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MARSHALL STAR

Serving the Marshall Space Flight Center Community

May 22, 2008

First external tank to fly with redesigned ice frost ramps, feedline support brackets

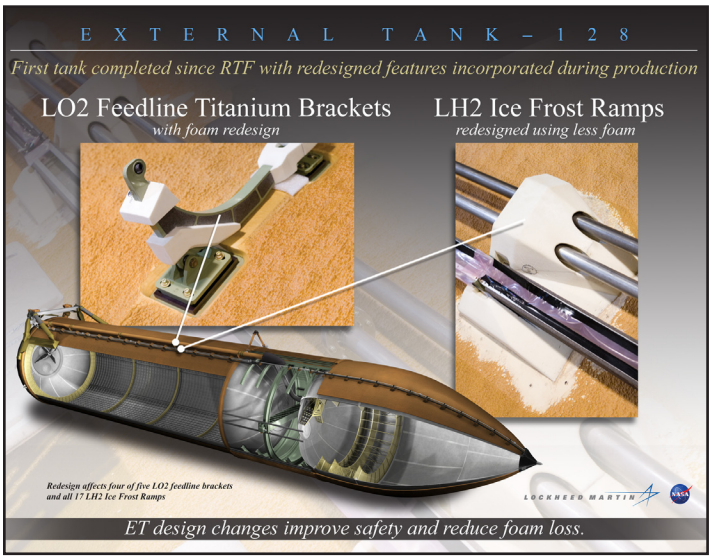
By Sanda Martel

Space shuttle Discovery has been cleared for a May 31 launch from the Kennedy Space Center, Fla., for a 14-day mission to the International Space Station. Launch time is scheduled for 4:02 p.m. CDT.

NASA's agency-wide flight readiness review was held May 19 for a comprehensive evaluation of all activities and elements necessary for the safe and successful performance of STS-124 mission operations, including the space shuttle vehicle, flight crew and payloads.

"We're on track for a May 31 launch," said Steve Cash, Shuttle Program deputy manager and manager of the Shuttle Propulsion Office at the Marshall Center. "We thoroughly reviewed everything, determined we're safe to fly, and are ready to go," he added.

Discovery's external fuel tank, ET-128, will be the first new tank to fly since the first Return to Flight mission, STS-114 in July 2005, with tank improvements incorporated during manufacturing instead of being added to the tank post-production. ET-128 is also the first tank with redesigned liquid hydrogen ice frost ramps and liquid oxygen feedline support brackets.



ET-128 is the first space shuttle external tank to fly with redesigned liquid hydrogen tank ice frost ramps and liquid oxygen feedline brackets.

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'Fire and smoke' is pretty cool

An interview with Johnny Heflin, design engineering team leader and former avionics manager in the Space Shuttle Main Engine Project office

Johnny Heflin began his career at the Marshall Center in 1990, while still a student at the University of Alabama in Huntsville. He spent 11 years in the propulsion test area, Instrumentation and Measurement Systems Branch, working on more than 40 test programs, before joining the space shuttle team in 2001.

How does your expertise help Marshall accomplish its mission? How does it help the space program?

My role is leading the team that manages the design, fabrication and field operations of all space shuttle main engine hardware product lines. We are responsible for ensuring engine hardware is ready and safe to fly. In a nutshell, our job is to remain vigilant, always trying to drive down the risk of spaceflight by identifying and mitigating any potential issues prior to flight. I lead a diverse team of technical experts and my technical background helps me to do that. I don't have to be an expert on everything, but I have to be able to understand what the experts are telling me. Without a strong technical background I would be at a real disadvantage and it would be difficult to be an effective leader.

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Heflin

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What is your background and what generally is your area of research?

My background is in measurement systems and avionics. Measurement systems consist of the techniques and tools necessary to measure things such as pressure or temperature, including sensors; wiring or harnesses; signal conditioning; electronics; data acquisition; processing systems and software.

Avionics is a broader field, which includes measurement systems along with additional systems required to operate and control a mechanical system in flight. The term avionics generally refers to flight systems.

