



5...4...3...2...1...

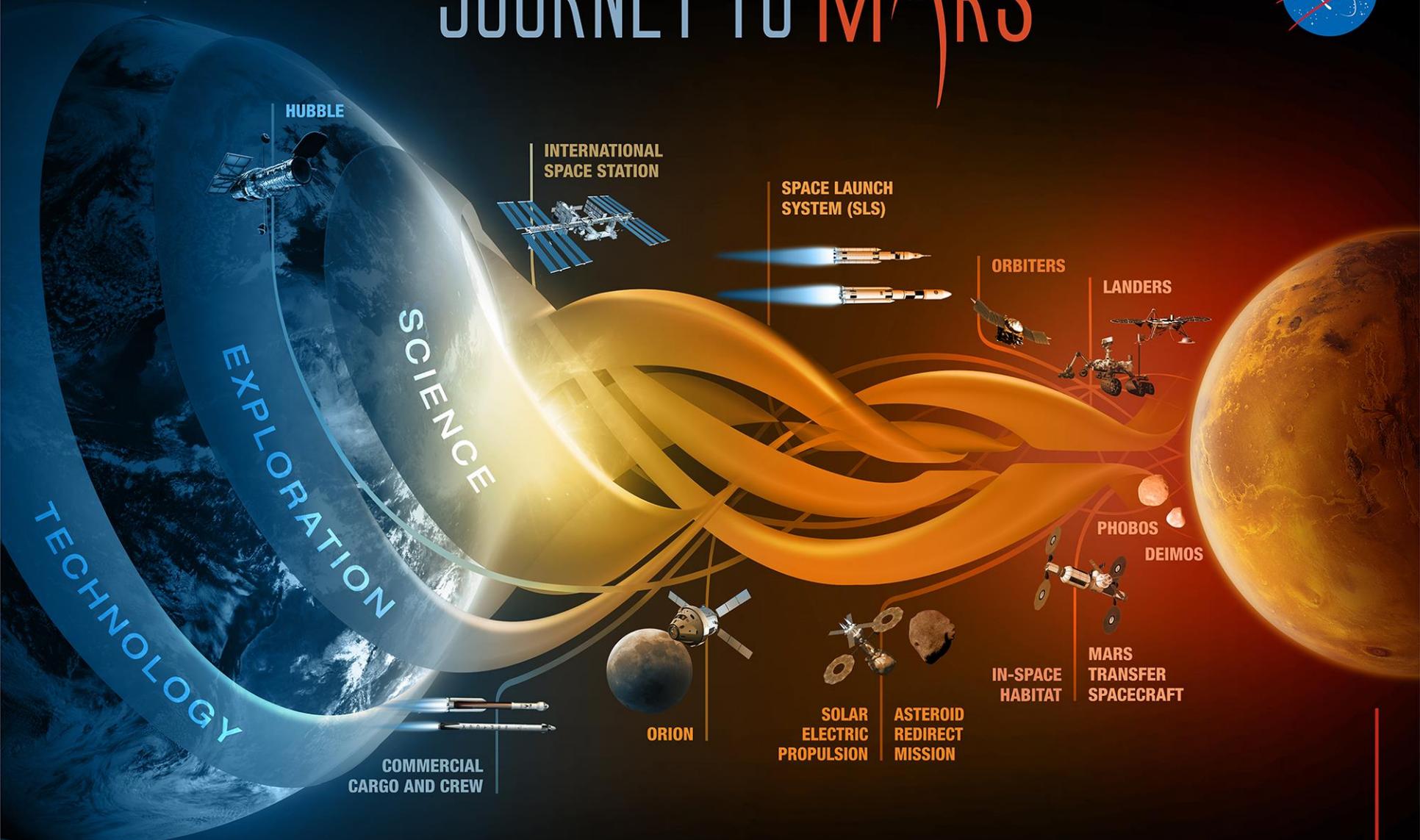
# SPACE LAUNCH SYSTEM

AN EVOLVING CAPABILITY FOR EXPLORATION

**Dr. Kimberly Robinson**  
Space Launch System Program



# JOURNEY TO MARS



MISSIONS: 6-12 MONTHS  
RETURN: HOURS

EARTH RELIANT

MISSIONS: 1 TO 12 MONTHS  
RETURN: DAYS

PROVING GROUND

MISSIONS: 2 TO 3 YEARS  
RETURN: MONTHS

EARTH INDEPENDENT

# Building Today



**Interim Cryogenic Propulsion Stage:** Test article currently in production; flight article begins summer 2015.

