



## New Approaches Speed X-33 Support at Marshall Center

by Peter Cobun

To climb quickly from the drawing board into space — while challenged by constraints of time and money — NASA engineers have discovered new ways to improve their historically methodical profession as they participate in development of the X-33 technology demonstrator.

The X-33 — whose advanced technologies could be included on America's next-generation space transportation system — is one of the fastest concept-to-flight space technology programs ever undertaken. But to accomplish such an engineering and technical feat, engineers at the Marshall Center found many traditional concepts and practices had to be discarded. NASA and its industry partners would have to chart a new course.

"In the past," said Joe Ruf, a Marshall fluid dynamics engineer, "we would have conducted a careful, systematic set of experiments on the X-33 test model, looking at the different effects of each test, and refining the model and test techniques

as we went."

But one of the basic concepts of the X-33 — to shave time and money off the traditional and prolonged process of design, development and flight of a new vehicle — required a new look at old practices.

With the first test flight of the X-33 scheduled for 1999, "We couldn't follow those practices with the X-33," said Ruf. "We don't have the time and we don't have the money. We had to break new ground. So we have performed much of our design, testing and analytical work in parallel. It's a practice called 'concurrent engineering' — a practice dictated by schedule and costs."

In recent months, the X-33 design has been assessed using two very different methods, representing both the traditional and the new, at the Marshall Center.

"What we're doing here," explained Dr. Paul K. McConnaughey, chief of Marshall's Fluid Dynamics Analysis Branch, "is attempting to design and analyze a type of configuration that we've never tested or flown before." To

accomplish this, he said, "We've deviated from tradition."

Tradition is exemplified by wind tunnel testing. Twenty different configurations of the X-33 demonstrator have undergone extensive tests in Marshall's Trisonic Wind Tunnel — with over 2,500 test runs completed since December 1996.

But Marshall engineers added another, newer methodology to the mix: computational fluid dynamics, which is an analytical prediction of a fluid's behavior. For the analysis, physical and thermodynamic laws that describe the behavior of a fluid — whether air, liquid oxygen, liquid hydrogen or other substances — are written in computer code. The shape of the hardware to be analyzed is then described to the computational fluid dynamics code by a mesh or grid. The grid is a series of points in space on which the code predicts the fluid's behavior.

With computational analysis, said McConnaughey, "We've broken new *continued on page 4*

## 1997 CFC Donations Reach \$323,284 After Three Weeks

Marshall Center's 1997 Combined Federal Campaign (CFC) has resulted in a total of \$323,284 in contributions to charitable organizations during the first three weeks of the campaign, according to CFC officials.

"Our vision for the campaign started to be and still is to help more people than before, said Steve Gaddis, executive chairperson for this year's Marshall CFC committee. "There is only one way to help more and that is to give more.

We are now in the middle of campaign and the average gift per person continues to increase. This shows the commitment and the desire of center employees to help people in real need."

"Hope is in Our Hands," added Gaddis. "Don't let this opportunity to help pass you by, please give to the CFC agency of your choice."

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Marshall Center employee Tina Swindell sings during the "Focus on Safety Day" activities in Morris Auditorium last week. Looking on are astronauts Carlos Noriega and Dave Brown. *Photo by Dennis Keim*

# Marshall-Built Mirrors Bound For Planet Saturn on Cassini

With a successful launch last week, NASA's Cassini spacecraft has begun a seven-year voyage to Saturn, in the most ambitious effort thus far to reach and explore the fascinating ringed planet.

As Cassini speeds outward on a complex trajectory that will eventually bring it to the most distant planet visible to the unaided human eye, it carries some unique hardware furnished by the Marshall Center. Part of the Cassini mission to explore Saturn will be performed with an instrument that depends, for accomplishment of its data collection, on a set of specialized optics produced in a unique Marshall facility.

Marshall's Astrionics Laboratory, with support from the System Dynamics Laboratory and the Materials Laboratory, built and tested seven mirrors for the Composite Infrared Spectrometer that is one of 10 specialized instruments aboard Cassini. The spectrometer will measure the infrared energy from Saturn, its rings and moons — especially the moon Titan — as part of a study of their structure and composition.

