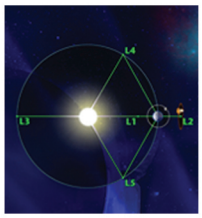
National Aeronautics and
Space Administration

# Space Launch System
Highlights

July 2012



# SLS Passes Major NASA Life-Cycle Review

On July 25, the SLS Program successfully completed a combined System Requirements Review and System Definition Review (SRR/SDR) for NASA. It is now ready to begin preliminary design for a heavy-lift launch vehicle that will carry Americans to new frontiers in space.

The reviews evaluated SLS evolvable vehicle design concepts against technical, performance, cost, and schedule requirements. Program and engineering documentation was examined by technical experts from across NASA, as well as industry consultants. This independent review board confirmed that the program is ready to move out of concept development and into preliminary design for the SLS rocket.

"This new heavy-lift launch vehicle will make it possible for explorers to reach beyond our current limits, to nearby asteroids, Mars and its moons, and to destinations even farther across our solar system," said William Gerstenmaier, associate administrator for the Human Exploration and Operations (HEO) Mission Directorate at NASA Headquarters. "The in-depth assessment confirmed the basic vehicle concepts of the SLS, allowing the team to move forward and start more detailed engineering design."

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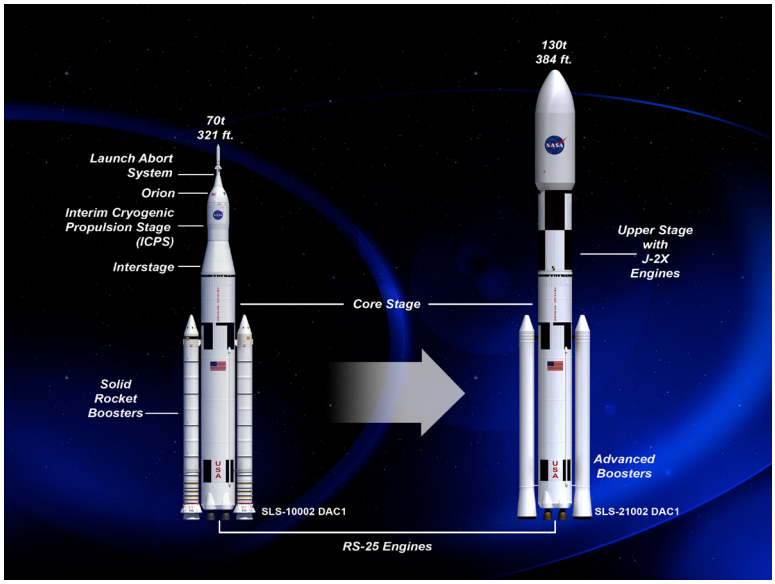


Artist's concept of SLS vehicle configurations. *Credit: NASA/MSFC*

# Risk Reduction Proposals Selected for SLS

NASA has selected six proposals to improve the affordability, reliability, and performance of an advanced booster for the SLS. The initial 70-metric-ton (t) SLS configuration will use boosters similar to the solid rocket boosters that powered the space shuttle to orbit. The evolved SLS vehicle will require an

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# Life-Cycle Review

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Combining the SRR/SDR assessments is just one of many ways that NASA is streamlining processes to provide the nation with a safe, affordable, and sustainable heavy-lift launch vehicle capability. This major milestone was reached less than 10 months after the SLS Program was publicly announced in September 2011. The next major program milestone – the preliminary design review – is targeted for next year.

"This is a pivotal moment for this program and for NASA," noted SLS Program Manager Todd May. "Reaching this key development point in such a short period of time – while following the strict protocol and design standards set by NASA for human spaceflight – is a testament to the team's commitment to delivering the nation's next heavy-lift launch vehicle."

"This is a pivotal moment for this program and for NASA."

Todd May
SLS Program Manager

# Risk Reduction Proposals

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advanced booster with a significant increase in thrust from any existing U.S. liquid or solid boosters.

"The initial SLS heavy-lift rocket begins with the proven hardware, technology, and capabilities we have today and will evolve over time to a more capable launch vehicle through competitive opportunities," said William Gerstenmaier, associate administrator for the HEO Mission Directorate at NASA Headquarters. "While the SLS team is making swift progress on the initial configuration and building a solid baseline, we also are looking ahead to enhance and upgrade future configurations of the heavy-lift vehicle. We want to build a system that will be upgradable and used for decades."

