




NASA's Space Launch System: *Exploration Beyond Earth's Orbit*

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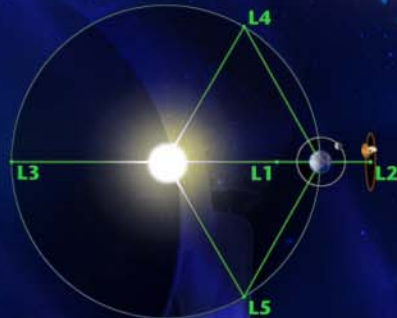
May 2012

A composite image of the solar system. In the upper left, a bright yellow Sun glows. To its right, Earth is shown with blue oceans and white clouds, with a small satellite orbiting it. Further right is Mars, a reddish-orange planet with dark surface features, and its two small moons. The foreground is filled with numerous brown, rocky asteroids of various sizes. The background is a deep blue space filled with stars.

Todd May, Program Manager
NASA's Vision and Mission

“To reach for new heights...
and reveal the unknown so that what we do and learn
will benefit all humankind.”

National Aeronautics and
Space Administration

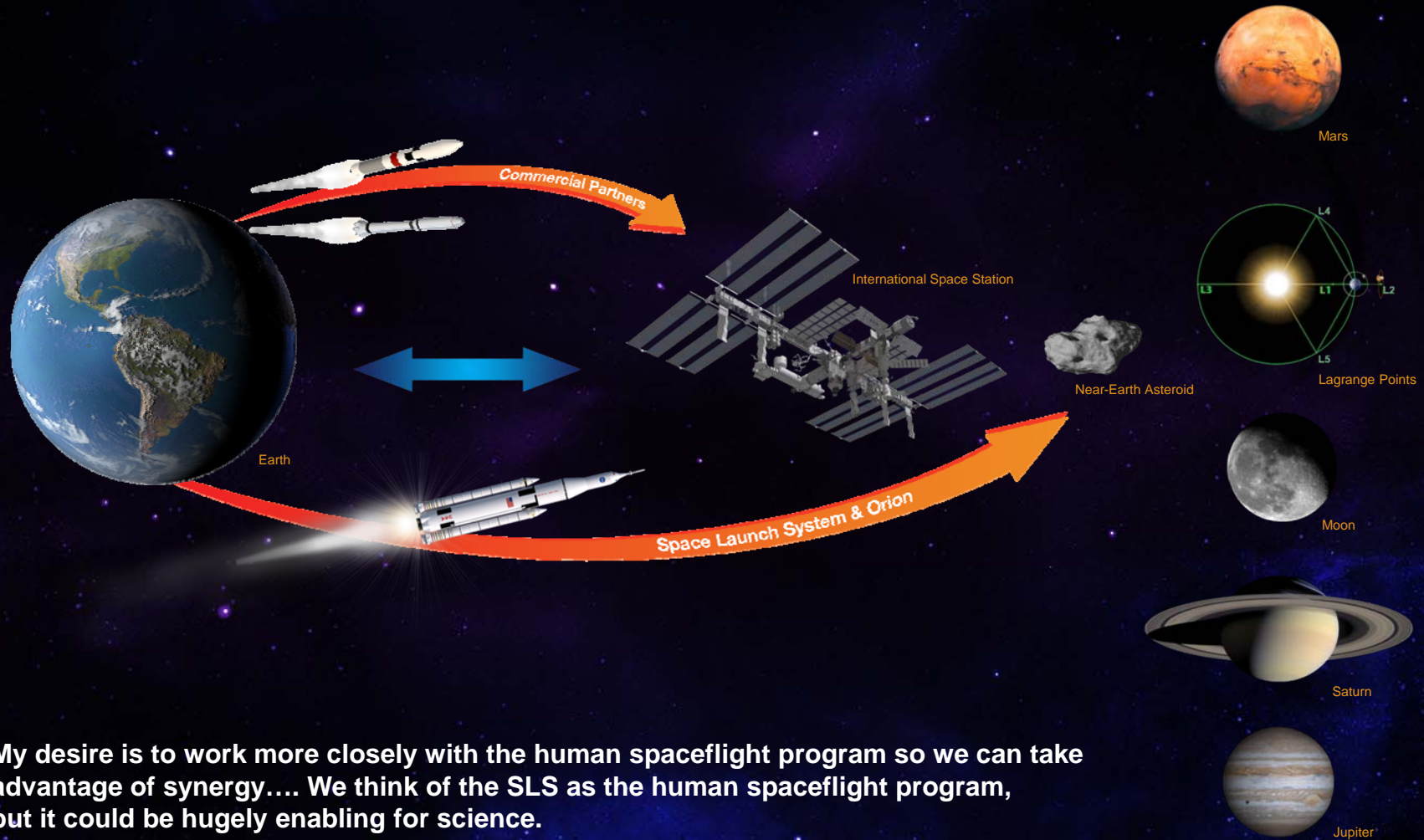


SLS Launches in 2017

“Extend and sustain human activities
across the solar system.”
NASA 2011 Strategic Plan



The Future of Exploration



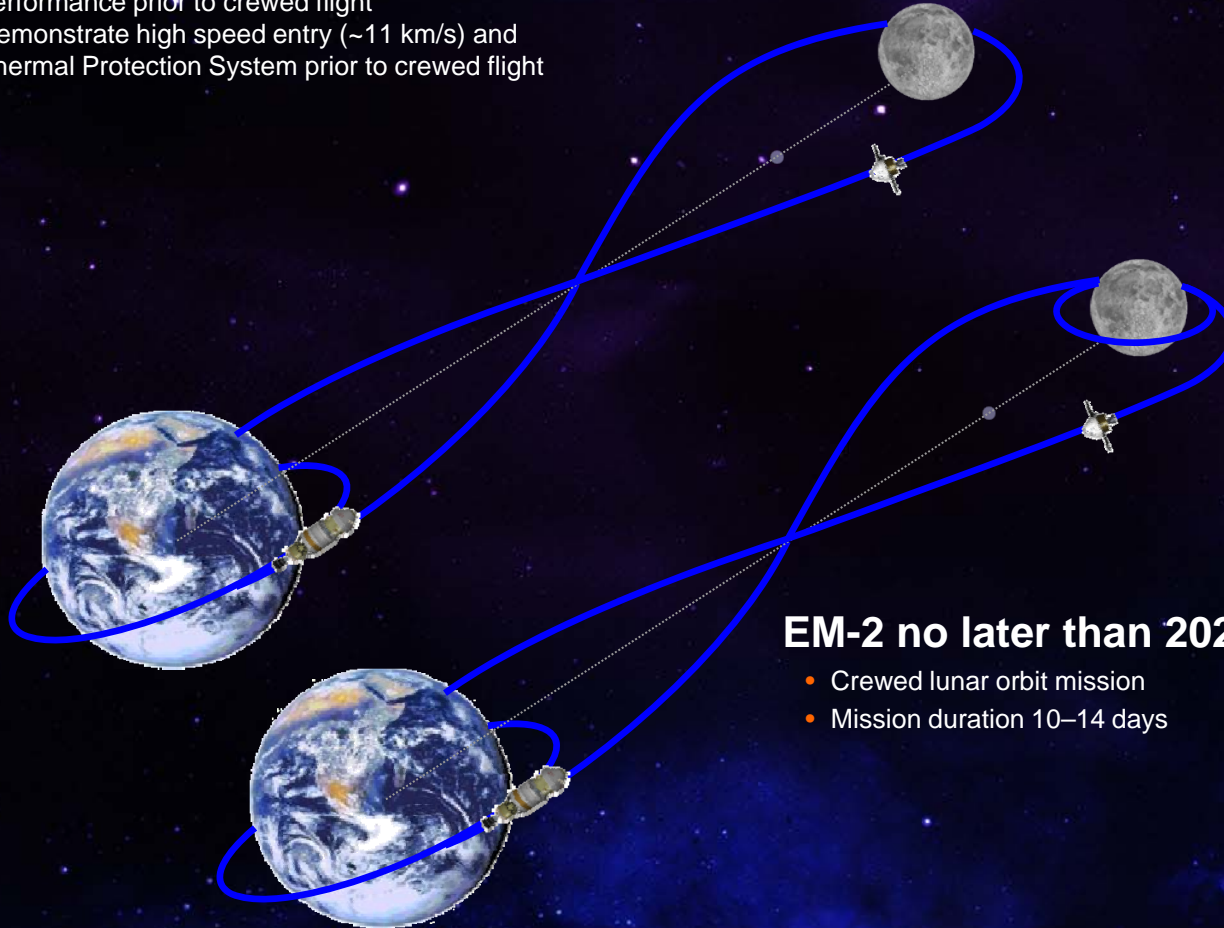
My desire is to work more closely with the human spaceflight program so we can take advantage of synergy.... We think of the SLS as the human spaceflight program, but it could be hugely enabling for science.