For the Marshall engineers who built and tested the spectrometer's mirrors in the center's state-of-the-art optics lab, the assignment was an opportunity to exercise and demonstrate the lab's capabilities to fabricate special-purpose optics for space-related application. That type of effort is

one facet of the charter for the Astrionics Lab's Optics and Radio Frequency Division: to perform research and development in the areas of optical system design, fabrication, test and analysis, and to provide technical support to projects involved in the development and/or application of these systems.

The effort, spanning two years, involved a team of some 10 specialized personnel, using an array of sophisticated, ultra-precise equipment located in Building 4487. When completed and tested, the finished mirrors were provided to Goddard Space Flight Center for integration into the infrared spectrometer.

"The project posed some unique challenges that had to be overcome, but it was exciting for our people to be part of an effort in the area of interplanetary exploration — especially since these opportunities don't come around very often," said Jim Bilbro, chief of the Optics and Radio Frequency Division.



One of seven mirrors custom produced at Marshall for an instrument on NASA's Saturn-bound Cassini spacecraft gets careful attention from John Cernosek in the Center's Astrionics Laboratory prior to being shipped out.

Photo by Emmett Given

## A&M Football Game Includes NASA Day

The Equal Opportunity Office is coordinating High School Senior Day/NASA Day at Alabama A&M University. It will be held in conjunction with the A&M vs. Tuskegee football game to be played Nov. 8 at 1:30 p.m. at the A&M Stadium. General admission tickets are \$10 each, student tickets are \$5 each (ages 6-12 years), and children under 6 are free. Tickets may be purchased in the NASA Exchange Office, Building 4752, Monday through Friday, from 8 a.m. to 4:30 p.m. For additional information contact Alice Sams at 4-0374 or Willie Love at 4-0088.

## Registrars Visit Center for ISO 9000 Preassessment

National Quality Assurance registrars are at the Marshall Center this week performing a preassessment audit as part of preparation for ISO 9000 certification.

The visit is a key step in the Center's ISO 9000 initiative, aimed at achieving compliance with the quality management system of the International Organization for Standards by early next year.

A four-member team headed by Lead Registrar Lee Bravener is working from offices on the seventh floor of Building 4200. They started Tuesday and will be conducting the preassessment audit through noon Friday.

According to Associate Director (Technical) Bob Schwinghamer, the purpose of the audit is to check on how well the Center is doing as it prepares for "the real thing." Schwinghamer, chairman of Marshall's ISO 9000

Implementation Team, said that "we're as ready as we can get, given the time we've had to get it done. We are trying to be registered by the end of February."

Schwinghamer noted that, in conducting the preassessment audit, the registrars will not attempt to visit all parts of the Center. Instead, they will randomly select areas, to gauge the Center's general level of preparedness.

"If they find deficiencies," said Schwinghamer, "we have time to correct them before the major audit in February."

## Employee Update Scheduled for Nov. 13

An Employee Information Update will be held on Nov. 13 at 9 a.m. in Morris Auditorium. Employees are encouraged to attend the Update or view it on Center closed circuit television.

# Liftoff Team Keeps Website Hot

In the fast-moving world of the Internet, one day's top finisher in the "What's Hot" race can be as cold as stone just days later. Building and maintaining a web site so that it's fresh, informative and in demand — in other words, keeping it "hot" — is a never-ending challenge.

A good example of how to consistently meet that challenge can be found on the web in a site that originates from the Marshall Center — specifically the Mission Operations Laboratory.

Creators of the site known as "Liftoff" have been staying on the cutting edge for two and one-half years, getting their start by producing a site that let the public participate for the first time in a NASA mission.

Then called "Astro-2 Live," that first Liftoff site was an overwhelming success. During the course of the STS-69 Shuttle mission, it accounted for over 2.9 million "hits," or file requests, from people in 59 countries — an unprecedented volume at the time. It also received international news attention, including coverage on the NBC Nightly News, CNN and several AP newswires.

Today, the legacy of Astro-2 Live is still alive and well, and the original site's offspring, a family of electronic pages titled "Liftoff to Space Exploration," continues to provide information and attract favorable notice.

