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256-544-0030  
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Manager of Public and Employee Communications: Dom Amatore  
Editor: Jenalane Rowe

## Joan A. Singer Named Manager of the Flight Programs and Partnerships Office at Marshall

On June 11, Marshall Space Flight Center Director Patrick Scheuermann named Joan (Jody) A. Singer manager of the Flight Programs and Partnerships Office (FPPO) at the Marshall Center.

As Flight Programs and Partnerships Office manager, Singer is responsible for overall management and direction of the office, including an annual budget of \$108 million and a combined workforce of over 500 civil servants and contractors. She holds primary responsibility for managing the



Jody Singer (NASA/MSFC)

*See Singer on page 6*

## TVA Government and Valley Relations Congressional Group Visit Marshall Center



*Tim Vaughn of the Materials & Processes Laboratory at NASA's Marshall Space Flight Center spoke to the Tennessee Valley Government and Valley Relations Congressional group during a tour of Marshall on June 5. In Building 4755, Vaughn, far right, provided the group highlights of the capabilities of friction stir welding and its uses for manufacturing hardware at Marshall. The group also toured Redstone Arsenal facilities. (NASA/MSFC/Ray Downward)*

# Production of Key Equipment Paves Way for NASA SLS RS-25 Testing

By Megan Davidson

NASA plans to begin testing RS-25 engines for its new Space Launch System (SLS) in the fall of 2014, and the agency's Stennis Space Center has a very big -- literally -- item to complete on the preparation checklist.

Fabrication recently began at Stennis on a new 7,755-pound thrust frame adapter for the A-1 test stand to enable testing of the engines that will provide core-stage power for SLS -- NASA's heavy-lift rocket that will provide an entirely new capability for human exploration and send humans in NASA's Orion spacecraft into deep space. The stand component is scheduled to be completed and installed by November 2013.

"This piece is, literally, a big part of the transition of the test stand to support the core stage engine testing needed for the SLS program," said Mike Kynard, manager of the SLS Liquid Engines Office at NASA's Marshall Space Flight Center. "Stennis is making great strides in preparation for RS-25 testing of the A-1 test stand and doing this in an innovative manner. We are excited about getting the data from these tests so that we can ensure the RS25s are ready to support the SLS missions."

"We initially thought we would have to go offsite to have the equipment built," said Gary Benton, RS-25 test project manager at Stennis. "However, the Stennis design team figured out a way to build it here with resulting cost and schedule savings. It's a big project and a critical one to ensure we obtain accurate data during engine testing."

Each rocket engine type requires a thrust frame adapter unique to its specifications. On the test stand, the adapter is attached to the thrust measurement system. A rocket engine then is attached to the adapter, which must hold the engine in place and absorb the thrust produced during a test, while allowing accurate measurement of the engine performance.

The J-2X equipment installed on the A-1 test stand now cannot be used to test RS-25 engines since it does not match the engine specifications and thrust requirements. The stand will be re-fitted with facility equipment to run RS-25. Equipment from Space Shuttle Main Engine (SSME) testing days will be used where practical, but



*Fabrication is underway on a 7,755-pound thrust frame adapter to be installed on the A-1 test stand at NASA's Stennis Space Center. The new adapter is needed to enable testing of RS-25 rocket engines, which will be used to provide core-stage power for NASA's new Space Launch System. (NASA/Stennis)*

some new facility equipment will be necessary.

"New facility propellant lines are needed to accommodate higher SLS propellant inlet conditions as well as a new thrust takeout structure that fits with the modern thrust measurement system installed since SSME testing ended on A-1," said Kynard.

NASA and the Lockheed Martin Test Operations Contract team worked together in designing the new adapter to make sure such requirements were met. They also communicated closely with the Jacobs Technology welding and machine shop teams to make sure what was being designed actually could be built.

The design had to account for a number of considerations, such as specific stresses on the equipment as an engine is fired and then gimballed, or rotated, during a test; what type and strength of bolts are needed to fully secure the equipment; and what materials can be used to build the adapter.

The fabrication process itself involves handling and shaping large segments of certain material, which required welders to receive specialized training. In addition, shop personnel had to create a welding procedure for dealing with the chosen construction material. For instance, the area of material being welded must maintain a heat of 300 degrees in order to ensure welds bond properly.

Physically, the adapter is the largest facility item on the  
*See SLS RS-25 Testing on page 5*

# NASA Awards Sample Return Robot Centennial Challenge Prize

By Janet Sudnik

After two days of extensive competition, Team Survey of Los Angeles was awarded \$5,000 in prize money after successfully completing Level 1 of the Sample Return Robot Challenge, a part of NASA's Centennial Challenges prize program.

