



# Space Launch System

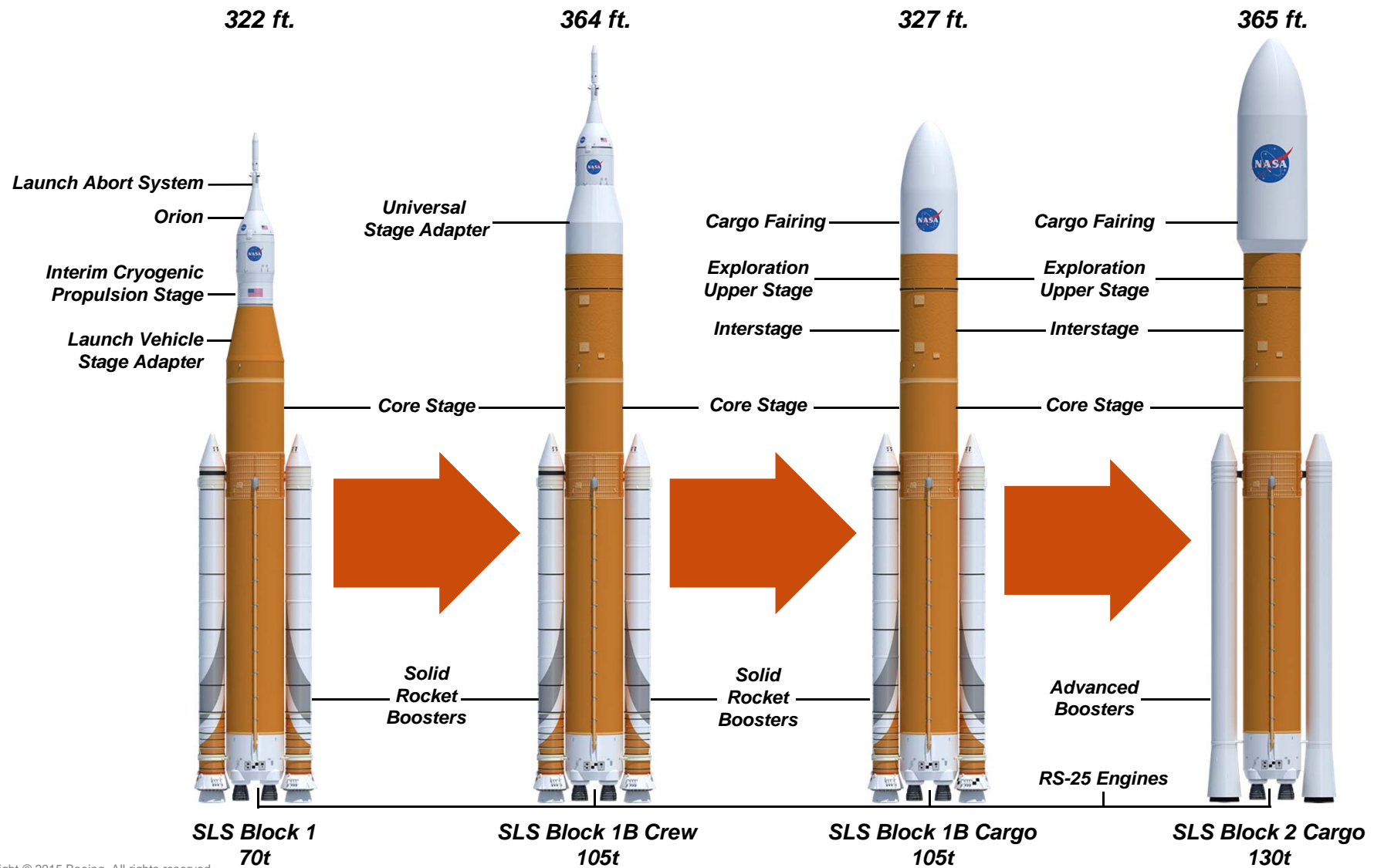
**Ben Donahue**  
*Boeing Exploration Launch Systems*

