The Marshall Star

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Engineers Test NASA's SLS Booster Forward Skirt to the Limits

By Megan Davidson

A critical connection between NASA's new rocket, the Space Launch System (SLS), and its twin solid rocket boosters that will help it get to space proved it could withstand millions of pounds of launch stress during a series of ground tests that ended May 20.

The booster forward skirt, which houses the electronics responsible for igniting, steering and jettisoning the two five-segment boosters and carries most of the forces acting on the boosters during launch, is one of two places at the top and bottom of the booster where it is attached by struts to the SLS core stage. The core stage, towering more than 200 feet tall with a diameter of 27.6 feet, will store cryogenic liquid hydrogen and liquid oxygen that will feed the vehicle's RS-25 engines.

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NASA Names Initial Winners in Student Launch Rocket Competition

By Rick Smith

The 2013-14 NASA Student Launch rocketry challenge has come to an end -- and brought something new to the Bonneville Salt Flats in Tooele County, Utah, where car and motorcycle enthusiasts regularly watch cutting-edge vehicles put to the test, speeding across the vast, flat expanse.

On May 17, all eyes there turned upward as 16 student-built rockets, ranging in size from 7-1/2 feet to 15 feet,

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A student-built rocket lifts off -- one of 16 that flew during the "launchfest" that concluded the 2013-14 NASA Student Launch rocketry competition. (MSFC/Dusty Hood)

SLS Booster Forward Skirt *Continued from page 1*

When completed, SLS will be capable of taking a crew and cargo on deep space missions, including to an asteroid and eventually Mars.

The five-segment boosters used during the launch of SLS will be the world's largest solid propellant rockets, measuring 177 feet long and 12 feet in diameter. ATK of Promontory, Utah, is the prime contractor for the boosters.

Loads on the hardware are forces -- primarily driven by mass and vehicle acceleration -- applied at different points on the vehicle. Structural loads tests are performed to ensure each piece of hardware can endure loads without any adverse effects to the vehicle, or most importantly, to the crew.

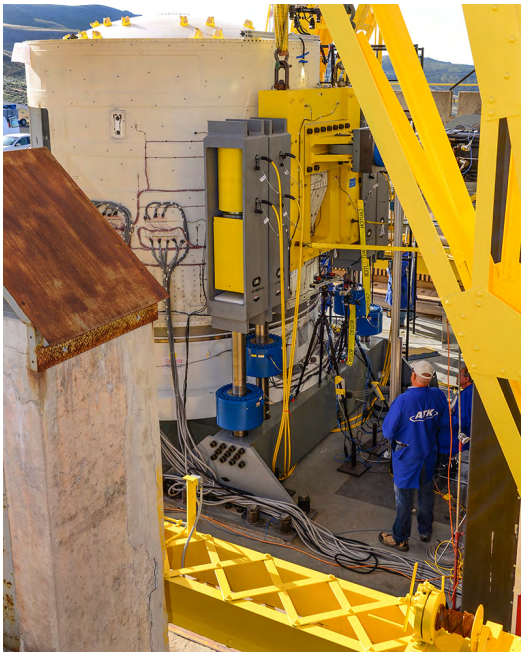
For the forward skirt test, conducted at ATK's facility in Promontory, engineers used increments of force -- about 200,000 pounds per minute -- to prove the design capabilities meet the strength requirements, with sufficient margin. The structure was also subjected to a combination of axial and lateral loads, which are critical at liftoff.

"Data will be reviewed over the coming weeks," said Brian Pung, SLS booster structures & assembly team lead at NASA's Marshall Space Flight Center, where the SLS Program is managed. "We are very pleased with the initial results. Completion of this test brings us closer to use of this heritage hardware on SLS."

The team intentionally took the hardware beyond required margins -- not typical for structural loads testing on this scale.

"Attempting to take a structure of this size to failure is somewhat unique for structural testing," said Shane Canerday, forward assembly subsystem manager at the Marshall Center. "We want to know the exact amount of force the hardware can take to address capability differences that may exist across the fleet of heritage forward skirts."

The SLS 70-metric-ton (77 ton) initial configuration will launch an uncrewed Orion spacecraft to demonstrate the integrated system performance of the SLS rocket and spacecraft prior to a crewed flight. The massive 130-metric-ton configuration will be the most capable, powerful launch vehicle in history for crewed, longer duration missions.



NASA and ATK engineers complete structural loads testing on the Space Launch System (SLS) booster forward skirt at ATK's facility in Promontory, Utah. Structural loads tests are performed to ensure each piece of hardware can endure loads without any adverse effects to the vehicle, or most importantly, to the crew. (ATK)

To watch a video about the forward skirt test, click here.

Davidson, an ASRC Federal/Analytical Services employee, supports the Office of Strategic Analysis & Communications.

