National Aeronautics and Space Administration

NASA facts

space launch system

Artist concept of Space Launch System 70t vehicle launching from Kennedy Space Center.

Building America's New Rocket for Deep Space Exploration

NASA's Space Launch System, or SLS, is an advanced launch vehicle for a new era of exploration beyond Earth's orbit into deep space. SLS, the world's most powerful rocket, will launch astronauts in the agency's Orion spacecraft on missions to an asteroid and eventually to Mars, while opening new possibilities for other payloads including robotic scientific missions to places like Mars, Saturn and Jupiter.

Offering the highest-ever payload mass and volume capability and energy to speed missions through space, SLS will be the most powerful rocket in history and is designed to be flexible and evolvable, to meet a variety of crew and cargo mission needs.

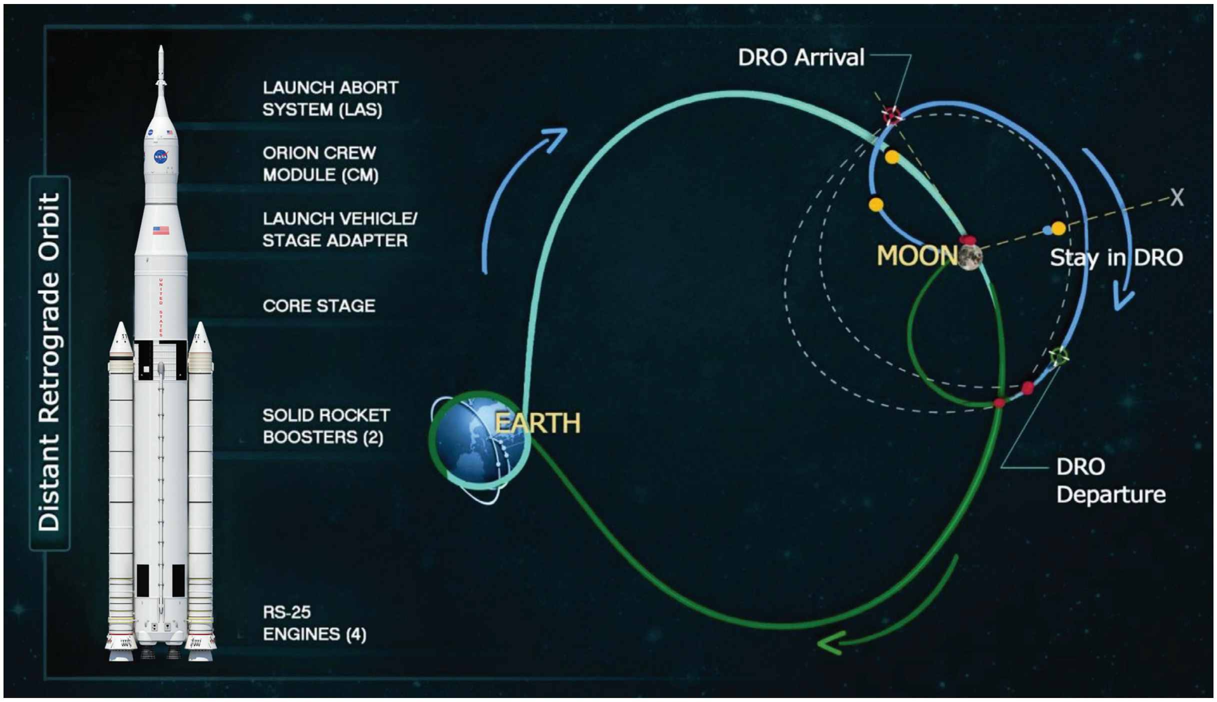
In 2013, NASA completed the preliminary design of the SLS and moved into production of the launch vehicle. Engineers continue to make rapid progress aimed toward delivering the first SLS rocket to NASA's Kennedy Space Center in Florida by 2017 for its first launch.