The test laboratory here at Marshall provides a tremendous opportunity to learn and be part of very exciting tests and I was fortunate to spend 11 years there. Fire and smoke is pretty cool to a young engineer. Heck, it's pretty cool to an old engineer, too! Once you feel the ground shake under your feet and know that you are a vital part of making it happen, you're hooked. It's a great place to work and to learn.

I moved to the Space Shuttle Main Engine Project office, in 2001, as the engine systems avionics subsystem manager and feel very fortunate to be a part of the manned space program. The Space Shuttle Main Engine Project is a great office with a top-notch civil service and contractor team. In my position, I am responsible not only for measurement systems, but also the engine controller hardware and software that actually controls the engine during hot fire operations. The space shuttle main engine is a mostly closed-loop, staged combustion engine. It's an extremely complex machine. The controller collects data and makes decisions on engine operations in real time to keep the engine operating as intended. It requires some pretty sophisticated software that has been modified over the years, adding capability to ensure safe engine operations.

David Higginbotham/MSFC

Johnny Heflin, Space Shuttle Main Engine Project design engineering team leader, stands in front of the nozzle exit of a space shuttle main engine. The nozzle contains 1,080 collant tubes that fill with liquid hydrogen for cooling purposes at main engine start during a space shuttle launch or test.

What is avionics? Explain how it works in the space shuttle main engine.

Avionics literally means "aviation electronics." It really refers to electronics used in flight, whether an airplane or space launch vehicle. Specific to the space shuttle main engine, avionics refers to the electronics on-board the engine used to operate and monitor the engine. This includes the engine controller, spark igniters, sensors and harnesses. The engine has an assortment of sensors that measure the operating conditions of the engine. These sensor outputs are then harnessed to the main engine controller, which is a sophisticated, specialized and redundant computer mounted on the engine. The controller hardware and software use the sensor data as feedback and adjust engine valves accordingly to keep the engine operating properly. The controller also monitors engine sensors for out-of-limit conditions which might indicate an anomaly and communicates that information to the orbiter and ground systems. The engine operating conditions are pretty extreme, so these parts are a bit of a challenge to design. Engine temperatures range from minus 420 degrees Fahrenheit up to several thousand degrees, sometimes with only a small thickness of metal between the two extremes.

Have you developed any technology? What influenced you to develop this technology?

I have worked many projects during my career, many of which were technology development projects. The data collected was used to further understand hardware performance and design. In my test area career, I was responsible for interpreting test requirements and establishing the measurement and instrumentation systems to ensure the requirements were met. Every measurement has limitations and uncertainty.

My job was to select and implement the proper measurement technique to gather accurate data that met customers' data requirements. Often customers didn't understand measurement issues so they didn't know what they needed. I had to learn to "pull it out of them" to ensure they got the data they needed.

The space shuttle main engine has evolved over time due to a continued focus on improving system safety and reliability. I have been fortunate to be a part of several upgrades and redesign projects which have helped to improve engine safety and reliability. For example, we recently implemented the Advanced Health Management System, also known as AHMS, an engine controller upgrade which incorporates the capability to monitor the vibration signatures on the two high pressure turbopumps on each engine. This allows us to better and more rapidly diagnose potential pump failures and if required, shutdown the engine safely. This represents

See Heflin on page 3

Space station Water Recovery System ships from Marshall

By Jennifer Morcone

The International Space Station crews will soon have a new water reclamation system that will recycle waste water, allowing up to six crew members to live aboard the orbiting laboratory. Last week the final element of the NASA designed International Space Station life support system, the Water Recovery System, departed Marshall for Kennedy Space Flight Center for its final preparations for launch.

NASA engineers at Marshall have led the design and development of the International Space Station Regenerative Environmental Control and Life Support System, or ECLSS, for more than 20 years. Once installed on the space station, the Water Recovery System will join the Oxygen Generation System to create a closed-loop life support system which will substantially reduce the dependence on Earth re-supply for crew member oxygen and water. The Oxygen Generation System was launched on space shuttle Discovery in July 2006.

