National Aeronautics and Space Administration

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SPACE LAUNCH SYSTEM

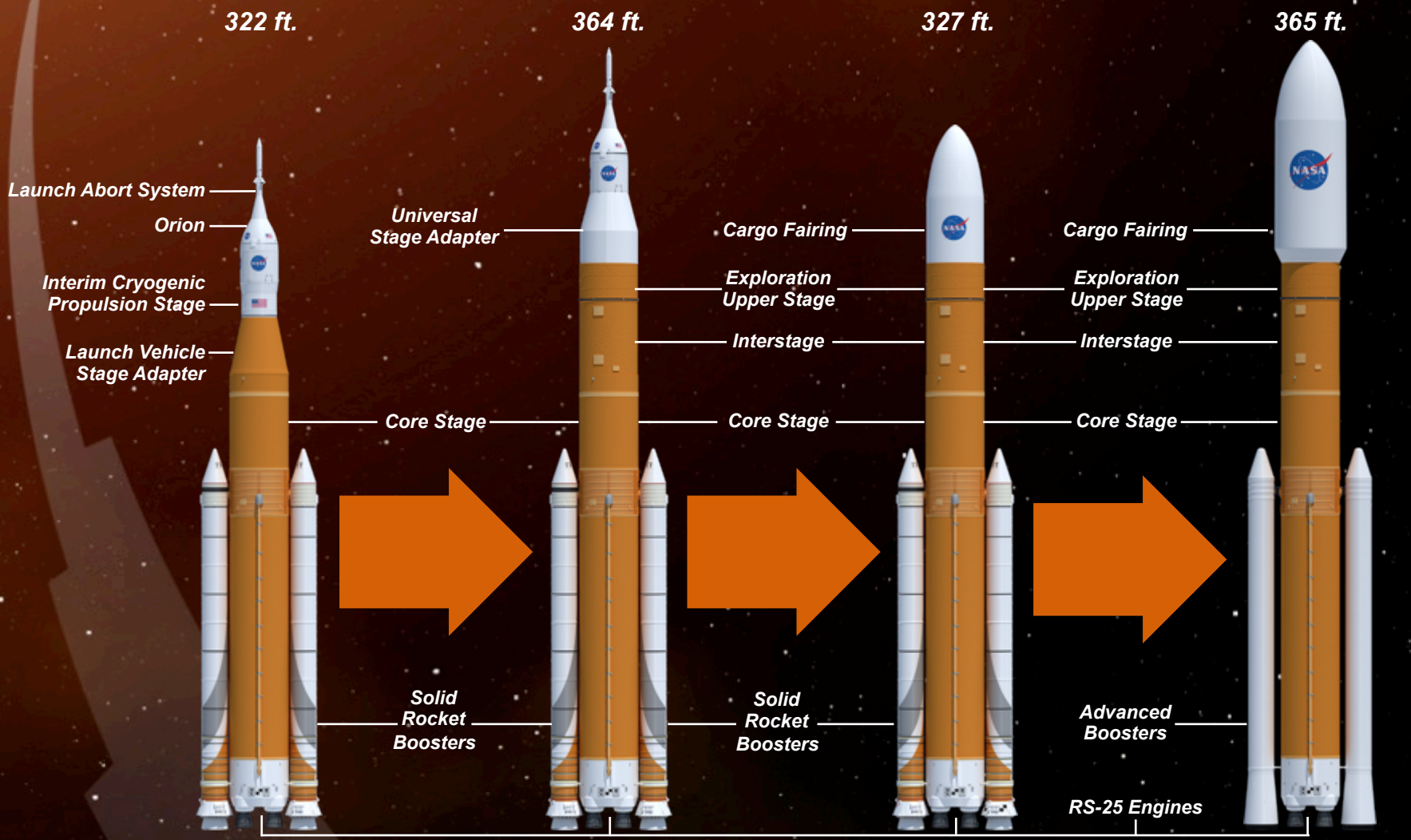
AN EVOLVING CAPABILITY FOR EXPLORATION

Space Launch System

5 May 2016

www.nasa.gov/sls

SLS Evolution Overview



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Recent Progress Toward Launch