The event, hosted by Worcester Polytechnic Institute (WPI) June 5-7 in Worcester, Mass., drew robotics teams from the United States, Canada and Estonia to compete for a total of \$1.5 million in NASA prize money. Eleven teams arrived to compete at WPI; 10 teams passed the initial inspection and took to the challenge field. After two rounds of Level 1 competition, Team Survey met the \$5,000 prize requirements and was declared the winner of this year's competition.

Team Survey members Jascha Little, Russel Howe, Zac Lizer, Tommy Smith, Zoe Stephenson, Scott Little, Brandon Booth and Joanna Balme, all from Los Angeles, were presented a check June 8 by NASA's Larry Cooper, Centennial Challenges program executive, at the opening of the TouchTomorrow technology festival. A WPI-organized science and robotics festival attracted thousands of attendees, showcasing the teams and robots as well as NASA and WPI exhibits in science, robotics and space technology.



A NASA Centennial Challenges first-prize, level 1 check is presented to team Survey for successfully completing level 1 of the NASA 2013 Sample Return Robot Challenge. (NASA/Bill Ingalls)

“It is evident from the level of improvements the teams have shown from last year’s event to this week’s Level 1 win that the technology has significantly progressed and the desired results of this challenge are within reach,” said Sam Ortega, program manager of Centennial Challenges, which is managed out of NASA’s Marshall Space Flight Center. “We are so proud of the great spirit and camaraderie the teams have shown, as well. It speaks volumes about the caliber of teams and individuals who compete in these events.”

See *Robot Challenge* on [page 5](#)

## Marshall Team to ‘Take Our Children to Work’ June 20

NASA’s Marshall Space Flight Center will hold its annual “Take Our Children to Work Day” June 20, with a variety of hands-on learning activities, demonstrations and participatory events scheduled from 8 a.m. to 2:30 p.m.

Children in grades 3-12 are invited to participate. Each child [must be preregistered](#) for the event; registration closes June 18 at noon.

Shuttle buses will be available to transport children and parents to activities around the center.

A complete roster of events is [available online](#); team members are encouraged to sign up children early for activities with limited spaces. The page also includes a centerwide bus schedule, badging and access information and other details.

For more information, contact Abbie Johnson at 544-0014 or [abbie.j.johnson@nasa.gov](mailto:abbie.j.johnson@nasa.gov). Read the June 19 issue of The Marshall Star for more details about the day’s events.

# Marshall Partners with Made in Space for 3D Printing Experiment

*From NASA Press Release*

To prepare for a future where parts can be printed on-demand in space, NASA's Marshall Space Flight Center and 3D printing firm Made in Space, Inc. of Mountain View, Calif., have partnered to launch the first 3D printing experiment to the International Space Station to demonstrate making 3D printed plastic parts in long-term microgravity.

If successful, the 3-D Printing in Zero G Experiment (3-D Print) will be the first device to manufacture parts in space. 3-D Print will use extrusion additive manufacturing, which builds objects, layer-by-layer, out of polymers and other materials. The 3-D Print hardware is scheduled to be certified and ready for launch to the space station next year.

"As NASA ventures further into space, whether redirecting an asteroid or sending humans to Mars, we'll need transformative technology to reduce cargo weight and volume," NASA Administrator Charles Bolden said during a recent tour of the agency's Ames Research Center at Moffett Field, Calif. "In the future, perhaps astronauts will be able to print the tools or components they need while in space."

NASA is a government leader in 3-D printing for engineering applications. The technology holds tremendous potential for future space exploration. One day, 3-D printing may allow an entire spacecraft to be manufactured in space, eliminating design constraints caused by the challenges and mass constraints of launching from Earth. This same technology may help revolutionize American manufacturing and benefit U.S. industries.

"The president's Advanced Manufacturing Initiative cites additive manufacturing, or '3-D printing,' as one of the key technologies that will keep U.S. companies competitive and maintain world leadership in our new global technology economy," said Michael Gazarik, NASA's associate administrator for space technology in Washington. "We're taking that technology to new heights, by working with Made in Space to test 3-D printing aboard the space station. Taking advantage of our orbiting national laboratory, we'll be able to test

new manufacturing techniques that benefit our astronauts and America's technology development pipeline."

In addition to manufacturing spacecraft designs in orbit, 3-D printers also could work with robotic systems to create tools and habitats needed for human missions to Mars and other planetary destinations. Housing and laboratories could be fabricated by robots using printed building blocks that take advantage of in-situ resources, such as soil or minerals. Astronauts on long-duration space missions also could print and recycle tools as they are needed, saving mass, volume and resources.

"The 3-D Print experiment with NASA is a step towards the future," said Aaron Kemmer, CEO of Made in Space. "The ability to 3-D print parts and tools on demand greatly increases the reliability and safety of space missions while also dropping the cost by orders of magnitude. The first printers will start by building test items, such as computer component boards, and will then build a broad range of parts, such as tools and science equipment."

