Spacecraft and Payload Adapter, Fairings and Interim Cryogenic Propulsion Stage

The Orion stage adapter will connect Orion to the ICPS on the SLS Block 1 vehicle and is the place where the small satellites will ride to space. The Orion stage adapter has been delivered to Kennedy for the first launch. Teledyne Brown Engineering of Huntsville, Alabama, has built the launch vehicle stage adapter that will connect SLS's core stage to the upper part of the rocket.

Artemis I Launch Vehicle Stage Adapter

The initial capability to propel Orion out of Earth's orbit for Block 1 will come from the ICPS, based on the Delta Cryogenic Second Stage used successfully on United Launch Alliance's Delta IV family of rockets.

It uses one RL10 engine made by Aerojet Rockedyne. The engine is powered by liquid hydrogen and liquid oxygen and generates 24,750 lbs. of thrust. This stage has been delivered to Kennedy and is ready for integration before the Artemis I launch.

Artemis I ICPS delivered to Kennedy Space Center

National Aeronautics and Space Administration

George C. Marshall Space Flight Center
Huntsville, AL 35812
www.nasa.gov/marshall

www.nasa.gov

FS-2019-10-067-MSFC

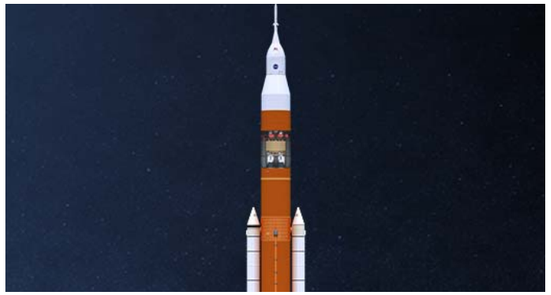
Exploration Upper Stage

The EUS will replace the ICPS on the fourth flight of the Space Launch System. The EUS is powered by four RL10 engines that produce almost four times more thrust than the one RL10 engine that powers the ICPS. This 97,000 lbs. of thrust will allow more than 37 t (81,000 lbs.) to be sent to the Moon.

With the EUS, NASA can use either a Block IB crew configuration to send Orion, astronauts and 10 metric tons of payload to deep space or use a Block 1B cargo configuration to send large cargos to the Moon, Mars or more distant destinations.

Another important feature that distinguishes the EUS from the ICPS is that it can fire more than one time during its journey to deep space. Boeing is under contract to build the EUS at the Michoud Assembly Facility and has completed the preliminary design review.

Aerojet Rocketdyne is under contract to produce the RL10 engines for the EUS and has completed manufacturing and testing of several engines.



Artist Concept SLS Block 1B Crew with EUS Cutaway

The SLS Team

SLS is America's rocket with more than 1,000 companies from across the U.S. and at every NASA center supporting the development of the world's most powerful rocket. The SLS Program at Marshall works closely with the Orion Program, managed by NASA's Johnson Space Center in Houston, and the Exploration Ground Systems at Kennedy. All three programs are managed by the Exploration Systems Development Division within the Human Exploration and Operations Mission Directorate at NASA Headquarters in Washington.

For more information about SLS, visit:

http://www.nasa.gov/artemis

http://www.nasa.gov/sls

http://www.twitter.com/NASA_SLS

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http://www.instagram.com/exploreNASA

Space Launch System

America's Rocket for Deep Space Exploration

NASA's Space Launch System, or SLS, is a super-heavy-lift launch vehicle that provides the foundation for human exploration beyond Earth's orbit. With its unprecedented power and capabilities, SLS is the only rocket that can send Orion, astronauts and cargo to the Moon on a single mission.

Offering more payload mass, volume capability and energy, SLS is designed to be flexible and evolvable and will open new possibilities for payloads, including robotic scientific missions to places like the Moon, Mars, Saturn and Jupiter.

The SLS team is producing NASA's first deep space rocket built for human space travel since the Saturn V. Engineers are making progress toward delivering the first SLS rocket to NASA's Kennedy Space Center in Florida for its first launch on the Artemis I lunar mission.

The Power to Explore Beyond Earth's Orbit

To fulfill America's future needs for deep space missions, SLS will evolve into increasingly more powerful configurations. SLS is designed for deep space missions and will send Orion or other cargo to the Moon, which is nearly 1,000 times farther than where the space station resides in low-Earth orbit. The rocket will provide the power to help Orion reach a speed of at least 24,500 mph needed to break out of low-Earth orbit and travel to the Moon.

