

ARTEMIS ASTRONAUTS LET'S GO

Video can be viewed at <u>https://www.youtube.com/wa</u> <u>tch?v=BC5khqpKovU&t=6s</u> This material is a work of the U.S. Government and is not subject to copyright protection in the United States.

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National Aeronautics and Space Administration

SPACE LAUNCH SYSTEM (SLS) UPDATE September 28, 2021

Brian Matisak

Block 1 Deputy Manager Systems Engineering & Integration Office SLS Program We go to the Moon to learn how to live on other worlds.

Apollo changed the world.

Artemis will do the same. But this time, the vision is different.

ARTEMIS

Image: Andrew McCarthy

ARTEMIS: LANDING HUMANS ON THE MOON



Lunar Reconnaissance Orbiter: Continued surface and landing site investigation

> Artemis I: First human spacecraft to the Moon in the 21st century

Artemis II: First humans to orbit the Moon and rendezvous in deep space in the 21st Century Gateway begins science operations with launch of Power and Propulsion Element and Habitation and Logistics Outpost Artemis III-V: Deep space crew missions; cislunar buildup and initial crew demonstration landing with Human Landing System

Early South Pole Robotic Landings

Science and technology payloads delivered by Commercial Lunar Payload Services providers Volatiles Investigating Polar Exploration Rover First mobility-enhanced lunar volatiles survey

Uncrewed HLS Demonstration



Humans on the Moon - 21st Century First crew expedition to the lunar surface

LUNAR SOUTH POLE TARGET SITE

BUILT TO EXPLORE

Video can be viewed at https://www.youtube.com/wa tch?v=E1EenrcQN08

THE POWER OF SLS AND ORION

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NASA

ORION

The only spacecraft capable of carrying and sustaining crew on missions to deep space, providing emergency abort capability, and safe re-entry from lunar return velocities

SLS

The only rocket with the power and capability required to carry astronauts to deep space onboard the Orion spacecraft

NATIONAL CAPABILITY

The SLS, Orion, and Exploration Ground Systems programs leverage more than 3,800 suppliers and 60,000 workers across all 50 states

THE POWER OF SLS FOUNDATION FOR A GENERATION OF DEEP SPACE EXPLORATION



Payload to LEO	95† (209.4k lbs)	95 † (209.4k lbs)	105† (231.4k lbs)	105† (231.4k lbs)	130† (286.6k lbs)	130 † (286.6k lbs)
Payload to TL I/Moon	> 27 † (59.5k lbs)	> 27 † (59.5k lbs)	38 † (83.7k lbs)	42 † (92.5k lbs)	> 43 t (94.7k lbs)	> 46 † (101.4k lbs)
Payload Volume	516 ft ³ (14.6 m ³)	8,118 ft ³ (229.9 m ³)	10,100 ft³ (286 m³)**	21,930 ft ³ (621.1 m ³)	10,100 ft ³ (286 m ³)**	34,910 ft ³ (988 m ³)
Low Earth Orbit (LEO) represents a typical 200 km circular orbit at 28.5 degrees inclination Trans Lunar Injection (TLI) is a propulsive maneuver used to set a spacecraft on a trajectory that will cause it to arrive at the Moon. A spacecraft performs TLI to begin a lunar transfer from a low circular parking orbit around Earth. The numbers depicted here indicate the mass capability at the Trans-Lunar Injection point.						
** Not including Orion/Service Module volume	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	8.8 M lbs	8.8 M lbs	8.9 M lbs	8.9 M lbs	9.5 M lbs	9.5 M lbs



5.5

NASA'S SPACE LAUNCH SYSTEM UNIQUE CAPABILITY FOR HUMAN AND ROBOTIC EXPLORATION

 Block 1B/2: Double the volume of any currently flying heavy lift vehicle

 Only vehicle that can launch Orion and a 10 ton co-manifested payload to the Moon

 Block 1: Launches nearly 70% more mass than any currently operational vehicle

 Block 2: Mars-enabling capability of greater than 46 tons to the Moon or 36 tons to Mars

DEPARTURE ENERGY

MASS

- Can reduce transit times by half or greater to the outer solar system
- •Block 1B/2 provides more frequent launch availability



2.6



Transit time to Jupiter in years

SLS



Orion with Co-

Manifested

Payloads



NASA'S SPACE LAUNCH SYSTEM BACKBONE OF DEEP SPACE EXPLORATION





LAUNCH SYS<u>TEM</u> PACE ARTEMIS I: FOUR RS-25 ENGINES

UPGRADED & READY FOR A BOLD NEW MISSION



Shown here from the bottom, looking up at the rocket from below, four liquid hydrogen (LH2) and liquid oxygen (LOX)-fueled RS-25 ENGINES are arranged in a square pattern, like legs on a table, providing stability and even distribution of propulsion forces to the rocket. At launch, they will produce

2 MILLION POUNDS OF THRUST

to help power the Space Launch System.



Including these first four engines, NASA has a total **16 ENGINES** available for the first four missions.



E2058

E2060

WHAT'S IN A NUMBER?

Each engine has its own number and NASA keeps a history of which engines are used on each mission. For the first SLS flight, they are engines **E2045**, E2056, E2058 and E2060.

ENABLING MISSION SUCCESS

These four proven engines contributed to 21 successful shuttle flights over three decades.

- E2045: most veteran engine with 12 FLIGHTS (First flight was STS-89 in January 1998 and last was STS-135 in July 2011); also flew on Astronaut John Glenn's last flight, STS-95
- E2056: Total 4 FLIGHTS, including STS-114, NASA's Return to Flight after Columbia
- E2058: Total 6 FLIGHTS, including first flight of a Swedish astronaut (Christer Fuglesang)
- E2060: Total 3 FLIGHTS, including STS-135, the last shuttle mission

WHAT'S NEW FOR SLS?

- ENGINE CONTROLLERS the brains of the engine
- HIGHER THRUST equates with better performance
- ADAPTED TO SLS UNIQUE OPERATING ENVIRONMENTS

SPACE LAUNCH SYSTEM GREEN RUN TEST

Monthly Reading Strategy and St

SOLID ROCKET BOOSTERS

to they be

INTERIM CRYOGENIC PROPULSION STAGE

HOSE

CAUTION OVERSIZE LOAD



ARTEMIS I: NASA'S PLANS TO TRAVEL BEYOND THE MOON

Video can be viewed at https://www.youtube.com/wa tch?v=GgmRAV8HNKE

BOOSTERS STACKED, PUSH-PULL TESTING AT KSC





ARTEMIS I CORE STAGE LIFT AND MATE

Video can be viewed at <u>https://www.youtube.com/wa</u> <u>tch?v=-sjn5jDpDjg&t=13s</u>

SLS PAYLOAD ADAPTERS





INTERIM CRYOGENIC PROPULSION STAGE STACKED





THEN MODAL TESTING, PAYLOAD INTEGRATION





NEA Scout

MISSION SIMULATIONS UNDERWAY





SLS PROGRESS TOWARD ARTEMIS II





SLS PROGRESS TOWARD ARTEMIS III AND BEYOND







Trial Composite Wound Case



Artemis III core stage production EUS Interstage weld confidence, development articles



WE GO AS THE ARTEMIS GENERATION

Video can be viewed at <u>https://www.youtube.com/wa</u> <u>tch?v=BfzPiEe-Aeg</u>







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