Made in Space previously partnered with NASA through the agency's Flight Opportunities Program to test its prototype 3D Print additive manufacturing equipment on suborbital simulated microgravity flights. NASA's Flight Opportunities Program offers businesses and researchers the ability to fly new technologies to the edge of space and back for testing before launching them into the harsh space environment.

For this mission, Made in Space was awarded a Phase III small business innovation and research contract from the Marshall Center. After flight certification, NASA plans to ship 3-D Print to the space station aboard an American commercial resupply mission. NASA is working with American industry to develop commercially provided U.S. spacecraft and launch vehicles for delivery of cargo -- and eventually crew -- to the International Space Station.

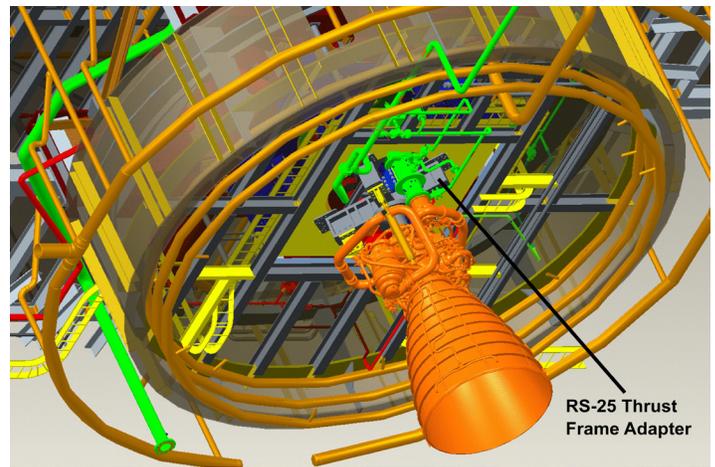
## SLS RS-25 Testing *Continued from page 2*

preparation checklist for RS-25 testing, but it is far from the only one, Benton said. Additional modifications will be made to the test stand configuration and equipment once J-2X gimbal testing is complete this summer.

Once testing begins, engineers and test team personnel at Stennis will draw on a wealth of engine testing experience. The RS-25 engines, previously known as the space shuttle main engines, were tested at Stennis for more than three decades.

The SLS Program is managed at the Marshall Center. For information about NASA's SLS Program, visit: [www.nasa.gov/sls/](http://www.nasa.gov/sls/).

*Davidson, an Analytical Services Inc. employee, supports the Office of Strategic Analysis & Communications.*



*This design image shows a RS-25 rocket engine installed on the A-1 test stand at Stennis. A line indicates the grey, cross-like thrust frame adapter, which is being fabricated for the stand. The adapter is attached to the thrust measurement system on the stand, and the RS-25 engine is attached to the adapter. The adapter holds the engine in place and absorbs the thrust produced during a test, while allowing accurate measurement of the engine performance. (NASA/Stennis)*

## Robot Challenge *Continued from page 3*

NASA uses prize competitions to increase the number and diversity of the individuals, organizations and teams that are addressing a particular problem or challenge. Prize competitions stimulate private sector investment that is many times greater than the cash value of the prize and further NASA's mission by attracting interest and attention to a defined technical objective.

To win prize dollars, teams were required to demonstrate a robot that can locate and collect samples from a wide and varied terrain, operating without human control. The objective of the challenge was to encourage innovations in autonomous navigation and robotics technologies.

Team Survey's robot successfully completed Level 1 by navigating from the starting platform and locating a sample that was previously identified in the robot's onboard computer. The robot then autonomously returned one undamaged sample to its starting platform within the 30-minute time limit. No teams made it to the second level of the competition this

year.

Returning teams this year included SpacePRIDE of Graniteville, S.C.; Survey of Los Angeles; Wunderkammer of Topanga, Calif.; Intrepid of Lynnwood, Wash.; and the University of Waterloo in Ontario, Canada. New teams entering the competition this year were Fetch of Alexandria, Va.; Middleman of Dunedin, Fla.; Mystic Lake Robots of The Woodlands, Texas; Team AERO of Worcester, Mass.; the Autonomous Rover Team of the University of California at Santa Cruz; and Kuukuglur of Estonia.

NASA's Centennial Challenges program is part of the agency's Space Technology Mission Directorate, which is innovating, developing, testing and flying hardware for use in NASA's future missions. For more information about the Space Technology Mission Directorate and the Centennial Challenges Program, visit: <http://www.nasa.gov/spacetech>.

