

## Moon Buggy Race Coming April 18

# *Students Set to Test Engineering, Racing Skills*

by Joy Carter

Take some creative engineering, mix with a little elbow grease, add the spirit of competition, and you've got the makings for an exciting 5th Annual "Great Moon Buggy Race."

Teams representing 15 colleges and high schools from across the country will participate in the event, beginning at 10 a.m. April 18 at the U.S. Space & Rocket Center.

Competitors will race their versions of a "moon buggy," modeled after the Marshall Center-managed Lunar Roving Vehicle that was used by astronauts to travel the Moon's surface. Teams will navigate their vehicles over a half-mile course of "lava ridges," "craters" and sand pits — simulating the lunar surface.

The race is sponsored by the Marshall Center, where the



A team of competitors race for the finish line in last year's "Great Moon Buggy Race" held at the U.S. Space and Rocket Center. Photo by Dennis Keim

Lunar Roving Vehicle was designed and developed. Other sponsors of the event include the American Institute of Aeronautics and Astronautics, the Alabama Aerospace Teachers Association and the U.S. Space & Rocket Center.

"The goal of the event is to inspire students toward excellence in engineering," said race coordinator Dr. Jim Dowdy, University Relations Officer with Marshall's Education Office. "Students are required to design a project that addresses a series of engineering problems that are similar to problems faced by the original moon buggy team. Vehicles must fold to fit into a 4-foot cube and maneuver difficult terrain."

Each two-member team — one male and one female — will carry their moon buggy — in its disassembled state — 20 feet to the starting line. When a signal is

given, the team will assemble its human-powered vehicle and race the course.

Prizes will be awarded to the three top-scoring college and high school teams. The first-place college team will win a trip to

See *Moon Buggy Race* on page 5

## **New Website Opens Window To Array of Marshall Images**

by Steve Calatrello

Internet users can now search, browse and download images illustrating the many contributions of the Marshall Center to America's space program.

Marshall Center's online collection of images — known as the Marshall Image Exchange — is linked to NASA's Image Exchange, the Agency's single point of entry to various photographic databases at all 10 centers.

"We are very proud and excited about Marshall's addition to the Agency site," said Dennis Keim, photographic monitor for multi-media services in the Information System Services Office and the project's team leader. "David Reynolds of the Technical Information and Operations Service Office, and Mike Jacoby of

See *New Website* on page 4

## **Former Marshall Director Rees Dies**



Eberhard Rees

Eberhard Rees, Marshall's second Center director, died April 2 in Deland, Fla. He was 89 years old.

Appointed director on March 1, 1970, Rees, who retired in 1973, is counted among the pioneers of rocket and space research.

Born April 28, 1908, in Trossingen, Wuerttemberg, Germany, Rees received his scientific and engineering education in Stuttgart and at the Dresden Institute of Technology. His studies focused on thermodynamics, engine design, production planning

See *Eberhard Rees* on page 5

# Marshall Satellite Helps Prove Einstein's Theory

A 26-year-old Marshall Center-developed satellite has played a major role in possibly finding the first direct evidence of a phenomenon predicted 80 years ago using Einstein's theory of general relativity — that the Earth is dragging space and time around itself as it rotates.

An international team of NASA and university researchers believe they have detected the effect by precisely measuring shifts in the orbits of two Earth-orbiting laser-ranging satellites, Marshall's Laser Geodynamics Satellite I (LAGEOS I), and LAGEOS II, a joint NASA/Italian Space Agency (ASI) spacecraft. The research, which is reported in the current edition of the journal *Science*, is the first direct measurement of a bizarre effect called "frame dragging."

Conceived and fabricated at Marshall, LAGEOS resembles a "cosmic golf ball," since it was covered with prismatic-like

mirrors. The satellite measures 2 feet in diameter and weighs 904 pounds.

The Center was assigned definition and development responsibility for the satellite as a part of a larger NASA study relating to Earth and oceanic dynamics. LAGEOS was launched by a Delta rocket at Vandenberg Air Force Base on May 4, 1976, and attained a nearly circular orbit about 3,600 miles above the Earth. There, it has acted as a sophisticated mirror reflecting laser beams directed at it by stations on the ground. By timing the round trip of the laser beams, scientists have been able to detect small movements in the Earth's crust, polar motion, and precise locations of various spots on Earth.