"As early as the late 1960's we knew that sustaining life in space would require recycling water and oxygen. A number of us have experienced the entire lifecycle of this technology, all the way from early ideas to implementation," said Bob Bagdigian, Regenerative Environmental Control and Life Support System project manager. "Knowing that we will soon see this system completed, gives us great pride."

The Water Recovery System will recycle crewmember urine and wastewater for reuse as clean water. By doing so, the system reduces the amount of water and consumables that will need to be launched from Earth by approximately 15,000 pounds or 6,800 kilograms per year.

The Water Recovery System reclaims urine and condensation from perspiration and through a series of treatment processes, creates water clean enough to drink. In fact, part of the same process has been used in third world countries to produce drinkable water.

A distillation process is used to recover water from urine. The process occurs within a rotating distillation assembly that compensates for the absence of gravity and therefore aids in the separation of liquids and gases in space. Once distilled, this water from the urine processor is combined with all other wastewaters for treatment. The water processor removes free gas and solids such as hair and lint, before the water goes through a series of filtration beds for further purification. Any remaining organic contaminants and microorganisms are removed by a high-temperature catalytic reaction. These rigorous treatment processes create water which meets stringent purity standards for human consumption.

David Higginbotham/MSFC

From left, Marshall engineers Tom Phillips, Phillip West and Robert Rutherford prepare one of the two International Space Station Water Recovery System racks for transport.

Engineers at Marshall and at Hamilton Sundstrand Space Systems International Inc., Windsor Locks, Conn., led the design and development of the Water Recovery System.

Morcone is a member of the Public & Employee Communications Office in the Office of Strategic Analysis & Communications.

Heflin

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a dramatic improvement in overall engine reliability.

The AHMS concept was born right here at Marshall, where engineers developed the capability as a ground system to support engine ground testing. The ground system has been in use with great success for many years. The AHMS project took that technology and applied it to the flight system. It was a real team effort across several NASA centers, and contractors such as Pratt & Whitney Rocketdyne, Canoga Park, Calif.; United Space Alliance of Houston; and Honeywell Aerospace Division, Clearwater, Fla. It was incredible to see the system fly for the first time on STS-116, which launched Dec. 9, 2006. It is fully implemented in the fleet today and has been flown successfully on the last six shuttle flights.

How critical is technology development and cultivation of technologists to the future of Marshall as a successful NASA center?

Marshall is largely an engineering center. We design, test, analyze, model and manage cutting edge technology for a living. As we move toward the future, Marshall's success in Constellation Program responsibilities will largely hinge on our ability to manage the technology and engineering needs of the new launch vehicle. It's imperative that we do everything we can to maintain our technical expertise. In the Space Shuttle Program, we see every day just how critical it is to have strong engineering capabilities. Recently, Marshall played a key role in resolving the engine cut-off sensor system issues.

Marshall supplied engineering expertise, lab and test facilities to help solve the problem. In the Space Shuttle Main Engine Project, we count on Marshall engineers and facilities to help assess and resolve issues all the time. It's a real team effort and we couldn't fly safely without them. It is essential that we maintain our technical edge. Current and future programs depend on it.

Sanda Martel, an ASRI employee who supports the Office of Strategic Analysis and Communications, conducted this interview for the Marshall Star.

34 selected for Space Flight Awareness honors

Thirty-four Marshall Center employees and contractors are being honored for their significant contributions to the space program. The honorees are attending a special recognition event in Orlando, Fla., on May 28. There will be an awards ceremony in their honor, and they will tour Kennedy Space Center and view the launch of STS-124, targeted for May 31.