*Sudnik, an Analytical Services Inc. employee, supports the Office of Strategic Analysis & Communications.*

## SLS Boosters Centered on Qualification Test

The center aft segment for qualification motor-1 (QM-1), a full-scale version of a solid rocket motor for the Space Launch System (SLS), was transported May 29 from a manufacturing area to its test area at ATK's facility in Promontory, Utah. SLS is an advanced heavy-lift launch vehicle that will provide an entirely new national capability for human exploration beyond Earth's orbit.

The center aft piece will be integrated with the other booster segments in preparation for a test firing of QM-1, scheduled for late 2013. The five-segment booster is the largest, most powerful solid rocket booster ever built for flight.

The SLS Program is managed at NASA's Marshall Space



Photo Credit: ATK

Flight Center. ATK is the prime contractor for the boosters. The booster development is on track to support SLS's first flight in 2017.

### **Singer** *Continued from page 1*

implementation of the center's work portfolio in the areas of human exploration projects and tasks; flight mission programs and projects; and International Space Station integration and operations. The office also identifies opportunities to develop and maintain partnerships with other government agencies and international and commercial partners that will help achieve NASA's vision.

Since 2011, Singer has served as the deputy manager of the Space Launch System (SLS) Program where she was responsible for the initial establishment and staffing of the office and the successful completion of significant acquisition and programmatic milestones, including the Systems Requirements Review, Systems Design Review, Key Decision Point B, and critical progress toward the Preliminary Design Review scheduled for July 2013. As the SLS deputy program manager, she was responsible for the overall design, development and production of the SLS elements, a combined workforce of almost 3,000 civil servants and contractors, and an annual budget of over \$1.3 billion.

Prior to this assignment, from 2007 to 2011, Singer served as deputy manager of Marshall's Space Shuttle Propulsion Office, where she helped lead the organization responsible for manufacturing, assembling and operating all shuttle propulsion elements, including the successful fly-out of the Space Shuttle Program. In addition to her role as the space shuttle deputy

manager, in March 2010, she assumed a dual role as deputy manager of the Ares Projects Office. From 2002 to 2007, she was manager of the Reusable Solid Rocket Booster Project Office, where she oversaw the work of several hundred NASA and contractor engineers and technicians responsible for the flight safety, performance, hardware integrity and the ground test program of the shuttle's reusable solid rocket booster hardware. During this tenure, she was responsible for critical return-to-flight activities for the booster program after the Columbia incident. In addition to these responsibilities in the human spaceflight program, Singer served as the assistant manager of the Shuttle Propulsion Office; and in other leadership positions within the External Tank Project Office, including deputy manager and business manager; and as a subsystem engineer in the Space Shuttle Main Engine Project Office.

Singer began her NASA career at the Marshall Center in 1985 in the professional intern program as an engineer in the Program Development Office. She earned a bachelor's degree in industrial engineering from the University of Alabama in Tuscaloosa. Her dedication and commitment to NASA have been recognized with many awards during her NASA career, including a Meritorious Presidential Rank Award -- the second-highest award given to career Senior Executive Service members. She has received two NASA Outstanding Leadership medals, a NASA Exceptional Service Medal, a Space Flight Awareness Award and a Silver Snoopy Award.

# Sunshine, Music, Camaraderie Mark Annual Marshall Picnic



*Dan Schumacher, manager of Marshall's Science & Technology Office, was among the hardy group of center leaders who volunteered to brave the dunking tank during the event. The picnic also included carnival midway games and other entertainment for kids and adults, and a variety of sports challenges - including volleyball and softball tournaments - hosted by various Marshall athletic clubs. (NASA/MSFC/Fred Deaton)*

*Ron Cantrell, quality assurance team lead in Marshall's Safety & Mission Assurance Directorate, assists his granddaughters Lauren Pierce, on his lap, and Carolyn Porter, left, with their bingo cards during the picnic. Lauren's mother is Allison Pierce, a budget analyst in Marshall's Office of Strategic Analysis & Communications. (NASA/MSFC/Fred Deaton)*



*The Huntsville-area rock band Back Road Sinners was among several local music acts that performed throughout the day's activities, courtesy of the MARS Music Club. (NASA/MSFC/Fred Deaton)*

*Children of NASA's Marshall Space Flight Center team members play under sunny skies at the annual Marshall Center Employee Family Picnic, held June 8 at the center. The picnic was organized and sponsored by the Marshall Exchange, with support from center directorates and clubs. (NASA/MSFC/Fred Deaton)*



*Willie Love, center, assistant director of the Office of Diversity & Equal Opportunity at Marshall, thanks Brian Garner, left, and Justin Greys, employees of Summer Fun Entertainment Services, which provided concessions for the event. Lunch was catered by Lawler's Barbecue for all Marshall team members and their families who purchased tickets. (NASA/MSFC/Fred Deaton)*