"General relativity predicts that massive rotating objects should drag space-time around themselves as they rotate," said Dr. Erricos Pavlis of the Joint Center for Earth System Technology. "Frame dragging is like what happens if a

bowling ball spins in a thick fluid such as molasses.

As the ball spins, it pulls the molasses around itself. Anything stuck in the molasses will also move around the ball. Similarly, as the Earth rotates, it pulls space-time in its vicinity around itself. This will shift the orbits of satellites near the Earth.

"We found that the plane of the orbits of LAGEOS I and II were shifted about six feet (two meters) per year in the direction of the Earth's rotation," Pavlis said. "This is about 10 percent greater than what is predicted by general relativity, which is within our margin of error of plus or minus 20 percent. Later measurements by Gravity Probe B, a Marshall Center-managed spacecraft scheduled to be launched in 2000, should reduce this error margin to less than one percent. This promises to tell us much more about the physics involved."

## MMA Now for All Employees; Breakfast Meeting is Thursday

The Marshall Management Association, which is presently undergoing a name change, will have its next meeting Thursday, April 9, at 7:15 a.m. in the cafeteria of Building 4203. Breakfast will be served and Acting Center Director Carolyn Griner will speak on "opportunities." The breakfast line will open at 7 a.m. and the cost is \$7.

The breakfast menu includes bacon, scrambled eggs, sausage, biscuits and gravy, hash browns, fruit cups, orange juice, bagels and coffee.

The Marshall Management Association is changing, according to association President Frank Six. Membership is now open to all Marshall Center employees, he stressed.

The association is not a "managers" club, added Six, but does have concerns such as: providing an open, creative and

*See Breakfast Meeting on page 5*

## 'Washington Update' Dinner for Sen. Shelby to be Held April 14

A "Washington Update" dinner for Sen. Richard Shelby will be held on Tuesday evening, April 14, at the Huntsville Marriott Hotel. A social will begin at 6:30 p.m., followed by dinner at 7 p.m. Tables for eight may be reserved. Tickets are \$25 each. If interested in attending, contact Mary Rutledge, 4-5252, by Wednesday, April 8.

## Neurolab Mission to Fly April 16; Includes Marshall Experiment

Space Shuttle program managers have affirmed April 16 as the launch date for NASA's second Shuttle mission of 1998 -- a two-week life sciences research flight that will focus on the most complex and least understood part of the human body, the nervous system.

A Marshall Microgravity Research experiment facility called the Bioreactor will be included. Details about that payload will be featured in next week's *Star*.

The 2 1/2 hour available launch window opens at 1:19 p.m. CDT. The STS-90 mission is scheduled to last 15 days, 21 hours, 50 minutes.

The mission commander is Richard Searfoss. Pilot for the flight is Scott Altman. Three mission specialists are assigned -- Richard Linnehan, who is also serving as the payload commander; Kay Hire; and Dave Rhys Williams from the Canadian Space Agency. Two payload specialists -- Jay Clark Buckley, Jr., and Jim Pawelczyk -- round out the seven member STS-90 crew.

Mission managers are reserving an option of extending the flight one additional day for science operations if Shuttle electrical power margins permit. A launch on April 16, and a 16- or 17- day nominal mission would have Columbia landing at Kennedy on May 2 or 3.