**Avionics:** Software Integration Test Facility preparing for qualification in second quarter 2016.



**Boosters:** Qualification Motor-1 test completed in March 2015.

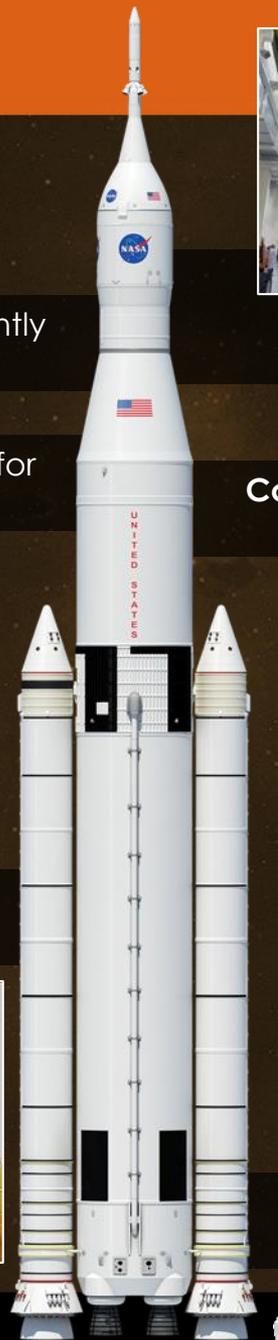


**Stage Adapters:** First flight hardware launched on Exploration Flight Test-1 in Dec. 2014.

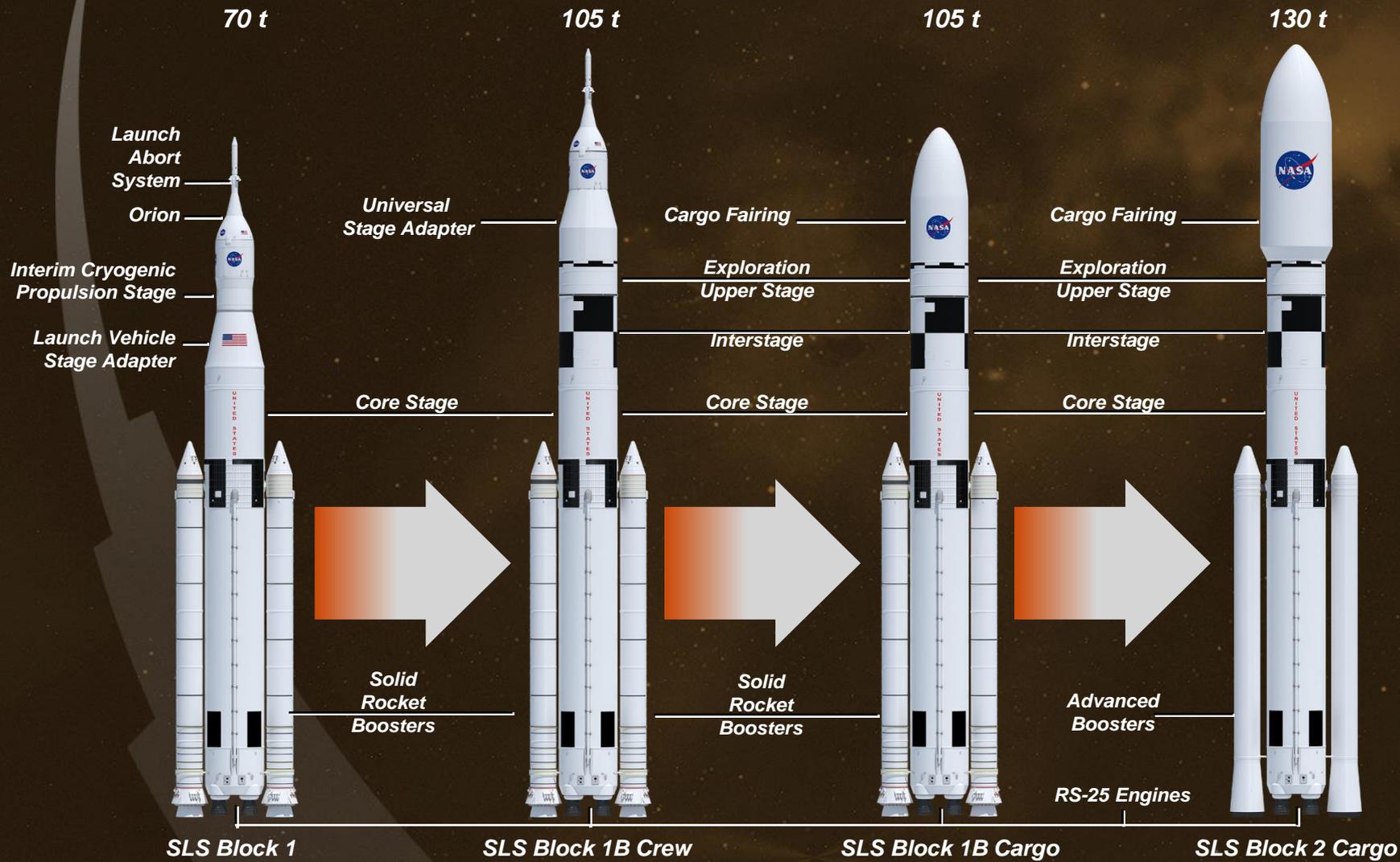
**Core Stage:** Production is underway on hardware for both test articles and EM-1 vehicle.