Core Stage production at Michoud

Booster testing at Orbital ATK

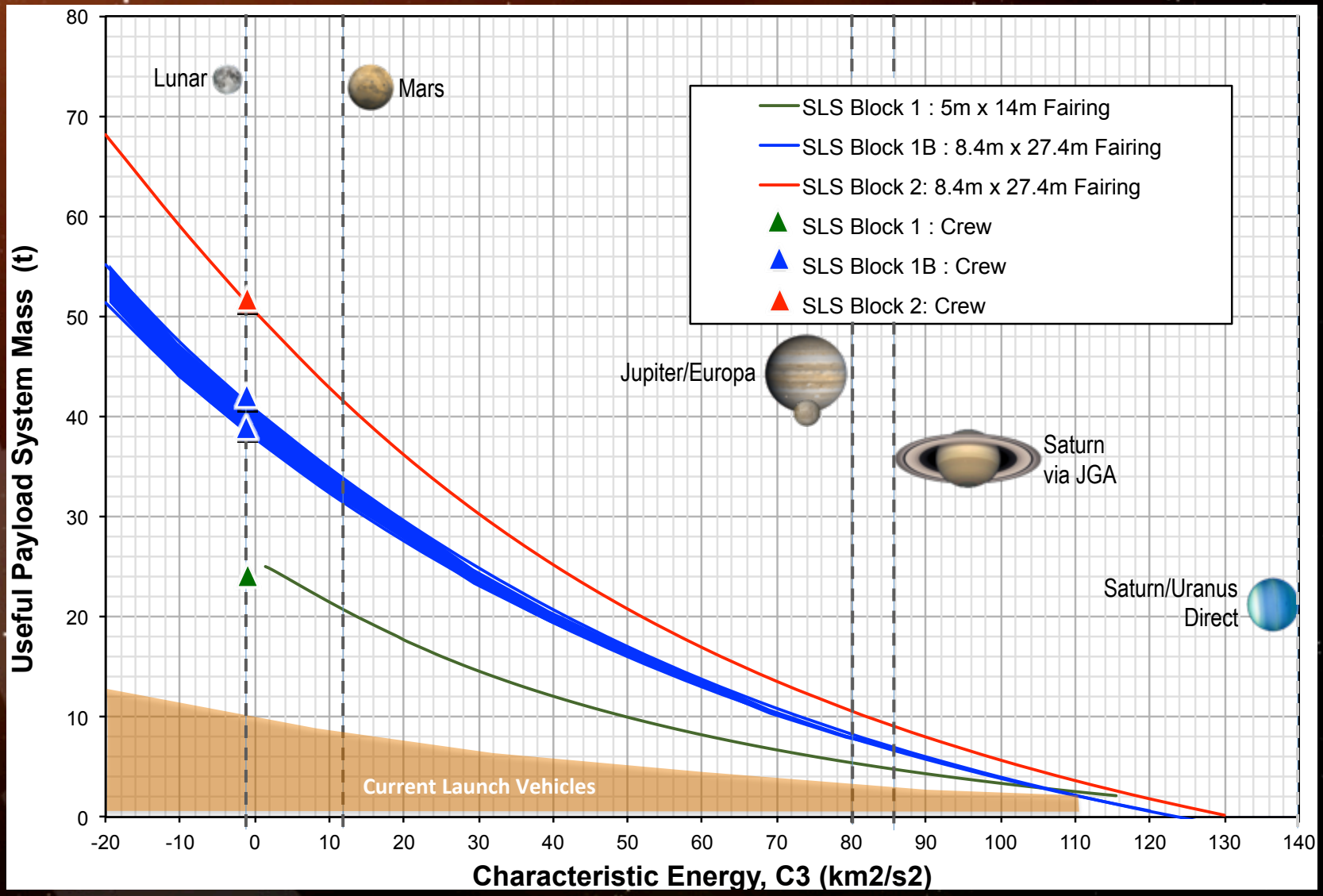
Engine testing at Stennis Space Center

Test stand construction at Marshall

Stage adapter welding at Marshall

Upper stage production at ULA

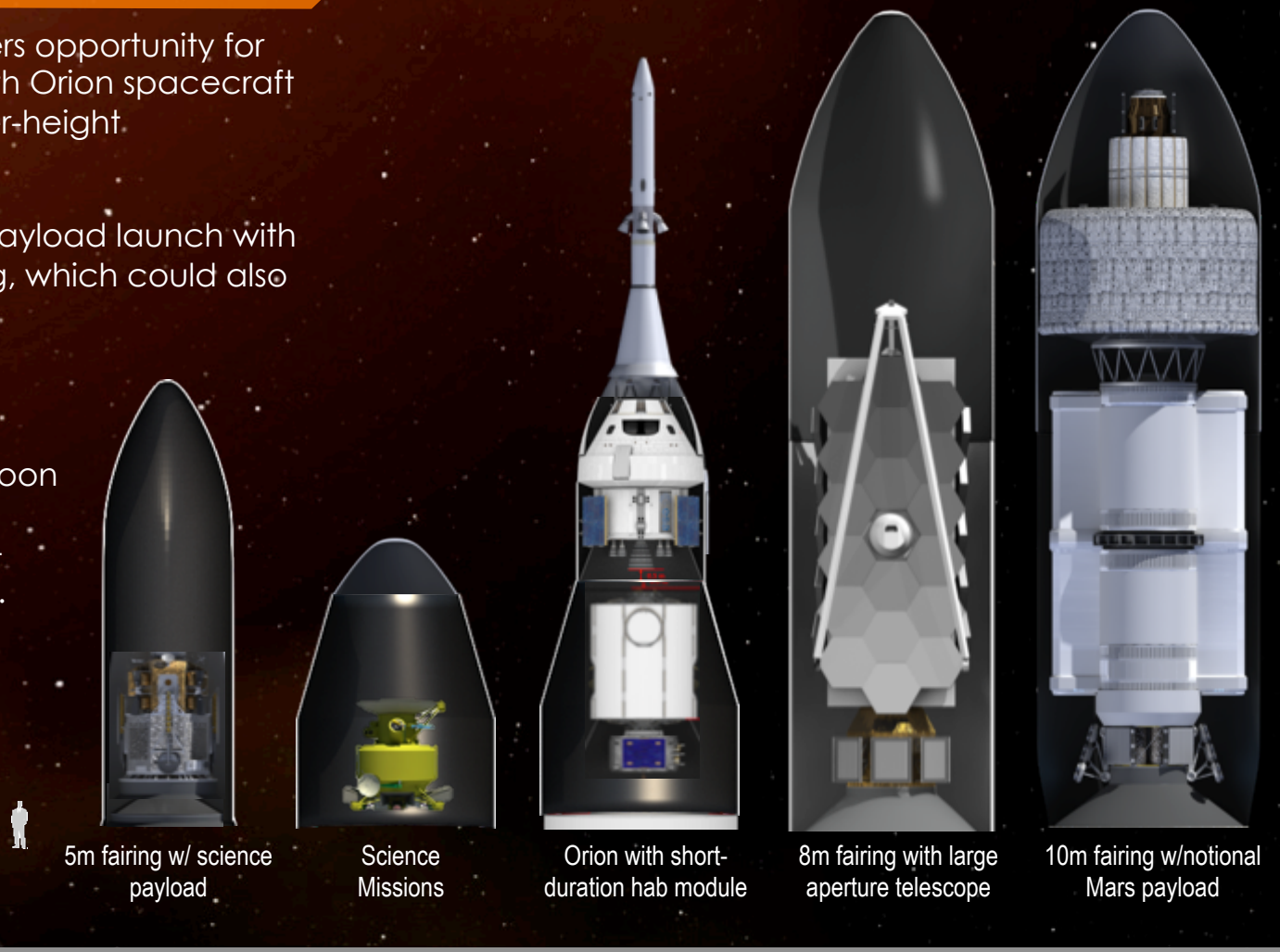
SLS Payload Mission Capture



SLS Payload Accommodations

Fairing Availability

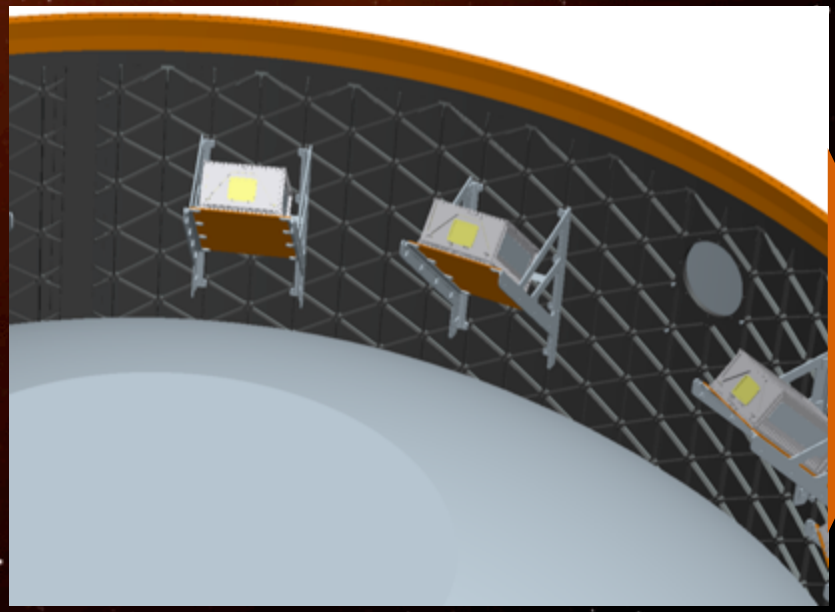
- Universal Stage Adapter offers opportunity for co-manifested payloads with Orion spacecraft or near-term 8.4-meter lower-height accommodations.
