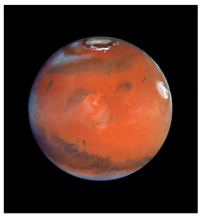
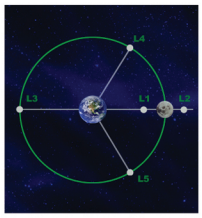
National Aeronautics and Space Administration

Space Launch System
Highlights

June 2013





SLS Program Kicks Off Preliminary Design Review

NASA kicked off the preliminary design review June 18-19 for its Space Launch System (SLS) Program. This major program assessment will allow development of SLS to move from concept to initial design of the launch vehicle.

"The preliminary design review is incredibly important, as it demonstrates the SLS design meets all system requirements within acceptable risk constraints, giving us the green light for proceeding with the detailed design," said Todd May, manager of the SLS Program at NASA's Marshall Space Flight Center. "We are on track and meeting all the milestones necessary to fly in 2017."

The preliminary design review process includes meticulous, detailed analyses of the entire launch vehicle. Representatives from NASA, its contractor partners, and experts from across the aerospace industry validate elements of the rocket to ensure they can be safely and successfully integrated.

The review process will take several weeks and is expected to conclude this summer.

Todd May, left, manager of the SLS Program at NASA's Marshall Space Flight Center in Huntsville, Ala., discusses the rocket's specifications with LeRoy Cain, who heads the independent standing review board for SLS, during the SLS Program's preliminary design review. *(Image: NASA/MSFC)*

SLS Work Forges Ahead at Key NASA Facilities

NASA officials unveiled a new Vertical Weld Center on June 21 at the Agency's Michoud Assembly Facility—furthering progress on production of the Space Launch System.

(continued on page 2)

SLS Work Forges Ahead

(*continued from page 1)*

NASA, Boeing, and government officials—including William Gerstenmaier, NASA associate administrator for Human Exploration and Operations, at center, cutting the ribbon—celebrated the unveiling of the Vertical Weld Center at Michoud. *(Image: NASA/MAF)*

Among those taking part in the ribbon cutting for the new tool were William Gerstenmaier, NASA associate administrator for Human Exploration and Operations; Dan Dumbacher, deputy associate administrator for Exploration Systems Development; Patrick Scheuermann, NASA Marshall Space Flight Center director; Roy Malone, Michoud Assembly Facility director; Todd May, Space Launch System Program manager at the Marshall Center; and other officials from NASA and The Boeing Company.

The Vertical Weld Center will weld barrel panels together to produce whole barrels for SLS's core stage, which will consist of two pressurized tanks, the intertank, the forward skirt, and the aft engine section. The core stage, towering more than 200 feet (61 meters) tall with a diameter of 27.6 feet (8.4 meters), will store cryogenic liquid hydrogen and liquid oxygen that will feed the vehicle's RS-25 engines.

The Vertical Weld Center stands about three stories tall and weighs 150 tons. Boeing is the prime contractor for the SLS core stage, including avionics.

"It seems like a long way away when we talk about 2017 or talk about 2021, but when you think about all the manufacturing work, hardware, and all the systems and design work that needs to come together, it's not that far away," Gerstenmaier said.

At Michoud, Gerstenmaier and Dumbacher saw some of the facility's manufacturing operations, where work is advancing on the SLS and Orion spacecraft programs.

Gerstenmaier, Dumbacher, and other NASA officials also participated in an employee town hall and recognition event at Michoud. Five NASA Silver Snoopy awards—presented by NASA astronaut Ricky Arnold—and two team awards were given to Michoud employees. The Silver Snoopy is awarded for outstanding achievements related to human spaceflight safety or mission success. It is presented by NASA astronauts, as it represents the astronauts' own recognition of excellence.

"When I look out here and see all these faces, all this excitement, I see the team that's going to be putting together that next vehicle that will take us beyond low-Earth orbit, beyond the moon, and that will move humans to places we've never been before," Gerstenmaier said. "Each one of you here in this group will start that foundation and start that movement towards this great, great adventure that we are about ready to go on."

Gerstenmaier and Dumbacher also visited NASA's Stennis Space Center to tour the engine processing facility, which houses the RS-25 SLS core stage engines; the B-2 test stand, which is being restored in preparation for testing of the SLS core stage; and the A-1 test stand, where the J-2X engine E10002 is testing.

Click **here** for a full story about the SLS core stage tools.