In coordination with the NASA Shuttle Web, the Liftoff team has prepared payload pages for each Marshall-managed Spacelab mission since STS-69. In doing so, they have built up a loyal following. Hits have grown from a meager 20,000 per day in 1995 to over a million on a recent day this month.

"I expect over eight million requests this month," said John Jaap, a Liftoff contributor and backup system administrator.

Other signs that Liftoff is on the mark are the dozens of web awards that continue to accumulate. Most treasured by team members are being selected as a Microsoft's Pick of the Week, The Ultimate Web Site, NetGuide Gold Site and Magellan 4 Star.

"We think that being there first with quality content is the basis of our popularity," said Becky Bray, web administrator in Mission Operations Lab. "We did the first Shuttle mission, the first QuickTime VR from space, the first 'Ask an Astronaut', and, of course, we have the best JAVA satellite tracker on the web."

One of Liftoff's many attractions is satellite tracking. Since Astro-2, Liftoff has generated computer images of the Shuttle's location over the Earth. Similar tracking of Mir's location was added early last year and is very popular, according to Bray.



The Liftoff homepage offers a varied menu.

The real coup came late last year, however, when Patrick

Meyer and Tim Horvath of Teledyne Brown created "J-Track," a JAVA applet, or mini-application. "For the first time," Horvath pointed out, "the average person can see where satellites are without having to understand and deal with complicated orbital tracking software."

According to Meyer, the innovation drew rave reviews from Sun Microsystems, the inventors of JAVA, and J-Track was twice featured as "Applet of the Week" on the firm's JAVA promotional web site,

Gamelan. Attention has continued to

grow, including recognition in PC-Magazine and the New York Times, and by a NASA Space Act Award.

Most recently, Microsoft contacted the Liftoff team about adding J-Track to the company's gallery of featured desktop items for Internet Explorer 4.0.

The team is determined to continue in their "full-court press" mode, so Liftoff can maintain its edge. At this moment, Becky Grimaldi of Teledyne Brown is leading the team which is busily getting everything set for the upcoming Marshall-managed Spacelab mission — next month's fourth U.S. Microgravity Payload flight on Columbia.

As Mission Operations Lab activities shift from Spacelab to Space Station, so does the Liftoff team's focus. They're already at work on a new outreach web site, called Nexus, to inform about and highlight Marshall's role in the Station program. Nexus (<http://nexus.nasa.gov>) will be the location for information about the science, hardware and payload activities onboard the International Space Station.



J-Track, a satellite tracking innovation of Liftoff.

# X-33 Team Here Finds New Ways to Save Time, Money

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ground in the development of a launch vehicle. The tool of computational fluid dynamics has come into its own. It allows us to supplement our traditional database and adapt it specifically for the X-33 configuration.”

Added Ruf: “You can do really rapid analysis with computational fluid dynamics, quickly gaining an idea of what a change in a vehicle’s configuration will do. This can be accomplished before you try to justify spending a lot more money on additional wind tunnel tests.”

Computational fluid dynamics, said McConnaughey, “is a tool that is complementary to wind tunnel testing. Computational fluid dynamics enables us to do things that cannot be done in the wind tunnel — to go beyond what the wind tunnel can do, to perform tests that would be more expensive or more dangerous in the wind tunnel.”

Such as testing for the effects of the rocket engine exhaust gases (plumes) on a vehicle. “We need to know the effect of the plume on vehicle base pressure, or what the plume is doing to the vehicle’s forebody aerodynamics,” said Ruf, whose branch has performed hundreds of analyses on rocket propulsion projects at Marshall.

“In wind tunnel tests on the X-33 at Marshall, no plume was used,” said Ruf. “It’s simply too expensive and too dangerous to test with a hot plume that’s at about 5,000 degrees F.”

An alternate method of testing, he said, is to substitute a cold plume, at about 500 degrees F, for the hot plume. “This is much less expensive and dangerous,” said Ruf. “However, there are several important effects that do not scale properly between a hot and cold plume. With computational fluid dynamics, we can model the hot plume gases in a computer, achieving two goals at

once: lowering the cost of wind tunnel testing and eliminating the hazards associated with the 5,000-degree gases.”