Michael Baysinger
Qualis Corporation/ Jacobs

Susan Best
Engineering Directorate

Chad B. Bryant
Shuttle Propulsion Office

Donnie Ray Burch
Engineering Directorate

Jenny Campbell
Office of the Associate Director

Kevin Clark
COLSA Corporation

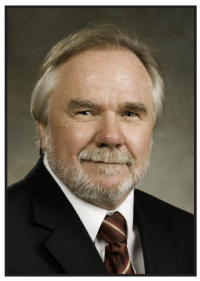
Renée Cox
Science & Mission Systems Office

Timothy Cruse
COLSA Corporation

Ryan K. Decker
Engineering Directorate

Dale Dugal
Bastion Technologies

Nicola A. Duncombe
Office of Human Capital



Joe P. Edmondson
Office of Center Operations

Gregory P. Frady
Engineering Directorate

Rex Garrison
SAIC

Melanie Gregory
Triumph Aerospace/ Jacobs

Robert L. Hawkins
Jacobs

Ketela Helton
Office of Procurement

John F. Hraba
Engineering Directorate

Carol D. Jacobs
Shuttle Propulsion Office

Alfrica Jones
Engineering Directorate

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Space Flight Awareness honors

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Cora Sue Knapp
Office of the Chief Financial Officer

Cynthia LeMaster
Engineering Directorate

George Leussis
Smithsonian Astro Observatory

Lewis Maddux
Shuttle Propulsion Office

Kevin McCarley
Engineering Directorate

Craig R. Murdoch
EG&G

Rosalyn M. Patrick
Safety & Mission Assurance Directorate

Carol Reynolds
Teledyne Brown Engineering

Andrew Schorr
Ares Projects

Ronald Sedam
Teledyne Brown Engineering

Keith N. Swearingen
Office of Strategic Analysis & Communications

Gary W. Tidwell
Office of the Chief Information Officer

Renee' M. Wilson
Engineering Directorate

Dennis R. Wooten
CIS

Reunion Weekend to be held at U.S. Space & Rocket Center on July 18-19

The U.S. Space & Rocket Center will host a special Reunion Weekend on July 18-19, which includes the fifth annual Saturn/Apollo Reunion and the second annual Space Camp Hall of Fame dinner. Both events will be held in the Davidson Center for Space Exploration.

Individual ticket prices for the Saturn/Apollo Reunion are $10 for adults and $5 for children. Tickets for the Hall of Fame Dinner are $40 each. For more information and to register, go to http://www.spacecamp.com/reunionweekend/. Check the Web site periodically for updates.

STS-124

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"The Flight Readiness Review Board's approval to proceed toward launch with ET-128 is a major milestone for the entire external tank team," said John Chapman, External Tank Project manager. "The extensive safety enhancements that will fly for the first time on this tank represent the culmination of innovative design, development, test and production work by many hundreds of people stretching back across several years," he added. "Every external tank we'll fly in the future will incorporate these same improvements."

The Space Shuttle Program approved the liquid hydrogen tank ice frost ramp redesign after foam debris loss during previous shuttle flights and after cracks were discovered during the post-STS-114 dissections on external tank ET-120.

The external fuel tank main propulsion system pressurization lines and cable trays are attached at multiple locations along the tank's length by metal support brackets. They are protected from forming ice and frost during tanking operations by foam protuberances called ice frost ramps. There are 36 ice/frost ramps on the tank – 12 on the liquid oxygen tank, seven on the intertank and 17 on the liquid hydrogen tank. The size and design of each ice frost ramp depends on its location.

Redesign changes have been made to all 17 ice frost ramps on ET-128 and to all subsequent liquid hydrogen tanks. The new ramps appear identical to the previous design but several changes have been made. A similar configuration was flown on ET-120 on the STS-120 mission, which flew Oct. 23-Nov. 7, 2007, and performed exceptionally well with no debris events observed.

The liquid oxygen feedline bracket configuration, which also has the potential for foam and ice debris loss, was redesigned to minimize ice formation in under-insulated areas and minimize foam damage or loss due to ice and foam interferences during normal feedline relative motion. Aluminum brackets have been replaced with titanium brackets at four locations. Titanium is much less thermally conductive than aluminum. Additional foam was added to the feedline to minimize cold spots and reduce ice.

