



MARSHALL STAR

Serving the Marshall Space Flight Center Community

Nov. 16, 2006

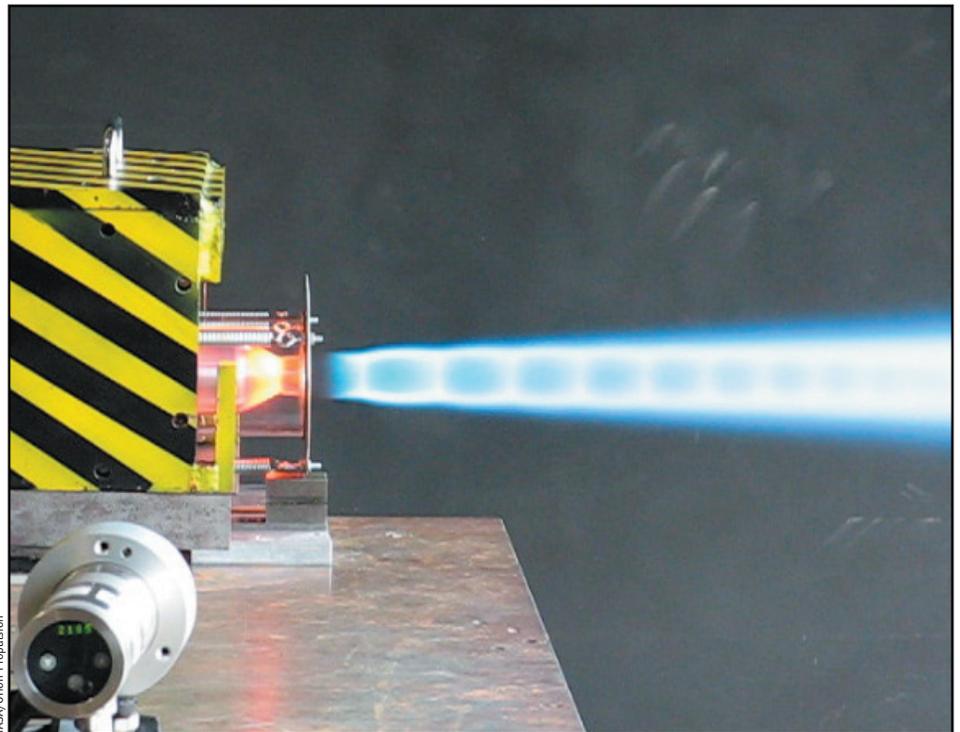
Taming the fire

Marshall researchers test innovative ceramic liners to improve engine life

By Rick Smith

As Marshall Center engineers watch, fire billows. Shaped metal glows white-orange. They've taken another step toward revolutionizing how NASA designs key elements of its rocket engines for next-generation launch vehicles and exploration spacecraft.

Marshall's Sandy Elam and Robert Hickman, combustion engineer and metallic materials engineer, respectively, are testing new component alloy combinations and innovative ceramic liner technologies designed to extend engine life. They're focused primarily on engine components for reaction control system thrusters, the relatively small-scale spacecraft engines that permit guidance and steering to alter



NASA/Orion Propulsion

A test article for an innovative new reaction control system thruster is test-fired at Orion Propulsion laboratories in Huntsville.

the craft's orbit or change its course.

Similar technology could impact the design of larger engine systems as well, Elam said. These include innovative liquid-oxygen/liquid-methane rockets now in development at Marshall and even the

mighty J-2X engines that will power the upper stages of the Ares launch vehicles, carrying the first Americans back to the moon and on to Mars in coming decades.

But improving engine component

See Ceramic liners on page 6

Marshall implements program management and public outreach

NASA announces Discovery Program selections

From NASA Headquarters

NASA has selected concept studies for missions that would return a sample of an enigmatic asteroid, probe the chemistry of Venus' atmosphere and reveal the interior structure and history of the Earth's moon.

Also selected for further study are three missions of opportunity that would make new use of two NASA spacecraft that have

completed their primary objectives.

"The science community astounded us with the creativity of their proposals," said NASA's Science Mission Directorate Associate Administrator Mary Cleave. "We look forward to the new knowledge of our solar system that these concepts may provide."