**ESA/ESTEC International Symposium  
On The Moon 2020-2030 Conference**  
Noordwijk, the Netherlands  
*Dec 15, 2015*



# SLS Evolution for Deep Space

## Affordable & Evolvable

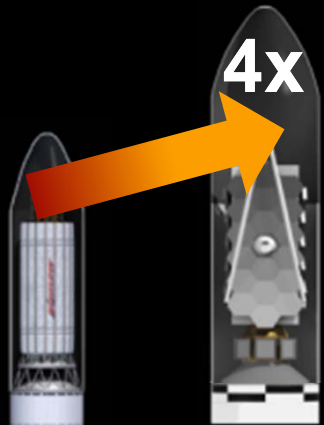


# Capability for Robust Exploration

## SLS Block 1B for Beyond Earth Orbit (BEO)



40 mT to **BEO**

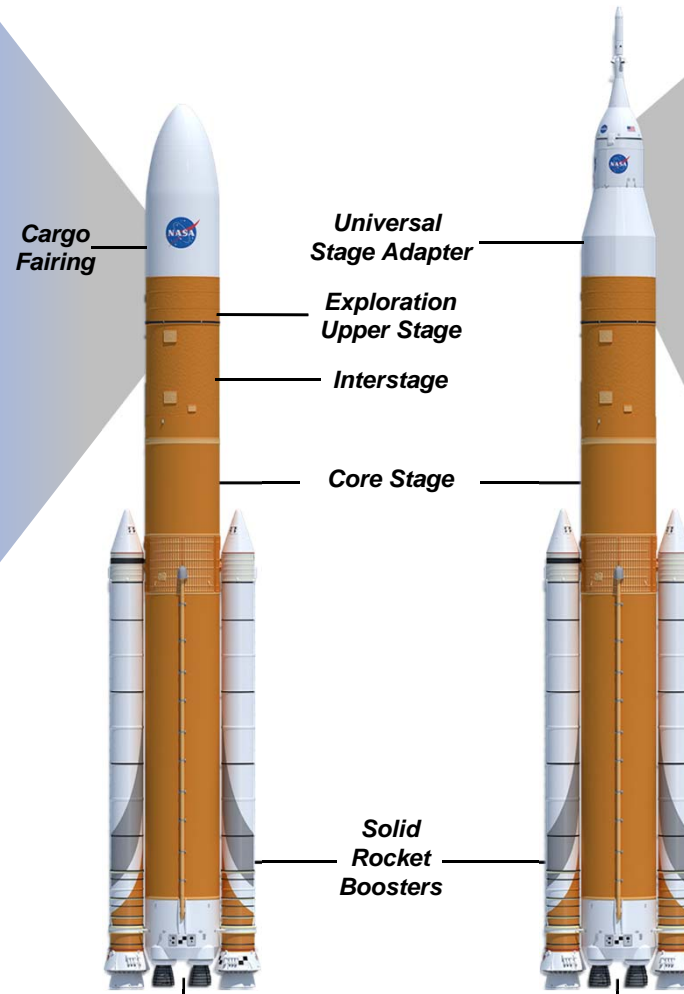


5m x 19m  
(300 m³)

8.4m x 31m  
(1200 m³)