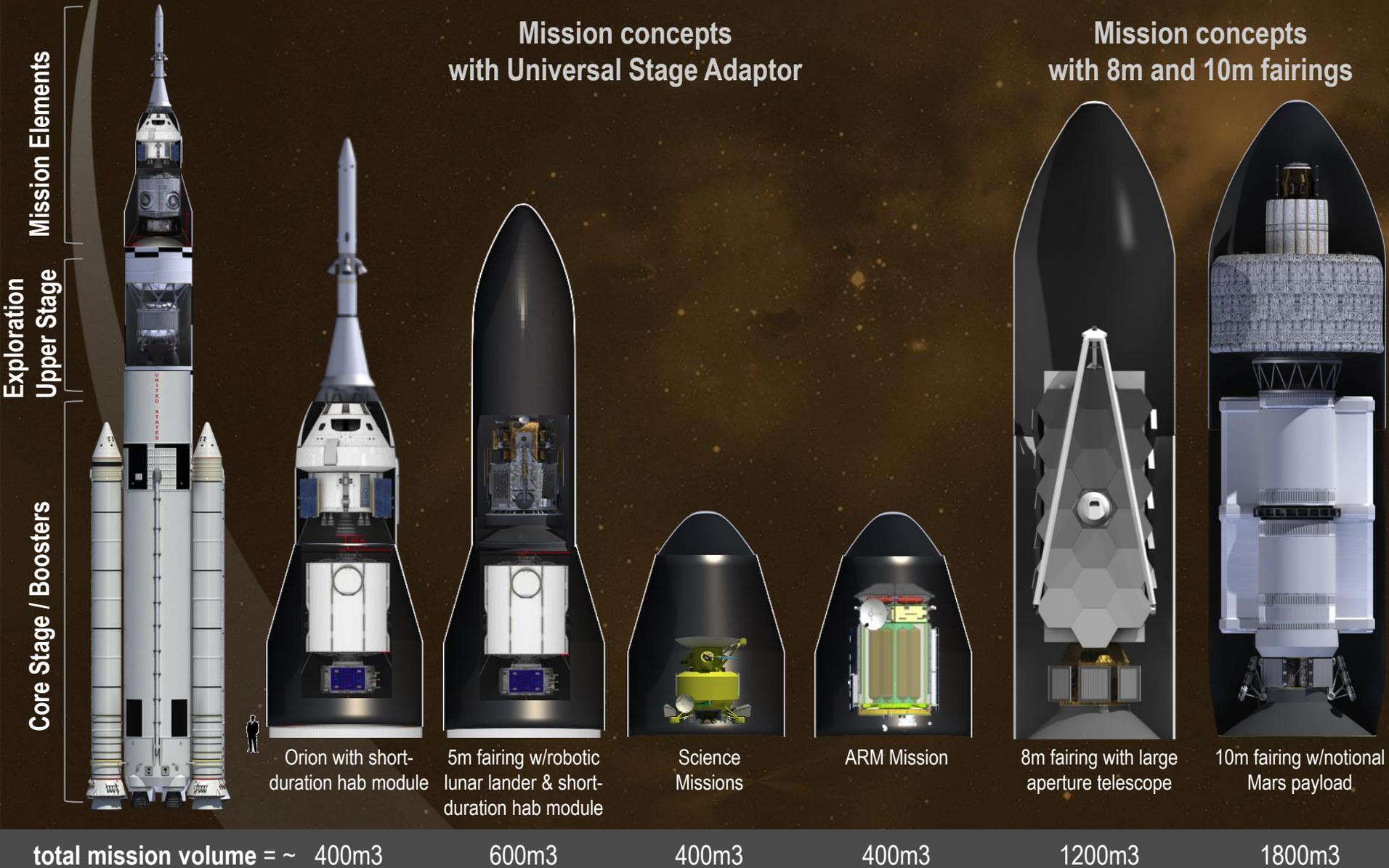
**Engines:** RS-25 testing has begun at Stennis Space Center; renovations underway to B-2 stand.