NASA's Discovery and New Frontiers Program Office at the Marshall

See Missions on page 4

Three Marshall Center managers receive Presidential Rank Awards

By Sanda Martel, Rita Roberts and Bill Hubscher

President George W. Bush recently honored three Marshall Center leaders with the Presidential Rank for Meritorious Executives, one of the highest honors given to federal employees.

The Marshall employees recognized with the award are Robin Henderson, associate director of the Marshall Center; Robert Lightfoot, manager of the Shuttle Propulsion Office; and Teresa Vanhooser, deputy director of Marshall's Engineering Directorate. They are three of only 28 NASA employees in the Senior Executive Service to be selected for the honor nationwide. The Senior Executive Service is the personnel system covering top managerial positions in approximately 75 federal agencies.



Robin Henderson

The Presidential Rank Award is presented annually to a select group of senior federal executives for outstanding leadership and service in some of the most critical positions in federal government. Executives who have consistently demonstrated strength, integrity and commitment to public service in their careers are nominated for the award by members of their agency. A board of private citizens reviews nominees' applications and only a select few are referred to the president for approval.

Henderson began her NASA career in 1983. She joined the Marshall Center as a technical analyst in the Hubble Space Telescope Project Planning and Control Office, helping to prepare the Hubble for delivery to space. From 1990 to 1993, she served as business manager of the Upper Stages Project Office and became business manager of the Microgravity Research Program in 1993. She was named deputy project manager in 1995. From 2002 to 2004, she was the chief operating officer of the National Space Science and Technology Center in Huntsville. Today, she provides daily

management across the center, and provides executive leadership to project and institutional management.

Lightfoot began his NASA career at the Marshall Center in 1989 as a test engineer and program manager for the space shuttle main engine technology test bed. In 1998, he was named deputy division chief of the Marshall Center's propulsion test division. He moved to the Stennis Space Center in Bay St. Louis, Miss., the following year to become the new chief of propulsion test operations. He served as the assistant associate administrator for the Space Shuttle Program at NASA Headquarters in Washington from 2003 to 2005 before being named to his current position at the Marshall Center.



Robert Lightfoot

Vanhooser joined NASA in 1980 as an engineer in the Marshall Center's Ground Systems Analysis Branch. She has held a number of managerial and leadership positions at Marshall, including, assistant mission manager for the first Atmospheric Laboratory for Applications and Sciences, or ATLAS-1 mission from 1987 to 1992; mission manager of ATLAS-2 from 1992 to 1993 and Microgravity Science Laboratory-1 from 1993 to 1997; manager of the Space Station Utilization Office in 1997; manager of the Payload Operations and Integration Department in 2000; and deputy director of Marshall's Flight Projects Directorate from May to August 2004 when she was named deputy director of Marshall's Engineering Directorate.

The writers, ASRI employees, support the Office of Strategic Analysis and Communications.



Teresa Vanhooser



CFC goal still within reach — employees have opportunity to contribute through Nov. 17

Marshall team members have contributed \$480,053 of the \$575,000 goal to the Combined Federal Campaign. An annual initiative by federal and military personnel to raise money for local charities, the campaign will run through Nov. 17. CFC donations made by 1,209 Marshall team members as of Nov. 9 have averaged \$397 per person.

Marshall employees may donate by cash, check or payroll deduction. For more information about the CFC campaign, visit <http://cfc.msfc.nasa.gov/>.

Space Shuttle Discovery arrives at launch pad; window opens Dec. 7



Space Shuttle Discovery arrived at launch pad 39B at NASA's Kennedy Space Center, Fla., on Nov. 9, perched atop the mobile launcher platform and carried by the massive crawler transporter. The shuttle assembly travels about 1 mph on its 4.2-mile journey to the launch pad. The launch window for the STS-116 mission to the International Space Station opens Dec. 7.