Individual awards will vary, with a total NASA investment of as much as $200 million. The awardees will develop engineering demonstrations and risk reduction concepts. This risk mitigation acquisition precedes the follow-on design, development, testing, and evaluation competition for the SLS advanced booster currently planned for 2015.

"We are building a new national capability to carry astronauts and science experiments beyond Earth orbit to new destinations in space," said Todd May, SLS program manager at Marshall. "Our industry partners have presented a variety of options for reducing risk while increasing performance and affordability, and we're looking forward to seeing their innovative ideas come to life."

## Proposals selected:

Northrop Grumman Aerospace Systems
- Subscale Composite Tank Set

Aerojet General Corporation
- Full-Scale Combustion Stability Demonstration

Dynetics, Inc.
- F-1 Engine Risk Reduction Task
- Main Propulsion System Risk Reduction Task
- Structures Risk Reduction Task

ATK Launch Systems, Inc.
- Integrated Booster Static Test

# Casting Begins for Booster QM-1

On July 16, ATK began casting Booster Qualification Motor 1 (QM-1) in Promontory, Utah. The first element to be cast is the forward segment, which is to be followed by the center/forward segment planned for next month.

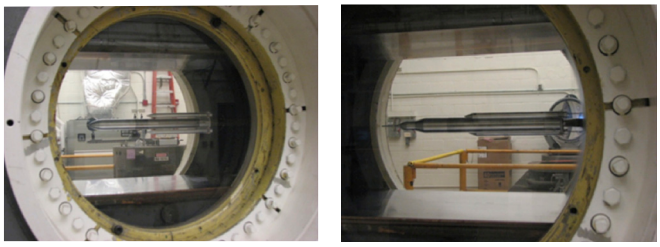
QM-1 is scheduled for static testing next spring. It is the first of two qualification motors that will be processed and static-tested to qualify design and processing for boosters to be used on the initial SLS rocket (70 t). As part of NASA's efforts to develop boosters for the SLS rocket, it represents an investment in high-technology American jobs by engaging an experienced workforce and building on investments already made in critical aerospace technologies and infrastructure.

The QM-1 forward segment is lowered into a casting pit. *Credit: ATK.*

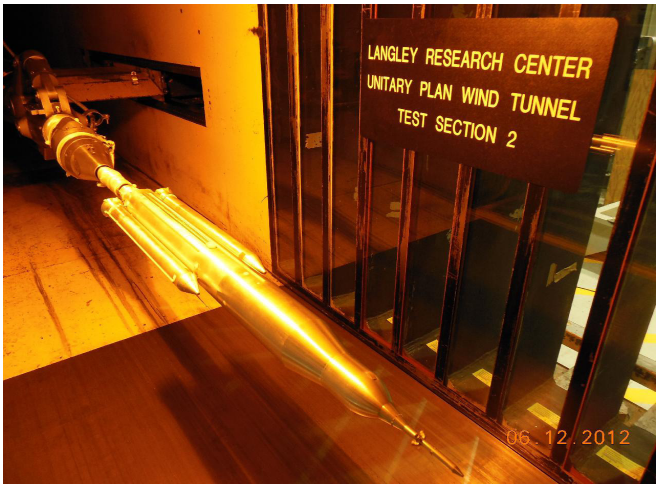
# SLS Completes Early Wind Tunnel Testing

Early wind tunnel testing has been completed at the Tri-Sonic Wind Tunnel at Marshall and the Unitary Plan Wind Tunnel at Langley Research Center (LaRC) for the SLS rocket. Today, new aircraft, spacecraft, and space launch vehicles are built only after their designs and components have been thoroughly tested in wind tunnels, where scale models are used to evaluate the design's performance. Any necessary changes can then be made safely, easily, and inexpensively before the full-scale vehicle is built. These efforts help ensure that the SLS rocket presents an affordable and sustainable backbone for continued U.S. leadership in human space exploration.

The tests evaluated scale models representing different vehicle configurations for crew and cargo. At Marshall, tests were conducted to determine how the designs responded to roll angles and angles of attack at Mach speeds of 0.3 to 5. At Langley, tests were conducted on a larger model, allowing for more detailed modeling of protuberances (e.g., bulges, knobs, and swellings on the outside of the rocket) at high Mach speeds. Both tests are being used to produce a flight database for vehicle guidance and control. These results will also be merged with information gathered during a transonic test to be conducted this fall at Boeing's Poly Sonic Wind Tunnel, which will improve the aerodynamics database as the vehicle design matures.