The Power to Explore Beyond Earth's Orbit

The SLS will be NASA's first exploration-class vehicle since the Saturn V took American astronauts to the moon more than 40 years ago and will expand our reach in the solar system, launching crews of up to four astronauts aboard the new Orion spacecraft to explore multiple, deep space destinations.

In addition to making human exploration missions possible, the SLS offers game-changing benefits for potential robotic science missions and other payloads. Its lift capability enables the launch of larger payloads than any other rocket; its high performance decreases the time it takes for robotic spacecraft to travel through the solar system, and by extension, cost and risk; and its ability to carry larger payload fairings than other rockets provides volume to fly unique missions like ultra-large space telescopes.

To fit NASA's future needs for deep-space missions, there will be several versions of the rocket, beginning with a 70-metric-ton (77 ton) lift capability to one of 130 metric tons (143 tons). An evolvable architecture allows NASA to provide the



Artist concept of the Exploration Mission-1 scenario.

nation with a rocket able to pioneer new human spaceflight missions and revolutionary scientific missions, while continuing to develop more powerful configurations with new cutting-edge technologies.

The next wave of human exploration will take explorers farther into the solar system — developing new technologies, inspiring future generations and expanding our knowledge about our place in the universe.

Capabilities and Missions

The 70-metric-ton configuration will provide 10 percent more thrust at launch than the Saturn V rocket and carry more than three times the payload of the space shuttle. The 130-metric-ton configuration will stand taller than the Saturn V and provide 20 percent more thrust.

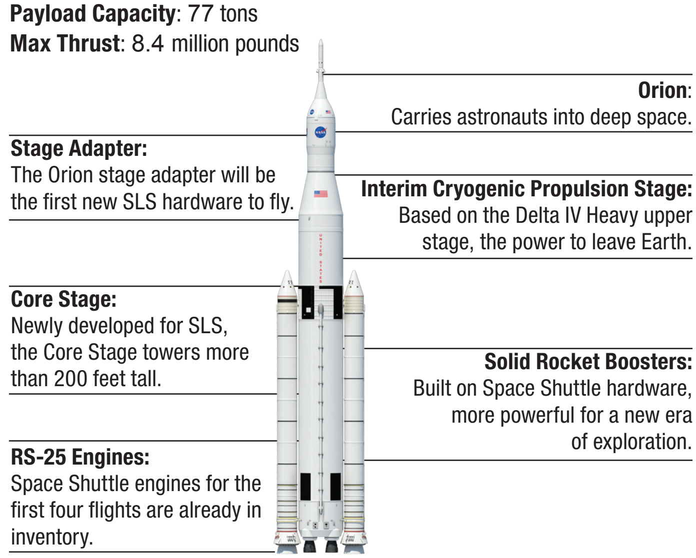
The first SLS mission — Exploration Mission 1 — will launch an uncrewed Orion spacecraft to a stable orbit beyond the moon and bring it back to Earth to demonstrate the integrated system performance of the SLS rocket and Orion spacecraft's re-entry and landing prior to a crewed flight. The second SLS mission, Exploration Mission 2, is targeted for 2021 and will launch Orion with a crew of up to four astronauts farther into space than humans have ever ventured.

The SLS also will send astronauts on NASA's first-ever crewed mission to study an asteroid relocated to a stable orbit around the moon. The mission provides experience in human spaceflight beyond low-Earth orbit, to test new systems and capabilities needed for a human mission to Mars in the proving ground around the moon.

The rocket is built on proven hardware from the space shuttle era and other exploration programs and cutting-edge tooling and manufacturing technology, significantly reducing development time, cost and making the vehicle more affordable to operate. The SLS core stage uses a liquid hydrogen and liquid oxygen propulsion system including four RS-25 engines that powered shuttle missions to space. The SLS also will use enhanced solid rocket boosters for its initial flights. This proven booster hardware is being modernized for this next-generation rocket, with upgrades to increase performance and fabrication improvements to decrease production time and cost.