- USA can also support dual-payload launch with industry-standard 5-m fairing, which could also fly on Block 1 configuration
- Universal Stage Adapter accommodations early as soon as 2023; 8.4- and 10-meter fairings available in the mid- and late-2020s, respectively.

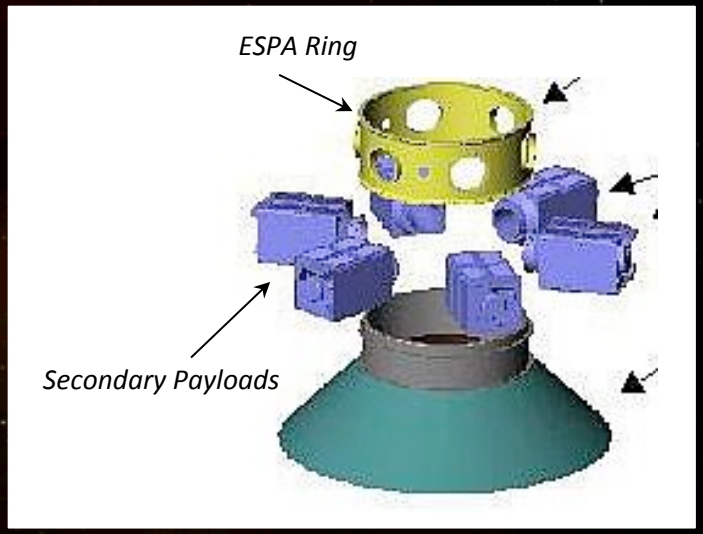


	5m fairing w/ science payload	Science Missions	Orion with short-duration hab module	8m fairing with large aperture telescope	10m fairing w/notional Mars payload
total mission volume = ~	250m3	400m3	400m3	1200m3	1800m3