— John Grunsfeld, Associate Administrator
NASA Science Mission Directorate
Nature, Jan 19, 2012

Initial Exploration Missions (EM)

EM-1 in 2017

- Un-crewed circumlunar flight – free return trajectory
- Mission duration ~7 days
- Demonstrate integrated spacecraft systems performance prior to crewed flight
- Demonstrate high speed entry (~11 km/s) and Thermal Protection System prior to crewed flight



EM-2 no later than 2021

- Crewed lunar orbit mission
- Mission duration 10–14 days



NASA's Space Launch System

- ◆ *Vital to NASA's exploration strategy and the Nation's space agenda.*
- ◆ Key tenets: safety, affordability, and sustainability
- ◆ System Requirements Review/ System Definition Review in progress
- ◆ Partnerships with NASA Exploration Systems Development (Headquarters), Orion and Ground Operations Programs, and Centers
- ◆ Prime contractors on board, engaging the U.S. aerospace workforce and specialized infrastructure
- ◆ Turning plans into progress: Design and development work moving forward today, to deliver an unsurpassed capability that launches in 2017

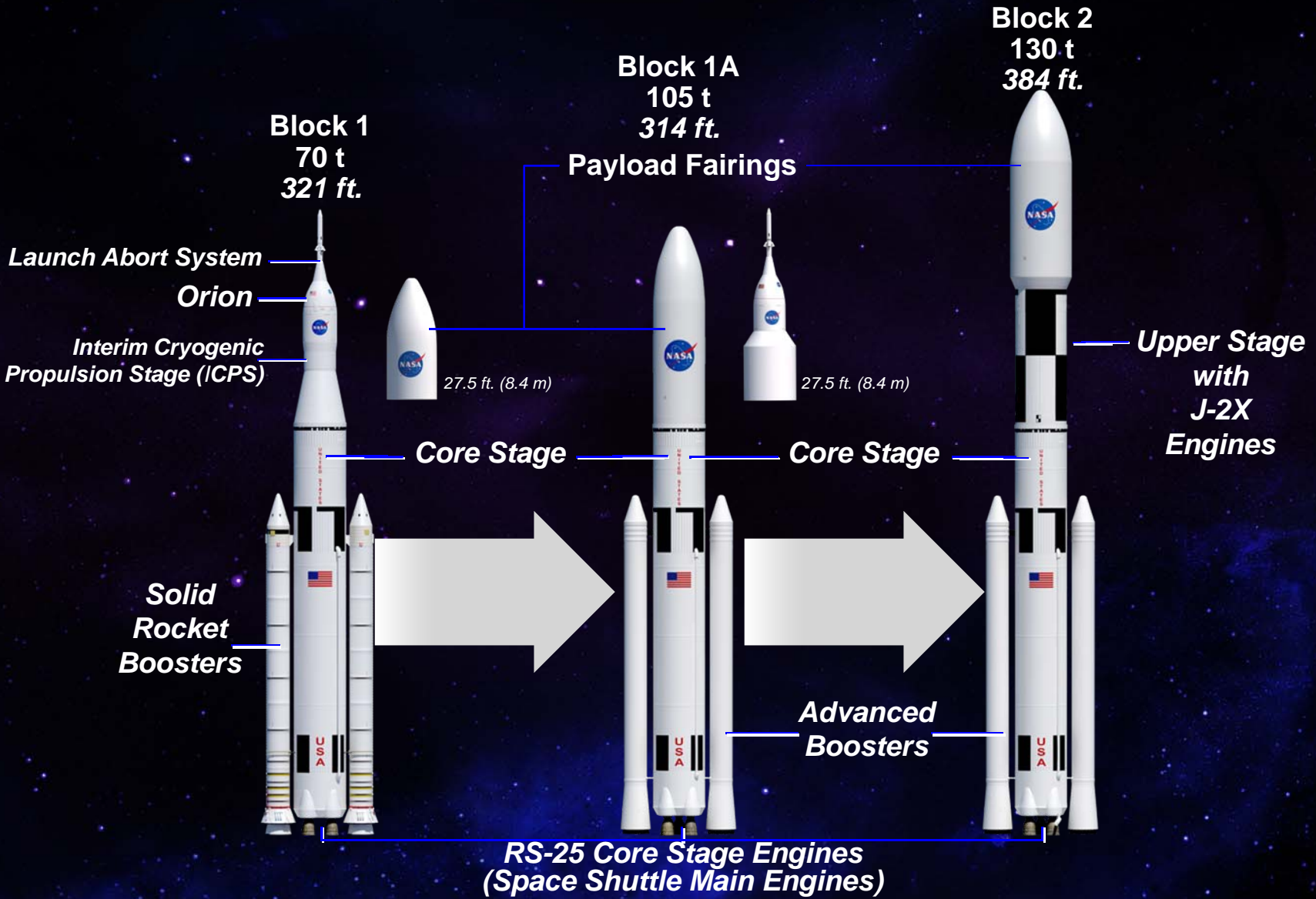


On Track for First Flight in 2017

A composite image of the solar system. In the upper left, a bright yellow Sun glows. To its right, Earth is shown with blue oceans and white clouds, with a small satellite in orbit. Further right is Mars, a reddish-orange planet with dark surface features, and its two moons. The foreground is filled with numerous brown, rocky asteroids of various sizes. The background is a deep blue space filled with stars.