SLS Initial Configuration at a Glance

Height: 322 feet
Launch Weight: 5.5 million pounds
Payload Capacity: 77 tons
Max Thrust: 8.4 million pounds



Initial Configuration Development

The initial 70-metric-ton configuration of SLS will stand 322 feet tall, higher than the Statue of Liberty. It will produce 8.4 million pounds of thrust at liftoff, the equivalent of 13,400 locomotive engines, and be capable of carrying 154,000 pounds of payload, about the same as 12 fully grown elephants.

Subscale Model Acoustic Test at Marshall Space Flight Center.

Core Stage and RS-25 Engines

The Boeing Company of St. Louis is developing the SLS core stage, including the avionics that will control the vehicle during flight. Towering more than 200 feet tall with a diameter of 27.6 feet, the core stage will store super-cooled liquid hydrogen and liquid oxygen that will fuel the RS-25 engines for the SLS. The core stage is being built at NASA's Michoud Assembly Facility in New Orleans using state-of-the-art manufacturing equipment, including a friction-stir-welding tool that is the largest of its kind in the world. At the same time, the rocket's avionics computer software is being developed at NASA's Marshall Space Flight Center in Huntsville, Alabama.

Propulsion for the SLS core stage will be provided by four RS-25 engines. Aerojet Rocketdyne of Sacramento, California, is adapting an inventory of 16 shuttle-heritage RS-25 engines for use on SLS. The engines are being reconfigured for the SLS with improvements, including more nozzle insulation and a new electronic controller.

RS-25 Installation into Test Stand: Stennis Space Center.

NASA Administrator Charles Bolden at Michoud Assembly Facility.

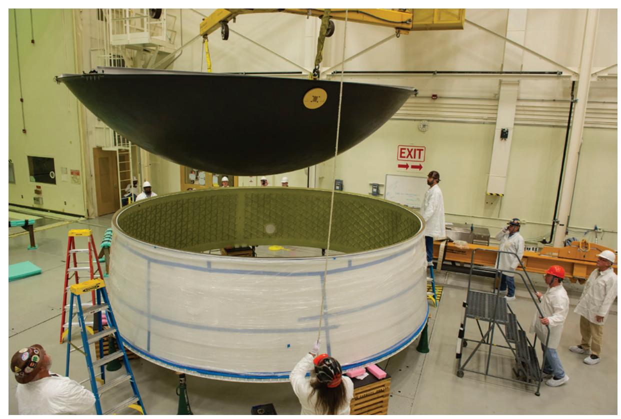
Boosters

Two shuttle-derived solid rocket boosters will be used for the initial flights of the SLS. In order to provide the additional power needed for the rocket, the prime contractor for the boosters, ATK of Brigham City, Utah, has modified them from the shuttle's configuration using four propellant segments to a five-segment version. ATK has successfully completed three full-scale development tests of the new design and is processing its first SLS hardware components in preparation for the motor's qualification tests.

Spacecraft and Payload Adapter and Fairings

Exploration Flight Test-1, Orion's first trip to space in 2014, marks the use of original SLS hardware: a stage adapter designed to connect Orion to a rocket upper stage. The adapter was developed by the team responsible for integrating the Orion spacecraft and other payloads with the SLS vehicle. Another, larger adapter is being built by Teledyne Brown Engineering of Huntsville, Alabama, and will connect SLS's core stage to the upper stage for its first flight.

The initial capability to propel Orion out of Earth's orbit for Exploration Mission-1 will come from an interim cryogenic propulsion stage based on the upper stage used successfully on United Launch Alliance's Delta IV family of rockets.



Orion Stage Adapter Diaphragm Installation at Marshall Space Flight Center.

Evolving the Launch Vehicle to Increase Capability

While work progresses on the initial 70-metric-ton SLS, an advanced development team is investing in new systems and technologies that will make SLS even more powerful, while improving affordability and increasing reliability. This evolved, flexible approach lets SLS carry out a wide variety of missions sooner, while incrementally increasing the power of the vehicle.