# SLS Evolution Overview



# SLS Block 1B & Mission Element Concepts Under Study

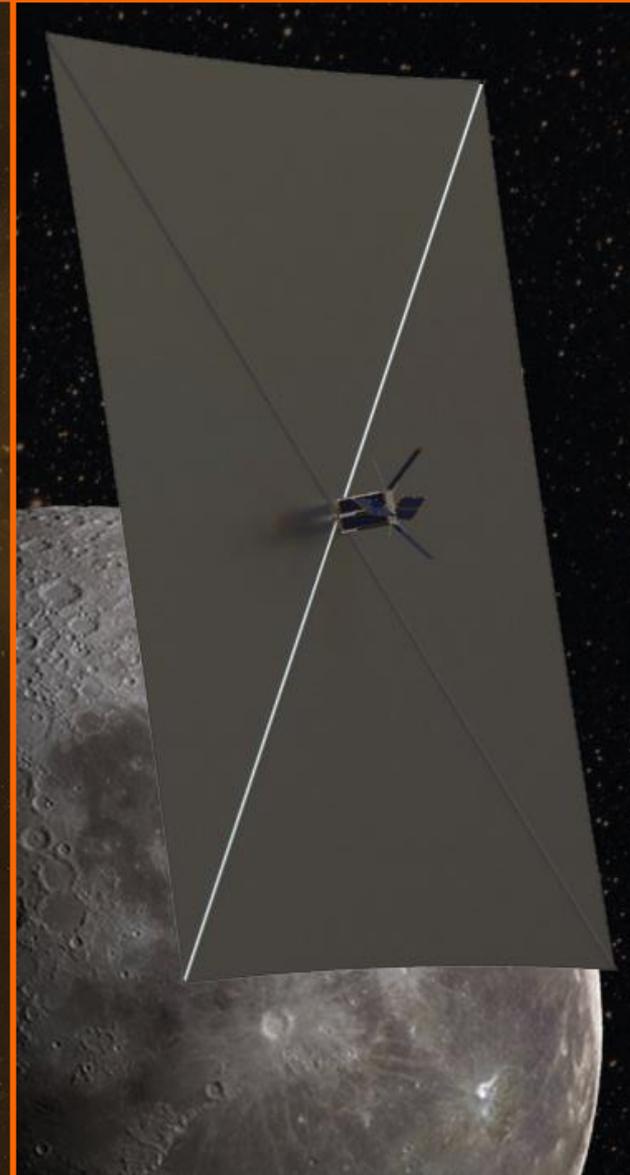


# Secondary Payload Capability

Eleven small-sat secondary payloads of 6U volume/mass (14 kg payload mass) will fly on the first flight of Space Launch System.