NASA/KSC

Native American Heritage Month event held Nov. 7

Observance of Native American Heritage Month was celebrated Nov. 7 in Building 4200 with live dancing by Daniel Tramper, at right, a full-blooded Cherokee from the Eastern Band of Cherokee in North Carolina. He performed several traditional dances, including the hoop dance, a Native American dance that symbolizes a sacred part of life. Marshall employees had an opportunity to learn about the rich heritage of the first Americans through storytelling, musical enchantments, crafts and food.



Doug Stoffer/MSFC

NASA turns to past to help develop engines of future

Unveiling a plaque commemorating the turn over of NASA Stennis Space Center's A-1 Test Stand from space shuttle main engine to J-2X engine testing are, from left, Stennis Space Center Director Richard Gilbrech; Scott Horowitz, NASA associate administrator for Exploration Systems; and Michael Hawes, NASA Space Operations deputy associate administrator for Program Integration.

The A-1 Test Stand at Stennis, near Bay St. Louis, Miss., was the focus of a ceremony Nov. 9, to transition the facility to a new program of work: testing the J-2X engines that will power NASA's next-generation launch vehicles, the Ares I crew launch vehicle and Ares V cargo launch vehicle. The Marshall Center is responsible for development of the Ares vehicles for NASA's Constellation Program. Constellation is charged with developing NASA's future crew exploration and launch vehicles and related systems and technologies for more ambitious exploration of the moon, Mars and destinations beyond.

Stennis conducted the final space shuttle main engine test on its A-1 test facility on Sept. 29. Testing on the stand for the J-2X engine is scheduled to begin in 2007.



Missions

Continued from page 1

Center assists the Science Mission Directorate at NASA Headquarters with Discovery program management, technology planning, systems assessment, flight assurance and public outreach.

Three missions were selected for concept studies:

- The Origins Spectral Interpretation, Resource Identification and Security mission would survey an asteroid and provide the first return of asteroid surface material samples to Earth. Michael Drake of the University of Arizona, Tucson, is OSIRIS's principal investigator. NASA's Goddard Space Flight Center in Greenbelt, Md., would manage the project.
- The Vesper mission is a Venus chemistry and dynamics orbiter that would advance our knowledge of the planet's atmospheric composition and dynamics. Gordon Chin of Goddard is Vesper's principal investigator. Goddard would manage the project.
- The Gravity Recovery and Interior Laboratory mission would use high-quality gravity field mapping of the moon to determine the moon's interior structure. Maria Zuber of the Massachusetts Institute of Technology in Cambridge, Mass., is GRAIL's principal investigator. NASA's Jet Propulsion Laboratory in Pasadena, Calif., would manage the project.

Three missions making new use of NASA spacecraft were selected for concept studies:

- The Deep Impact eXtended Investigation of Comets mission would use the existing Deep Impact spacecraft for an extended flyby mission to a second comet to take pictures of its nucleus to increase our understanding of the diversity of comets. Michael A'Hearn of the University of Maryland in College Park is DIXI's principal investigator.
- The Extrasolar Planet Observations and Characterization

mission would use the high-resolution camera on the Deep Impact spacecraft to search for the first Earth-sized planets detected around other stars. L. Drake Deming of Goddard is EPOCh's principal investigator.

- The Stardust NExT mission would use the existing Stardust spacecraft to flyby comet Tempel 1 and observe changes since the Deep Impact mission visited it in 2005. In 2005, Tempel 1 has made its closest approach to the sun, possibly changing the surface of the comet. Joseph Veverka of Cornell University in Ithaca, N.Y., is NExT's principal investigator.

These proposals were among approximately two dozen submitted in response to NASA's Discovery Program 2006 Announcement of Opportunity in April. The announcement solicited two types of investigations: complete missions to design, build and fly new spacecraft to accomplish specific planetary science objectives; and missions of opportunity that propose scientific uses for existing spacecraft or build instrumentation for spacecraft of other space agencies.

NASA may select one or more investigations to continue into a development effort after detailed review of the concept studies. Decisions about which mission concepts will proceed to development are expected next year.

New missions will receive \$1.2 million to conduct concept studies. If selected for continuation beyond the concept phase, each project must complete its mission, including archiving and analyzing data, for less than \$425 million.

