigator is Kevin Jones, University of Florida.

Improvement Plan

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15 visit, congratulated NASA employees for many successes, but the challenges have in many ways just begun. Declining budgets and streamlining have made it more important than ever for us to provide every employee with access to knowledge about CI and the reinventing government initiative, as well as CI tools and techniques. To enhance our CI capabilities, new CI training courses will be made available to NASA employees. One set of training, required of employees by the vice president, is a course called "Creating a Customer Driven Government." This course explains all aspects of government reinvention and helps people understand what to expect and what part they play. Another example of new CI training will initially support an initiative to achieve dramatic changes to the agency's internal directives system. It will then be applied to selected processes that require dramatic change to meet customer requirements.

The NASA CI plan will be improved and updated on an annual basis.

All employees are encouraged to read the plan, support and participate in its implementation, and help identify ways to improve it. For a copy of the NASA CI plan, or to obtain more information about NASA's CI approach, please contact Goddard's CI focal point, Headquarters Code Quality Advisor, or the Office of Continual Improvement (Code T) at (202) 358-2146.

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