National Aeronautics and Space Administration

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SPACE LAUNCH SYSTEM

PROGRESS TOWARD THE PROVING GROUND

Angie Jackman
NASA Space Launch System
June 2017

www.nasa.gov/sls

Exploring Space In Partnership

Now

Using the International Space Station

2020s

Operating in the Lunar Vicinity

2030s

Leaving the Earth-Moon System and Reaching Mars Orbit

Advancing technologies, discovery and creating economic opportunities

Phase 0

Solve exploration mission challenges through research and systems testing on the ISS. Understand if and when lunar resources are available. Develop standards

Phase 1

Conduct missions in cislunar space; assemble Deep Space Gateway and Deep Space Transport

Phase 2

Complete Deep Space Transport and conduct Mars verification mission

Phases 3 and 4

Missions to the Mars system, the surface of Mars

SLS CAPABILITY AVAILABILITY

SLS Block 1
As Early As 2019

Provides

Initial Heavy-Lift Capability

Enables

Orion Test

SmallSats to Deep Space

SLS Block 1B Crew
As Early As 2022

Provides

105 t lift capability via Exploration Upper Stage

Co-manifested payload capability in Universal Stage Adapter

Enables

Deep Space Gateway

Larger CubeSat- and ESPA-Class Payloads

SLS Block 1B Cargo
As Early As 2022

Provides

8.4-meter fairings for primary payloads

Regular flight cadence for additional launches

Enables

Europa Clipper/Lander

Deep Space Transport

Large-Aperture Space Telescopes

Ice or Ocean Worlds Missions

Interstellar Medium

SLS Block 2
As Early As 2028

Provides

130 t lift capability via advanced boosters

10-meter fairings for primary payloads

Enables

Crewed Mars Orbit Missions

Crewed Mars Surface Missions

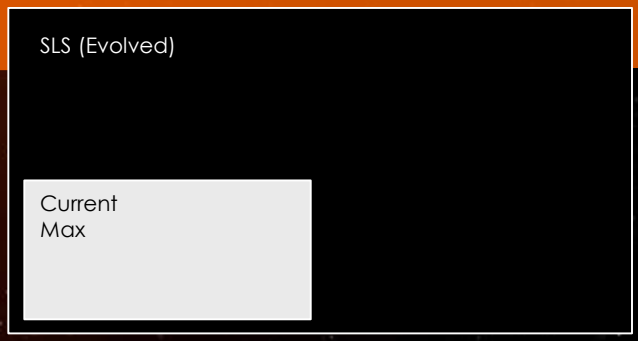
SLS SPACE LAUNCH SYSTEM

www.nasa.gov/sls

Benefits of Space Launch System

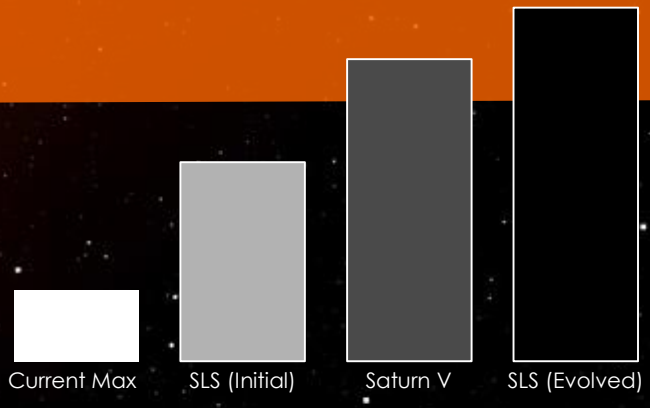
Volume

- Space Launch System will be able to offer payload accommodations with five times more volume than any contemporary launch vehicle.
- Payload fairings of up to 10-meter diameter are planned.



Mass

- Space Launch System will offer an initial capability of greater than 70 metric tons to low Earth orbit; current U.S. launch vehicle maximum is 28 t.
- Evolved version of SLS will offer greatest-ever capability of greater than 130 t to LEO.