Missions of opportunity will receive \$250,000 to conduct concept studies. If selected for continuation, each mission of opportunity must complete its project, including data archive and analysis, for less than \$35 million.

Four vying for election to NASA Exchange-MSFC Council

Four Marshall Center employees responded to the request for petitions to fill two vacant positions on the NASA Exchange-MSFC Council. The term of office is two years.

The exchange's primary goal is to contribute to the health and welfare of the employees at Marshall, and it is active in funding centerwide events such as the Marshall Fall Cookout and the Holiday Reception. To achieve the goal and help with the events, the exchange manages vending machines throughout the center, the Space Shop and

barbershop in Building 4203, an auto repair shop, two snack bars and the Wellness Center.

The candidates for the positions are Hansel Gill of the Engineering Directorate, Judy Green of the Engineering Directorate, Bennie Jacks of Safety & Mission Assurance Directorate and May Wales of the Office of Center Operations.

The election will be held electronically. It will begin Nov. 16 and will end Dec. 7. Only civil service employees are eligible to vote. To vote, employees should go to <http://oscar.msfc.nasa.gov/cd/exchange.nsf/vf>.



Hansel Gill

Hansel Gill has been with the Marshall Center since 1990. Gill began his career as a participant in the Student Aid Program in the Financial Management Office and then as a Cooperative Education student in the Materials & Processes Laboratory. He now works as a materials engineer in the Metals Engineering Branch of the Engineering Directorate.

"I've often commented that I was raised here at Marshall, and some of my most memorable experiences have been associated with NASA Exchange-MSFC events and activity clubs. I hope that the support that I would bring to the Exchange Council would ensure many more memorable experiences for the Marshall family."

Judy Green started her career at the Marshall Center in 1997 in the Public Affairs Office. Before joining Marshall, she worked for the Tennessee Valley Authority for 10 years as a document control clerk. Green is currently the executive support assistant for the Propulsion Systems Department in the Engineering Directorate.

"I have served on numerous committees sponsored by the NASA Exchange-MSFC and believe the exchange is a valuable asset to all Marshall employees."

Her greatest accomplishments are three sons and two grandsons.



Judy Green

Bennie Jacks began her career at the Marshall Center in June 1966. She is currently serving as a management analyst in the Business Management Office of the Safety & Mission Assurance Directorate.

Jacks served on the NASA Exchange-MSFC Council from 1998-2002. She feels that the vast experience that she has gained during her career at Marshall has made her knowledgeable in the numerous and various activities associated with the Exchange Council.

"Throughout the years, I have taken advantage of and promoted the numerous services that the exchange has to offer. I love working with people and am willing to serve out of concern and support for the people at the center once again."



Bennie Jacks

May Wales is currently working in the Environmental Engineering & Occupational Health Office in the Office of Center Operations as an environmental and occupational health support specialist.

"My 32 years of government service has offered me a wide variety of opportunities in working in numerous areas throughout the center. I have worked on many special assignments and committees that have given me the privilege of getting to know people and their issues and concerns. As an Exchange Council board member, I can use this knowledge to help individuals and organizations to understand more about the many benefits the exchange has to offer."



May Wales

Ceramic liners

Continued from page 1

technologies is no simple task. The sustained heat of engine operations quickly wears out certain components, notably the injector system, which controls the flow of propellants into the engine, and the thrust chamber, which ignites the propellants in the combustion chamber and accelerates gaseous combustion to provide thrust. Over time, materials in these components crack and become brittle, requiring replacement. And while innovative new propellants have been developed in recent years to improve engine thrust and efficiency, they operate at higher temperatures than current engine components can handle.

A traditional solution to these challenges is to bulk up the components, increasing their thickness and mass to better withstand the punishment of engine operations. That added weight and mass creates drawbacks, however, hindering a rocket's lift capacity and reducing overall efficiency.

Since 1999, Marshall engineers have been examining new materials and processes for resolving these issues and delivering lightweight, long-lasting thrust chambers and injectors, designed to withstand higher temperatures and operate for longer periods of time.