Spaceflight Partners: PaR Systems

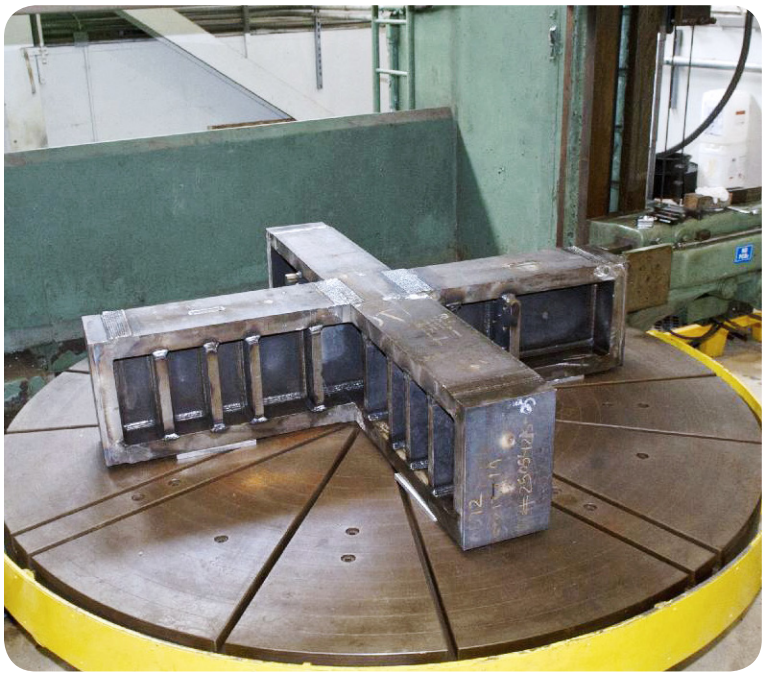
EDITOR'S NOTE: Every month, SLS Highlights turns the spotlight on one of the industry partners helping to create the largest rocket ever built for human space exploration. In this issue, we profile PaR Systems of Shoreview, Minn.

PaR Systems, a custom robotics company, was contracted by The Boeing Company to develop weld tools for the SLS core stage. PaR's advanced manufacturing process will be used to fabricate the barrels, domes, and segmented ring components. The I-STIR Robotic Weld Tool (RWT) also performs many of the welds on Orion.

The I-STIR technology team has installed similar systems for both the SLS and Orion programs at NASA's Marshall Space Flight Center, Michoud Assembly Facility, Johnson Space Center, and Kennedy Space Center to support not only hardware production, but also the critical process development activities.

The Vertical Weld Center at the Michoud Assembly Facility is an I-STIR Robotic Weld Tool, made by PaR Systems. It will be used for welding on the SLS core stage. *(Image: Boeing)*

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



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. *(Image: NASA/Stennis)*

NASA plans to begin testing RS-25 engines for SLS in the fall of 2014, and the agency's Stennis Space Center in Bay St. Louis, Miss., has a very big 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. 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 RS-25s are ready to support the SLS missions."

(continued on page 4)

SLS RS-25 Testing

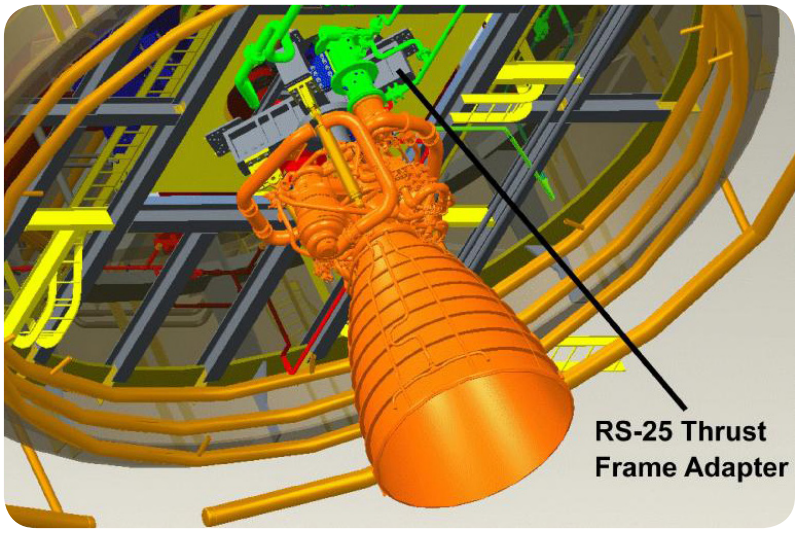
(*continued from page 3)*

Click **here** for the full story on RS-25 testing.

"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.



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. *(Image: NASA/Stennis)*

The stand will be re-fitted with facility equipment to run the RS-25s. Equipment from space shuttle main engine testing days will be used where practical, but 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 space shuttle main engine testing ended on A-1," said Kynard.