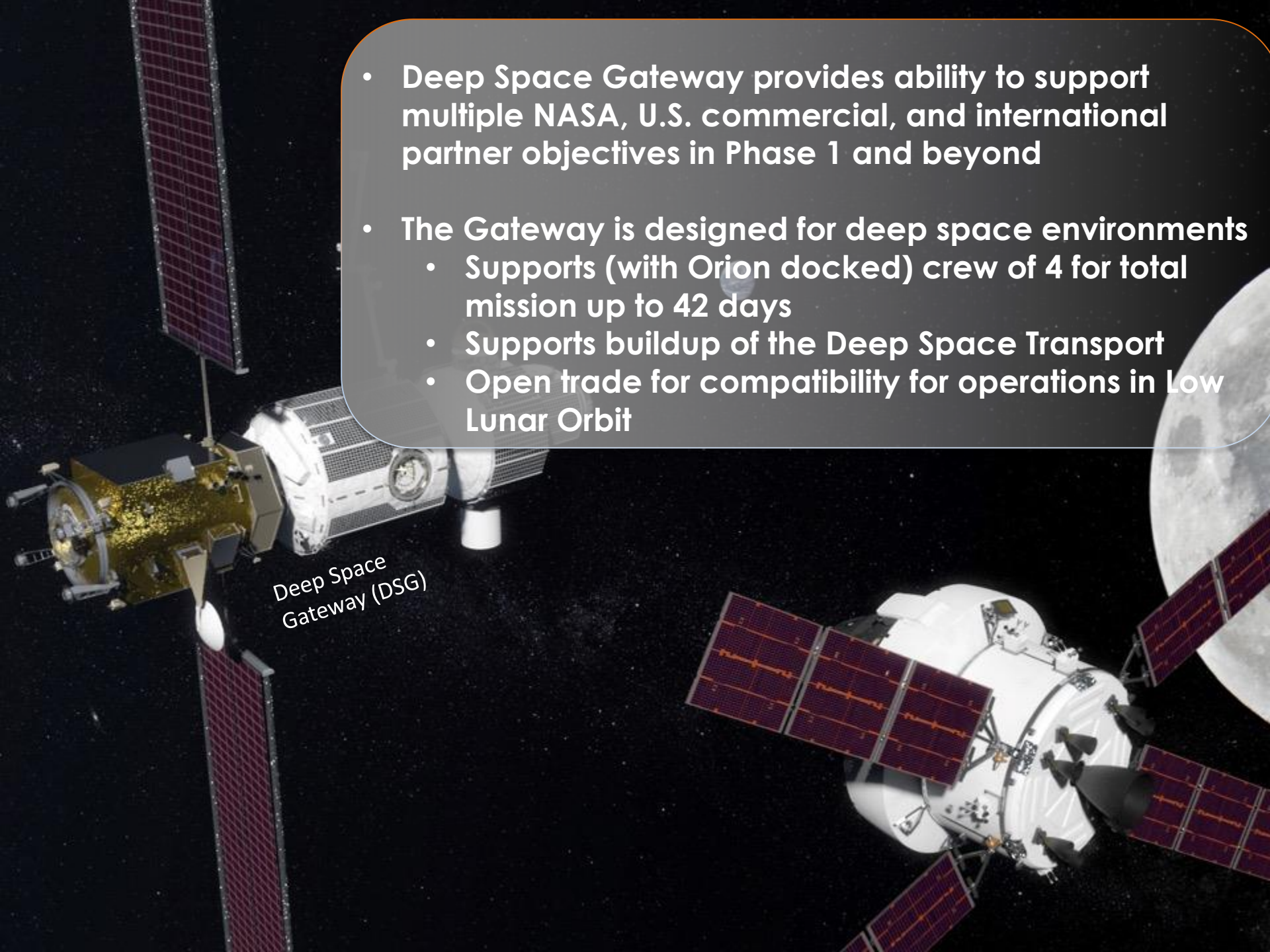


Departure Energy

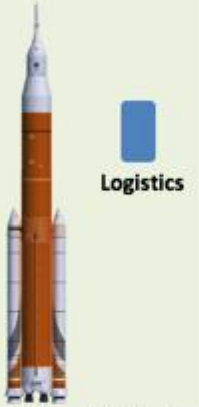
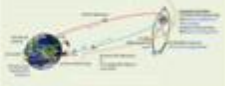
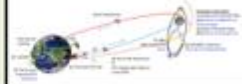
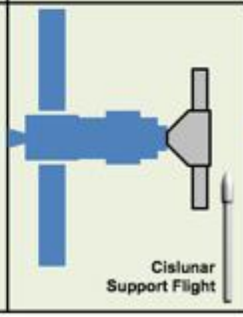
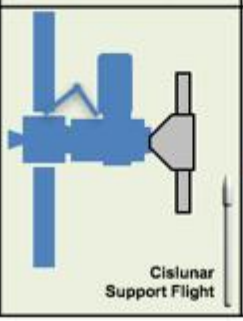
- SLS offers reduced transit times to the outer solar system by half or greater.
- Higher characteristic energy (C3) also enables larger payloads to destination.

- Deep Space Gateway provides ability to support multiple NASA, U.S. commercial, and international partner objectives in Phase 1 and beyond

- The Gateway is designed for deep space environments
  - Supports (with Orion docked) crew of 4 for total mission up to 42 days
  - Supports buildup of the Deep Space Transport
  - Open trade for compatibility for operations in Low Lunar Orbit



Phase 1 Development

		Deep Space Gateway Buildup			
EM-1	**Europa Clipper**	**EM-2**	**EM-3**	**EM-4**	**EM-5**
2018 - 2025					**2026**
SLS Block 1 Crew: 0	SLS Block 1B Cargo	SLS Block 1B Crew: 4 CMP Capability: 8-9T	SLS Block 1B Crew: 4 CMP Capability: 10mT	SLS Block 1B Crew: 4 CMP Capability: 10mT	SLS Block 1B Crew: 4 CPL Capability: 10mT
	 Europa Clipper (subject to approval)	 40kW Power/Prop Bus	 Habitation	 Logistics	 Airlock
Distant Retrograde Orbit (DRO) 26-40 days	Jupiter Direct	Multi-TLI Lunar Free Return 8-21 days	Near Rectilinear Halo Orbit (NRHO) 16-26 days	NRHO, w/ ability to translate to/from other cislunar orbits 26-42 days	NRHO, w/ ability to translate to/from other cislunar orbits 26-42 days
					
Gateway (blue) Configuration (Orion in grey)			 Cislunar Support Flight	 Cislunar Support Flight	