For the latest test series, Elam and Hickman — both members of the Engineering

Directorate, funded for this effort by the Science and Mission Systems Office — started with test articles combining two metals currently used in reaction control thrusters. The first, rhenium, is a "refractory" metal that can withstand sustained high temperatures much more effectively than conventional alloys. The second, iridium, protects against metallic oxidation, a common chemical breakdown process that can speed up engine deterioration over time.

For small thrusters, these materials typically are made using chemical vapor deposition, a process that uses high-temperature gases to deposit thin, durable layers of one material onto the surface of another to form the desired liner. After the iridium surface is created, the same process is used to build up the required thickness with rhenium.

Despite the successful demonstration of these materials and the chemical vapor deposition process in recent years, Elam said challenges remain. This current fabrication process produces materials with less-than-optimum strength and durability. Over time, the iridium protection diffuses away, exposing the rhenium and reducing the life of the thruster.

Most frustrating of all for engine developers, operating temperatures for these parts typically max out around 2,000 degrees Celsius (3,632 degrees Fahrenheit). That's well short of the ideal operating margins — 2,500 degrees Celsius (4,532 degrees

Fahrenheit) — required for next-generation thruster operations.

To combat these issues, Elam and Hickman began evaluating new fabrication options, seeking greater versatility in thruster design and fabrication. Since August, they've fabricated and successfully tested two promising options.

In the first, the iridium/rhenium liner is formed using a patented "electrodeposition" process called El-Form, in which a metal solution is introduced via electrical current to a material surface, leaving behind a thin, uniform liner coating — one hopefully more durable than materials bonded via vapor deposition, Elam said.

The second option is an innovative vacuum plasma spray process that transforms the material elements into "functional gradient materials," blended composites that smoothly transition at the molecular level from one material at one surface to another material at the opposite surface. This process eliminates distinct bond joints between material layers, creating an extremely strong and durable component.

During hot-fire testing this fall at Marshall and at Orion Propulsion, a Huntsville contract firm tapped by Marshall to

support the test series, both options showed real promise in eliminating the problems associated with conventional fabrication techniques.

The next challenge, Elam said, was to address the necessary increase in temperature margins. She and Hickman began testing ways to combine the two fabrication

"We're hoping to show some dramatic results and make these technologies and techniques available to industry right away. It's going to take much more robust, longer-life rocket engines to handle the harsh environments of long-term space exploration. We're excited to help forge that path."

— Sandy Elam, combustion engineer

processes and add a durable ceramic layer to the interior of the thruster. The iridium layer will still prevent oxidation, but adding the ceramic layer will help heat tolerances reach the 2,500-degree Celsius goal.

"Achieving this higher temperature limit will provide a safer margin of error and longer life for existing thruster designs," Elam said. "It also will enable engineers to pursue new thruster designs and consider alternative propellant options, often supporting more powerful engines that can burn hotter and offer higher system performance."

In December, Elam and Hickman will conclude their research effort by hot-fire testing a final version of the small thruster with the ceramic layer, increasing the temperature margin to demonstrate the durability of the new fabrication process and combination of materials.

"We're hoping to show some dramatic results and make these technologies and techniques available to industry right away," Elam said. "It's going to take much more robust, longer-life rocket engines to handle the harsh environments of long-term space exploration. We're excited to help forge that path."

Elam and Hickman expect to publish their results in May 2007, at the 54th Joint Army-Navy-NASA-Air Force Propulsion Meeting in Denver, Colo.

The writer, an ASRI employee, supports the Office of Strategic Analysis and Communications.

Marshall to team with Alabama A&M for High School Senior Day on Saturday, Nov. 18

By Shelley Miller

The 10th Annual High School Senior Day will be held at Alabama A&M University Saturday, Nov. 18, at Louis Crews Stadium on the Alabama A&M campus in Huntsville. NASA and the Marshall Center will team with the university for the event, contributing volunteers and resources to support the day's activities.

Beginning at 8 a.m., high school seniors from across the Southeast will gather at the gymnasium to learn about the

importance of a college education and future career opportunities, including areas of study that support NASA's mission for space exploration. Information will be available about scholarship and academic prospects in business, education, engineering, math and science. Seniors also will tour the campus and attend the football game between the Alabama A&M Bulldogs and Prairie View A&M University Panthers of Prairie View, Texas. Kickoff is at 1:30 p.m.