# Closet-Sized Utility Rack Installed on Space Station

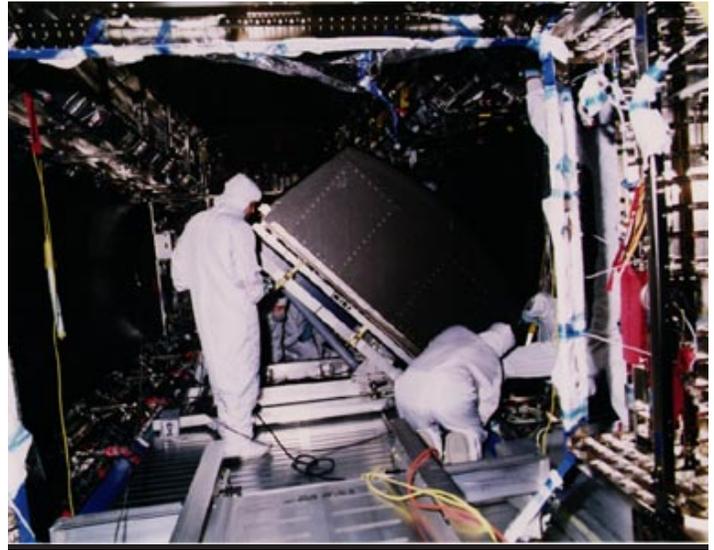
The first of the closet-sized "utility" racks has been installed inside the International Space Station's U.S. laboratory module by Boeing technicians at the Marshall Center's space station manufacturing building. The rack is the first of two which will supply electrical power to the scientific racks inside the laboratory module, the centerpiece of the space station.

When the laboratory module is in orbit, it will have a total of 24 racks, 13 of those containing science experiments. The other 11 racks, to be installed over the next several months, will provide other utilities: power, temperature and humidity control, air revitalization and other support systems for the science racks.

"The installation of this first system rack represents another major milestone for the space station program," said Steve Goo, Boeing manufacturing manager for the U.S. lab. "This marks the point where we are actually gathering data and providing power at a total lab level with the racks and module working together. This is significant in terms of driving down technical risks."

The space station racks are about the size of a standard home bedroom closet, but a little heavier. The first rack installed weighs about 1,200 pounds. Its exterior is made of graphite composite.

The laboratory module is to be shipped to the Kennedy Space Center this August to begin final preparations for its scheduled launch in May 1999 aboard the Space Shuttle Endeavour, on STS-98. When it is launched aboard the Shuttle, the laboratory module will have just five of the 11 system racks inside it. The six additional system racks will be delivered in a smaller module, the Marshall-managed Multi-Purpose Logistics Module (MPLM) on Shuttle flight STS-99, scheduled for June 1999.



The first utility rack for the U.S. laboratory module of the International Space Station is installed by Boeing technicians. The rack, about the size of a closet and weighing almost 1,200 pounds, is the first of two which will supply electrical power to the scientific racks inside the laboratory module.

Photo courtesy of Boeing

## Flexiplace Program To be Tested Here

Marshall's Flexiplace Program will be implemented April 13, according to Sue Payne of the Human Resources Office.

Three options are available for employee participation:

- (1) Regular Option — a long-term work arrangement whereby the employee reports to the regular office at least one day a week;
- (2) Episodic Option — a short-term arrangement (30 days or less) to complete all or portions of projects;
- (3) Medical Option — an employee works at home on a full/part-time basis due to illness or disability.

Applications are available in Electronic Forms and will be accepted as follows:

Regular Option, April 13-17, 1998

Episodic Option, April 13- indefinitely

Medical Option, April 13- indefinitely

Marshall Policy Directive (MPD)

3000.1 contains the Center's Flexiplace Policy and Marshall Policy Guidance

(MPG) 3000.1 contains the Flexiplace

Procedures and Guidance. Both the MPD

and MPG may be accessed electronically.

Employees interested in participating in the Flexiplace Program may contact Sue Payne at 4-7530 or by electronic mail.



The Education Programs Office hosted the Greater Alabama Council of the Boy Scouts of America District Executives meeting April 3. Thirty-nine members from across the state of Alabama attended the 9 am to 3pm meeting in Bldg. 4200, room G13-1 and G21. The members were treated to a tour of the Space Station engineering mock-ups and the station manufacturing facility.

