NASA**facts**

space launch system

Building America's Next Heavy-Lift Launch Vehicle

NASA's Space Launch System is an advanced, heavy-lift launch vehicle which will provide an entirely new capability for science and human exploration beyond Earth's orbit. The Space Launch System will give the nation a safe, affordable and sustainable means of reaching beyond our current limits and open new doors of discovery from the unique vantage point of space.

The Space Launch System, or SLS, will carry the Orion Multi-Purpose Crew Vehicle, as well as important cargo, equipment and science experiments, to deep space. The Orion spacecraft will carry up to four astronauts beyond low Earth orbit on long-duration, deep space missions and include both crew and service modules and a launch abort system to significantly increase crew safety.

As NASA's commercial partners create an American supply line to the International Space Station, SLS will provide the transportation needed for NASA to reach further into our solar system. However, if needed, SLS will support backup transportation to the International Space Station.

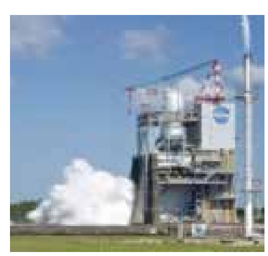
SLS will be the most powerful rocket in history and is designed to be flexible and evolvable, to meet a variety of crew and cargo mission needs.

The Power to Explore Beyond Earth's Orbit

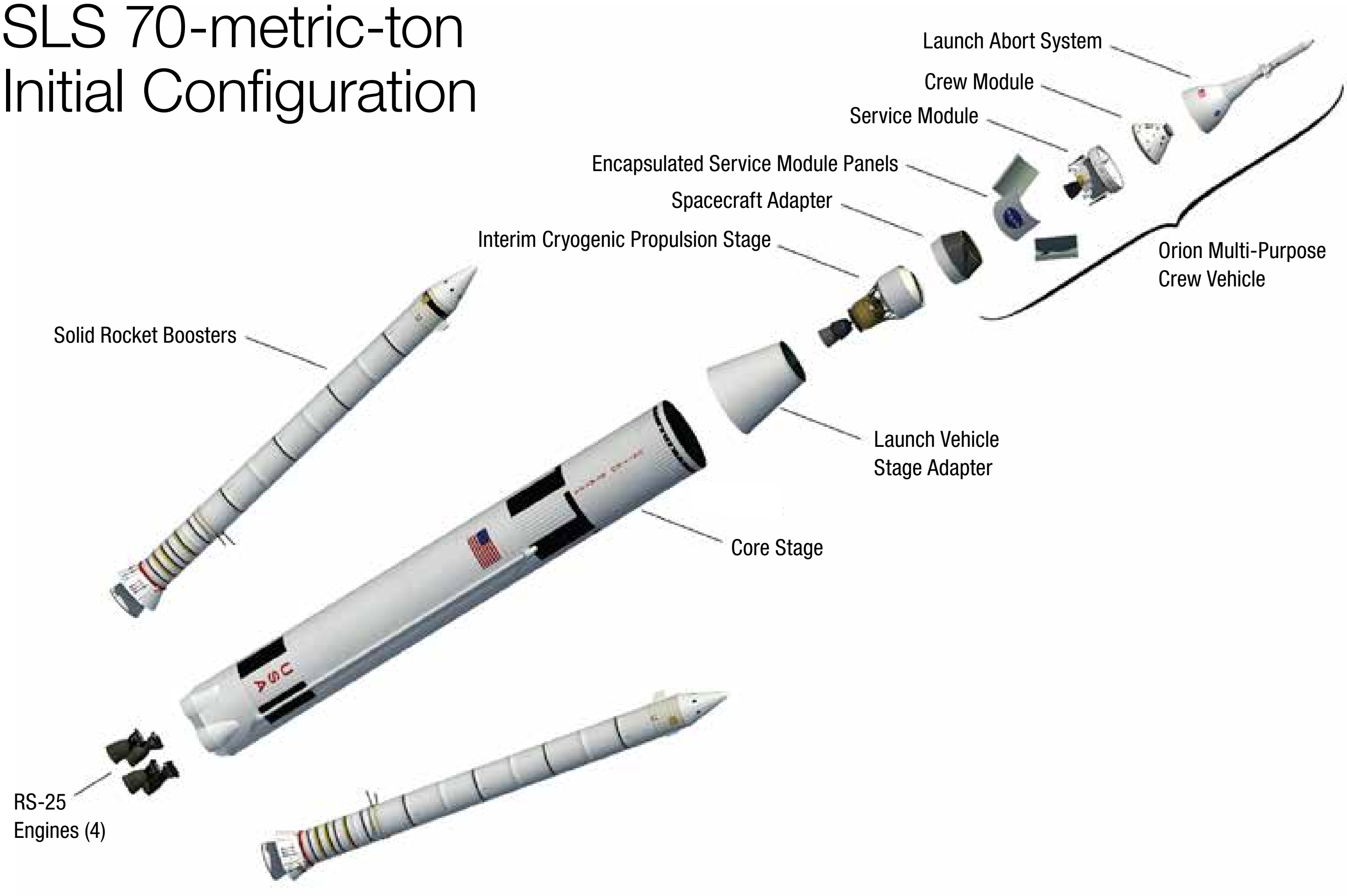
The SLS will be NASA's first exploration-class vehicle since the Saturn V took American astronauts to the moon over 40 years ago. With its superior lift capability, the SLS will expand our reach in the solar system, allowing astronauts aboard the Orion spacecraft to explore multiple, deep-space destinations including near-Earth asteroids, Lagrange points, the moon and ultimately Mars.