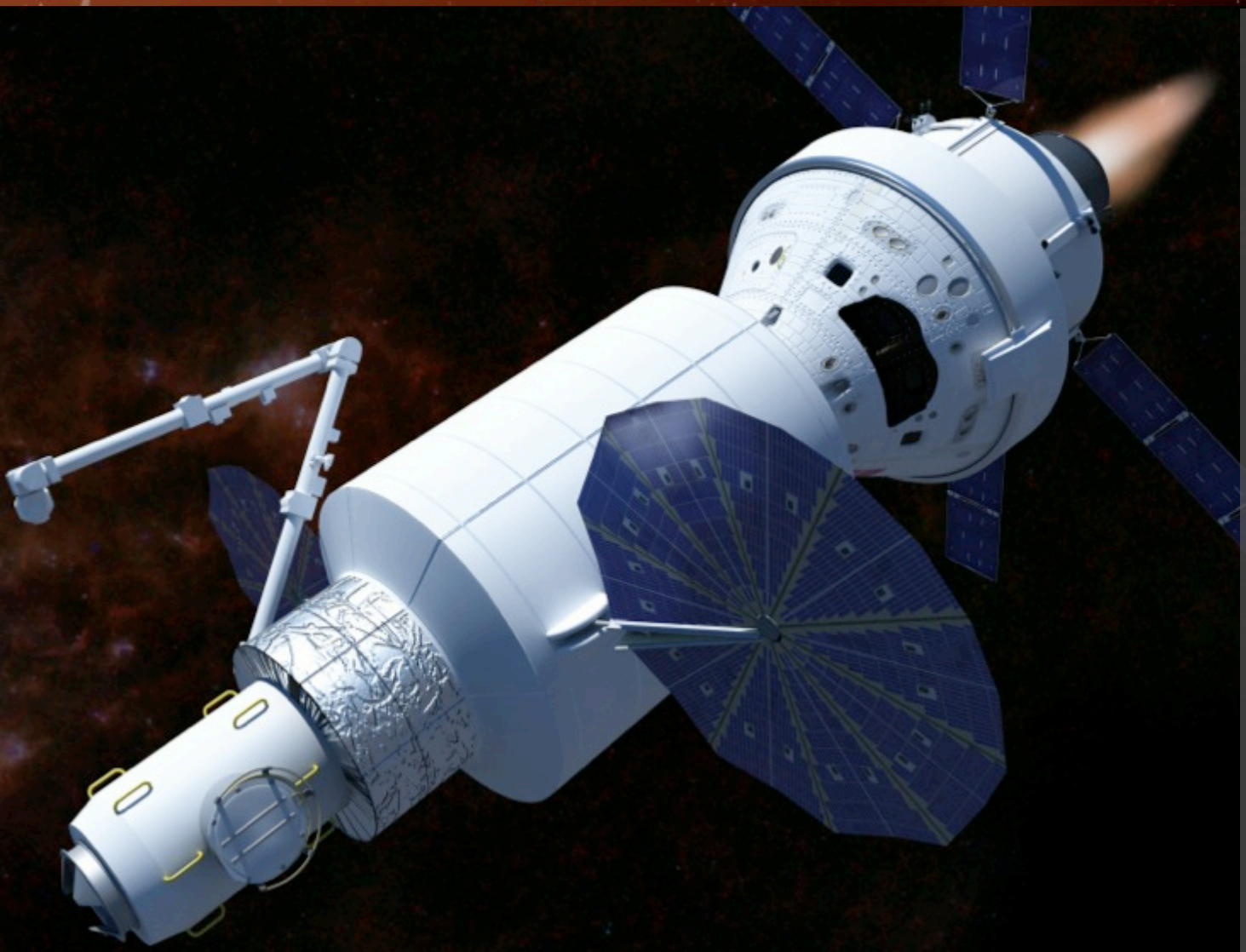
Secondary Payload Capability

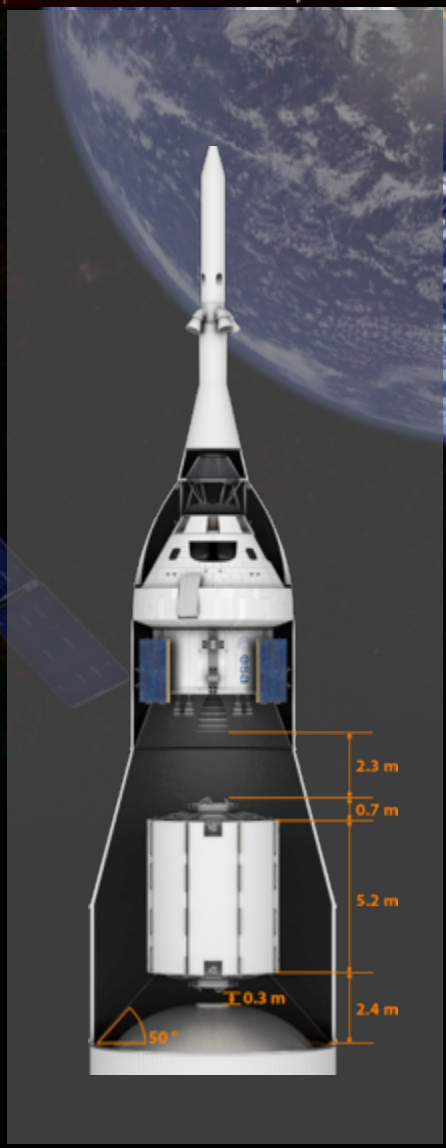
- Block 1 vehicle offers at least thirteen 6U payload locations
- 6U volume/mass is the current standard (14 kg payload mass)
- Payloads will be “off” from roll-out through Orion separation and payload deployment
- Payload Deployment System Sequencer; payload deployment will begin with pre-loaded sequence following MPCV separation and ICPS disposal burn
- Payload requirements captured in Interface Definition and Requirements Document
- Block 1B and 2 vehicles offer up to six larger, ESPA-class secondary payload (>180 kg) accommodations