Photo by Emmett Given

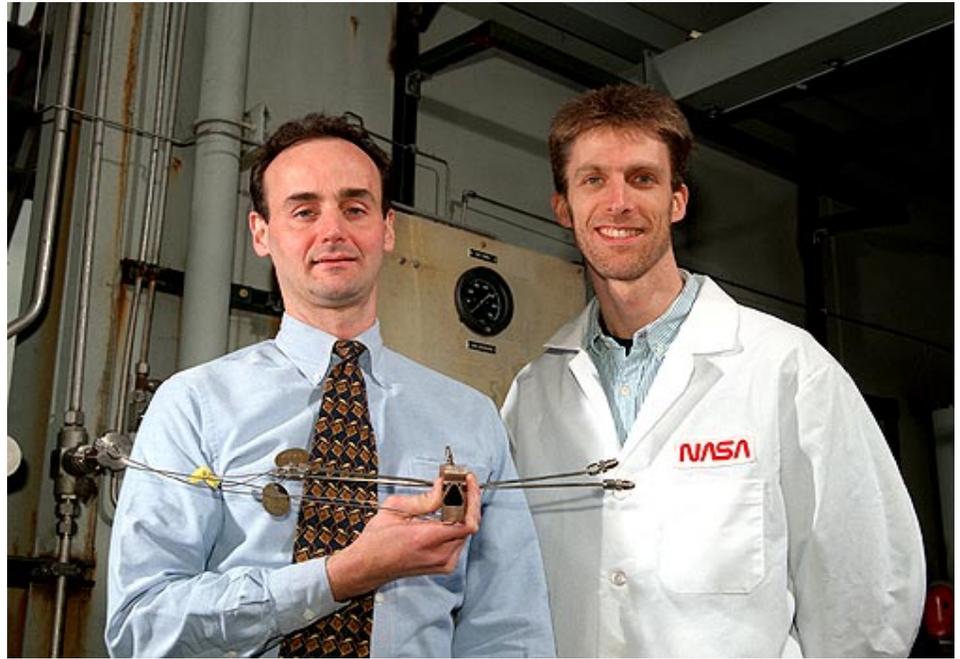
# Marshall Engineers Complete Series of Thruster Tests

by Deana Nunley

Engineers and scientists developing technology for an air-breathing rocket engine have successfully completed one phase of component testing at the Marshall Center. More than 180 tests have been performed on a rocket thruster during the last nine months.

The rocket thrusters will provide most of the launch vehicle's speed at both takeoff and the final stage that pushes the vehicle into orbit. Air-breathing propulsion will provide the vehicle speed during the middle phase of flight. Marshall engineers conducted extensive testing to measure the thruster's performance with different chamber pressures and fuel mixtures before integrating the thrusters into the engine.

An air-breathing rocket engine that consumes oxygen in the air - instead of stored oxidizer - is one of the technologies Marshall's Advanced Space Transportation Program is pursuing to dramatically reduce the cost of access to space. More than 50 representatives of industry, academia and government met last month at a NASA-sponsored workshop in Huntsville to discuss the status of air-breathing rocket technology. Workshop participants concluded the technology is ready to be demonstrated in a subscale, flight-type engine. NASA's industry partners in this effort are Aerojet Corp. of Sacramento, Calif.; Pratt and Whitney of West Palm Beach, Fla.; Rocketdyne of Canoga Park, Calif.; Astrox Corporation of Rockville, Md.; Pennsylvania State University at University Park; and the University of Alabama in Huntsville.



Marshall Center employees Paul Dumbacher and John Cramer are shown holding an air-breathing rocket engine thruster. Photo by Terry Leibold

## Concrete to be Removed in 4200 Complex Parking Lots

The construction contractor is planning to start removing concrete April 10 in the parking lots south of Buildings 4200 and 4201, according to May Wales, Marshall parking coordinator. The contractor will work Saturday and Sunday to finish the concrete removal and make preparations to pour concrete on April 13.

Parking may resume in the area on April 14. No cars will be allowed to be located in the first two rows in those areas Friday through Monday.

The remainder of the concrete work will be done in the following weeks.

The contractual completion date for all the concrete work in the 4200 complex is April 30.

## New Website

Continued from page 1

Computer Sciences Corporation's Internet Delivery Services, worked closely together to develop the Website," said Keim.

Keim said the Marshall Image Exchange, accessible at <http://www.1.msfc.nasa.gov/MIX>, contains about 350 images documenting the Center's significant role in developing space transportation systems, propulsion and space-based microgravity research for America's space program. The collection will continue to grow. Its link to NASA's Image Exchange gives users access to more than 300,000 images from the space agency as a whole.

Users may search the Website by using key words, or browse a number of pre-selected topics. Searches return thumbnail-sized images, textual descriptions, image numbers and links to higher-resolution images plus the NASA Center that stores each image. The site also provides tips on searching, copyright information and a comments section.

