



NASA SPACE LAUNCH SYSTEM INTEGRATED, PREPARING FOR LAUNCH



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NASA Space Launch System Program

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THE POWER OF SLS

FOUNDATION FOR A GENERATION OF DEEP SPACE EXPLORATION



Payload to LEO	95 t (209.4klbs)	95 t (209.4klbs)	105 t (231.4k lbs)	105 t (231.4k lbs)	130 t (286.6k lbs)	130 t (286.6k lbs)
Payload to TLI/Moon	> 27 t (59.5k lbs)	> 27 t (59.5k lbs)	38 t (83.7k lbs)	42 t (92.5k lbs)	> 43 t (94.7k lbs)	> 46 t (101.4k lbs)
Payload Volume	516 ft³ (14.6 m³)	8,118 ft³ (229.9 m³)	10,100 ft³ (286 m³)**	21,930 ft³ (621.1 m³)	10,100 ft³ (286 m³)**	34,910 ft³ (988 m³)

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.



SLS Block 1 Crew



SLS Block 1 Cargo



SLS Block 1B Crew



SLS Block 1B Cargo



SLS Block 2 Crew



SLS Block 2 Cargo

** Not including Orion/Service Module volume

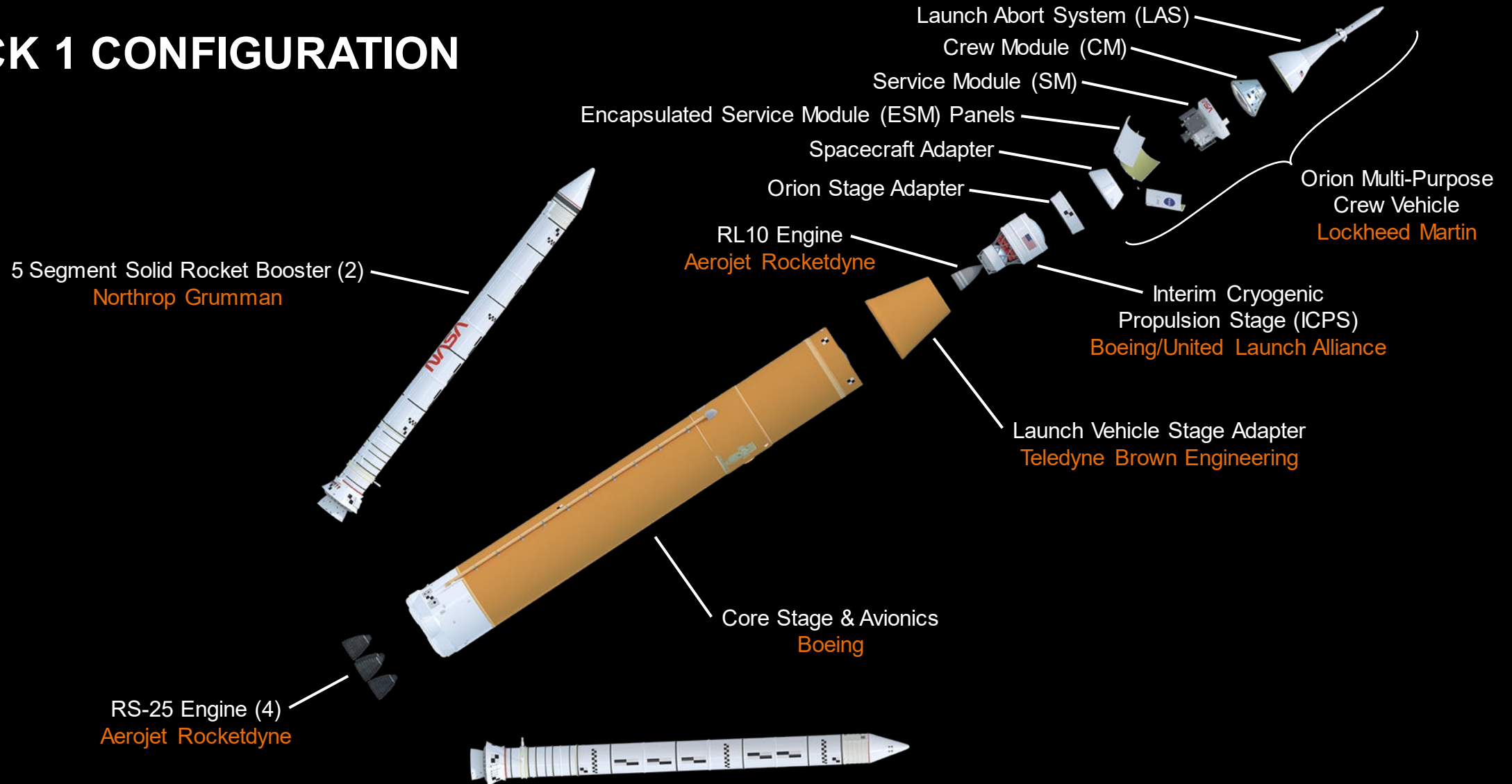
Maximum Thrust	8.8 M lbs	8.8 M lbs	8.9 M lbs	8.9 M lbs	9.5 M lbs	9.5 M lbs
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NASA'S SPACE LAUNCH SYSTEM