Computational fluid dynamics is being used by Marshall engineers, as well, to determine the aerodynamic loads or pressures on the X-33, analyzing the majority of the vehicle’s critical body components.

Airload pressure tests historically have been performed in the wind tunnel. “In a traditionally paced program,” said Ruf, “one which is not as accelerated or limited by costs as the X-33 program, there are a number of analyses we would do before testing in the wind tunnel. We would perform an analysis up front to determine maximum airload, or maximum dynamic pressure. Then, we would test that particular case in the wind tunnel. But, in this program, we were into the wind tunnel before we knew the launch trajectory, and before we knew what the final configuration was.”

“Now,” said McConnaughey, “because of the schedule and cost issues, the program cannot run another wind tunnel test for aerodynamic loads in time to make an impact on the vehicle structural design. So we’re doing it analytically with computational fluid dynamics — but we’re using the wind tunnel data that is available as a check on our analytical predictions.”

Analytical predictions through computational fluid dynamics also were made in a variety of other areas during the X-33’s design and development at Marshall. For instance, they enabled prediction of engine performance, and an estimate of the vehicle’s sonic boom strength, one factor in environmental impact assessment.

Tony Springer, one of the Marshall X-33 test engineers who have performed over 30 weeks of wind tunnel tests since late last year, knows the value of wind tunnel testing — as well as the newer discipline of computational fluid dynamics.

“Wind tunnel testing allows you to fly the vehicle before you actually fly it,” he said. “It allows for variations in configurations for what the vehicle will look like, whether changes in tails, fins, flaps, nose or different body shapes. Through wind tunnel testing, you can see what changes will do to a vehicle’s performance.”

It was through wind tunnel tests on the X-33 model at Marshall last December that instability problems were discovered in an early vehicle configuration. By testing new configurations, controls were found to stabilize the vehicle, and successful design changes adapted.

Computational fluid dynamics played a significant role in those changes, as well. “Neither computational fluid dynamics nor wind tunnel testing replaces the other,” said Springer. “Instead, they are complementary of one another. We all know that the final product of both computational fluid dynamics and wind tunnel testing is to provide an aerodynamic database for the vehicle for all the various flight regimes.

“In other words,” he added, “to work together to provide a successful X-33 vehicle.”

## American Education Week To Be Observed Nov. 16-22

The theme for this year's American Education Week is "Teaching People to Think and Dream." This is the 75th year that American Education Week has been observed nationally.

To observe American Education Week at the Marshall Center, employees who are involved in providing ongoing support to the educational community are invited by the Center to a recognition ceremony and reception in their honor on Nov. 20. The reception will be held from 12:30 to 2 p.m. in the south end of Building 4755. Employees who serve the educational community and can attend the reception may confirm their attendance by electronic mail to [tammy.rowan@msfc.nasa.gov](mailto:tammy.rowan@msfc.nasa.gov) in the Education Programs Office.

# Founder of NASA College Scholarship Fund Dies

Pulitzer Prize Winning author James A. Michener died at his home in Austin, Texas, on Oct. 16 at the age of 90. Michener was the author of 48 books including *Tales of the South Pacific* (which was his first novel in 1947 and which won him the Pulitzer Prize), *Texas* (in 1985), *Space* (in 1982), and many others. Michener visited the Marshall Center in 1980 as a member of the NASA Advisory Council, a group mostly from universities and industry, who advised the NASA administrator on plans and programs.

Michener and his wife, Mari, contributed over \$110,000 to establish the NASA College Scholarship Fund, Inc., in 1982, and subsequently made a \$25,000 contribution to the fund in 1991. He gave as his reasons for the gifts that he held the people of NASA in such high esteem for their good work through the years and that he thought it important for education to go forward in this country. He specifically requested that the scholarships be awarded to the children of NASA employees who were pursuing science or engineering degrees.

Michener felt very strongly about the space program and personally appeared before Congress; most recently, to support continuation of this Nation's Space Station program.

Many NASA employees have contributed to the fund directly or through the Combined Federal Campaign.

## NASA, HHS Join Forces to Fight Breast Cancer, Women's Illnesses

An agreement that enlists NASA technologies to fight breast cancer and other women's illnesses will be signed Thursday by representatives of NASA and the Department of Health and Human Services (HHS).

