National Aeronautics and Space Administration

NASA

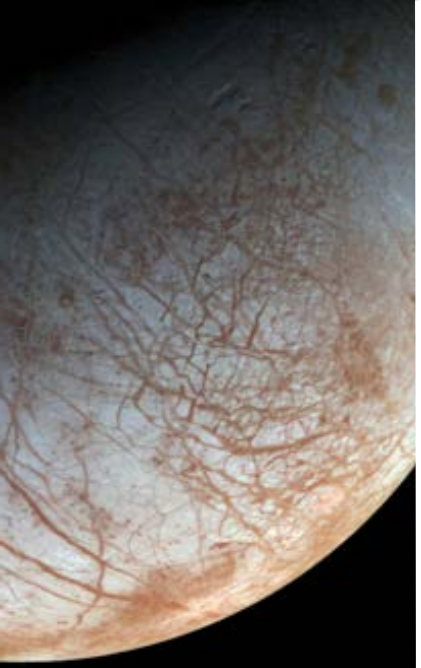
SPACE LAUNCH SYSTEM

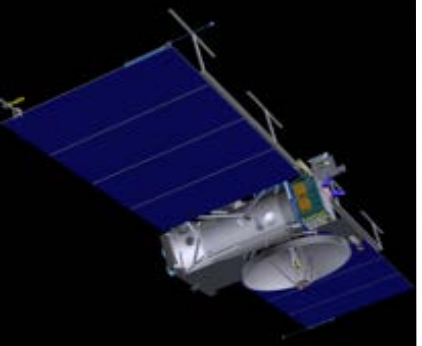
Secondary Payload Accommodations in Block 1 and Beyond

Robert Stough

SLS Spacecraft/Payload Integration & Evolution

20 July 2018





SLS ENABLES HUMAN AND ROBOTIC EXPLORATION

VOLUME

- **Three times more volume** than any contemporary heavy lift vehicle
- **Only vehicle** that can carry the Orion and a co-manifested payload to the Moon

Orion with Science Missions

8m fairing with large aperture telescope

MASS

- Block 1: Can launch **more mass** than any contemporary launch vehicle
- Block 2: Mars-enabling capability of **greater than 45 metric tons** to Trans Lunar Injection

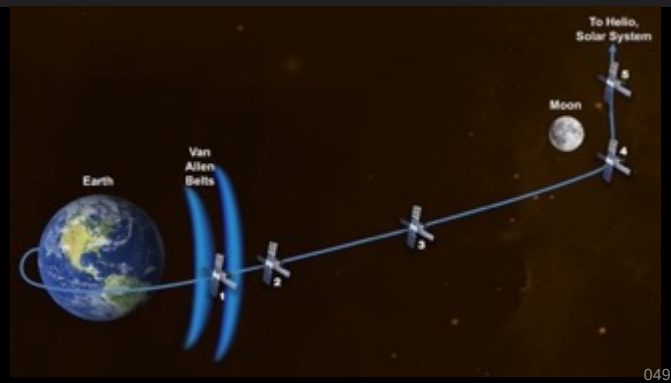
Contemporary Heavy Lift

SLS Block 1 Exploration Class

SLS Block 2 Exploration Class

DESTINATIONS

- Enables larger payloads to **deep space destinations**
- **Reduce transit times by half or more** to the outer solar system
- Game-changing benefits for extremely **high-energy missions**