*Compared to current EELV*

Enables **larger payloads** with more sensors, **simpler designs**



*SLS Block 1B Cargo*

*SLS Block 1B Crew*

**Orion & Cargo to BEO**



**Co-manifest Cargo Volume**

*Universal Stage Adapter*

Enables transport of **Crew and Mission Equipment** in **Single BEO mission**

# The Journey to Mars

## Capability Roadmap



Space Launch System



Orion



Transfer Habitat

Solar Electric Propulsion



Mars Lander



Mars Ascent

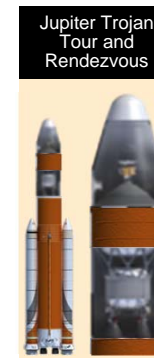
The Human Mission to Mars

2010s

2020s

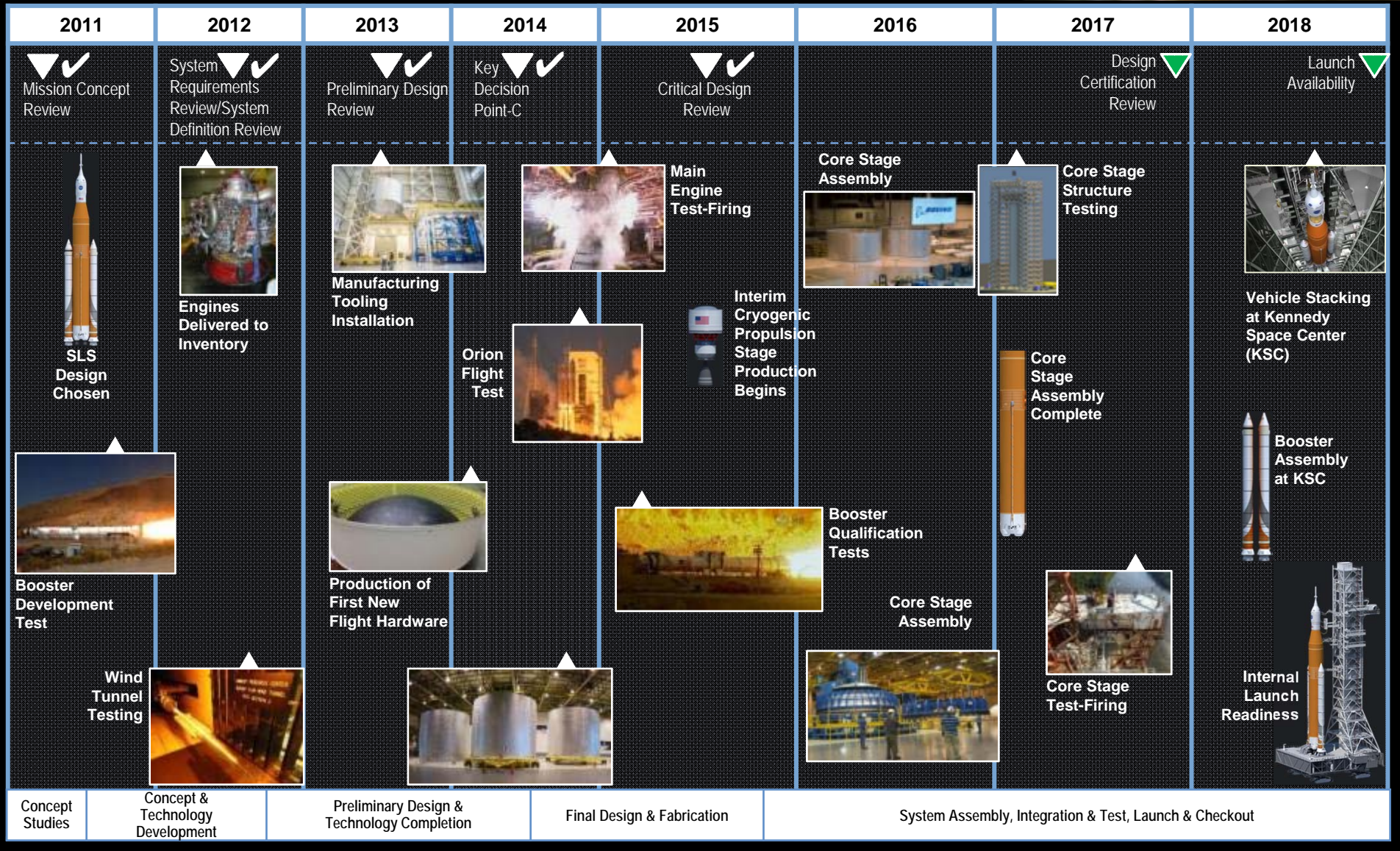
2030s