The SLS heavy-lift launch vehicle is essential to NASA's deep-space exploration endeavors. The system will be flexible and include multiple launch vehicle configurations. The SLS will carry crew, cargo and science missions to deep space.

Above: Artist rendering of the SLS 70-t configuration launch. Below: SLS Program Manager Todd May shares progress on the core stage with NASA Deputy Associate Administrator Lori Garver, RS-25 engines in the Space Shuttle Main Engine Processing Facility, solid rocket motor test firing, J-2X test firing



SLS 70-metric-ton Initial Configuration



Providing an evolvable architecture allows customization of the SLS to fit individual mission requirements, increasing capability with each configuration.

The next wave of human exploration will take explorers further into the solar system – finding potential resources, developing new technologies, and discovering answers to mysteries about our place in the universe.

Capabilities and Missions

America's new heavy-lift rocket will be the largest launch vehicle ever built and more powerful than the Saturn V rocket that carried Apollo astronauts to the moon. The 70-metric-ton-(77 ton) configuration will lift more than 154,000 pounds and will provide 10 percent more thrust than the Saturn V rocket while the 130-metric-ton-(143 ton) configuration will lift more than 286,000 pounds and provide 20 percent more thrust than the Saturn V.

The first SLS mission — Exploration Mission 1 — in 2017 will launch an uncrewed Orion spacecraft to demonstrate the integrated system performance of the SLS rocket and spacecraft prior to a crewed flight.

The second SLS mission, Exploration Mission 2, is targeted for 2021 and will launch Orion and a crew of up to four American astronauts.

The SLS will use proven hardware and cutting-edge tooling and manufacturing technology from the Space Shuttle and other exploration programs. This will significantly reduce development and operations costs. It will use a liquid hydrogen and liquid oxygen propulsion system, which will include the RS-25 engine from the Space Shuttle Program for the core stage and the J-2X engine for the upper stage. The SLS also will use solid rocket boosters for the initial development flights, while industry will compete to design advanced boosters based on performance requirements and affordability considerations.