NASA, Partner Collaborate on Key Piece of Orion Flight Test Hardware

Technicians from Janicki Industries in Hamilton, Wash., work in collaboration with engineers from NASA's Langley Research Center in Hampton, Va., and NASA's Marshall Space Flight Center to build part of the SLS. Above, they are working on a diaphragm for the Multi-purpose Crew Vehicle Stage Adapter. Joint efforts between NASA and Janicki Industries enable engineers to verify proper functioning of this part of the SLS vehicle with the Orion spacecraft for Exploration Flight Test-1 in 2014. The adapter will attach Orion to the launching rocket, and the diaphragm will be used to keep launch vehicle gases away from the spacecraft. United Launch Alliance, which makes the Delta IV in nearby Decatur, Ala., delivered a full-size section of the rocket June 26 to Marshall, where engineers test fit it with the adapter. *(Image: NASA/Langley)*

A Good Fit: Adapter, Delta IV Rocket Test Article Successfully Connected for Exploration Flight Test-1

It was a good fit for a spacecraft adapter and a Delta IV test article, as two critical elements of EFT-1 were successfully connected during a fit check June 26 at NASA's Marshall Space Flight Center in Huntsville, Ala.

The adapter will join the Orion spacecraft to a United Launch Alliance (ULA) Delta IV rocket which is being constructed at ULA's facility in Decatur, Ala., and will launch Orion on the 2014 flight test.

"Great work is being done in North Alabama in preparation for EFT-1," said Mark Geyer, the Orion Program manager from NASA's Johnson Space Center in Houston. "The capabilities of the Orion spacecraft and SLS launch vehicle will open exciting deep space destinations, including sending humans to an asteroid, and ultimately sending humans to Mars."

The adapter weighs about 1,000 pounds and is being designed and built at Marshall. ULA delivered a full-size test section of the rocket in early June specifically for the June 26 adapter fit check.

"The fit check we had [June 26] was successful and gets us even closer to launch," said Kris Walsh, EFT-1 program manager for ULA. "We are thrilled to be a part of the team that is getting Orion ready for its first orbital flight test."

An adapter is lowered onto a ULA Delta IV test article for a fit check June 26 at one of Marshall's testing facilities. *(Image: NASA/MSFC)*

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 SLS, was transported May 29 from a manufacturing area to its test area at ATK's facility in Promontory, Utah. The center aft piece will be integrated with the other 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. *(Image: ATK)*

Former SLS Deputy Jody Singer Named Manager of Marshall's Flight Programs and Partnerships Office

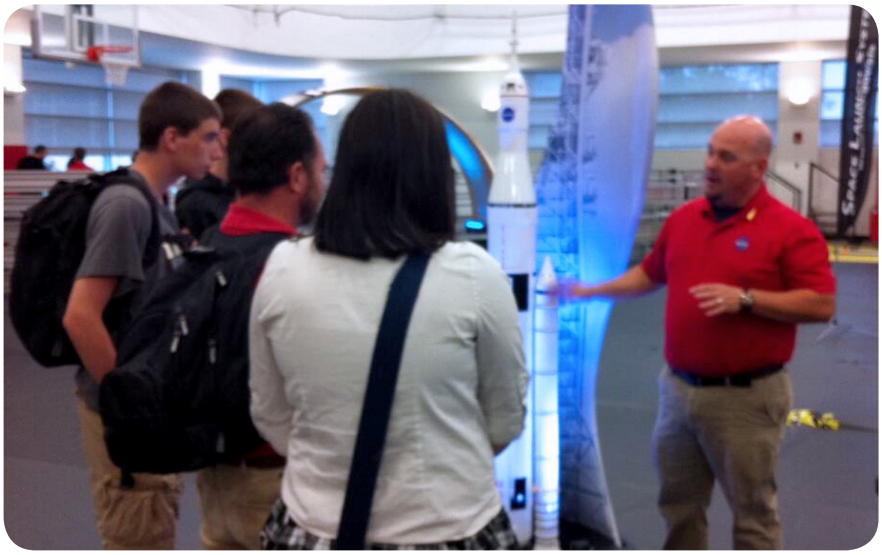
Jody Singer *(Image: NASA/MSFC)*

The former deputy director of the SLS Program at NASA's Marshall Space Flight Center, Jody Singer, was recently named manager of the center's Flight Program and Partnerships Office. Keith Hefner, manager of the Program Planning & Control Office, part of the SLS Program Office at the Marshall Center, will serve as acting SLS deputy director.

Singer served as SLS deputy director from 2011 until her new appointment. 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 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.

SLS On the Road…

Kirk Pierce, far right, a Media Fusion employee supporting the SLS Program Office at NASA's Marshall Space Flight Center, shares fun facts about the rocket with participants at the Sample Return Robot Challenge in Worcester, Mass. The event—held June 5-7 and hosted by Worcester Polytechnic Institute—drew robotics teams from the United States, Canada, and Estonia to compete for a total of $1.5 million in NASA prize money.
(Image: NASA/MSFC)



For more SLS news, updates and resources, visit www.nasa.gov/sls

Follow SLS on:

SLS on Deck:

- SLS PDR Board
- J-2X E10002 Engine Testing
- NASA Technology Day on the Hill
- Joint Propulsion Conference