Every SLS configuration uses the core stage with four RS-25 engines. The first SLS vehicle, called Block 1, can send more than 26 metric tons (t) or 57,000 pounds (lbs.) to orbits beyond the Moon. It will be powered by twin five-segment solid rocket boosters and four RS-25 liquid propellant engines. After reaching space, the interim cryogenic propulsion stage (ICPS) sends Orion on to the Moon. The first three Artemis missions will use a Block 1 rocket with an ICPS.

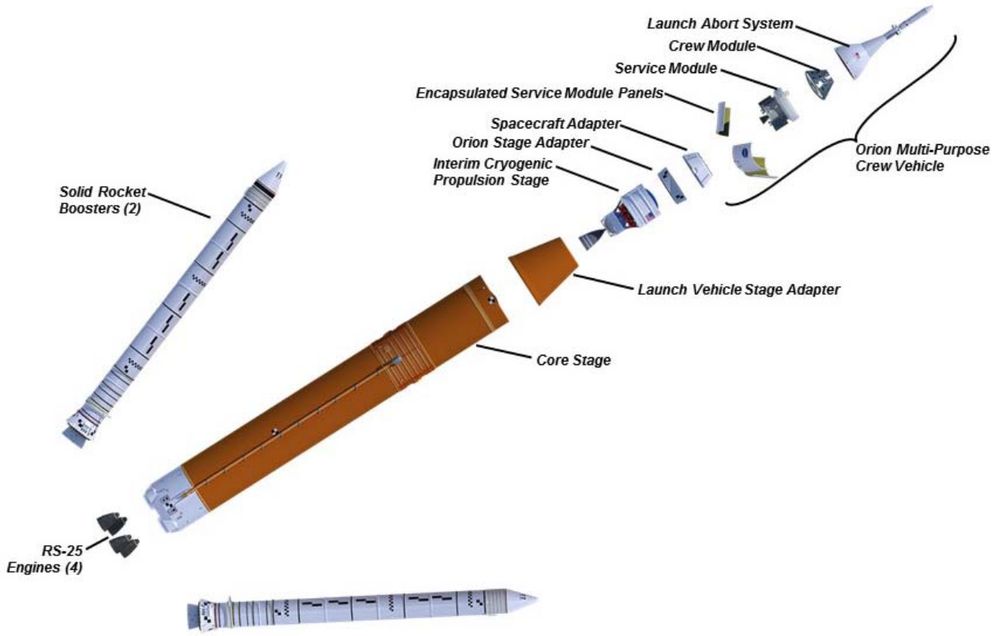
The next planned evolution of the SLS, the Block 1B crew vehicle, will use a new, more powerful exploration upper stage (EUS) to enable more ambitious missions. The Block 1B vehicle can, in a single launch, carry the Orion crew vehicle along with large cargos for exploration systems needed to support a sustained presence on the Moon.

The Block 1B crew vehicle can send up to 37 t (81,000 lbs.) to deep space including Orion and its crew. Launching with cargo only, SLS has a large volume payload fairing to send larger exploration systems to the Moon and Mars or for science spacecraft on solar system exploration missions. The Block 1B rocket with the EUS will be used for the Artemis IV mission to the Moon.

The next SLS configuration, Block 2, will provide 11.9 million lbs. of thrust and will be the workhorse vehicle for sending cargo to the Moon, Mars and other deep space destinations. SLS Block 2 will be designed to lift more than 45 t (99,000 lbs.) to deep space. An evolvable design provides the nation with a rocket able to pioneer new human spaceflight missions.

NASAfacts

Block 1 - Initial SLS Configuration



Space Launch System Missions

Artemis I, the first integrated flight of SLS and Orion, uses the Block 1 configuration, which stands 322 feet, taller than the Statue of Liberty, and weighs 5.75 million lbs. SLS will produce 8.8 million lbs. of maximum thrust, 15 percent more thrust than the Saturn V rocket.

For Artemis I, Block 1 will launch an uncrewed Orion spacecraft to an orbit 40,000 miles beyond the Moon, or 280,000 miles from Earth. This mission will demonstrate the integrated system performance of SLS, Orion and Exploration Ground Systems prior to a crewed flight.