Alabama A&M University alumni Charles Scales, NASA associate administrator for the Office of Institutions and Management, will take the field to perform the pregame coin toss. Accompanying Scales will be Steve Cook, manager of Marshall's Exploration Launch Projects Office.

All Marshall employees and their family members are invited to attend. Tickets can be purchased at the Alabama A&M Athletics Ticket Office, online at <http://www.ticketmaster.com> or by calling 372-4700.

The writer, an ASRI employee, supports the Office of Strategic Analysis and Communications.

Marshall Center holiday reception and tree lighting ceremony to be held Nov. 30

Save the date! Marshall team members are invited to join Center Director David King on Thursday, Nov. 30, for a reception to kick off the holiday season. The celebration will be from 1 to 3 p.m. in the Activities Building 4316. Part of the Marshall Center's annual

festivities, a tree lighting ceremony will be held the same day at 4:15 p.m. in front of Building 4200.

Additional details will be announced in the Marshall Star and on "Inside Marshall."

Classified Ads

To submit a classified ad to the *Marshall Star*, go to *Inside Marshall*, to "Employee Resources," and click on "Employee Ads — Submit Ad." Ads are limited to 15 words, including contact numbers. No sales pitches. Deadline for the next issue is 4:30 p.m. Thursday.

Miscellaneous

K&N P/N 57-9014-1 used intake for 2000/2001 V8 Toyota Tundra, \$125. 256-714-6609

China cabinet, \$275; long sofa, \$195; large copper collection, \$395; men's leather coat, \$30. 852 6952.

Formal living room set, sofa and loveseat, beige, \$350. 722-5051

Tahari 3-piece pantsuit, misses 6, pale gray w/yellow pinstripes, top, \$100. 256-325-4111

"Beatle Bass" guitar w/gigbag, short scale, lightweight, hollow-body electric bass, violin finish, \$225. 256-303-3702/Decatur

Mirage truck rack fits full-sized short bed truck, \$100. 777-3594

Two tickets: BTL "Cirque Jungle," Nov. 24, 8 p.m., Row M, seats 24-25, \$80. 881-4335

Hardware cloth, 1/8th inch, 36" wide, approx. 75' in sections, mostly 12' long, \$40 for all. 931-427-8205

Sony HDTV Projection TV, 57", 1080i, 3 yrs. old, \$950. 497-3608

2004 Coachman travel trailer w/super slide, 32', new April 2005, camped in 4 days, \$15,500. 256-426-0856

Sears LifeStyler CardioFit Plus exercise machine, \$125. 883-2948

Oak hardwood flooring, approx. 140 sq. ft., 3/4" nail-down butterscotch, \$200; oval oak coffee table, \$60. 895-9589

Nordic Track 1000 ETX space saver treadmill, \$400. 256-714-8580

Four tickets Titans/Giants game, Nov. 26, 306, Row GG (17-20), \$40 each. 864-6094

Two adjacent 5th row seats, Broadway Theatre League Production, "The Producers," Jan.12, 8 p.m., \$100. 325-0085

Beseler 23CIICX enlarger, timer, carriers, easel, trays, complete darkroom setup, manuals, \$50. 714-7045
Gently-worn silver fox stole, \$40; new brass candlesticks, \$6 each. 837-6776

Nike SQ460 10.5 degree, regular shaft driver, hit approx. 50 times, \$100. 256-417-5495

Shoei motorcycle helmet, small, sun visor, \$350; Ladies Teknic black leather motorcycle jacket, small, \$200. 256-503-8282

Manual treadmill, air resistance cushion deck, folds for storage, quiet, no motor, \$79. 961-1603

Corner TV cabinet, light oak, w/36" Toshiba TV, \$800. 489-5318

Browning 12-gauge Gold Hunter, Grade I, 3.5" magnum, unfired-NIB, \$850. 882-9407

Tires, 4-wheeler, new ITP Mud Lites, wheels, lug nuts, center pieces, fits Honda 450 & up. 225-259-1523

Acer, 19" LCD monitor, 1 yr. old, \$140; three working 17" CRT monitors, \$25 each or make offer.