SLS EVOLVABILITY

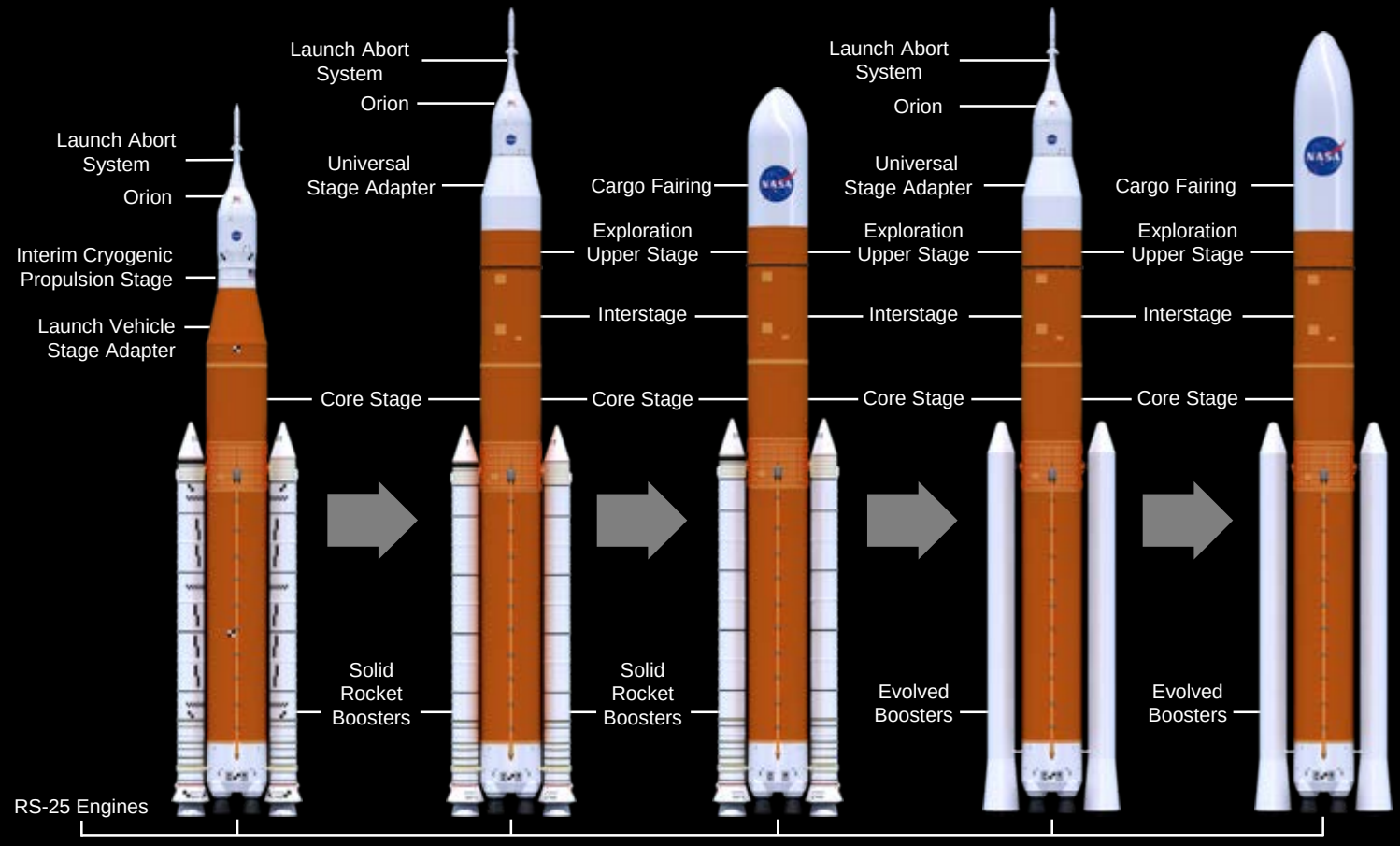
Foundation for a generation of deep space exploration

	SLS Block 1	SLS Block 1B Crew	SLS Block 1B Cargo	SLS Block 2 Crew	SLS Block 2 Cargo
Payload Volume	N/A**	10,100 ft³ (286m³)**	18,970 ft³ (537 m³)	10,100 ft³ (286m³)**	31,950 ft³ (905 m³)
Payload to TLI/Moon	> 26 t (57k lbs)	34–37 t (74k–81k lbs)	37–40 t (81k–88k lbs)	> 45 t (99k lbs)	> 45 t (99k lbs)
Maximum Thrust	8.8M lbs	8.8M lbs	8.8M lbs	11.9M lbs	11.9M lbs
Height	322 ft	364 ft	327 ft	364 ft	365 ft