You may access NASA's Image Exchange on the World Wide Web at: <http://nix.nasa.gov>.

**For information on the Open House scheduled for May 16 call 1-888-901-NASA (6272) or (256) 544-5552. Or visit the Open House Website at: <http://www.msfc.nasa.gov/openhouse/>**

## Upcoming Events

### Marshall Center's Open House '98 Set for May 16

The Marshall Center Open House is scheduled for 9 a.m. to 6 p.m. May 16. Visitors will be able to see the Space Station being built, meet astronauts, see rocket tests and visit Mission Control Huntsville, in addition to choosing from a host of other exciting activities.

The official homepage for Marshall's Open House is up and running. Visitors to the site can volunteer to help with the event, peruse the exhibiting organizations' homepages, or look up Marshall Open House policies and guidelines. Retirees interested in volunteering should call Billie Swinford at 4-0087.

The web address is: <http://www.msfc.nasa.gov/openhouse/> or for more information on the open house, visitors may call 1-888-901-NASA.

### Marshall's Earth Day '98 Celebration Set for April 22

Marshall will celebrate Earth Day '98 on April 22. The theme is "Clean Water for Future Generations," to highlight the Clean Water Act.

Earth Day events at Marshall will be highlighted with a recycling display in Building 4200 from April 20 to April 24 with recycling information, literature, recycled sculptures and artwork by pre-school children who attend the Marshall Child Development Center; a "Spot an Environmentalist" contest for Center employees and on-site contractors; and an Earth Day tree planting ceremony on April 22.

## Moon Buggy Race

*Continued from page 1*

Kennedy Space Center in Florida to witness a Space Shuttle launch. The first-place high school team will win a weekend at Space Camp in Huntsville, sponsored by the Alabama Aerospace Teachers Association.

A prize will also be awarded by the American Institute of Aeronautics and Astronautics for the buggy that is judged best design from an original, creative concept and offers the best technical solution to navigating the lunar surface.

College teams scheduled to compete in the race are from the College of New Jersey, Ewing; the University of Evansville, Evansville, Ind.; the University of Vermont, Burlington; Pittsburg State

University, Pittsburg, Kan.; Mississippi State University, Starkville; Southern Illinois University, Carbondale; Arizona State University, Tempe; North Dakota State University, Fargo; Auburn University, Auburn, Ala.; Ozark Community College, Springfield, Mo.; the University of Puerto Rico at Humacao; and the University of Tennessee, Knoxville.

High school teams competing are from Eastlake High School, Chula Vista, Calif.; Autauga County Vocational Center, Prattville, Ala.; and Monterey High School, Monterey, La.

General admission to the Space & Rocket Center on the day of the event will include viewing the moon buggy competition.

## Eberhard Rees

*Continued from page 1*

and methods development. After graduation in 1934, he became assistant to the manager of a steel mill in Leipzig, Germany. In 1940 he became technical plant manager of the German Guided Missile Center at Peenemuende.

As World War II ended, Rees was among the German rocket experts that surrendered to Allied forces and emigrated from Germany to work for the U. S. Army.

## Breakfast Meeting

*Continued from page 2*

stimulating forum; understanding our capabilities and our uniqueness; knowing our competition; understanding the changes affecting us; examining models of success; helping each other; understanding each other; creating partnerships; and recognizing opportunities to serve our agency and our nation.

"Our purpose is to make Marshall better," explained Six. "Employees can become members by sending \$25 to Treasurer Jerry Williams, GP31. These annual dues support our scholarship program."

For more information about the breakfast, contact Jerry Williams at 4-0295.

Initially assigned to Fort Bliss, Texas,

Rees and other members of the Wernher von Braun team were eventually transferred to Redstone Arsenal in Huntsville. Assigned to the Army Ballistic Missile Agency, Rees served as Deputy Director of Development Operations.

On January 31, 1958, the von Braun team used a modified Jupiter-C rocket to launch Explorer I, America's first orbiting satellite. Two years later, with von Braun as director and Rees as deputy for technical and scientific matters, the NASA Marshall Space Flight Center was created. There an expanded team would develop the Saturn rockets that launched humans to the moon in 1969. As the Apollo program drew to a close, von Braun transferred to NASA Headquarters, and Rees became Center Director.