Among the potential payloads are these three candidates identified by NASA's Advanced Exploration Systems:

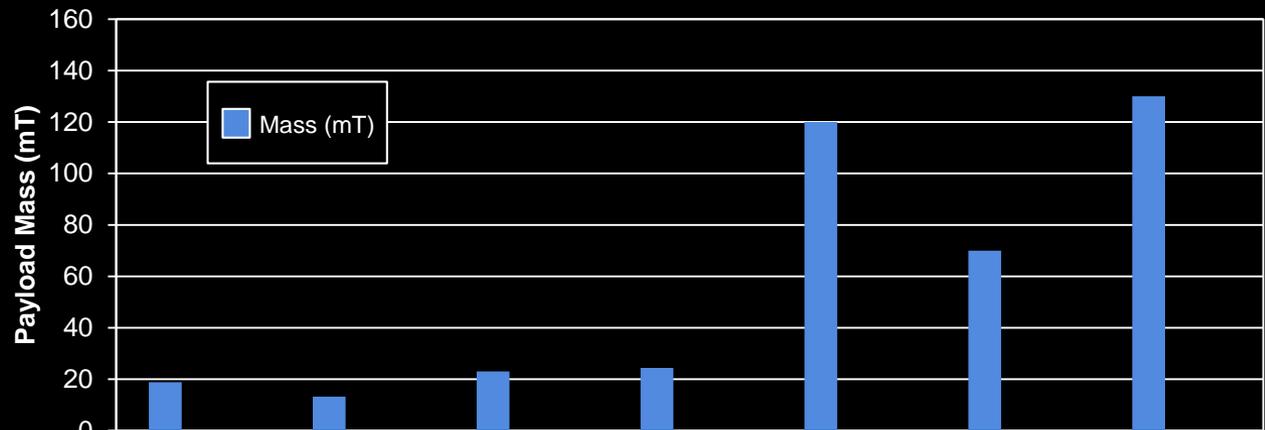
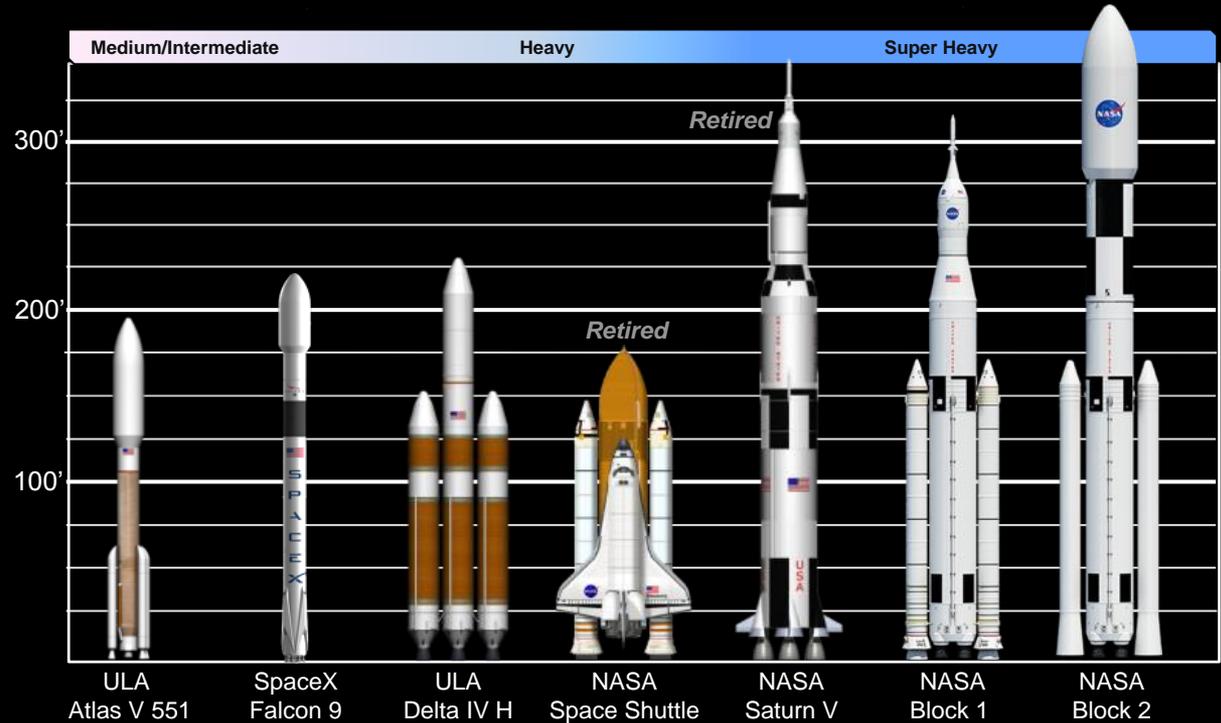
- BioSentinel: Study radiation-induced DNA damage of live organisms in cislunar space; correlate with measurements on ISS and Earth.
- Lunar Flashlight: Locate ice deposits in the moon's permanently shadowed craters
- Near Earth Asteroid (NEA) Scout: Flyby/rendezvous and characterize one NEA that is a candidate for a human mission.