Opening the Solar System  
***Faster*** for Science and Exploration

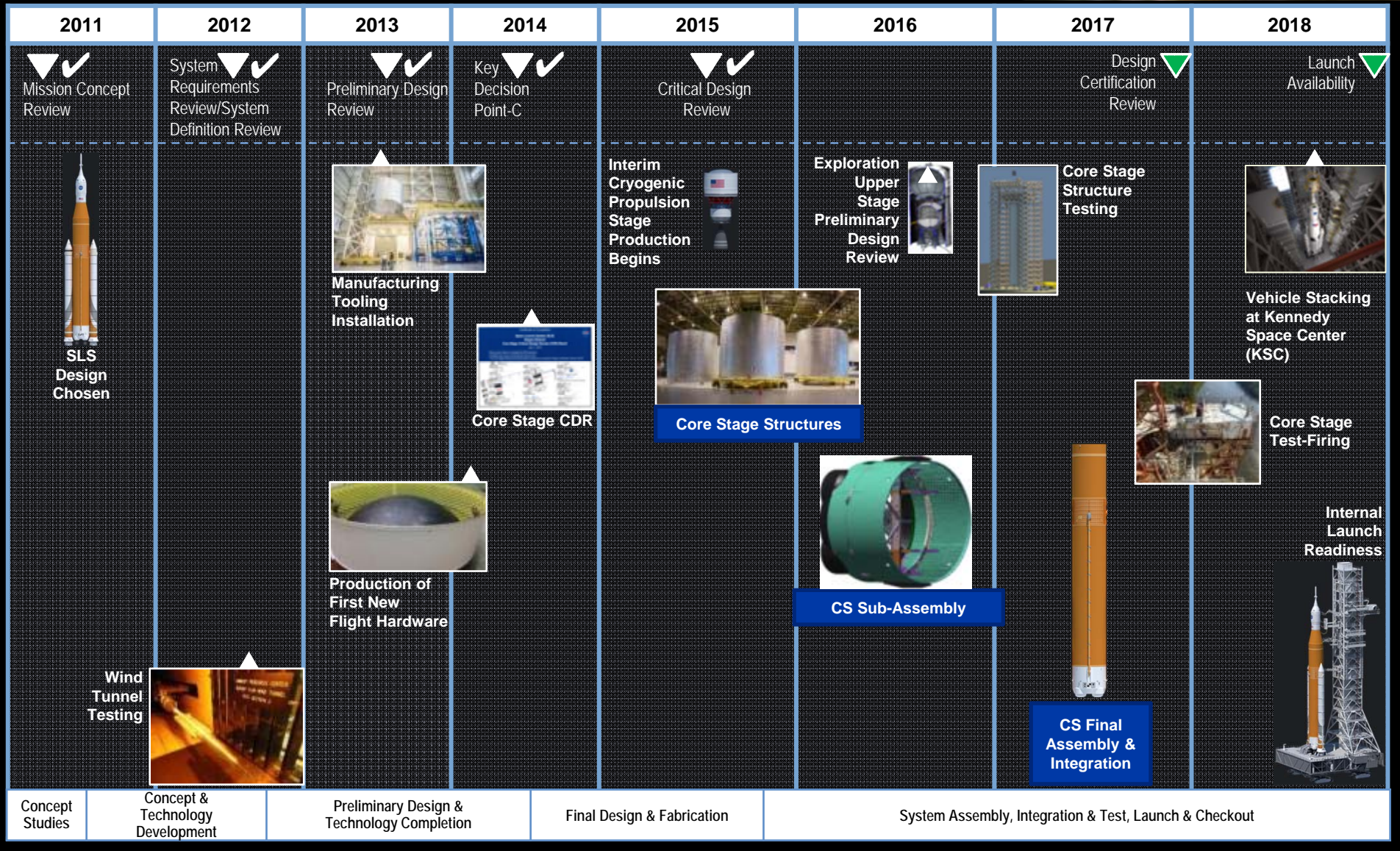


Space Launch System lays the **Foundation** for the  
**Human Journey to Mars**

# SLS Program Milestone Schedule



# SLS Stages Milestone Schedule

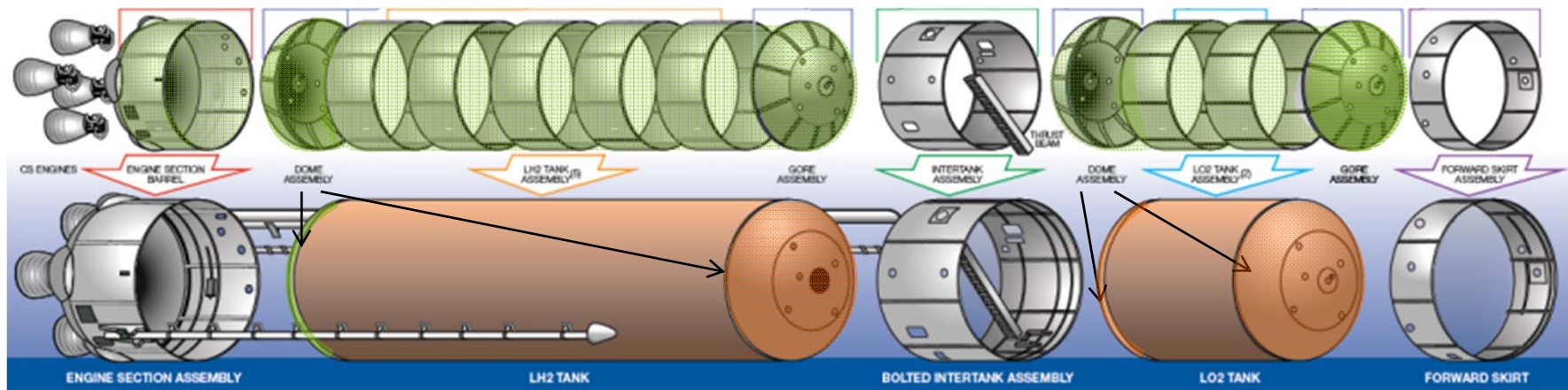


# Building the Rocket

## Space Launch System: Core Stage



### Flight Fidelity Hardware Built



**Over 70% of Qualification Stage Produced – that's over 76,000 lbs!**

# Proving the Design

## Space Launch System: Core Stage



### Component Qualification Testing Ongoing

*Critical Design Review*  
**5 months ahead of schedule**



Item	Rev	Rev	Rev	Rev	Rev
1.0	1.0	1.0	1.0	1.0	1.0
2.0	2.0	2.0	2.0	2.0	2.0
3.0	3.0	3.0	3.0	3.0	3.0
4.0	4.0	4.0	4.0	4.0	4.0
5.0	5.0	5.0	5.0	5.0	5.0
6.0	6.0	6.0	6.0	6.0	6.0
7.0	7.0	7.0	7.0	7.0	7.0
8.0	8.0	8.0	8.0	8.0	8.0
9.0	9.0	9.0	9.0	9.0	9.0
10.0	10.0	10.0	10.0	10.0	10.0
11.0	11.0	11.0	11.0	11.0	11.0
12.0	12.0	12.0	12.0	12.0	12.0
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95.0	95.0	95.0	95.0	95.0	95.0
96.0	96.0	96.0	96.0	96.0	96.0
97.0	97.0	97.0	97.0	97.0	97.0
98.0	98.0	98.0	98.0	98.0	98.0
99.0	99.0	99.0	99.0	99.0	99.0
100.0	100.0	100.0	100.0	100.0	100.0