BACKBONE OF DEEP SPACE EXPLORATION



BLOCK 1 CONFIGURATION

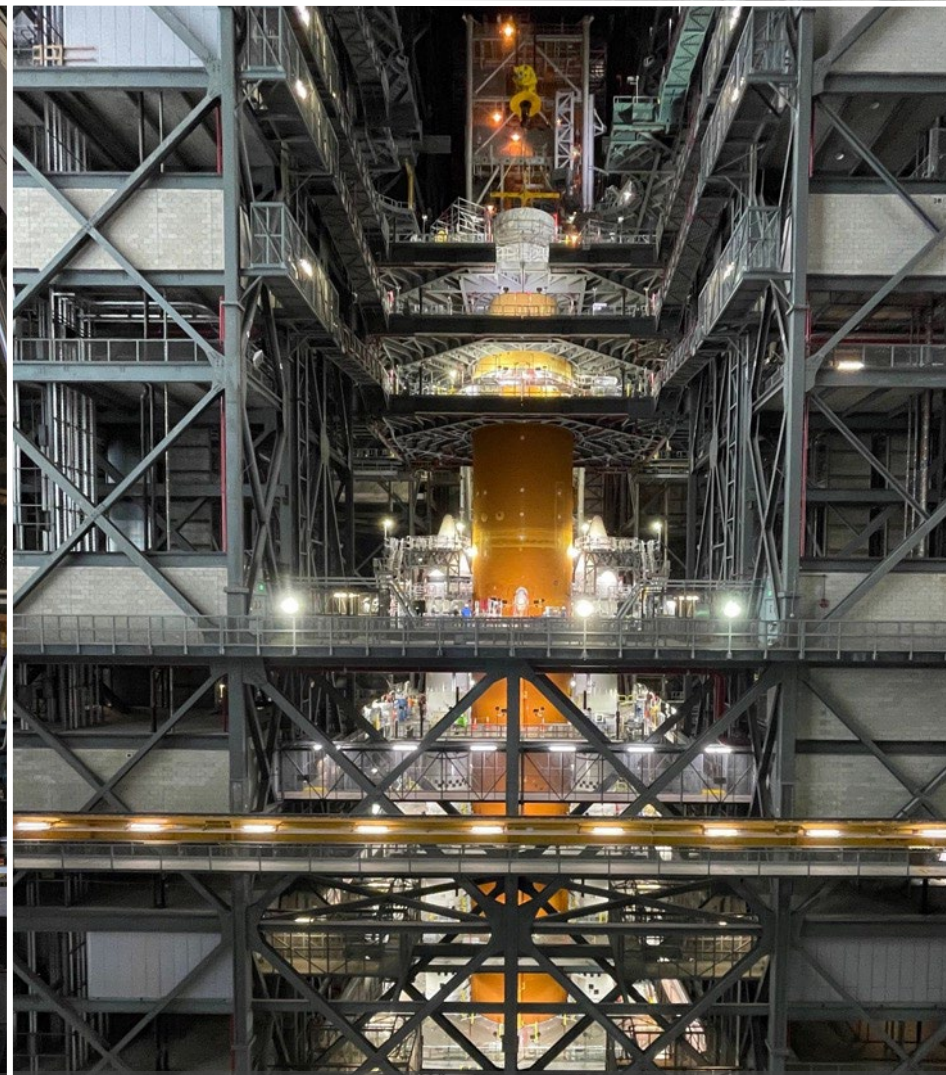




INTEGRATED TEST AND CHECKOUT



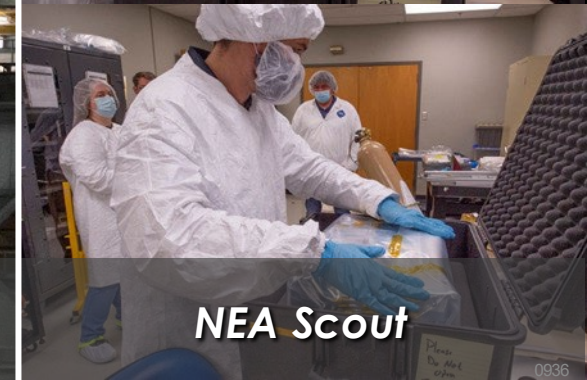
Orion mass simulator for integrated modal testing