The liquid oxygen tank feedline, approximately 70 feet long and about 17 inches in diameter, carries liquid oxygen from the liquid oxygen tank to the orbiter where it is distributed internally to the main engines. The feedline is attached to the tank with five brackets that resemble an L-shaped boomerang. The brackets allow movement or "articulation" of the feedline to compensate for propellant flow during fueling on the launch pad and during detanking. During launch, the brackets also compensate for thermal expansion and contraction of the external tank.

A number of external tank improvements were made before the first Return to Flight mission and additional changes have been made since that time, but until ET-128, modifications were made after the tanks were manufactured.

While external tank foam loss can never be completely eliminated, the program continues to make improvements to minimize foam and ice loss by looking at areas where debris may be shed, prioritizing them and methodically eliminating them one at a time.

For more information about External Tank ET-128, visit http://www.nasa.gov/centers/marshall/news/background/factsheets.html.Under Space Shuttle, read "Space Shuttle External Tank ET-128, STS-124."

Martel, an ASRI employee, supports the Office of Strategic Analysis and Communication.

Moving toward NASA's 50th anniversary ...

Nothing gets a family talking more than pulling down an old scrapbook or photo album from the shelf. For almost 50 years, the Marshall Star has kept team members informed about what's gone on at the center. It has been a solid news source for employees and management. However, it is also possible to page through the newspaper as sort of a Marshall Center "family album." It illustrates how the center's culture has changed over time. It reflects everything from changes in hair styles and clothing to changes in space programs and technology.

On Friday, May 23, Marshall historian Mike Wright will open some of the old issues of the Star from the 1960s through the 1990s as part of a slide presentation at 10 a.m. in Building 4203, Room 1201. All team members are invited.

The program is part of the center's efforts to mark the 50th anniversary of NASA on Oct. 1, and the upcoming anniversary of the Marshall Center in 2010.

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, May 29, is 4:30 p.m. Thursday, May 22.

Miscellaneous

Two complete twin-size mattress sets, 4 years old; king-size wicker headboard, bedding. 883-2237

Speakers, 40-watts, wood composites with walnut veneer, model MC-800, $35. 541-0627

Wood coffee table, rolls, glass paneled top, matching end tables, $150. 489-1673

Computer desk, hutch, printer shelf, laminate maple finish, $30. 837-6352

Lawnmower, Tecumseh 5HP engine, extra blade/filter, CD, $50; large pet carrier, plastic, 32x22x26, $40. 828-6213

Leather sofa, love seat, chocolate/burgundy, $600; TaylorMade golf irons, left-handed, steel, $250. 651-9738

Dining table, paid $850, four upholstered chairs, cherry with wrought iron, protective glass cover, $450. 859-9165

Teen girl's clothes, sizes 4-6, accessories; Boonaroo 2008 general admission ticket, $300. 350-4932

Bird houses, $20; two dryers, $75 each. 837-0327

Woodplay redwood playset, swing, ladder, slide and treehouse, $150. 558-0648

Red couch, floral design, 6 1/2 feet, $250; 12-foot lighted Christmas tree, $200. 334-444-9544

Four Velux skylights, Comfort Plus, FS106-0074, flashing kits, $195 each. 837-2035

Michelin tire, 215-65R-16, $40; Car GPS system, $80; 35mm slide projector, $25. 852-6952

Kitchen Aid dryer, attached ironing board. 603-3055

Garmin GPS Map60 with city select v.6, $150. 278-1974

New wheelchair made by DRIVE, 22" wide seat, 31" wide wheels, $80.00. 509-1626

Game Boy, $40; sit-or-stand infant double stroller, $75. 993-1992

Lily Flagg pool membership, includes 2008 dues, $1,000. 881-5809.