Student Launch *Continued from page 1*

soared high into the cloudless blue. Each sophisticated machine carried three working science or engineering payloads. Some roared to altitudes of nearly 20,000 feet. The roughly 250 student participants and some 500 spectators cheered and applauded each successful parachute deployment and vehicle touchdown on the bright white hardpan.

The social media audience, watching live coverage on NASA Television and UStream and following real-time updates on Twitter, was equally jovial. One proud father, whose son was part of the team from Mississippi State University in Starkville, summed up the day's launches on the NASA Student Launch Facebook page: "This is awesome!"

This was the first year the challenge was held at the Utah site. It is organized annually by NASA's Marshall Space Flight Center and sponsored by ATK Aerospace Group of Magna, Utah.

Teams designed and built their rockets and experiments beginning in the fall of 2013. They maintained websites to document their experience and visited elementary and middle schools in their communities to inspire younger students to pursue the study of technical subjects critical to the work of NASA and the nation.

Nine preliminary awards were presented at a post-launch banquet May 17. The grand prize -- $5,000 from ATK -- will be awarded in late May after final post-flight analysis and reviews are complete. This year's preliminary awards included:

- **Best Vehicle Design**: The University of North Carolina in Charlotte received the award for the most creative, innovative, safety-conscious rocket design.
- **Best Payload Design**: The University of Notre Dame in South Bend, Indiana, won the award for the most creative and innovative payload experiment, emphasizing safety and scientific value.
- **Best Web Design**: Vanderbilt University in Nashville, Tennessee, won for the best rocketry website.
- **Project Review Award**: Vanderbilt University was honored for delivering the best combination of written preliminary design, critical design and flight readiness reviews and formal presentations.
- **Education Engagement Award**: Vanderbilt University won for inspiring the study of rocketry and STEM-related topics -- science, technology, engineering and mathematics -- among younger students and their community.
- **Closest to Altitude Award**: The team from Vanderbilt University won when their rocket came closest to their goal altitude without going over. Their rocket reached an altitude of 4,850 feet -- just 150 feet shy of their 5,000-foot goal.
- **Safety Award**: The University of Louisville in Louisville, Kentucky, was honored for having the best safety practices.
- **Peer Awards**: All rocket teams submitted votes for peer awards in each division. The "Best-Looking Rocket" award went to the team from the University of Hawaii Community Colleges in Kane'ohe. The "Best Team Spirit" prize was awarded to the team representing the University of Florida in Gainesville.

Approximately 250 student participants and some 500 spectators crowd the viewing area May 17 at Utah's Bonneville Salt Flats. (MSFC/Dusty Hood)

A successfully flown rocket awaits retrieval by its student builders. (ATK/Justin Loeloff)

The Marshall Center's Academic Affairs Office, part of the Office of Human Capital, has managed the rocketry challenge since its creation in 2000. This is the seventh year ATK has provided corporate sponsorship. The National Association of Rocketry supported launch readiness reviews and range safety.

Archived launch-day coverage is available on UStream.

Smith, an ASRC Federal/Analytical Services employee, supports the Office of Strategic Analysis & Communications.

Flying Saucers All in a Day's Work for Marshall Center's Carole McLemore

By Shannon Ridinger

Carole McLemore has had some incredible experiences during her 29 years at NASA's Marshall Space Flight Center. Her most recent project, NASA's Low Density Supersonic Decelerator (LDSD) is no different. This rocket-powered, saucer-shaped test vehicle is testing new deceleration capabilities that could allow safe and more accurate landings of heavier spacecraft on planets with thin atmospheres like Mars.

Carole McLemore stands in the middle of the Supersonic Inflatable Aerodynamic Decelerator test article that will be flown on the LDSD flight. (NASA/JPL)

McLemore is the mission manager for LDSD, which is a Technology Demonstration Mission (TDM) project. In this role, McLemore interfaces with project representatives at NASA's Jet Propulsion Laboratory on a daily basis. She works with the program office for TDM at the Marshall Center, and with Space Technology Mission Directorate managers at NASA Headquarters on needs, issues and risks to ensure the project has the best possible chance to accomplish its mission.

"Future missions to Mars, whether robotic or human, will require massive payloads," said McLemore. "To be able to accommodate them, we need technologies that can slow large, heavy equipment and landers entering the Martian atmosphere from supersonic speeds. Low-density supersonic decelerators can help us solve this problem by using atmospheric drag to slow down heavy vehicles."

McLemore's career has definitely been a full one. She's been the systems analysis and integration lead for the Space Shuttle Program, helping to process scientific payloads, the project manager for multiple International Space Station (ISS) projects, and led the In Situ Resource Utilization/Fabrication and Repair project that included developing a lunar regolith simulant for engineering and scientific research. She's done everything from attending shuttle launches to traveling a mile underground into a Montana mine searching for geological material to make lunar regolith simulants. She says working on LDSD has been a great experience, and she's very excited about the knowledge the team will gain on deceleration capabilities from the project.