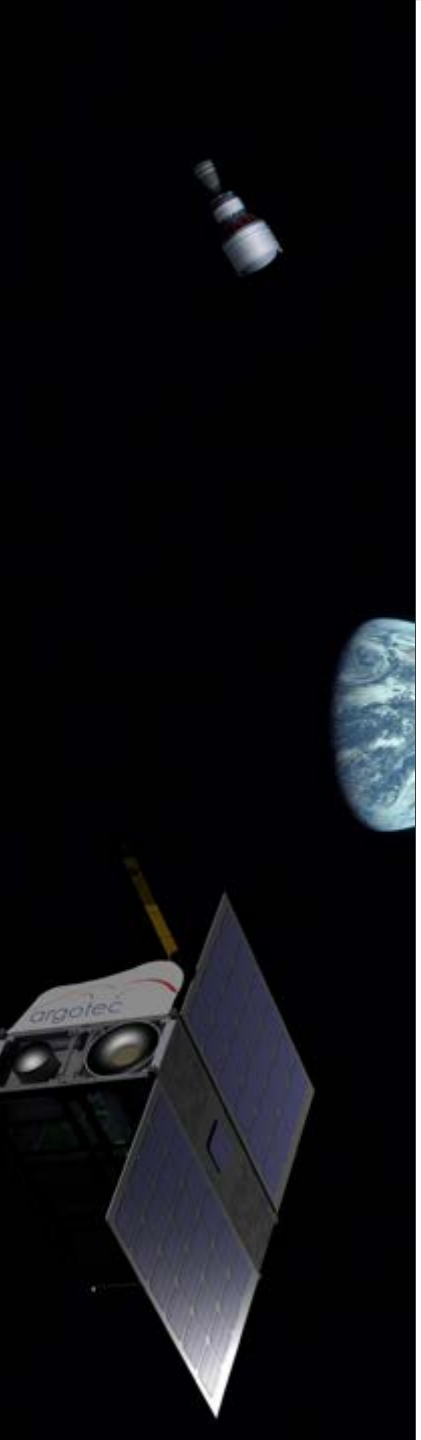
Trans-Lunar Injection (TLI) is a propulsive maneuver used to set a spacecraft on a trajectory that will cause it to arrive at the Moon. A spacecraft performs TLI to begin a lunar transfer from a low circular parking orbit around Earth.

The numbers depicted here indicate the mass capability at the Trans-Lunar Injection point.

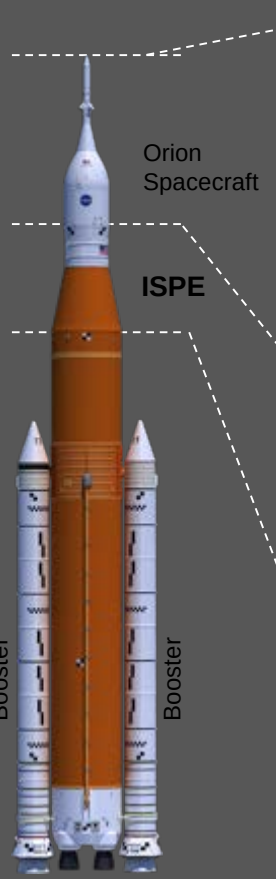
** Not including Orion/Service Module volume