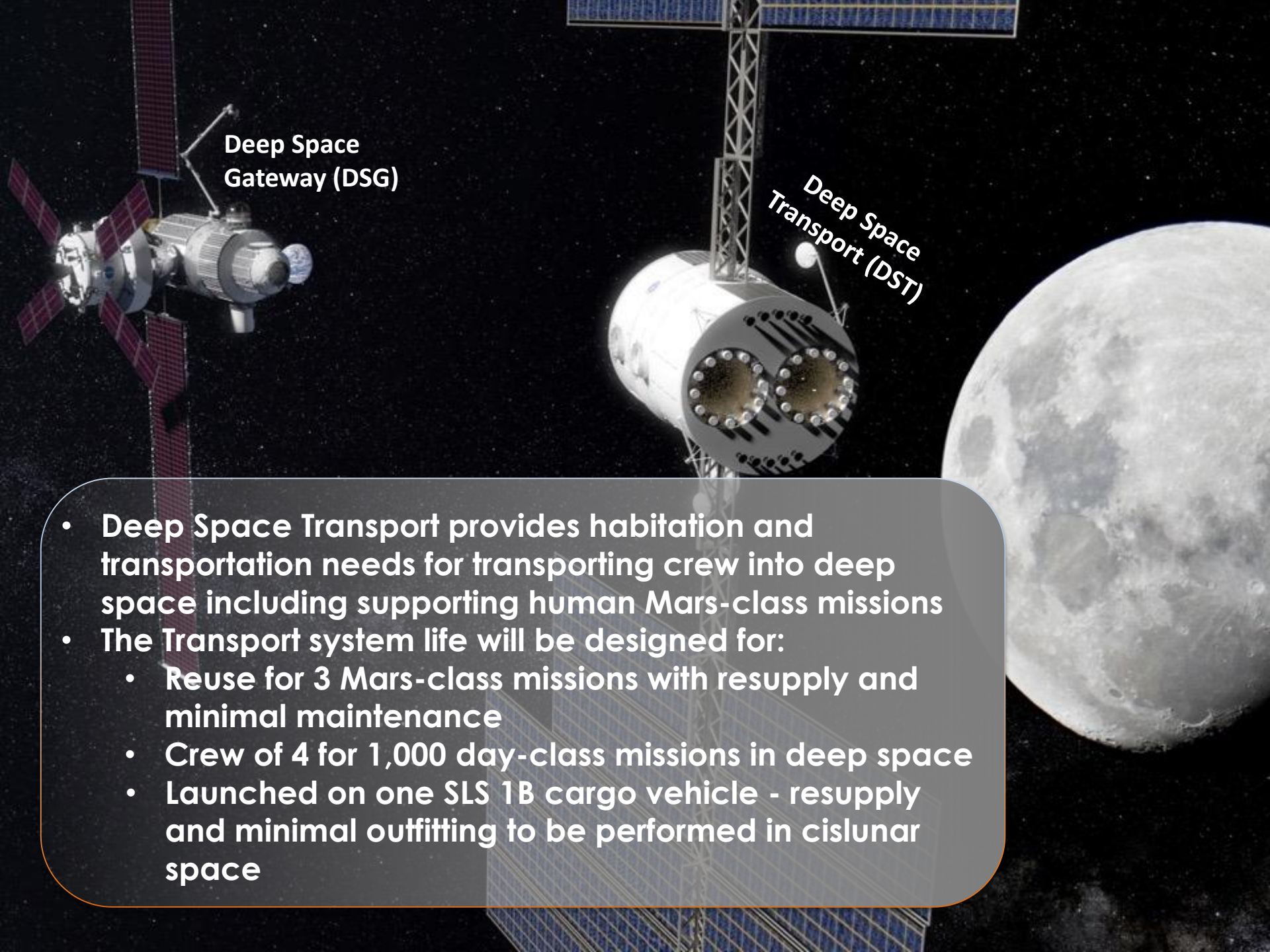
These essential Gateway elements can support multiple U.S. and international partner objectives in Phase 1 and beyond

Known Parameters:

- Gateway to architecture supports Phase 2 and beyond activities
- International and U.S. commercial development of elements and systems
- Gateway will translate uncrewed between cislunar orbits
- Ability to support science objectives in cislunar space

Open Opportunities:

- Order of logistics flights and logistics providers
- Use of logistics modules for available volume
- Ability to support lunar surface missions



- Deep Space Transport provides habitation and transportation needs for transporting crew into deep space including supporting human Mars-class missions
- The Transport system life will be designed for:
  - Reuse for 3 Mars-class missions with resupply and minimal maintenance
  - Crew of 4 for 1,000 day-class missions in deep space
  - Launched on one SLS 1B cargo vehicle - resupply and minimal outfitting to be performed in cislunar space

PROGRESS TOWARD LAUNCH

Core Stage production at Michoud

Booster testing at Orbital ATK

Engine testing at Stennis Space Center

Upper stage prep at Cape Canaveral

Structural testing at Marshall

Ongoing work for Block 1B

For More Information:

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