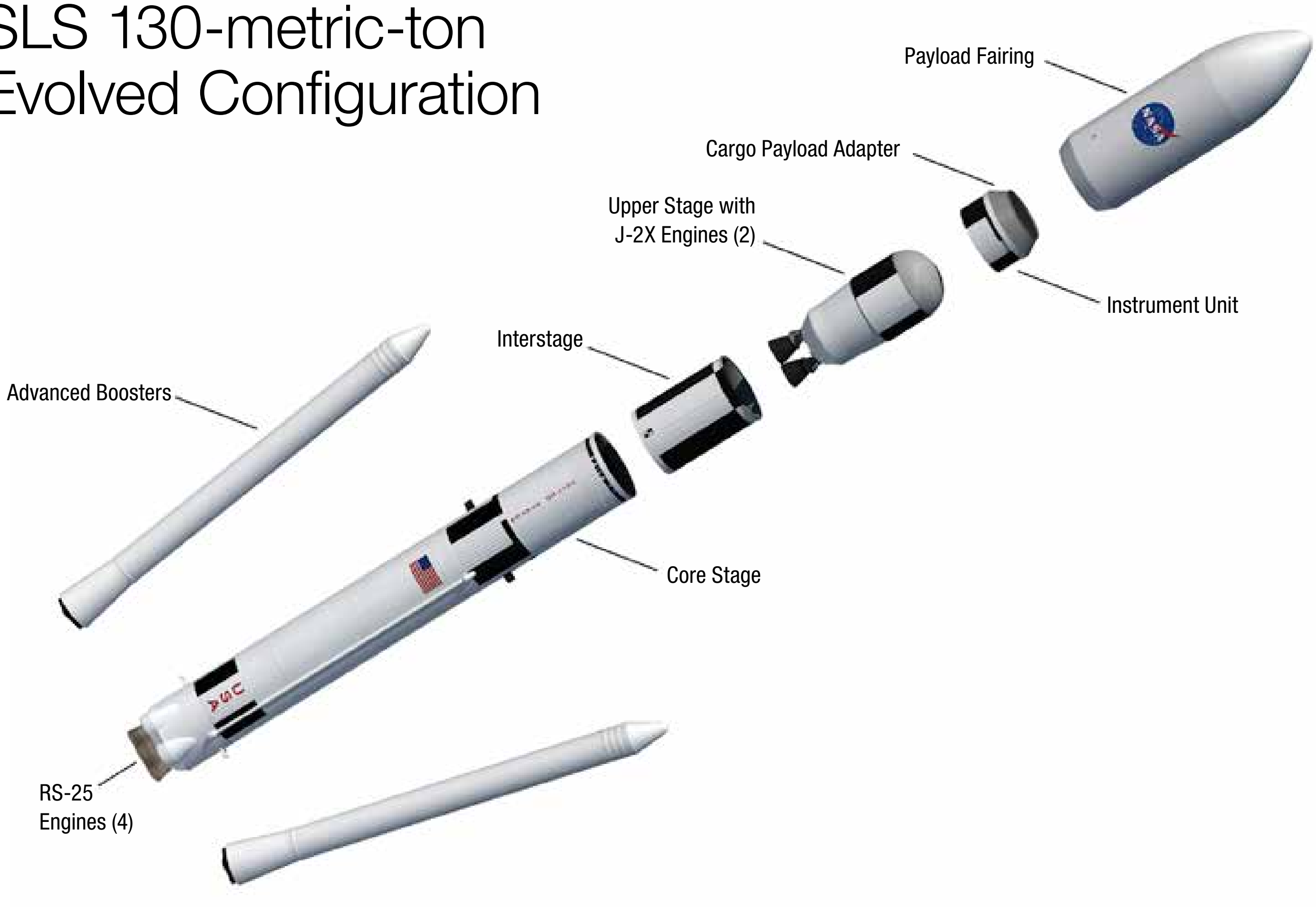
Initial 70-metric-ton Rocket Development

The 70-metric-ton SLS will stand 321 feet tall, provide 8.4 million pounds of thrust at liftoff, weigh 5.5 million pounds and carry 154,000 pounds of payload.

Core Stage and RS-25 Engines

The Boeing Co. of Huntsville, Ala., is developing the SLS core stage, including its avionics. Towering over 200 feet tall with a diameter of 27.5 feet, the core stage will store cryogenic liquid

SLS 130-metric-ton Evolved Configuration



hydrogen and liquid oxygen that will feed the RS-25 engines for the SLS. The stage is being built at NASA's Michoud Assembly Facility in New Orleans with state-of-the-art manufacturing equipment. Flight computer hardware and battery unit development are under way.