OSA STA stacked on top of launch vehicle for modal testing



CubeSat payload integration complete



NEA Scout



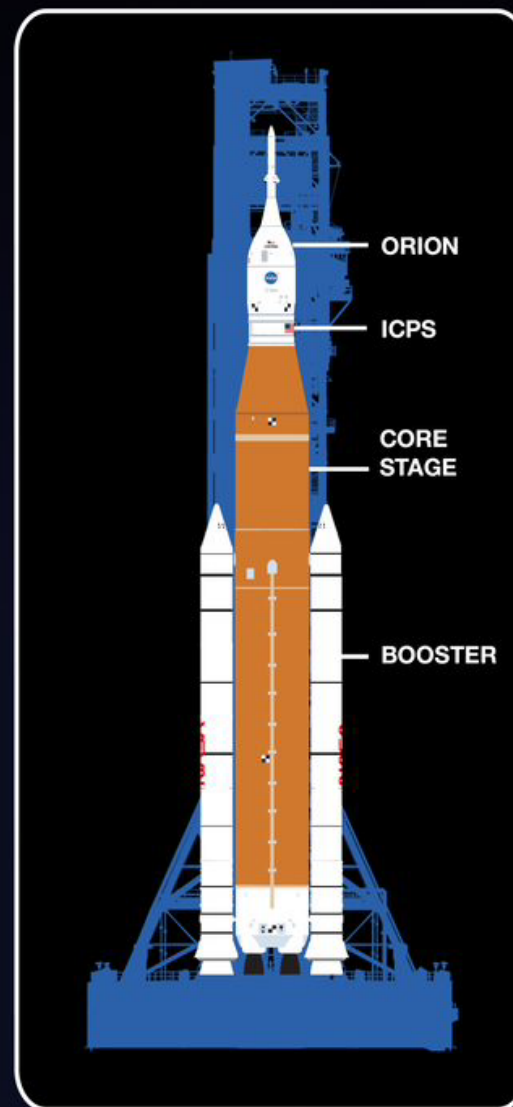
ARTEMIS I

National Aeronautics and
Space Administration



Integrated Testing: SLS Rocket, Orion Spacecraft, & Ground Systems

- 10 ☒ Verify function of interfaces between Orion and ground systems
- 9 ☒ Verify function of interfaces between SLS core stage and boosters with ground systems
- 8 ☒ Verify function of interfaces between SLS upper stage with ground systems
- 7 ☒ Verify function of interfaces throughout integrated SLS and Orion with ground systems
- 6 ☒ Integrated test of all SLS and Orion critical communications systems
- 5 ☒ Test countdown commanding sequence with simulated countdown before rolling to launch pad
- 4 ☒ Checkout various SLS systems functionality
- 3 ☒ Checkout SLS and Orion functionally with launch pad systems before and after roll out
- 2 ☐ Demonstrate tanking and detanking SLS with cryogenic, or supercold, propellants, at the launch pad
- 1 ☐ Test and install pyrotechnics for flight termination system