Wind tunnel testing was conducted at Marshall, using force and moment models of SLS vehicle configurations for cargo (left) and crew (right). *Credit: NASA/MSFC*




Wind tunnel testing was also conducted at Langley, using scale models of several SLS vehicle configurations. *Credit: NASA/LaRC*

# SLS Engines Contractor Signs Mentor-Protégé Agreement

A mentor-protégé agreement valued at over $475,000 was signed by a NASA prime contractor and a historically black university on July 12. The 2-year agreement is between Pratt & Whitney Rocketdyne (PWR) of Canoga Park, Calif., and Alabama Agricultural and Mechanical (A&M) University of Normal, Ala.

PWR – which specializes in the design, manufacture, and service of aircraft engines, space propulsion systems, and industrial gas turbines – is responsible for developing RS-25 and J-2X engines for the new SLS rocket. Historically black colleges and universities (HBCUs) – such as Alabama A&M University – are American schools established before 1964 with the primary purpose of educating African-American students.

“These landmark partnerships have a significant impact on our ability to provide our students the experiences that make them competitive,” said Dr. Andrew Hugine, Jr., president of Alabama A&M University. “We welcome the opportunity to play an integral role in the continued success of this project with NASA and Pratt & Whitney Rocketdyne.”

The NASA Mentor-Protégé Program was established in 2008 by NASA’s Office of Small Business Programs. It pairs large companies with eligible small businesses and institutions, establishing long-term relationships, enhancing technical capabilities, and enabling protégés to successfully compete for larger, more complex prime contract and subcontract awards.

*Credit: The Huntsville Times/Bob Gathany*

# 2012 Space Exploration Celebration

Garry Lyles, SLS chief engineer, addressed the 2012 Space Exploration Celebration on July 20 at the U.S. Space & Rocket Center. The keynote speaker was veteran astronaut Charlie Duke, who became the 10th astronaut to walk on the Moon during Apollo 16. Lyles discussed the new heavy-lift SLS rocket and showed the inspirational video *Space Launch System: Future Frontier* during an update on NASA’s next generation of crewed space vehicles. About 400 people attended the event, which commemorated NASA’s first Moon landing on July 20, 1969 during Apollo 11.

The agreement was signed at Marshall by (at table, left to right) Kim Spencer, Marshall contracting officer; Dr. Andrew Hugine, Jr., Alabama A&M president; and Paul Fowler, PWR director of supply management. Other Marshall employees present included (left to right) Robin Henderson, Marshall associate Center director; Mike Kynard, SLS Engines manager; Jody Singer, SLS deputy program manager; Earl Pendley, SLS procurement manager; and (far right) Kim Whitson, Marshall procurement deputy director. *Credit: NASA/MSFC*

# SLS Education and Public Outreach

Todd May, SLS program manager, addressed 56 teachers, faculty, and mentors for rocketry teams representing middle and high schools, as well as colleges and universities, from 19 states and Puerto Rico during a dinner on July 20. The group was attending an advanced rocketry workshop sponsored by Marshall's Academic Affairs Office in Huntsville, Ala. This event was held in preparation for next year's Student Launch Projects competition, which challenges students to design, build, and launch a reusable rocket with a scientific or engineering payload to 1 mile above ground level. *Credit: NASA/MSFC*

Jody Singer, SLS deputy program manager, spoke to ~400 math and science teachers at a forum sponsored by the Intrepid Air, Sea and Space Museum in New York City on July 20. *Credit: NASA/MSFC*

NASA Associate Administrator for Education and veteran astronaut Leland Melvin dropped by the SLS exhibit to greet visitors during a 4-day celebration for space shuttle *Enterprise* when it arrived at the Intrepid Air, Sea and Space Museum. *Credit: NASA/MSFC*

On July 14, a 5-foot scale model of the SLS rocket was brought out to Kennedy Space Center's Launch Complex 39A by the Space Coast Rocketry Association of Melbourne, Fla. The club launched its fun rocket as a surprise for 134 students from 31 countries who had just finished competing in a rocket launch contest sponsored by the 2012 International Space University (ISU). *Credit: ISU*

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