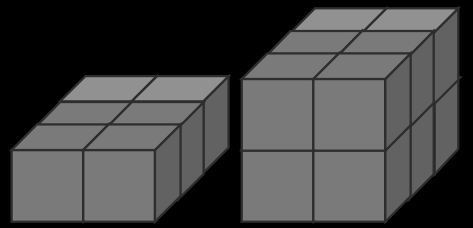


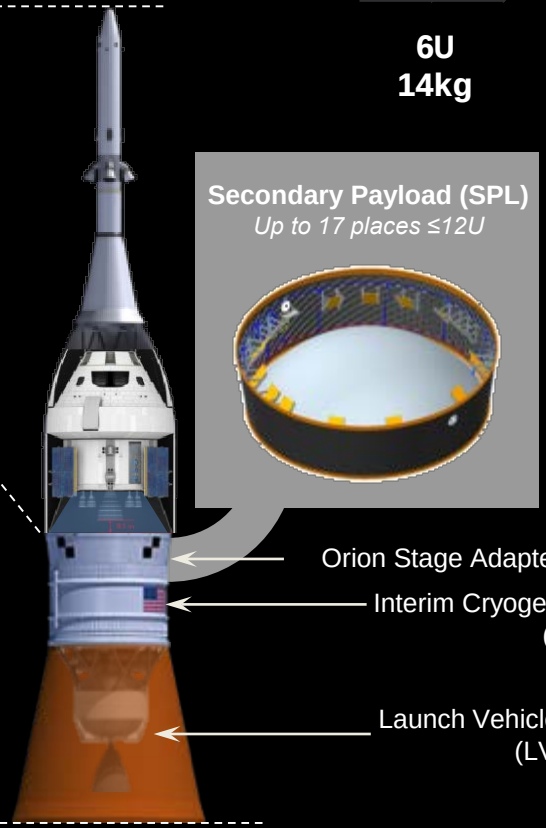
SLS BLOCK 1 PAYLOAD ACCOMODATIONS

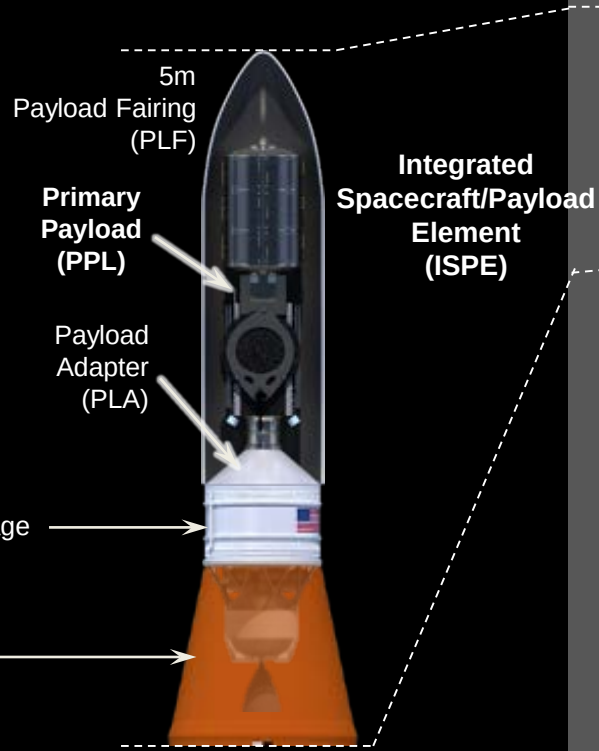


SLS Block 1 Elements
(Crew Configuration)