ARTEMIS I VEHICLE ROLLED TO PAD





WET DRESS REHEARSAL

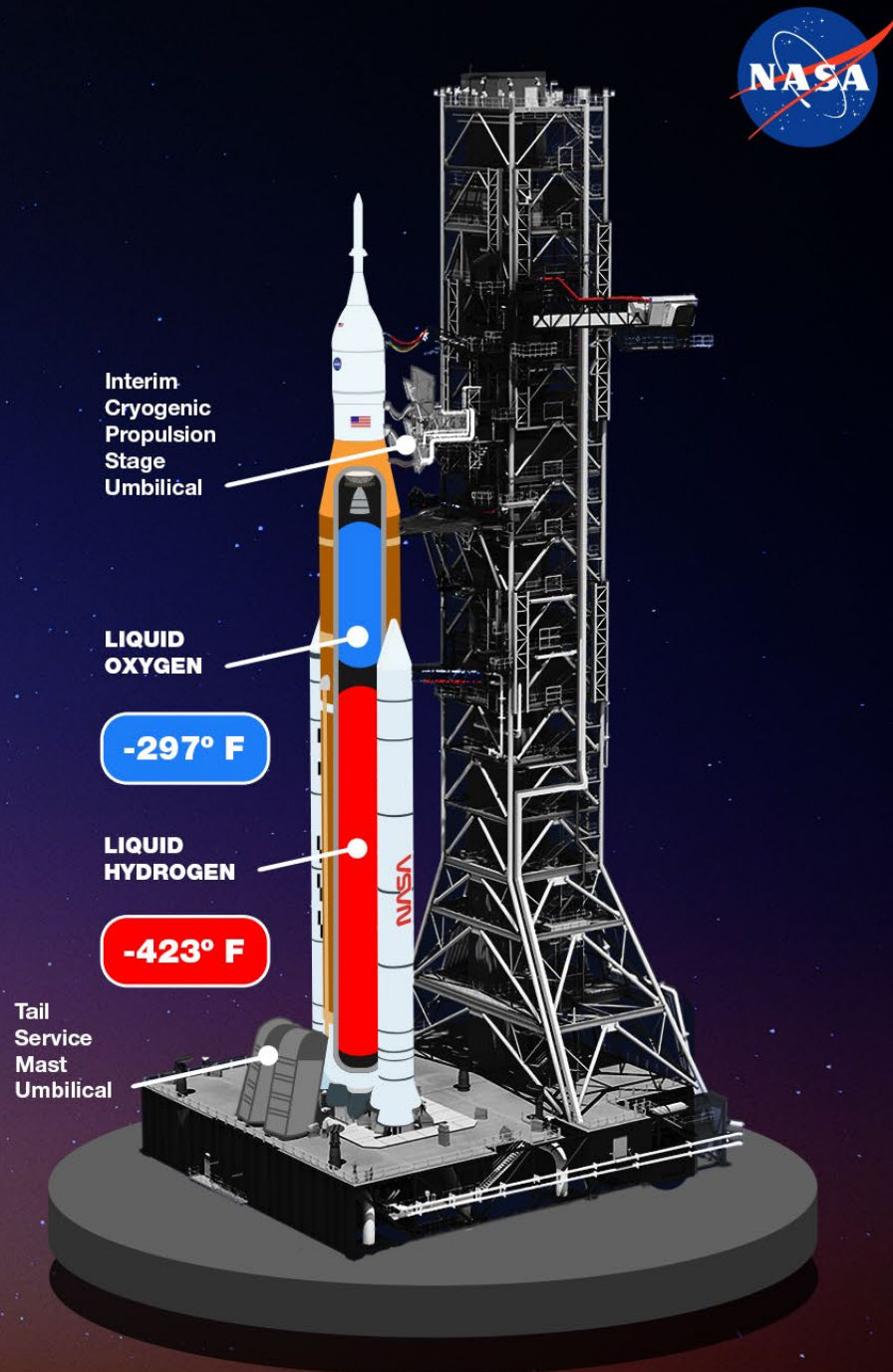
LAST MAJOR TEST BEFORE LAUNCH

The Artemis I Wet Dress Rehearsal tested new ground-side propellant systems with the SLS rocket and Orion spacecraft. Engineers checked out the propulsion system, flight computers, communications, safety, and other systems.



NEXT UP:

SLS and Orion roll back to the Vehicle Assembly Building and prepare for **ARTEMIS I LAUNCH**





A B C

CUBESATS DEPLOY
ICPS deploys 10
CubeSats total

MISSION DURATIONS:
Total: 26–42 days
Outbound Transit: 8–14 days
DRO Stay: 6–19 days
Return Transit: 9–19 days

ARTEMIS I

The First Uncrewed Integrated Flight Test of NASA's Orion Spacecraft and Space Launch System Rocket

1 LAUNCH
SLS and Orion lift off from pad 39B at Kennedy Space Center.

2 JETTISON ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM

3 CORE STAGE MAIN ENGINE CUT OFF
With separation.

4 PERIGEE RAISE MANEUVER
5 EARTH ORBIT
Systems check with solar panel adjustments.

6 TRANS LUNAR INJECTION (TLI) BURN
Maneuver lasts for approximately 20 minutes.

7 INTERIM CRYOGENIC PROPULSION STAGE (ICPS) SEPARATION AND DISPOSAL
ICPS commits Orion to moon at TLI.

8 OUTBOUND TRAJECTORY CORRECTION (OTC) BURNS
As necessary adjust trajectory for lunar flyby to Distant Retrograde Orbit (DRO).

9 OUTBOUND POWERED FLYBY (OPF)
60 nmi from the Moon; targets DRO insertion.

10 LUNAR ORBIT INSERTION
Enter Distant Retrograde Orbit.

11 DISTANT RETROGRADE ORBIT
Perform half or one and a half revolutions in the orbit period 38,000 nmi from the surface of the Moon.