U.S. Representative Anna Eshoo of Calif., NASA Administrator Daniel Goldin, NASA Ames Research Center Director Dr. Henry McDonald and Dr. Susan Blumenthal, Assistant Surgeon General and Deputy Assistant Secretary for Women's Health at HHS are expected to attend the ceremony.

The agreement establishes a cooperative framework between NASA's Ames Research Center, Moffett Field, Calif., and the HHS Office on Women's Health to identify, develop and transfer NASA technologies to benefit women's health. Major areas of concern are cancer, reproductive health, pregnancy, osteoporosis and education. Breast cancer is the leading cause of death of women ages 35 to 50 in the United States, and more than 500,000 breast biopsies are done each year in the U.S.

## Wright to Lecture at Library Wed.

Mike Wright, Marshall historian, will discuss "The History of Rocketry" 7-8:30 p.m. tonight at the Huntsville-Madison County Public Library. The lecture is free and open to the public. It is sponsored by the Huntsville L-5 Society, a chapter of the National Space Society. Contact Ronnie Lajoie, 461-3064.



The American Institute of Aeronautics and Astronautics sponsored the Third Annual Great Paper Airplane Contest at the Marshall Center last week. One participant takes careful aim with his paper airplane. Marshall Center Deputy Director Carolyn Griner was one of the judges. **Photo by Dennis Olive**

## CFC Total Grows

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The CFC financial manager said at the end of the third week, 37 additional offices had 100 percent of their employees participating in the campaign. Those offices are: CC01, CL01, CM21, CR60, EA01, EB01, EB31, ED21, ED31, ED71, EE54, EH21, EH31, EJ32, EJ33, EJ42, EJ43, EJ44, EL01, EL23, EO02, GP20, JA10, LA01, LA02, LA10, LA20, LA40, MG01, MG10, MG20, MG21, PF01, PP01, PP02, PP04 and PS04.

The CFC campaign will run through Nov.7.

### What CFC Means to Me...



"The Combined Federal Campaign provides an opportunity for each of us to be involved in types of community service. You never know when you, your co-worker, or family will require the services from the agencies supported by our giving. I feel it is a privilege to contribute annually."

**David Hughes, EN41**

## Employee Ads

### Miscellaneous

- ★ Canoe, 17ft Mohawk whitewater; Perception, bags/paddles, grunchpads \$400. 881-4748
- ★ Sears Kenmore clothes washer \$100; dishwasher \$75; children swing set \$100. 881-6040
- ★ Brittany puppies, 9 weeks, AKC \$100. 828-1640
- ★ Four Auburn/Arkansas tickets \$20 ea.; Honda "Bra" 1990 and later models \$65 o.b.o. 852-0666
- ★ Huffy stationary exercise bike; Pro-Walker treadmill; bicycle, 10-speed, Free Spirit, boys, 27 inch. 852-6225
- ★ Cellular phone, Nokia 2160, digital/analog with leather case, pager/voice capability \$85. 882-1780
- ★ Golden Retriever puppies, AKC registered, \$150, all shots vet certified; hay, fresh cut \$2.25/bale. 837-2461
- ★ Cross country ski machine \$185. 233-6100
- ★ Smith Corona word processor, laptop style, separate printer with case \$225. 880-4091
- ★ Buck stove wood burning fireplace insert with blower and thermostat \$250. 539-3304
- ★ Sears Kenmore dishwasher, \$200. Can deliver. Six gallon portable console humidifier \$100. 883-9361

### Vehicles

- ★ 1985 GMC van \$1,850. 883-1701
- ★ 1996 Dodge Caravan, 2-slide doors, luggage racks, back seat, alloy wheels \$12,900 or best offer. 830-8339
- ★ 1992 GMC Safari SLE, extended van, ABS, dual a/c, luggage rack, full power \$7,500. 890-0896
- ★ 1985 Yamaha XT350. 828-1640
- ★ 1990 Pontiac Grand Am, 169K miles, blue, air, PS, PB, PW, tape \$2,700. 729-6231
- ★ 1988 Ford Ranger, p/u, 4-cylinder, 5-speed, 89K miles, s.w.b., black/ext, tan/int sport stripes \$2,875. 753-2278
- ★ 1987 Nissan Sentra, 130K miles, new transmission, a/c, radio \$2,500. 881-2566
- ★ 1990 Dodge Grand Caravan LE, 95K miles, Michelin tires, 3.3L engine, all power \$5,000. 837-3746