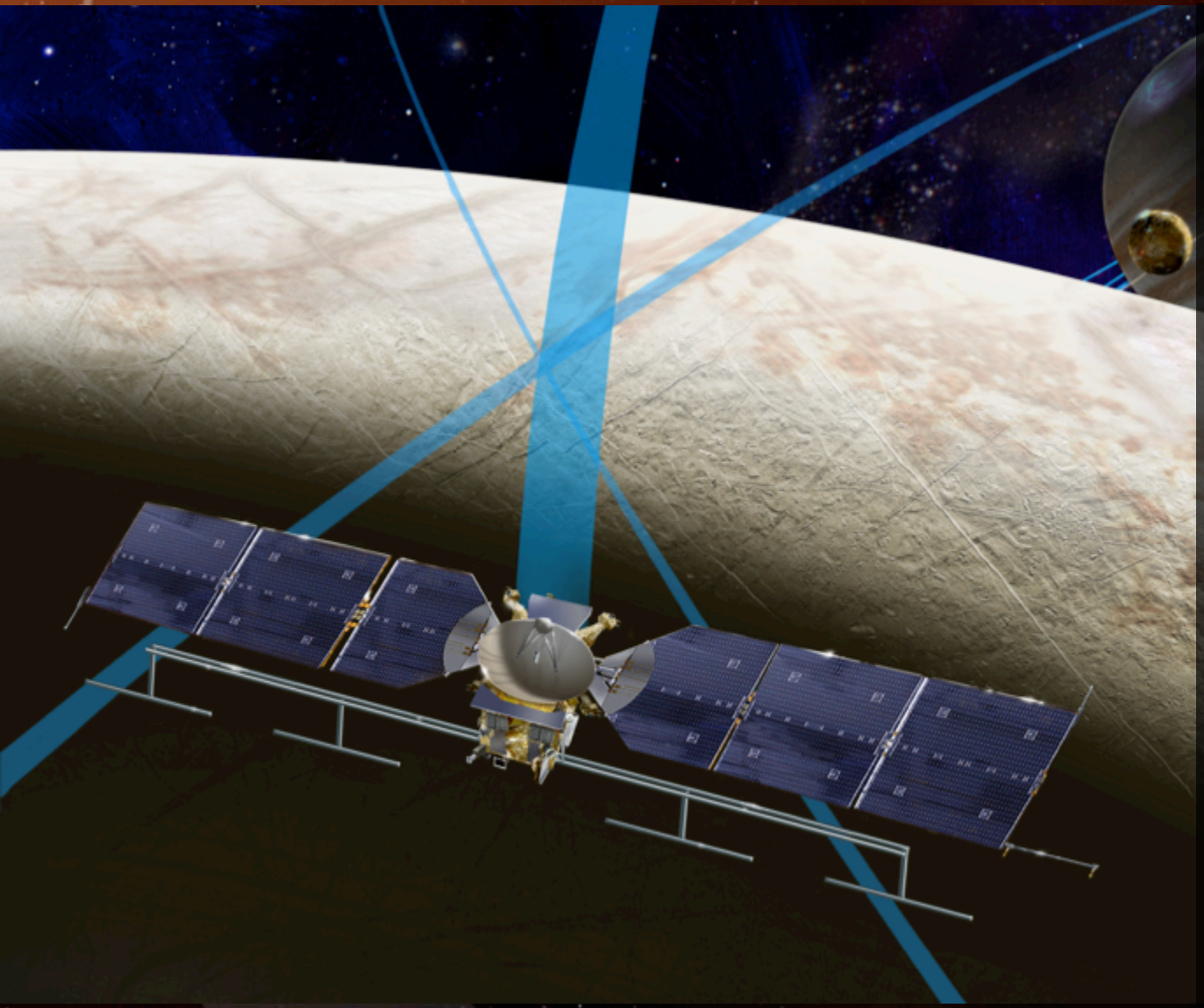


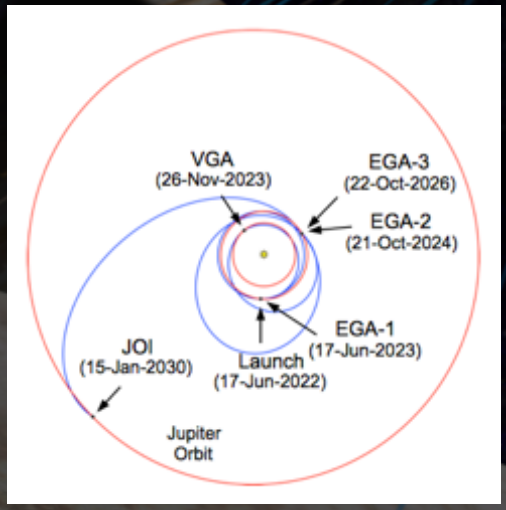
Utilization of SLS Mass Capabilities

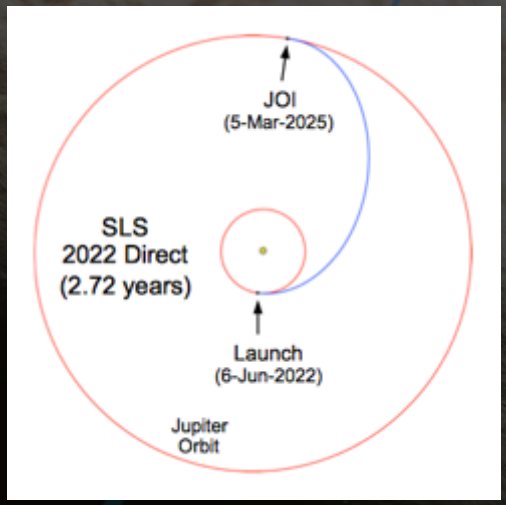




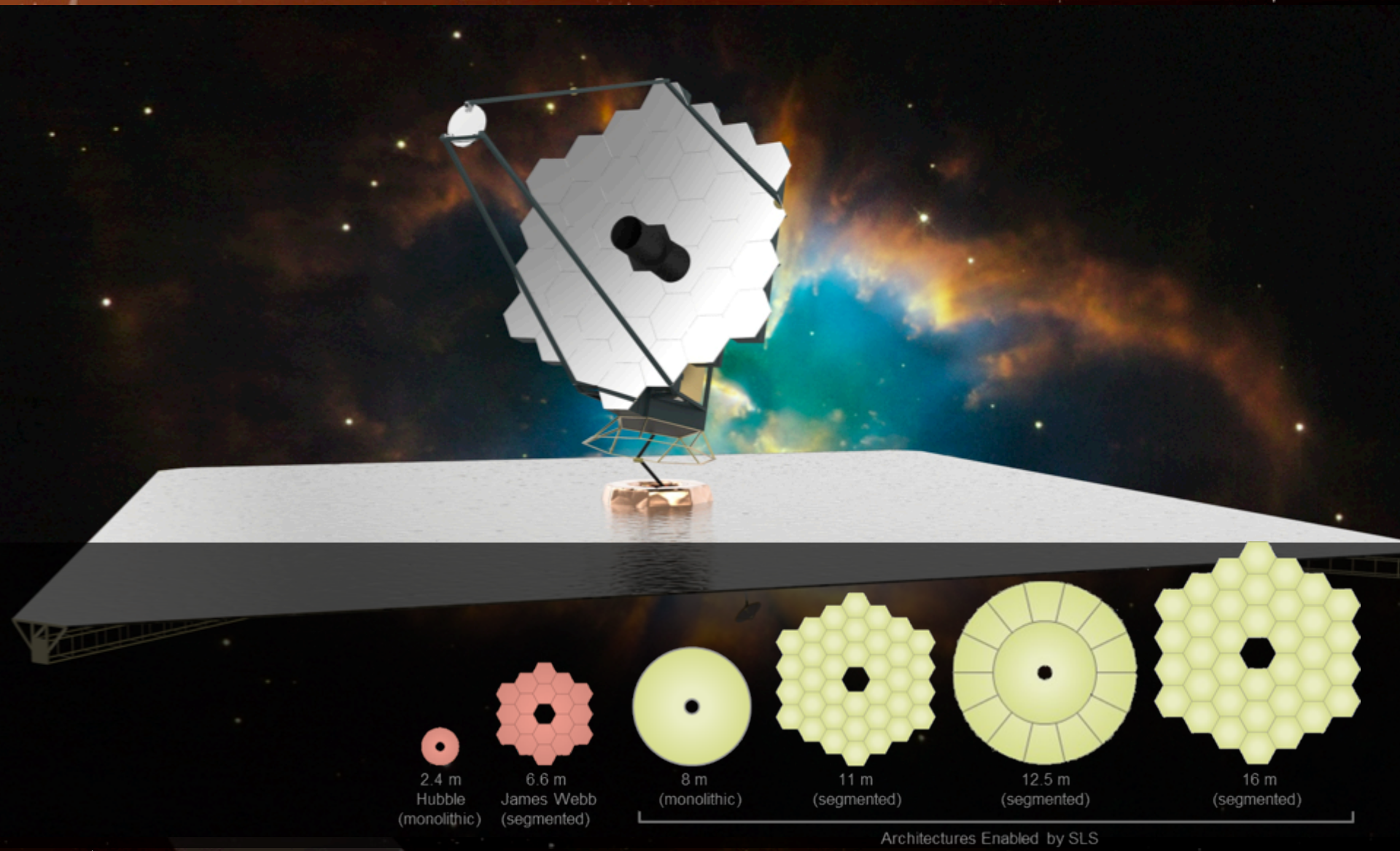
Utilization of SLS Departure Energy







Utilization of SLS Volume



For More Information:

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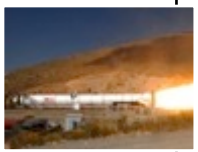
Space Launch System Path to the Pad

2011	2012	2013	2014	2015	2016	2017	2018
Mission Concept Review	System Requirements Review/System Definition Review	Preliminary Design Review	Key Decision Point-C	Critical Design Review		Design Certification Review	Launch Availability

With design and development work mostly complete, the SLS Program is now building and testing components of the world's most powerful rocket to be ready for launch in 2018. Each of these steps advances NASA on the Journey to Mars.