12 DRO DEPARTURE
Leave DRO and start return to Earth.

13 RETURN POWERED FLYBY (RPF)
RPF burn prep and return coast to Earth initiated.

14 RETURN TRANSIT
Return Trajectory Correction (RTC) burns as necessary to aim for Earth's atmosphere.

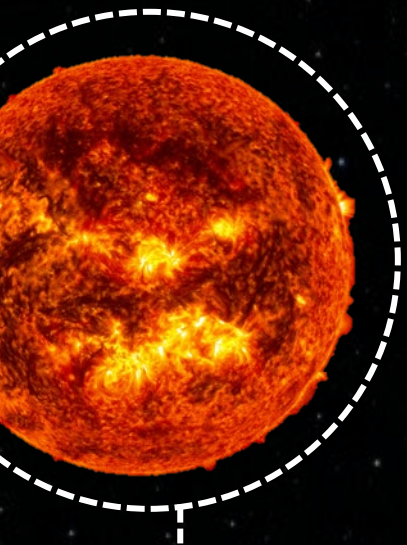
15 CREW MODULE SEPARATION FROM SERVICE MODULE

16 ENTRY INTERFACE (EI)
Enter Earth's atmosphere.

17 SPLASHDOWN
Pacific Ocean landing within view of the U.S. Navy recovery ship.

10/7/2021

ARTEMIS I CUBESATS HITCH A RIDE TO SPACE



SUN

- CuSP (Southwest Research Institute)

MOON

- Lunar IceCube (Morehead State University)
- LunaH-Map (Arizona State University)
- OMOTENASHI (JAXA)
- LunIR (Lockheed Martin)
- EQUULEUS (JAXA)

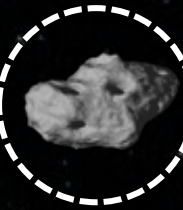


EARTH-MOON

- ArgoMoon (ESA/ASI)

ASTEROID

- NEA Scout (NASA)



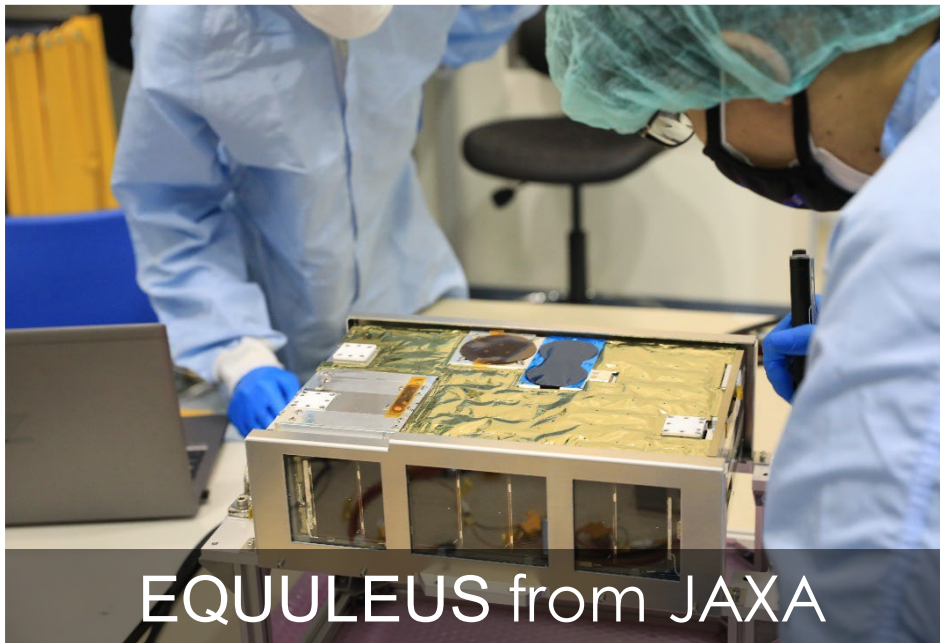
...AND MORE

- BioSentinel (NASA)
- Team Miles (Miles Space)

ARTEMIS I CUBESAT PAYLOAD INTEGRATION



Team Miles



EQUULEUS from JAXA



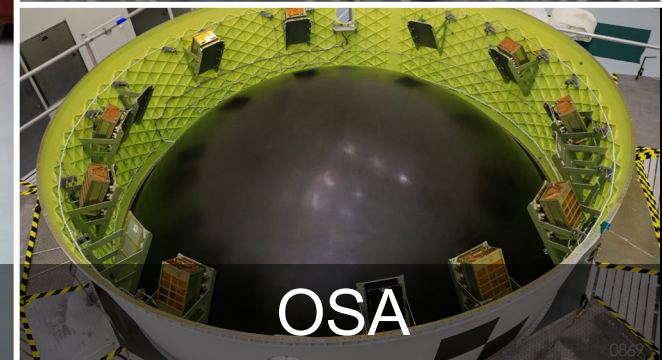
Lunar IceCube from
Morehead State
University



NEA Scout from Marshall Space
Flight Center



OMOTENASHI from JAXA



OSA

ARTEMIS I TEST OBJECTIVES



Rigorous checkout prior to crewed flights

- **Test Orion's heat shield at lunar re-entry velocities**
 - 24,500 mph or Mach 32
 - Re-entry will be as hot as 5,000°F – half as hot as the surface of the Sun!
- **Test all SLS, Orion systems in deep space environment**
- **Test recovery systems and retrieve Orion**
- **Test all ground processing and launch facilities**
- **Deploy secondary payloads (CubeSats)**