"Currently, we are using technology that dates back to NASA's Viking program from the '70s to decelerate payloads," said McLemore. "These new drag devices are the first steps to potentially landing humans and payloads on Mars that far outweigh previous missions' capabilities."

During an experimental flight test for LDSD scheduled in June, a large balloon about the size of three football fields will carry the saucer-shaped test vehicle from the U.S. Navy's Pacific Missile Range Facility in Kauai, Hawaii, to an altitude of about 120,000 feet. It will then be dropped and its booster rocket will quickly kick in and propel it to 180,000 feet, reaching Mach 4. Once in the very thin air high above the Pacific, the Supersonic Inflatable Aerodynamic Decelerator -- the world's largest deceleration device -- will deploy, inflate and slow the vehicle.

A short time later the second deceleration device, a 30.5 meter parachute -- the world's largest supersonic parachute, at double the size of one used on the recent Mars Science Laboratory mission -- will deploy and slow the vehicle down further before landing in the ocean.

The experimental flight will be the first of three, with the others tentatively scheduled for 2015. The flight dynamics data will be collected via a number of instruments and will then be analyzed and applied to future test flights.

Part of facing challenges means taking calculated risks,

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Marshall and Team Redstone Sign Collaborative Agreement in Additive Manufacturing

NASA's Marshall Space Flight Center and the U.S. Army Aviation and Missile Research Development and Engineering Center (AMRDEC) recently signed a collaborative agreement to share knowledge and resources to encourage development of additive manufacturing technologies.

The specific objectives of the agreement are to increase awareness of additive manufacturing capabilities across Team Redstone; identify important research and development needs of the defense and space communities; and recognize areas of potential collaboration between team members that could generate significant advances in additive manufacturing technologies.

"Additive manufacturing is a step toward the future," said Dr. Dale Thomas, associate director, technical, of Marshall Center. "It is changing the way organizations design and manufacture products around the world, and space is one of the key places where humanity will see the impact of this technology."

Additive manufacturing -- often referred to as "3D printing" -- is a process by which digital design data is used to build up a part by depositing successive layers upon layers. Parts can be manufactured using liquids, powders, paper or sheet material.

"Teaming with NASA Marshall and other partners, AMRDEC will investigate procurements of additive manufacturing machines to support our research needs," said James Lackey, acting director of AMRDEC. "When you come to learn and appreciate the potential of additive manufacturing, it's hard not to judge this as a true game-changer -- one that will ultimately have far-reaching, historical impacts onto our society at-large."

Dale Thomas, left, Marshall Center's associate director, technical, and James Lackey, acting director of the U.S. Army Aviation and Missile Research Development and Engineering Center, sign an agreement to establish an additive manufacturing integrated product team for research and development efforts. (NASA/MSFC/Emmett Given)

The additive manufacturing agreement was facilitated by Phil Farrington, professor of industrial and systems engineering and engineering management at the University of Alabama in Huntsville. "This effort continues a long tradition of collaboration between the AMRDEC and Marshall. This exciting new technology has the potential to radically change the way we manufacture aerospace and defense systems," said Farrington.

McLemore *Continued from page 4*

and the LDSD experimental flight test is certainly no different. McLemore said there is no guarantee that the first test will be successful, but the LDSD team will learn a great deal, no matter what the outcome.

"You can't do the extremely complex and complicated work we do and not expect to have challenges and failures," said McLemore. "This is why we test technologies like LDSD, because we know that even if the result is not exactly what we expect, we will take what we learn and use it to make ourselves and our project better."

Find more information about LDSD here.

Ridinger is a public affairs officer in the Office of Strategic Analysis & Communications.

Trumpeting Achievements

Astronaut Michael Hopkins, right, and Grammy Award winner Irvin Mayfield Jr. pose during a special event for employees at Michoud Assembly Facility on May 8. Hopkins spoke about his 166 days aboard the International Space Station with Expedition 37/38, taking two spacewalks, exercising in microgravity, his return to Earth in March and more. The space talk was followed by a concert featuring Mayfield and the New Orleans Jazz Orchestra. (NASA/Michoud Assembly Facility/Eric Bordelon)

Obituaries

Joseph "Joe" R. Dabbs, 79, of Nashville, Tennessee, died May 4. He retired from the Marshall Center in 1995 as an aerospace engineer.

Zack Thompson, 82, of Huntsville, died May 6. He retired from the Marshall Center in 1986 as an aerospace engineer. He is survived by his wife, Betty Thompson.

Benton E. "Jack" Phelps Jr., 94, of Elkton, Tennessee, died May 11. He retired from the Marshall Center in 1979 as a financial manager. He is survived by his wife, Geraldine Phelps.

John Ervin Phillips, 89, of Huntsville, died May 12. He retired from the Marshall Center in 1974 as a production controller. He is survived by his wife, Fannie Phillips.