Booster Development Test

Engines Delivered to Inventory

Manufacturing Tooling Installation

Production of Adapter for Orion Flight Test

SLS Design Chosen

RS-25 Development Testing Begins

Core Stage Production Begins

Upper Stage Production Begins

Booster Qualification Tests

RS-25 Flight Testing Begins

Integrated Upper Stage Structural Testing

Core Stage Assembly Complete

Core Stage Structural Testing

Core Stage Test-Firing

Boosters Fabrication Complete

Booster Assembly at KSC

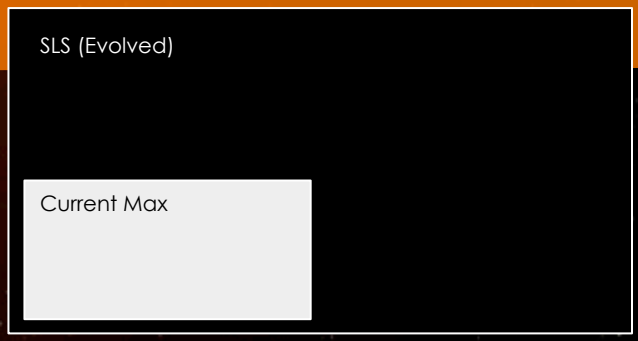
SLS Launch Readiness

Concept Studies	Design & Development	Final Design & Fabrication	System Assembly, Integration and Test, Launch Checkout

Benefits of Space Launch System

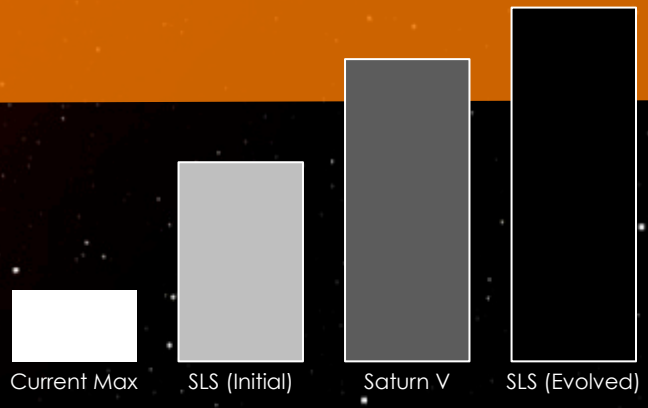
Volume

- 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.



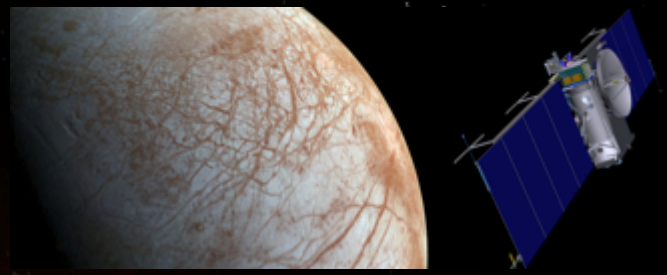
Mass

- 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.