ARTEMIS II



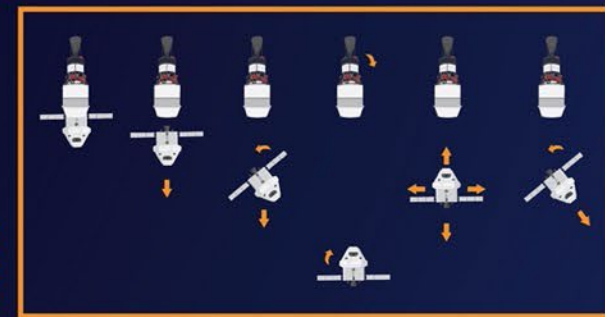


ARTEMIS II

First Crewed Test Flight to the Moon Since Apollo

- 1 LAUNCH**
Astronauts lift off from pad 39B at Kennedy Space Center.
- 2 JETTISON ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM**
- 3 CORE STAGE MAIN ENGINE CUT OFF**
With separation.
- 4 PERIGEE RAISE MANEUVER**
- 5 APOGEE RAISE BURN TO HIGH EARTH ORBIT**
Begin 24 hour checkout of spacecraft.
- 6 PROX OPS DEMONSTRATION**
Orion proximity operations demonstration and manual handling qualities assessment for up to 2 hours.
- 7 INTERIM CRYOGENIC PROPULSION STAGE (ICPS) DISPOSAL BURN**
- 8 HIGH EARTH ORBIT CHECKOUT**
Life support, exercise, and habitation equipment evaluations.
- 9 TRANS-LUNAR INJECTION (TLI) BY ORION'S MAIN ENGINE**
Lunar free return trajectory initiated with European service module.
- 10 OUTBOUND TRANSIT TO MOON**
4 days outbound transit along free return trajectory.
- 11 LUNAR FLYBY**
4,000 nmi (mean) lunar farside altitude.
- 12 TRANS-EARTH RETURN**
Return Trajectory Correction (RTC) burns as necessary to aim for Earth's atmosphere; travel time approximately 4 days.
- 13 CREW MODULE SEPARATION FROM SERVICE MODULE**
- 14 ENTRY INTERFACE (EI)**
Enter Earth's atmosphere.
- 15 SPLASHDOWN**
Ship recovers astronauts and capsule.