Girl's white dresser with mirror $150; oak dining set, 6 chairs, table, hutch, pad, $350. 468-1066

30" smooth cook top, 175.00; 30" coil cook top, $125.00. 658-0987

Vehicles

2006 F-250 ATV, 2WD, $2,300 obo. 893-2284

2005 Ford Explorer Sport Trac, XLTPremium, new tires, tonneau cover, leather, 43K miles, $15,250. 859-0796

2004 Ford Ranger, 4.0LV6, four door, bedliner, trailer package, MP3, extras, $14,500. 586-2215 or 656-4867

2003 Club Car, green, tan seats, Trojan battery, split windshield, charger, $2,250 obo. 682-6326

2003 Chevrolet Z71, white, 14k miles. 444-0137

2003 Jeep Cherokee Laredo, 2WD, 59k miles, $11,000. 655-6701

2001 Honda CRV LX, black/gray, 101k miles, $7,900. 883-6894 or 468-6894

1999 Ford Expedition, leather, third row seat, rear air, 175k miles, $4,500. 426-2417 or 426-2207

1999 Toyota 4-Runner Limited Edition, white, brown interior, sunroof, CD, A/C, $7,000. 694-1260

1996 C280 Mercedes Benz, four door, golden tan, 150k miles, $6,000. 503-9720

1994 Ford F-150, needs transmission, asking $1100 for body. 658-6353

1992 E-Z-GO gas golf cart, four seats, extended top, $1,450 obo. 682-6326

1989 Ford F-150, 10-inch lift, $4,500. 520-9244

1987 Coachmen Fifth-Wheel travel trailer, 28-feet long, 20-foot box, sleeps six, $5,800. 227-0339

Wanted

Used backpack, one person tent, mess kit, canteens, purification equipment for backpacking. 325-9264

Reliable person for house cleaning. References required. 508-6989

Tree stand, 300 pounds. 813-391-9673

Ping-pong table, garden chipper/shredder. 655-7972

Free

Compost/dirt, approximately 8 cubic yards. 585-0682

Lab-mix dog, 8 months old, to good home. 586-2994

Found

Found a silver bracelet in the parking lot of 4202 on May 14

Shuttle Buddies to meet May 26

The Shuttle Buddies will meet at 8:30 a.m. May 26 at Mullins Restaurant on Andrew Jackson Way. For more information, call Deemer Self at 881-7757.

Progress docks to International Space Station

From www.nasa.gov

A new Progress cargo carrier docked to the Earth-facing port of the International Space Station's Zarya module at 4:39 p.m. CDT May 16 with more than 2.3 tons of fuel, oxygen, air, water, propellant and other supplies and equipment aboard.

The station's 29th Progress unpiloted spacecraft brings to the orbiting laboratory more than 770 pounds of propellant, more than 100 pounds of oxygen and air, about 925 pounds of water and 2,850 pounds of dry cargo. Total cargo weight is 4,657 pounds.

Progress 29 launched from the Baikonur Cosmodrome in Kazakhstan on May 14, at 3:22 p.m. It replaces the trash-filled Progress 28 which was undocked from Pirs on April 7 and destroyed on re-entry.

Progress 29 used the automated Kurs system to dock to the station. Expedition 17 Commander Sergei Volkov was at the manual TORU docking system controls, should his intervention have become necessary.

Once Expedition 17 crew members have unloaded the cargo, Progress 29 will be filled with trash and station discards. It will be undocked from the station and like its predecessors deorbited to burn in the Earth's atmosphere.

NASA TV

A NASA TV view of the Progress 29 cargo carrier as it approaches the International Space Station for docking.

The Progress is similar in appearance and design to the Soyuz spacecraft, which brings crew members to the station, serves as a lifeboat and returns the astronauts to Earth.

Obituaries

Aubrie Bowling, 76, of Huntsville died May 3. He retired from the Marshall Center in 1992 as a contract specialist.

Louie Lofton, 67, of Madison died May 6. He retired from the Marshall Center in 1999 as an aerospace engineer. He is survived by his wife, Martha Allen Lofton.

Walter Stafford, 77, of Huntsville died May 10. He retired from the Marshall Center in 1981 as an engineering technician. He is survived by his wife, Doris Stafford.

Jenny Adams, 53, of Huntsville died May 19. She was a program analyst in the Program, Planning & Control Office in Ares Projects.

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