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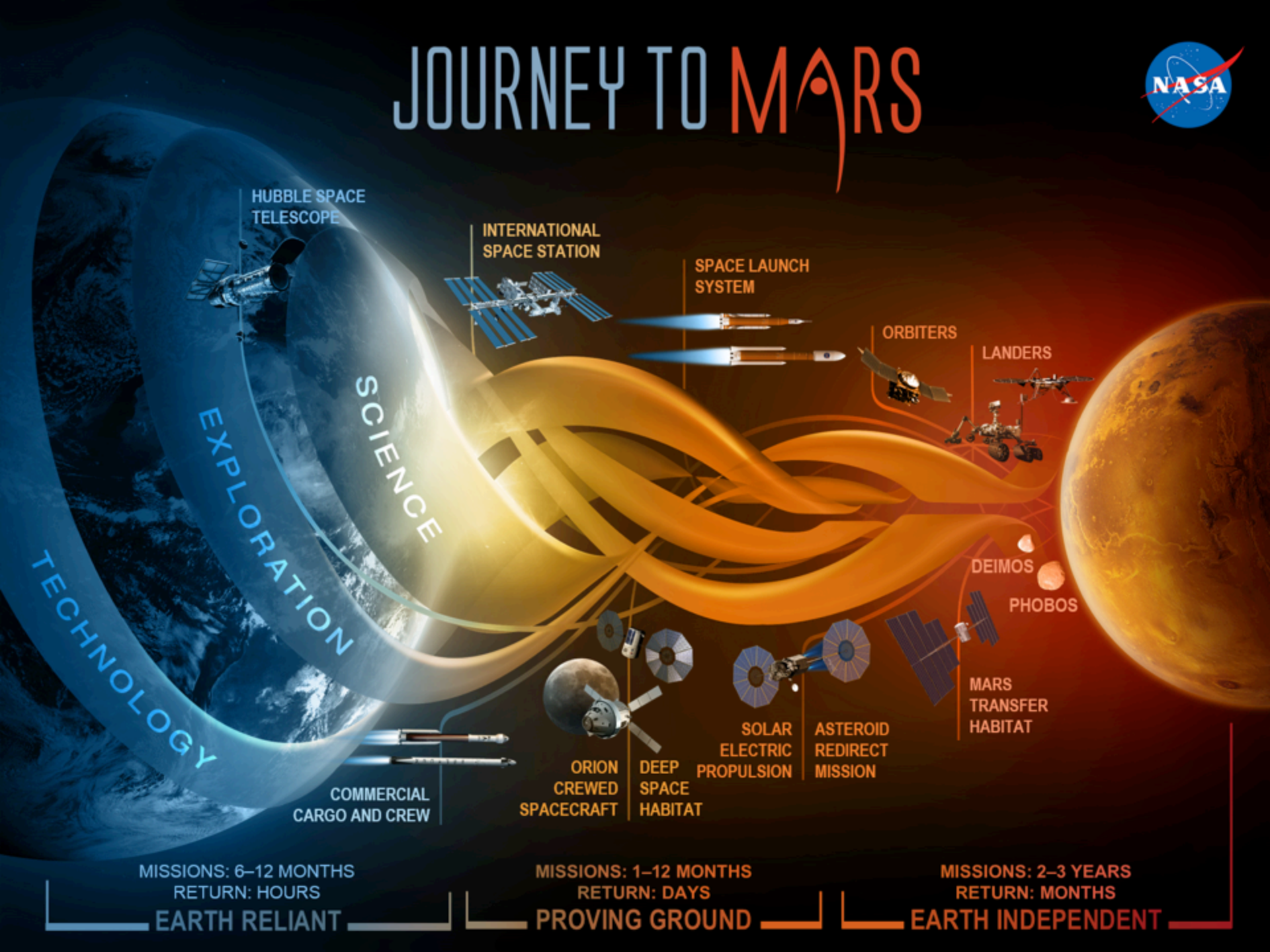
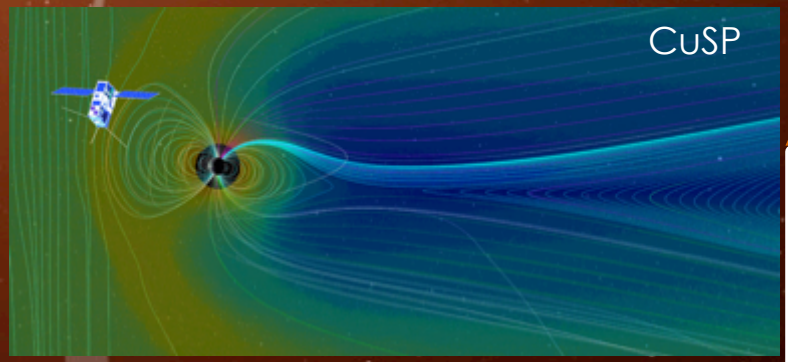
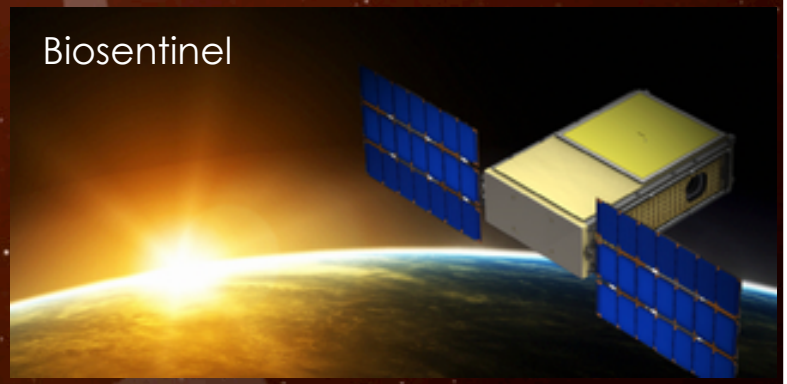

JOURNEY TO MARS
NASA
HUBBLE SPACE TELESCOPE
INTERNATIONAL SPACE STATION
SPACE LAUNCH SYSTEM
ORBITERS
LANDERS
SCIENCE
EXPLORATION
TECHNOLOGY
DEIMOS
PHOBOS
MARS TRANSFER HABITAT
SOLAR ELECTRIC PROPULSION
ASTEROID REDIRECT MISSION
ORION CREWED SPACECRAFT
DEEP SPACE HABITAT
COMMERCIAL CARGO AND CREW
MISSIONS: 6–12 MONTHS
RETURN: HOURS
EARTH RELIANT
MISSIONS: 1–12 MONTHS
RETURN: DAYS
PROVING GROUND
MISSIONS: 2–3 YEARS
RETURN: MONTHS
EARTH INDEPENDENT

New Opportunities for SmallSats





EM-1 Trajectory