### Lost

- ☞ Prescription eyeglasses: Tortoise shell wire frames with blue tips on the earpieces, progressive lens. Pink fold over vinyl case. 4-8704
- ☞ Pair of sunglasses in Post Office or Credit Union on Friday, Oct 17. 4-1944

### Found

- ☞ A pair of eyeglasses found in Bldg. 4200. Call 4-4758 to identify.
- ☞ Miniature tape recorder found in Building 4200, Morris Auditorium, call 4-4758 to identify.
- ☞ Heart shaped pendant in north parking lot of Bldg. 4203. Call 4-3851 to identify.
- ☞ Blue & white jacket left at the 4200 lobby desk, call 4-4758 to identify.

## Center Announcements

- ★ **Toastmasters International** — Toastmasters will meet Oct. 28 at 11:30 a.m. in bldg. 4610 cafeteria conference room.
- ★ **MARS Dance Club** — The MARS Ballroom Dance Club will offer Foxtrot and Tango lessons (\$8 per person) from 7 to 8 p.m. Nov. 3, 10, 17, and 24. The classes will be held in the Parish Hall of Saint Stephen's Episcopal Church at 8020 Whitesburg Drive. These lessons are available to club members and their partners/guests. For more info. call Pat Sage at 544-5427.
- ★ **Management Operations Office (MOO)** — MOO retirees will meet for breakfast/lunch on Oct. 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.
- ★ **NCMA** — The National Contract Management Association will meet on Oct. 23 at the UAH Bevill Center from 7 a.m. to 8:30 a.m. Registration begins at 6:45 a.m. and breakfast will be served at 7 a.m. The cost is \$9 for members and guests. For reservations call 533-3954 by Oct. 20.

- ★ **Stop Abuse** — Aware of waste, fraud or abuse? Telephonically contact the MSFC Office of Inspector General at 544-9188 or send complaints to Mail Stop M-DI. Confidentiality will be maintained.
- ★ **Spot Sealed Bid Sale** — A Sealed Bid Sale of government surplus property will be held Oct. 27 at the Defense Reutilization and Marketing Office, Warehouse Rd., Redstone Arsenal. Inspection is Oct. 22-24 from 8 a.m. to 3 p.m. Bids must be submitted by fax, handcarried or mailed by 3 p.m. Oct. 24. To view material for the sale or for further info. call E. Couch (842-9474) or D. Davis (842-2570.)
- ★ **Public Service Announcement** — Self help for hard of hearing in Huntsville will feature Dr. Robert Rane discussing "Vertigo & Tinnitus" on Oct. 28 at 6:30 p.m. in the Airport Road Publix meeting room, 4851 Whitesburg Drive, SE. Anyone, whether they have a hearing loss or not, is invited to attend. For information on the organization or the purchase of a Uniphone 1000 TDD/telephone call 852-4580.
- ★ **Redstone Toastmasters** — Toastmasters will meet Oct. 28 at 6 p.m. in Morrison's Cafeteria Conference Room, located in the Madison Square shopping mall.
- ★ **Retired Senior Volunteer Program** — The Huntsville/Madison County Senior Center will participate in "Make a Difference Day" on Oct. 27 from 7 a.m. to 6 p.m. at the Senior Center.

## Job Opportunities

**CPP 98-1-CV, Secretary (OA), GS-318-7**, with promotion potential to GS-8. Global Hydrology Research Office, Office of the Manager. Closes October 23.

**CPP 98-3-MB, IFMP Training Program Coordinator, GS-301-12/13**, with promotion potential to GS-13. Human Resources and Administrative Support Office. Closes October 24.

**CPP 98-4-MB, IFMP Training Program Manager, GS-301-14**, Human Resources and Administrative Support Office. Closes October 24.

# MARSHALL STAR

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