Garry Lyles, Chief Engineer
The SLS Design

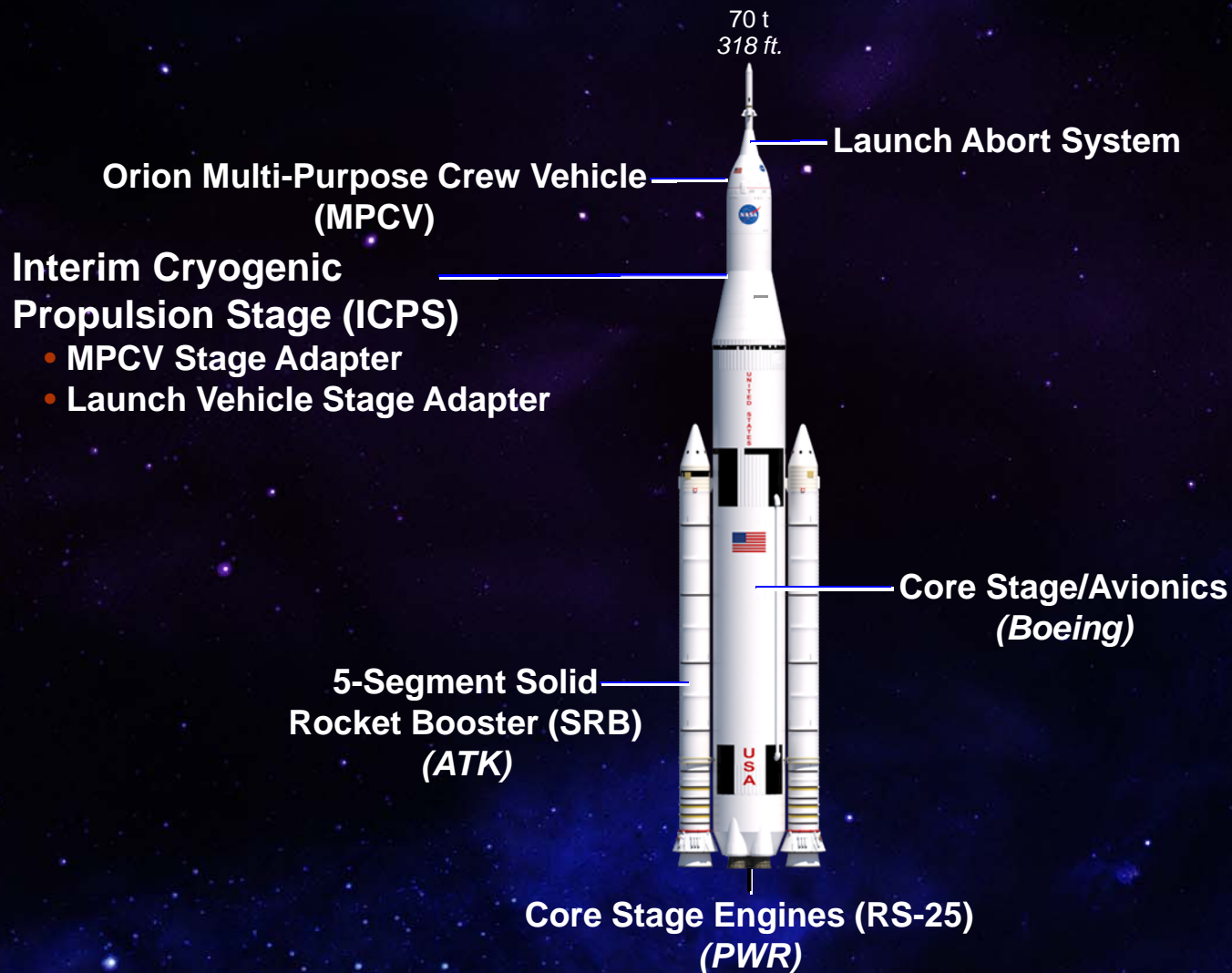
SLS Architecture Block Upgrade Approach



Starting with Available Assets and Evolving the Design

SLS 70 Metric Tons: *First Flight 2017*

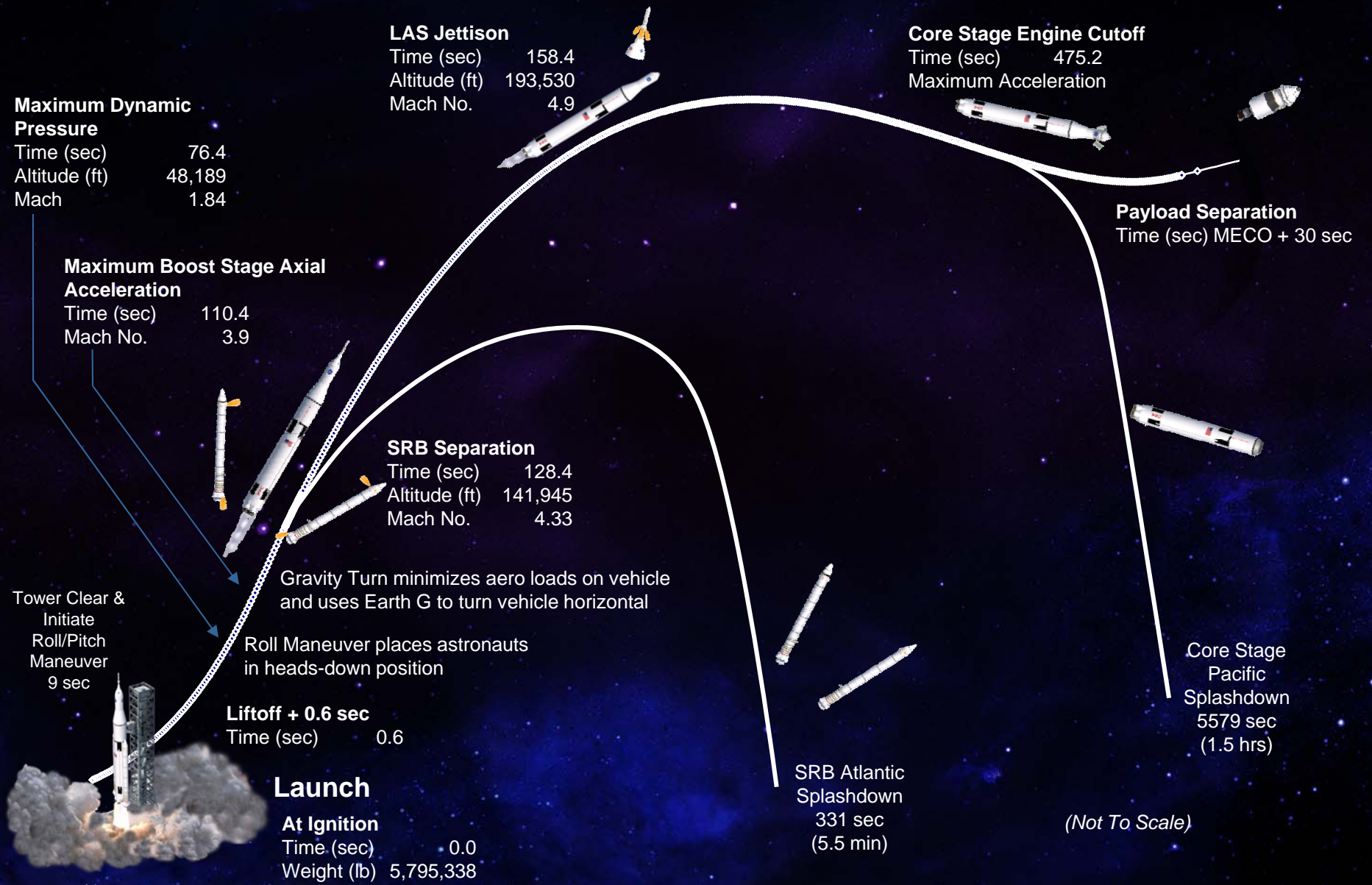
INITIAL CAPABILITY, 2017-21





***SLS will launch from
Kennedy Space Center
in 2017***

Ascent Mission Profile: SLS/Orion



SLS: Being Built Today



First ring forging prepared for Orion Stage Adapter, Cudahy, WI, April 2012.