The Artemis II mission will send astronuats on a flight to orbit the Moon. These missions pave the way for landing astronauts on the Moon in 2024, during the Artemis III mission.

Building the Rocket

NASA is building the rockets needed for several missions. To reduce cost and development time, NASA is using proven hardware from the space shuttle and other exploration programs while making use of cutting-edge tooling and manufacturing technology.

Some parts of the rocket are new and other parts have been upgraded with modern features that meet the needs of deep space missions, which require higher launch vehicle performance levels.

Core Stage

The Boeing Company, in Huntsville, Alabama, is building the SLS core stage, including the avionics that will control the vehicle during flight. Towering more than 200 feet with a diameter of 27.6 feet, the core stage will store 730,000 gallons of super-cooled liquid hydrogen and liquid oxygen that will fuel the RS-25 engines.

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.

The core stage is in final assembly for Artemis I and Boeing is building and outfitting structures for Artemis II. The SLS Avionics flight software is being developed and tested at NASA's Marshall Space Flight Center.

Artemis I Core Stage

SLS Evolution

Payload to TLI/Moon	> 26 t (57k lbs)	> 26 t (57k lbs)	34-37 t (74k–81k lbs)	37-40 t (81k–88k lbs)	> 45 t (99k lbs)	> 45 t (99k lbs)
Payload Volume	N/A*	9,030 ft³ (256m³)*	10,100 ft³ (286m³)*	18,970 ft³ (537 m³)	10,100 ft³ (286 m³)*	34,910 ft³ (988 m³)
	SLS Block 1 Crew	SLS Block 1 Cargo	SLS Block 1B Crew	SLS Block 1B Cargo	SLS Block 2 Crew	SLS Block 2 Cargo
Maximum Thrust	8.8M lbs	8.8M lbs	8.8M lbs	8.8M lbs	11.9M lbs	11.9M lbs

* Not including Orion/ Service Module volume

NASA has designed the Space Launch System as the foundation for a generation of human exploration missions to deep space, including missions to the Moon and Mars. SLS will leave low-Earth orbit and send the Orion spacecraft, its astronaut crew and cargo to deep space. To do this, SLS has to have enough power to perform a maneuver known as trans-lunar injection, or TLI. This maneuver accelerates the spacecraft from its orbit around Earth onto a trajectory toward the Moon. The ability to send more mass to the Moon on a single mission makes exploration simpler and safer.

RS-25 Engines

Propulsion for the SLS core stage will be provided by four RS-25 engines. Aerojet Rocketdyne of Sacramento, California, is upgrading an inventory of 16 RS-25 shuttle engines to SLS performance requirements, including a new engine controller, nozzle insulation and required operation at 512,000 pounds of thrust. During the flight, the four engines provide around 2 million lbs. of thrust.

The engines for Artemis I are built, tested and are being attached to the core stage. After the engines are installed, the core stage is fully assembled and NASA's Pegasus barge will transport the entire stage to Stennis Space Center near Bay St. Louis, Mississippi, for green run testing.

Aerojet Rocketdyne has tested the new controllers for the first 4 SLS missions and has started development testing of new, advanced components to make the engines more affordable.

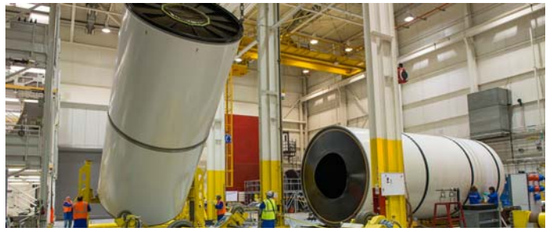
Artemis I RS-25 Engines

Boosters

Two shuttle-derived solid rocket boosters will power the initial flights of the SLS. To provide the additional power needed for the rocket, the prime contractor for the boosters, Northrop Grumman, of Redondo Beach, California, has modified the original shuttle's configuration of four propellant segments to a five-segment version. The design includes new avionics, propellant design and case insulation and eliminates the recovery parachutes.

At the Utah facility, Northrop Grumman has cast all booster segments needed for Artemis I and Artemis II. At Kennedy, engineers are refurbishing and upgrading space shuttle booster components to meet SLS requirements.

Trains will carry booster segments from Utah to Kennedy Space Center where they will be stacked with other booster components. The boosters' avionics systems are being tested at Kennedy and Marshall.



Artemis I Solid Rocket Booster Segments