### Technical Performance Measures

*Indicate proven design maturity*

### Flight Avionics Testing Facility: SITF-D



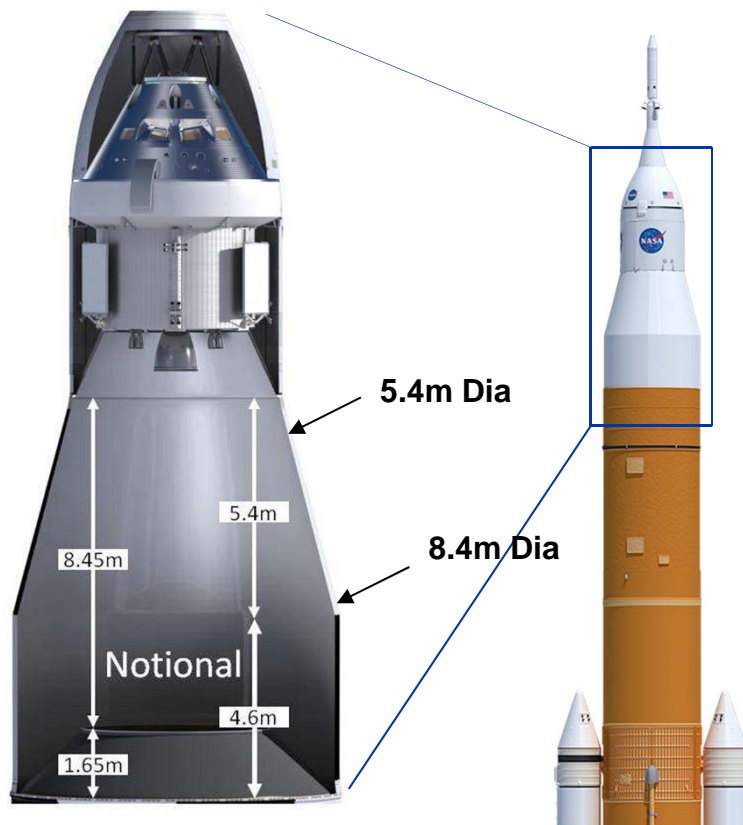
### Development Testing Ongoing

*(L to R: Cryo Seals, Purge Test (Haz Gas), LOX Anti-Geyser, LOX STE)*



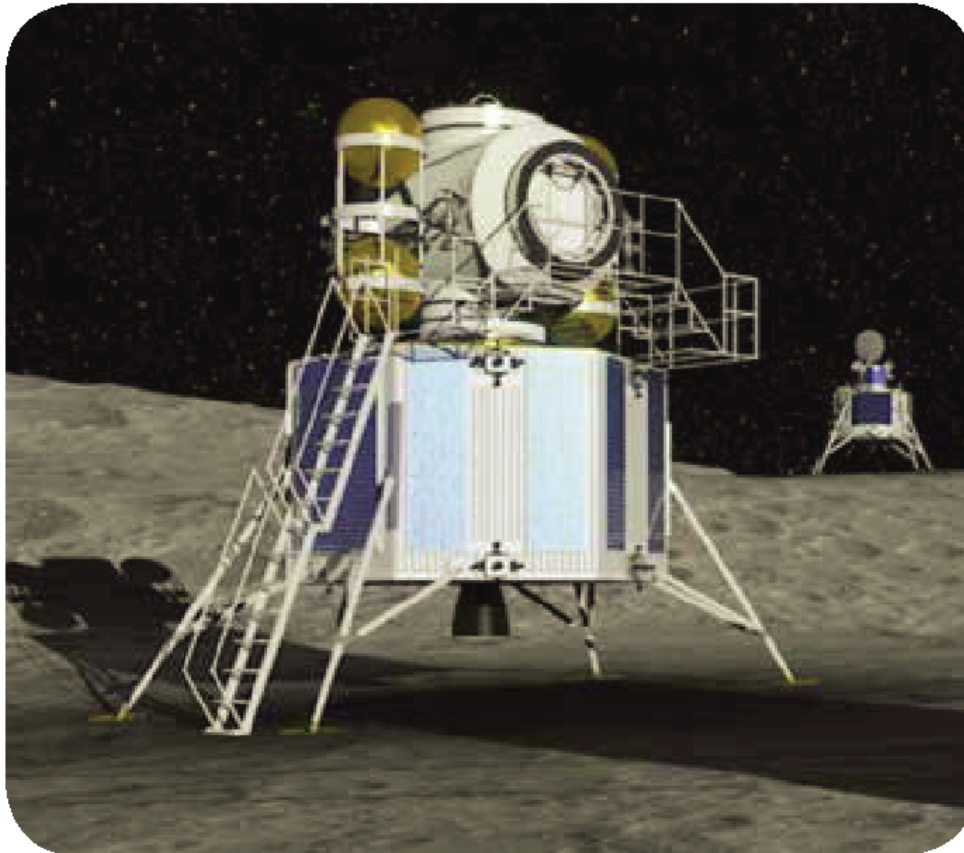
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# SLS Block 1B with Co-manifested Payload



# SLS Enabling Crew to Lunar Surface

ESA Lander Concept Shown



SLS is Capable of Launching Crewed Lunar Landers such As the ESA European Lander Concept (left)

- SLS Block 1B can put 40 tons to Trans-Lunar Injection
- SLS Block 1B Fairing diameter is 8.4 m
- International Cooperation could enable this Mission in the 2020's

The human-rated Moon lander (European concept) on the lunar surface.

From 2013 ISECG Global exploration Roadmap

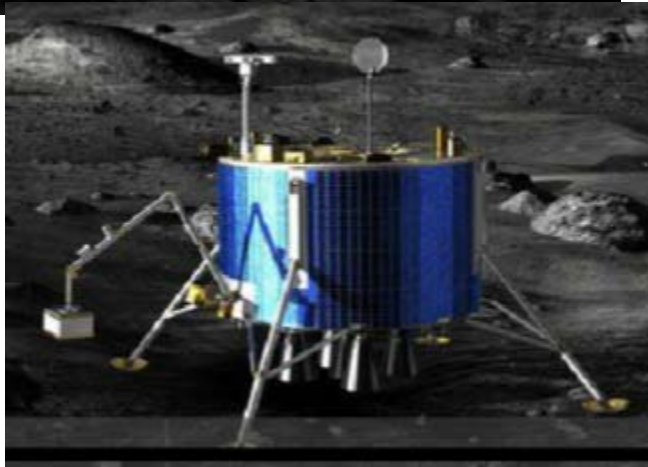
# SLS Co-manifest for Lunar Science

## ESA Lunar Lander Concept



SLS is Capable of Launching Robotic Lunar Landers Co-manifested with Orion

- SLS Block 1B can put 10 ton co-manifested to TLI
- SLS Block 1B Universal Stage Adaptor diameter is 5.4 m to 8.4 m, and 10 m in height
- International Cooperation could enable this Mission in the Early 2020's



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***SLS Enables Beyond Earth Exploration***