PROXIMITY
OPERATIONS
DEMONSTRATION
SEQUENCE



SLS PROGRESS TOWARD ARTEMIS II



Orion Stage Adapter painted



Booster motor segments complete



ICPS in final processing



Launch Vehicle Stage Adapter



Four-fifths of Artemis II core stage assembled

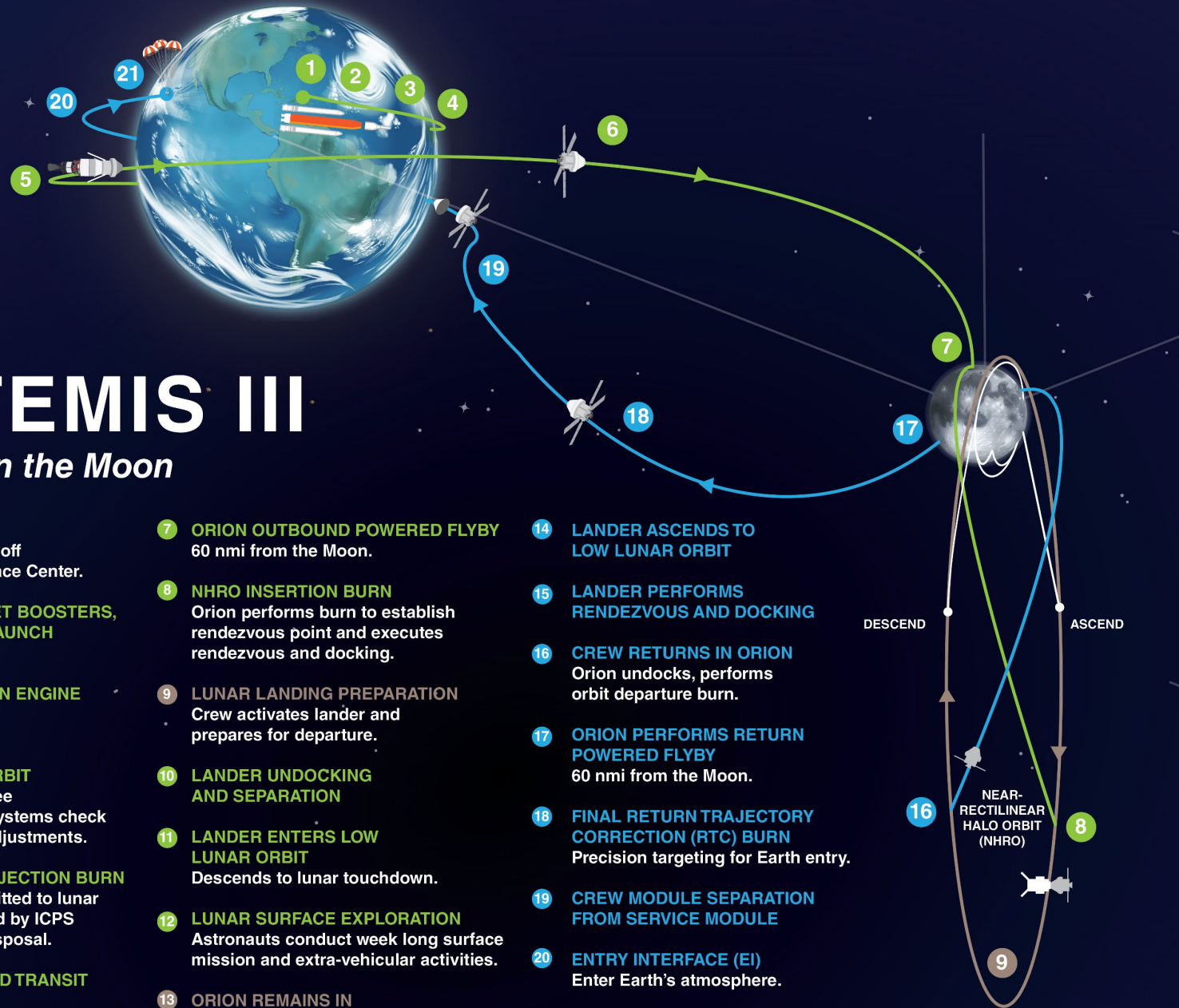


RS-25 engines complete



ARTEMIS III

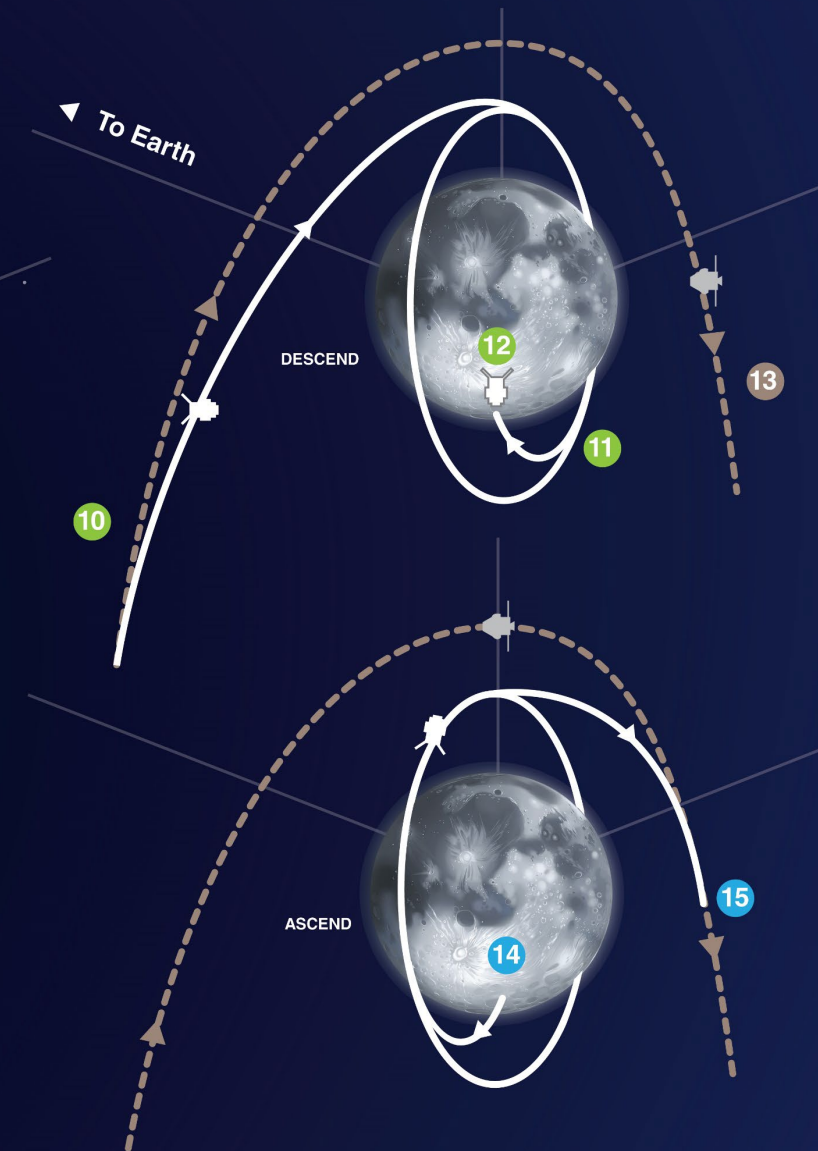




ARTEMIS III

Landing on the Moon

- 1 LAUNCH**
SLS and Orion lift off from Kennedy Space Center.
- 2 JETTISON ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM**
- 3 CORE STAGE MAIN ENGINE CUT OFF**
With separation.
- 4 ENTER EARTH ORBIT**
Perform the perigee raise maneuver. Systems check and solar panel adjustments.
- 5 TRANS LUNAR INJECTION BURN**
Astronauts committed to lunar trajectory, followed by ICPS separation and disposal.
- 6 ORION OUTBOUND TRANSIT TO MOON**
Requires several outbound trajectory burns.
- 7 ORION OUTBOUND POWERED FLYBY**
60 nmi from the Moon.
- 8 NHRO INSERTION BURN**
Orion performs burn to establish rendezvous point and executes rendezvous and docking.
- 9 LUNAR LANDING PREPARATION**
Crew activates lander and prepares for departure.
- 10 LANDER UNDOCKING AND SEPARATION**
- 11 LANDER ENTERS LOW LUNAR ORBIT**
Descends to lunar touchdown.
- 12 LUNAR SURFACE EXPLORATION**
Astronauts conduct week long surface mission and extra-vehicular activities.