The SLS core stage will get its power from four RS-25 engines — former space shuttle main engines built by Pratt & Whitney Rocketdyne of Canoga Park, Calif. The SLS Program has an inventory of 15 RS-25 flight engines, which operated with 100 percent mission success during 135 space shuttle missions.

Boosters

Two five-segment solid rocket boosters will be used for the first two, 70-metric-ton-flights of the SLS. The prime contractor for the boosters — ATK of Brigham City, Utah — has begun processing its first SLS hardware components in preparation for the initial qualification test planned for spring 2013.

Spacecraft and Payload Adapter and Fairings

The spacecraft and payload integration team is responsible for integrating the Orion spacecraft and payload with the SLS vehicle using structural adapters.

The team also will procure and integrate an interim cryogenic propulsion stage to power the first two flights of the SLS, based on Boeing's Delta Cryogenic Second Stage used on the Delta IV family of launch vehicles. The interim cryogenic propulsion stage will boost the Orion spacecraft to the correct altitude and trajectory needed to send the spacecraft around the moon in order to check out vital systems during the initial test flights.

Evolving the Launch Vehicle to Increase Capability

While work progresses on the initial 70-metric-ton-SLS, the advanced development team is working on improving affordability, increasing reliability and increasing performance needed to evolve the initial vehicle to configurations that can provide even greater lift capacity. This evolved, flexible approach can meet a variety of missions needed to carry crew and cargo of varying sizes. Configurations over 100 metric tons up to 130 metric tons are currently being studied.

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 activities. Once the SLS' initial flights are complete, it will require an advanced booster with a significant increase in performance over existing U.S. boosters. NASA is seeking strategies for liquid and solid advanced boosters that will 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. NASA is also looking to industry and academia for advanced development propulsion, structures, materials, manufacturing, avionics and software concepts.

130-Metric-Ton Evolved Rocket Development

The massive 130-metric-ton-configuration will be the most capable, powerful launch vehicle in history. Towering a staggering 384 feet tall, it will provide 9.2 million pounds of thrust at liftoff and weigh 6.5 million pounds. It will be able 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.

Upper Stage and J-2X Engine

The 130-metric-ton-SLS will include an upper stage to provide additional power needed to travel to deep space. The upper stage, built by Boeing, 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.

Two J-2X engines being developed by Pratt & Whitney Rocketdyne will power the upper stage. The J-2X is a highly efficient and versatile rocket engine — the first liquid oxygen and liquid hydrogen rocket engine to be developed in 40 years that will be certified to transport humans.

The first development J-2X engine, named E10001, was assembled and began testing at the Stennis Space Center in 2011. It achieved a 500-second, full-flight mission duration firing during its eighth test. This is the earliest full-flight mission duration test for any other U.S. engine program in history.

Agency Partners

The SLS Program at NASA's Marshall Space Flight Center in Huntsville, Ala., 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 — the operations and launch facilities — at NASA's Kennedy Space Center in Cape Canaveral, Fla. All three programs are managed by the Explorations Systems Development Division within the Human Exploration and Operations Mission Directorate at NASA Headquarters in Washington.

The other SLS agency partners include NASA's Ames Research Center in Moffett Field, Calif., which is responsible for physics-based analysis; NASA's Glenn Research Center in Cleveland, which is responsible for composites research and payload fairing development; NASA's Goddard Space Center in Greenbelt, Md., which is responsible for payloads; NASA's Langley Research Center in Hampton, Va., which is responsible for wind tunnel testing; NASA's Michoud Assembly Facility, which will manufacture and assemble the SLS core and upper stages, as well as the main propulsion system; and NASA's Stennis Space Center, which is responsible for J-2X and RS-25 testing.

For more information on SLS, visit:

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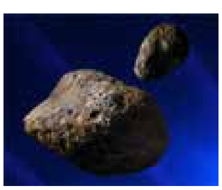
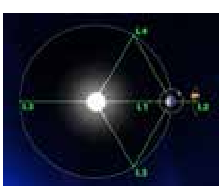

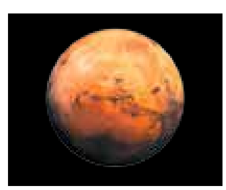

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