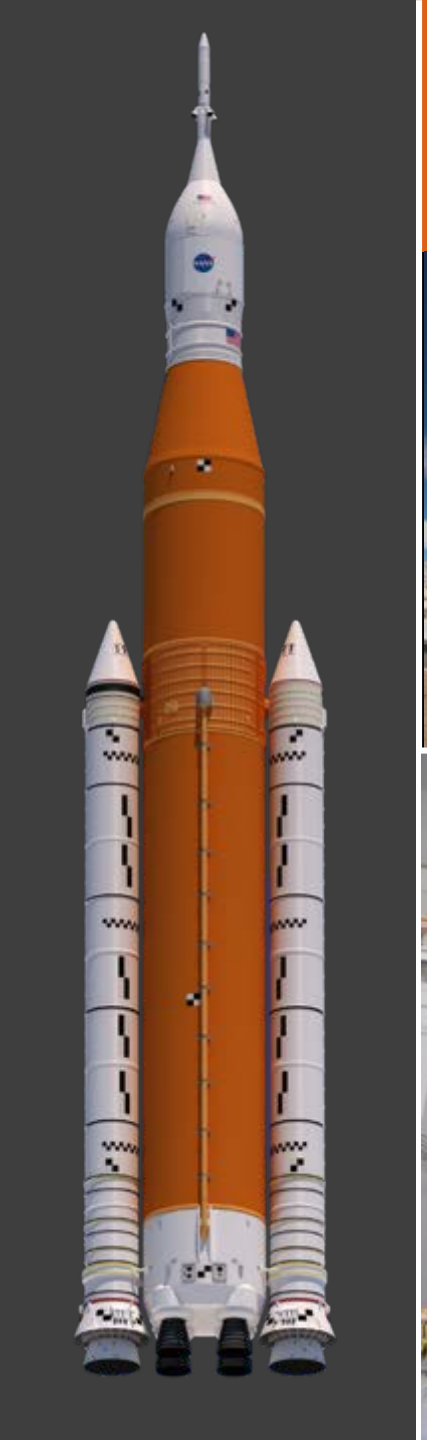


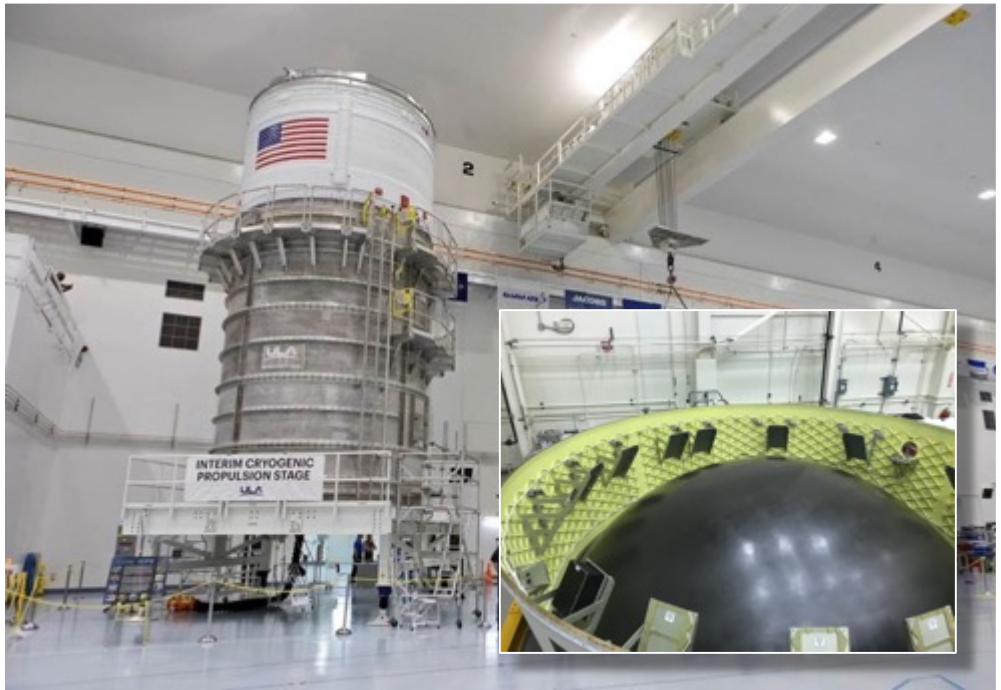




SLS Block 1 Elements
(Cargo Configuration)