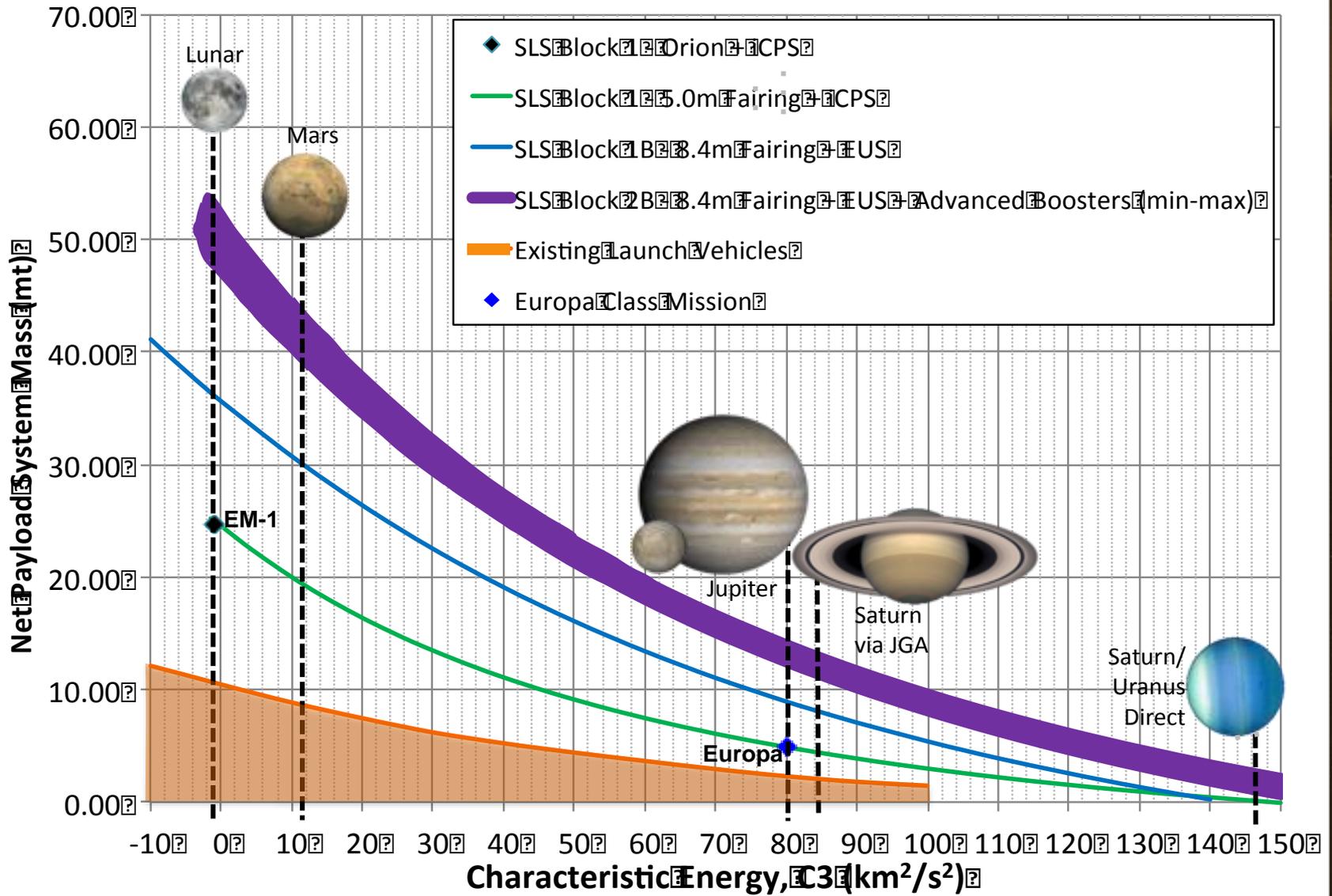
# SLS Payload Lift/Volume Capability

## Compared to Existing Vehicles

- Up to 4 times the mass to LEO
- Up to 8 times the volume to destination
- Up to 3 times faster to destination
- More mass/volume translates to less orbital deployment complexity/risk



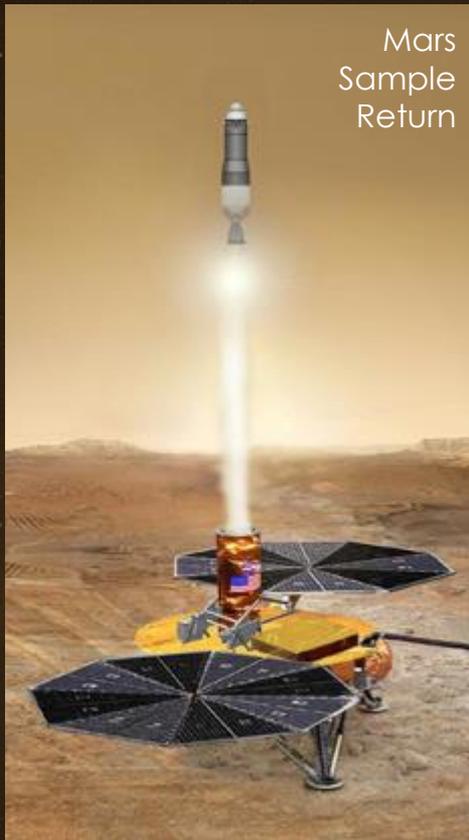