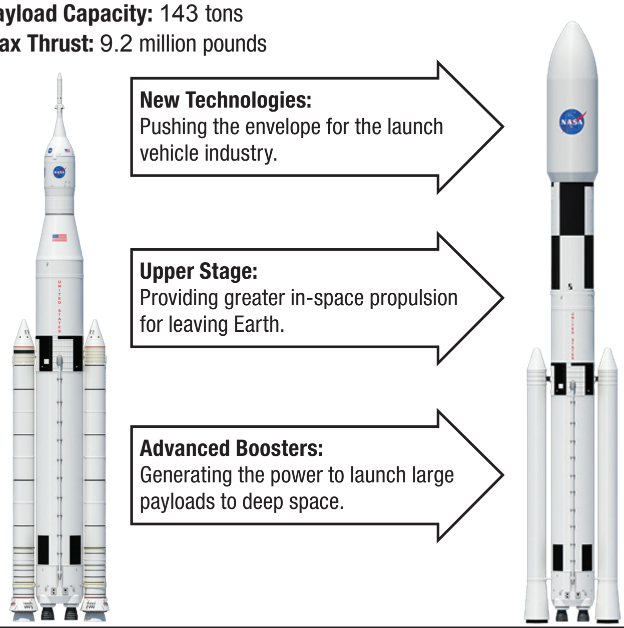
The advanced development team is engaging NASA, the Department of Defense, industry and academia to provide the most innovative and affordable ideas for advanced development in areas including: improvements to structures, materials, manufacturing, avionics, software and analysis techniques. These new technologies will not only make the evolved SLS a truly cutting-edge rocket, but benefit the entire U.S. launch industry.

Evolved Configuration Development

The massive 130-metric-ton configuration will be the most capable, powerful launch vehicle in history. Towering a staggering 384 feet tall, taller than the Saturn V rocket, it will provide 9.2 million pounds of thrust at liftoff and weigh 6.5 million pounds. It will possess the high capacity to carry payloads weighing 286,000 pounds to orbit. This configuration will use the same core stage, with four RS-25 engines, as previous configurations.

SLS Initial Configuration at a Glance

Height: 384 feet
Launch Weight: 6.5 million pounds
Payload Capacity: 143 tons
Max Thrust: 9.2 million pounds



Upper Stage

Future configurations of SLS will include an upper stage to provide additional power needed to travel to deep space. The upper stage will share common attributes with the core stage such as its outer diameter, material composition, subsystem components, and tooling to save cost and design time. NASA has conducted advanced upper-stage engine research through its J-2X testing and is working with industry, the Department of Defense and other partners to explore options that will not only maximize the exploration potential of SLS but support advanced, affordable solutions for the larger launch industry.

Advanced Boosters

Reaching the full potential of SLS will require advanced boosters with a significant increase in performance over existing boosters. NASA has contracted with four industry teams to research strategies for liquid and solid advanced boosters that reduce risks while enhancing affordability, improving reliability and meeting performance goals in preparation for a full and open design, development, test and evaluation advanced booster competition.

Agency Partners

The SLS Program at the Marshall Center has been working closely with the Orion Program, managed by NASA's Johnson Space Center in Houston, and the Ground Systems Development and Operations Program at the agency's Kennedy Space Center. All three programs are managed by the Exploration Systems Development Division within the Human Exploration and Operations Mission Directorate at NASA Headquarters in Washington. All NASA centers have been involved in the development of SLS, providing services including wind-tunnel analysis, engine testing and payload fairing research.

For more information on SLS, visit:

http://www.nasa.gov/sls/

http://www.twitter.com/NASA_SLS

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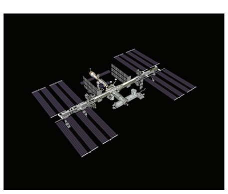
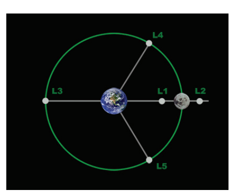
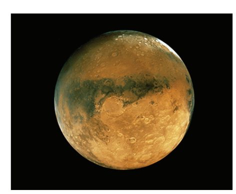

International Space Station


Moon



Lagrange Points


Asteroid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