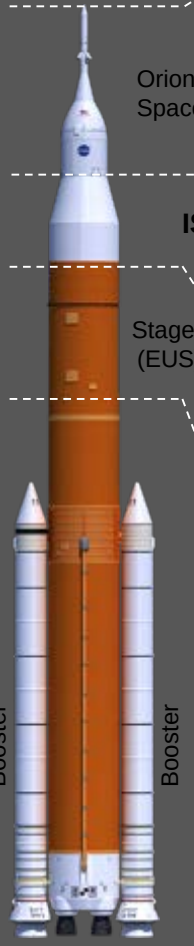
PROGRESS TOWARD EM-1

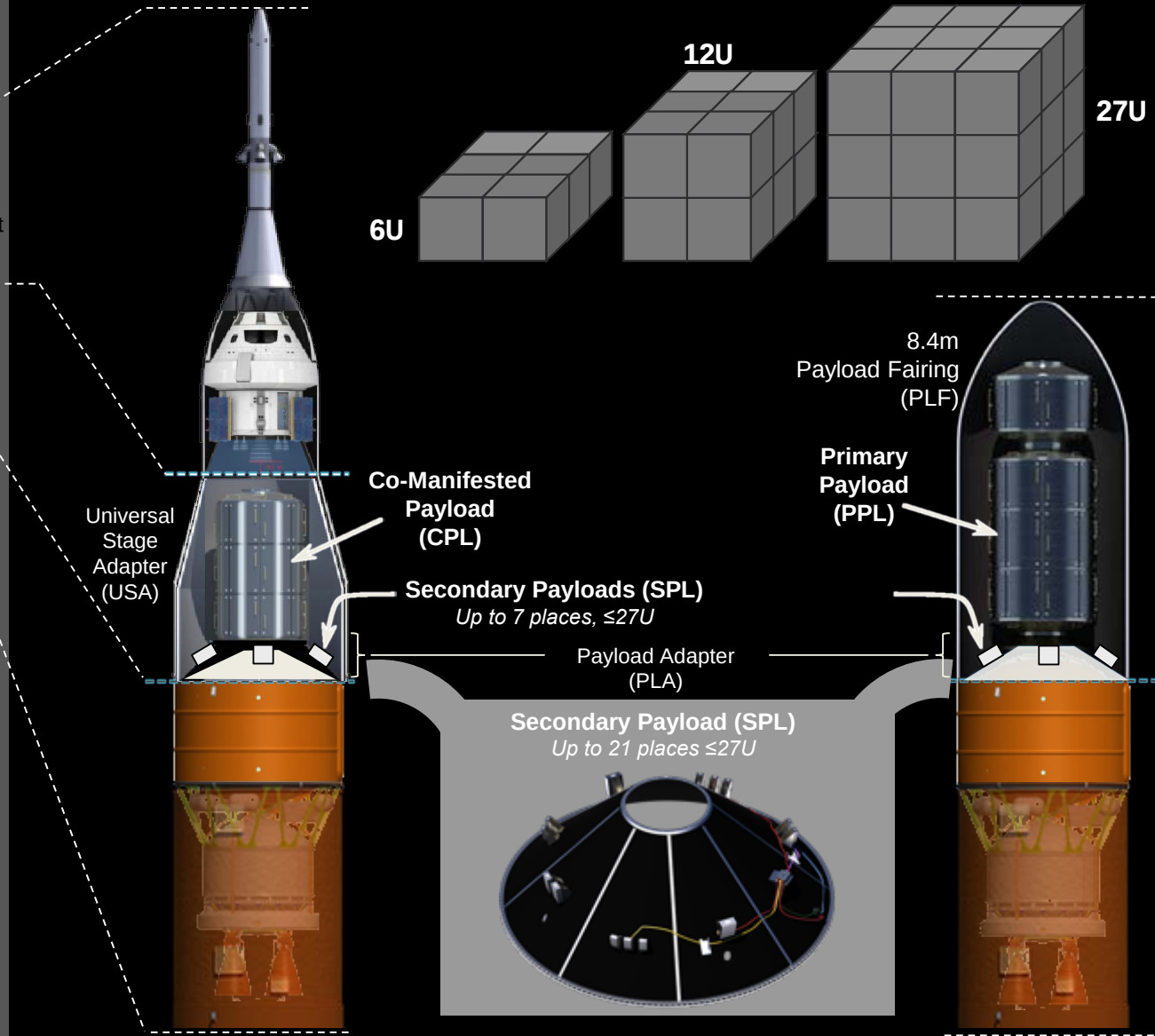




SLS BLOCK 1B/2 PAYLOAD ACCOMODATIONS

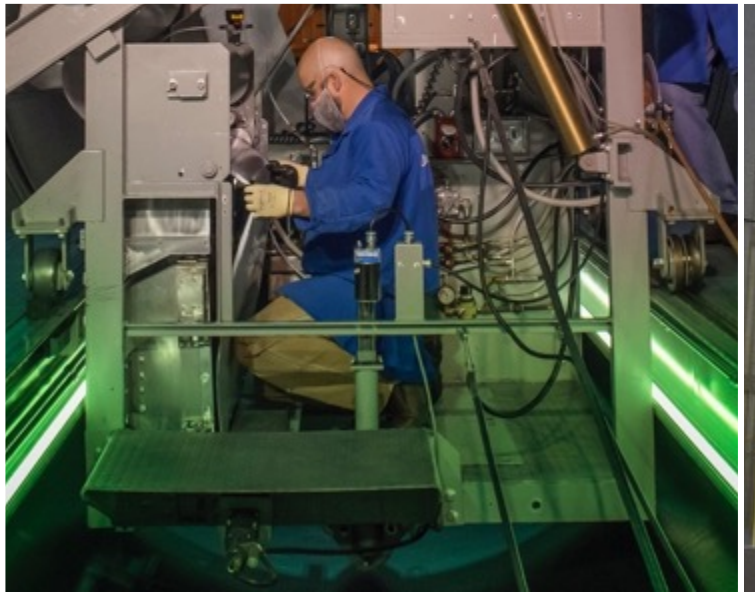
SLS Block 1B Elements
(Crew Configuration)