## Obituaries

**Fields, James, 79**, Huntsville, died March 1. He retired from Marshall in 1971 where he worked as an engineering technician. He is survived by his wife Caroline Fields.

**Oakes, Henley, 78**, Huntsville, died March 23. He retired from Marshall in 1972 where he worked as an engineering technician. He is survived by his wife Dorothy Oakes.

**Salmon, Carl, 67**, Huntsville, died March 16. He retired as a materials engineering technician March 31, 1995.

## Employee Ads

### Miscellaneous

- ★ 1983 Bomber Scout bass boat w/40HP Mercury, trailer, depth finders, \$2,500; 55 gal. aquarium, \$30. 851-6014 after 6 p.m.
- ★ 1989 Glasstream 192 Riattia, dry storage, Chevy V8 Mercruiser out drive, trailer, life jackets, boat accessories, \$8,500 firm. 539-6010 or 830-0539
- ★ 1989 Glasstream 182, Caravelle I/O, 175 HP, \$6,300. 722-0417
- ★ Men's suit size 38, \$60; men's sportcoats size 38, \$30. 776-9165
- ★ Solar hot water panels & tanks. 931-0351 after 5 p.m.
- ★ Black laquer computer desk and chair, \$125 for both. 895-0462
- ★ Female double yellow head Amazon, 5 yrs, talks, cage, accessories, \$800. 423-3376 after 6 p.m.
- ★ 6HP rear tine tiller, used, disassembled \$350. 837-0085
- ★ Refrigerator, Amana, 17 cu.ft., \$100; bicycle, men's 12-speed, \$60. 882-6446
- ★ 15 1/2 foot red fish boat, 75 HP Evrnuide motor, trailer, \$850. 883-8947
- ★ 22HP Kubota tractor with a 60" landscape box and a 48" finish mower \$4,000. 656-4509

### Vehicles

- ★ 1992 Buick Skylark Gran Sport, 4-door, automatic, A/C, V6, PL/PW, 78K miles, \$6,900. 837-9717
- ★ 1988 Honda Accord DX, hatchback, 5-speed, 112K miles, \$2,800. 880-3776
- ★ 1989 Mazda RX-7 GXL, 108K miles, rebuilt engine, \$3,900. 922-1619
- ★ 1990 Mazda B2600 pickup, cab plus, five speed, \$3,800. 882-6366
- ★ 1990 Acura Integra GS, blue, 3-door auto sunroof, options, 85K miles, \$7,000 o.b.o. 461-0902
- ★ 1986 Taurus LX, \$980. 883-8947
- ★ 1989 Olds, Delta 88, \$2,500. 922-0958
- ★ 1994 Nissan Quest XE, dual air, new tires, burgundy/gold color, \$11,950. 776-3040
- ★ 1991 Ford Taurus GL, V-6, 4-door, AC/PW/PL, AM/FM cassette, 119K miles, leave message. 830-8354
- ★ 1991 Buick Regal custom, 4-door, PW/PD/PL, cruise, tilt steering. 533-5039

### Wanted

- ★ Dogloo or dog house. 776-3040

### Free

- ★ Dog house large wood. 881-0354
- ★ Dog, year old, yellow, lab mix, neutered male, current shots. 837-2419 after 5 p.m.

# MARSHALL STAR

Marshall Space Flight Center, Alabama 35812

The Marshall Star is Published every Wednesday by the Public Affairs Office at the George C. Marshall Space Flight Center, National Aeronautics and Space Administration. Contributions should be submitted no later than Friday noon to the Marshall Public Affairs Office (CA10), Building 4200. Submissions should be written legibly and include the originator's name. The Marshall Star does not publish commercial advertising of any kind.