# SIs Characteristic Energy



# Game-changing Vehicle For Exploration



Human Missions to Mars



Mars Sample Return



Europa Exploration



Asteroid Redirect Mission



Ultra-Large Space Telescopes

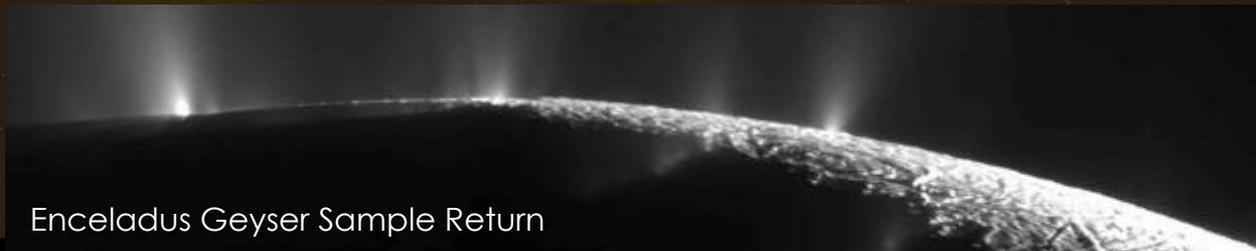


Space Stations

*NASA's Space Launch System*



Interstellar Probe



Enceladus Geyser Sample Return



[www.nasa.gov/sls](http://www.nasa.gov/sls)