- 13 ORION REMAINS IN NHRO ORBIT**
During lunar surface mission.
- 14 LANDER ASCENDS TO LOW LUNAR ORBIT**
- 15 LANDER PERFORMS RENDEZVOUS AND DOCKING**
- 16 CREW RETURNS IN ORION**
Orion undocks, performs orbit departure burn.
- 17 ORION PERFORMS RETURN POWERED FLYBY**
60 nmi from the Moon.
- 18 FINAL RETURN TRAJECTORY CORRECTION (RTC) BURN**
Precision targeting for Earth entry.
- 19 CREW MODULE SEPARATION FROM SERVICE MODULE**
- 20 ENTRY INTERFACE (EI)**
Enter Earth's atmosphere.
- 21 SPLASHDOWN**
Ship recovers astronauts and capsule



SLS PROGRESS TOWARD ARTEMIS III AND BEYOND



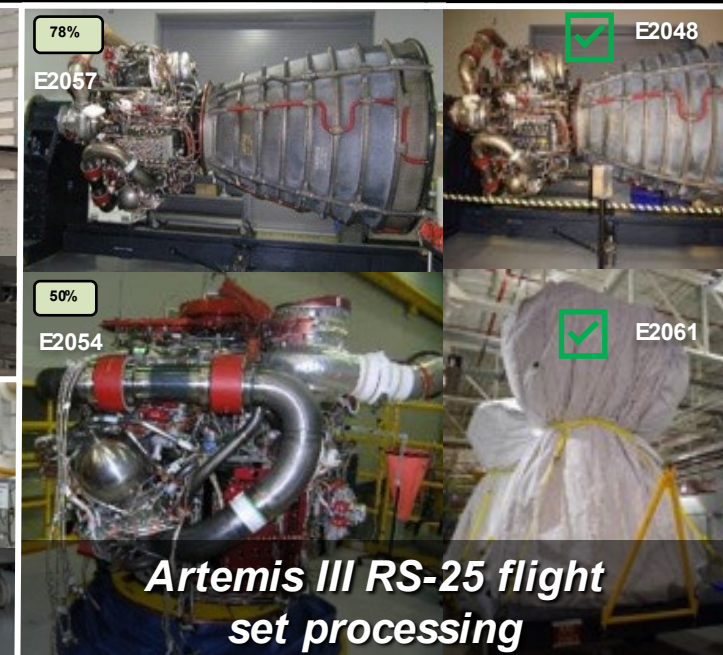
**Artemis III and FSB-2
booster segments**



**Universal stage adapter manufacturing
demonstration article**



RL10 engines complete



**Artemis III RS-25 flight
set processing**



**Artemis III core stage
Liquid Hydrogen tank**



**EUS Interstage weld confidence,
development articles**



Pathfinder composite case





THIS IS AMERICA'S ROCKET



SLS

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

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

NATIONAL CAPABILITY

The SLS and Orion programs (including Exploration Ground Systems at Kennedy Space Center) leverages over 3,800 suppliers and over 60,000 workers across all 50 states



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