Writer-Editor - Angela D. Storey  
Editorial Assistant - Betty Humphery  
Director, Media Services - David B. Drachlis  
Director of Public Affairs - John B. Taylor  
U.S. Government Printing Office 1998-633-111- 80004

## Carpool

- ★ Decatur to NASA and back. Monday, Wednesday, Friday. Non-Smoker, flexible hours. male or female. 351-6855
- ★ Participants to share driving between Cullman and MSFC. Have two openings. 734-9487

## Center Announcements

- ★ **AGA** — The North Alabama Chapter of the Association of Government Accountants will meet April 16 at the Marriott at the Space and Rocket Center. Social begins at 5:30 p.m. and program will start at 6 p.m. Col. Joe Young will speak on "Effective Communication." For reservations, please contact Sandra Julian at 876-2300.
- ★ **MOO** — The Management Operations Office retirees will meet for breakfast/lunch on April 23 (4th Thursday each month) at the Cracker Barrel in Madison at 10 a.m. In addition to retirees, all present or former MOO employees are welcome. Call 539-0042 if you have any questions.
- ★ **AFGE** — The next monthly meeting for the AFGE-Local 3434 Union will be held April 14, 11:30 to 12 noon in Bldg. 4200, room P106
- ★ **Facilities** — The Facilities retirement breakfast will be at Shoney's at the corner of University and Parkway on April 14 at 8 a.m.
- ★ **STOP ABUSE** — Aware of waste, fraud or abuse? Phone the MSFC Office of Inspector General at 544-9188 or send complaints to mail stop M-DI. Confidentiality will be maintained.
- ★ **NARFE** — The National Association of Retired Federal Employees will meet April 11 at the Senior Center on Drake Avenue. Sergeant Paul Ballance will speak on "Police Operations and Community Relations." Refreshments at 9:30 a.m. and program at 10. For more information, call 837-0382 or 881-3168.
- ★ **Shuttle Buddies** — The Shuttle Buddies will meet for breakfast April 27 (each 4th Monday) at 9:15 a.m. at Shoney's, University West. For questions call Deemer Self at 881-7757.
- ★ **Toastmasters International** — The NASA Lunar Nooners Toastmasters Club will meet April 14 at 11:30 a.m. in the 4610 cafeteria conference room. For more information, call Debbie Hagar at 461-4992, or Lee Johns at 544-5142.
- ★ **Spring Dinner Dance** — Tickets for the April 11 dance are now on sale by the MARS Ballroom Dance Club. The semi-formal event will be held in the VBC West Hall and will feature ballroom music by the Barry Orth Orchestra. Social will begin at 6:30 p.m., and a buffet dinner will be served at 7 p.m., followed by dancing from 8 to 11:30 p.m. Tickets are

\$18 per person. Paid-up members get a \$3 discount and a free ticket for each ticket purchased. They are available from Tamara Landers (4-6818), Pat Sage (4-5427), Ed Ogozalek (837-1486, Linda Kinney (4-0563, and Bob William (4-3998). Reservations for a table of 8 can be made by calling Woody Bombara (650-0200).

- ★ **Training Opportunity** — The Program/Project Management Initiative announces that the third Project Management Shared Experiences Program course "Creative Approaches in Project Management" will be held April 20-24 at the Ramada Inn Hagerstown, MD. If interested contact Sherry Douglas at 202-554-8677 ext. 27 or e-mail at sdouglas@tadcorps.com.
- ★ **Public Inquiries** — Please visit the Public Inquiries Office located in Bldg. 4200, room 101. Imagine manufacturing medicine that is far superior to drugs made on Earth, a movie studio where out-of-this world effects won't be just "special effects" and booking your accommodations at a bed and breakfast in space—a place to rest and relax after a round of golf without the effects of gravity. Read about these and more in the Advanced Space Transportation Program brochure. Other publications and handouts related to Marshall and NASA are available.

## Thank You

"*Thank You*" to each and everyone who participated and contributed to the great success of Black History Month. It would not have been possible without your support. A special "Thank You" to: Charles Scales, Willie Love and EO staff, the Black History Core Team, Host Team, Janice Robinson, Haley Little and Associates of SCSC, Connie James, Debbie Solomon, Anthony Perkins, Yolanda Dail and Associates of I-Net and Tom Essenmacher and Photo Lab. Thank you all for a job well done!

Jan Matthews  
Procurement Office

## Job Opportunities

**CPP 98-37-PL, Administrative Officer, GS-341-9**, Observatory Projects Office. Closes April 16.  
**Reassignment Bulletin 98-16-JB, AST, Technical Management, GS-801-13**, Space Shuttle Projects Office, Solid Rocket Booster Project, KSC Resident Office. Closes April 23.

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