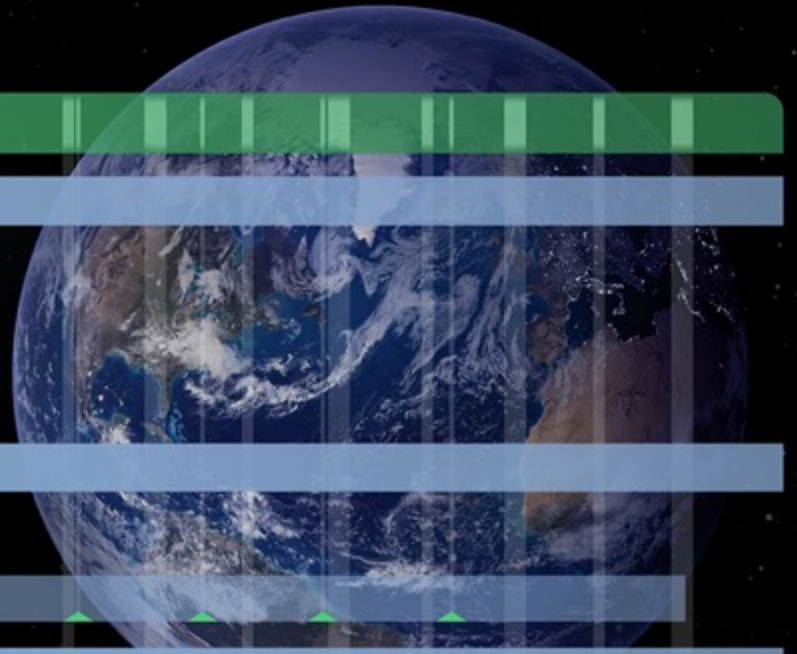
SLS Block 1B Elements
(Cargo Configuration)

PROGRESS TOWARD FUTURE FLIGHTS



Rendered image of USA

NASA Exploration Campaign



NOTIONAL LAUNCHES

EARLY SCIENCE & TECHNOLOGY INITIATIVE

- **SMD**–Pristine Apollo Sample, Virtual Institute
- **HEO/SMD**–Lunar CubeSats
- **SMD**/HEO–Science & Technology Payloads

SMALL COMMERCIAL LANDER INITIATIVE

- **HEO**–Lunar Catalyst & Tipping Point
- **SMD**/HEO–Small Commercial Landers/Payloads

MID TO LARGE LANDER INITIATIVE TOWARD HUMAN-RATED LANDER

- **HEO**/SMD–Mid-sized Landers (~500kg–1000kg)
- **HEO**/SMD–Human Descent Module Lander (5-6000kg)
- **SMD**/HEO–Payloads & Technology/Mobility & Sample Return
- **SMD**–Mars Robotics

LUNAR ORBITAL PLATFORM—GATEWAY

- **HEO**–Orion/SLS (Habitation Elements/Systems)
- **HEO**/SMD–Gateway Elements (PPE, Commercial Logistics)/Crew Support of Lunar Missions
- **HEO**/SMD–Lunar Sample Return Support

2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030

Timelines are tentative and will be developed further in FY 2019

MARCH 2018

IT'S HAPPENING NOW!

SAMPLE DEPLOYMENT LOCATIONS

Bus Stops	Description	Altitude (approx.)	Flight Time (PMA Based)
1	First opportunity for deployment, cleared 1st radiation belt	36,507 km	4 Hrs. 1 Min.
2	Clear both radiation belts plus ~ 1 hour	70,242 km	6 Hrs. 59 Min.
3	Half way to the moon	192,300 km	1 Days, 0 Hrs. 54 Min.
4	At the moon, closest proximity (~240 km from surface)	395,248 km	5 Days, 21 Hrs. 50 Min.
5	Past the moon plus ~12 hours (lunar gravitational assist)	355,807 km	6 Days, 9 Hrs. 49 Min.

Note: All info based on a 5.9 day trip to the moon
(PMA Trajectory)