NASASLS

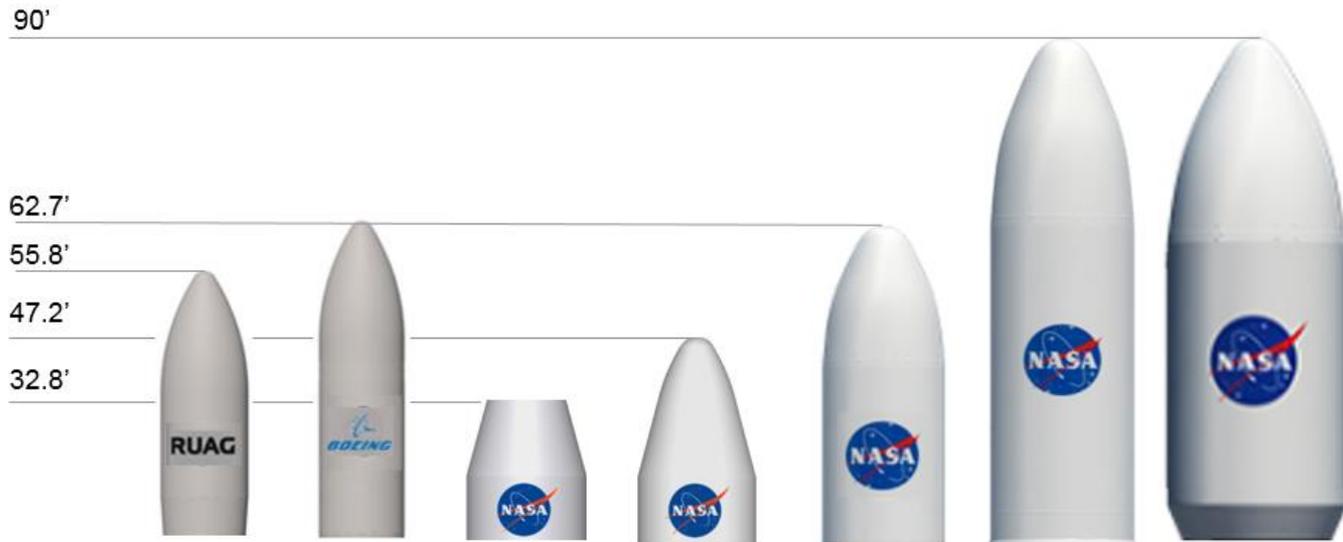


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# Notional Fairing Volumes



Payload Accommodation	5.4m	5.1m	USA2	USA4	8.4m Short	8.4m Long	10m
Type	5m COTS	5m COTS	8.4m CPL	8.4m PLF	8.4m PLF	8.4m PLF	10m PLF
Length	55.8 ft	62.7 ft	32.8 ft	47.2 ft	62.7 ft	90 ft	90 ft
Diameter	17.8 ft	16.8 ft	27.6 ft	27.6 ft	27.6 ft	27.6 ft	33 ft
Internal Diameter	15.0 ft	15.0 ft	24.6 ft	24.6 ft	24.6 ft	24.6 ft	29.8 ft
Usable Volume	7,740 ft <sup>3</sup>	9,033 ft <sup>3</sup>	12,600 ft <sup>3</sup>	13,800 ft <sup>3</sup>	21,800 ft <sup>3</sup>	34,800 ft <sup>3</sup>	49,900 ft <sup>3</sup>
Potential Availability (No Earlier Than)	2019	2019	2021	2022	2024	2025	2026

COTS: Commercial Off-the-Shelf    USA: Universal Stage Adapter    CPL: Co-manifested Payload    PLF: Payload Fairing (new)