Boss TU2 guitar tuner, \$80; DigiTech RP50 guitar effects, \$40. 655-6293

Beginner golf clubs, includes driver, 3 wood, irons, pw and putter, bag, \$50. 859-4048

Toy Poodle, black male, 13 weeks old, AKC registered, \$300. 355-0102

Large, 72"x42", Whirlpool bathtub w/six jets and a working pump, \$200. 655-6701

Vehicles

1998 Cadillac Eldorado, red, 2 door, 58K miles, \$10,750. 256-885-2293

1999 Ford E-150XL van, tan, 98K miles, a/c, \$7,450. 256-755-7772

1983 Jeep CJ-7 Laredo, 6 cyl., 4 speed, 3 tops (hard w/doors, soft w/doors, bikini), \$6,300. 931-565-4332
Dirt bike, 110cc, \$450; 4 wheeler, 70cc, \$350; both with helmets. 256-858-5552

1987 Honda Accura Legend, 4 door, needs some work, runs good, \$800. 684-5712

1995 Toyota 4Runner SRS, 4x4, green w/tan leather, new tires, auto, 135K miles, \$5,350. 256-461-8854

2005 Kia Optima EX, loaded, V6, 4-door sedan, 1,595 miles, \$16,000. 256-755-7222

1964 Ford F100 292CID, \$850. 256-339-0970

1996 Buick Regal, 51K miles, a/c, auto, 2nd owner, recent maintenance, \$4,700. 837-1774

2002 white Grand Prix GT sedan, 4 door, tan leather, 82K miles, \$8,900. 508-3673

1995 Cadillac Seville SLS, Northstar, leather, heated seats, new tires, \$5,500. 468-3803

1992 Ford Mark III leisure van, small V8, overdrive, fully equipped, \$2,500. 256-753-2583

Wanted

Child restraint system, forward facing car seat, 20-40 lbs. 256-259-4467

Found

Treo holder, south parking lot, Bldg. 4203. Call 544-0154 or 464-9034 after 6 p.m. to identify/claim

Necklace in Bldg. 4711 parking lot. Call 544-9244 to identify/claim

Free

To good home, 2 female Beagles, 1.5 yrs. old. 931-636-2726

Lost

Motorola Verizon cell phone, silver and black, in Bldg. 4202/4203 area. 544-4680

Car door handle from 1999 VW Beetle. 227-0339/ Dave

NASA urges Tuskegee students to aim for the stars



David Higginbotham/MSFC

NASA Astronaut Michael Barratt, left, looks on as Charles Chitwood, deputy director of the Marshall Center, talks to community leaders, teachers and students at Tuskegee Elementary School in Tuskegee, Ala., about the Vision for Space Exploration and the future of the space program. The Vision for Space Exploration calls for the safe return of the space shuttle to complete the International Space

Station, and human and robotic exploration of the solar system. NASA officials visited Nov. 2-3 to kick off the school's participation in the NASA Explorer Schools Program — a three-year partnership between schools and NASA. The program encourages students to study science, technology, engineering and math.

MARSHALL STAR

Vol. 47/No. 10

Marshall Space Flight Center, Alabama 35812
 (256) 544-0030
<http://www.nasa.gov/centers/marshall>

The Marshall Star is published every Thursday by the Public and Employee Communications Office at the George C. Marshall Space Flight Center, National Aeronautics and Space Administration. Classified ads must be submitted by 4:30 p.m. Thursday, and other submissions no later than 5 p.m. Friday to the Marshall Public and Employee Communications Office (CS20), Bldg. 4200, Room 103. Submissions should be written legibly and include the originator's name. Send e-mail submissions to: intercom@msfc.nasa.gov. The Star does not publish commercial advertising of any kind.

Manager of Public and Employee
 Communications — Dom Amatore
 Editor — Jessica Wallace

GPO U.S. Government Printing Office 2007-623-033-20075

PSRRT STD
 US POSTAGE PAID
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 PERMIT NO. 298