Stages Industry Day at Michoud Assembly Facility, New Orleans, Nov 2011.



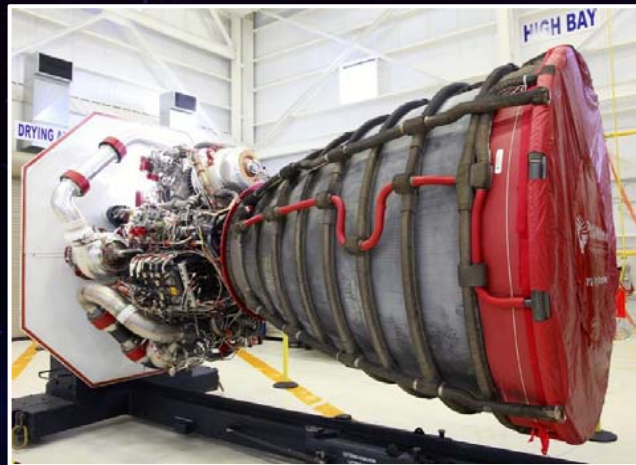
Solid Rocket Booster development motor test, Promontory, Utah, Sep 2011.



KSC is preparing Launch Complex 39B for SLS/Orion operations, 2012.



Installing the J-2X powerpack in test stand at SSC.




RS-25 Core Stage Engine in the KSC Engine Processing Facility, 2011.



J-2X Upper Stage Engine powerpack test, Stennis Space Center (SSC), MS, Feb 2012.



Meeting with Space Campers at U.S. Space & Rocket Center, Huntsville, AL, Feb 2012.

A composite image of space. In the top left is a bright yellow sun. In the center is Earth with a satellite nearby. To the right is Mars with its moons. The bottom half is filled with various sized brown and grey asteroids.

Jody Singer, Deputy Program Manager
Hardware Progress



*RS-25 Engines
received at
Stennis Space Center
April 2012*

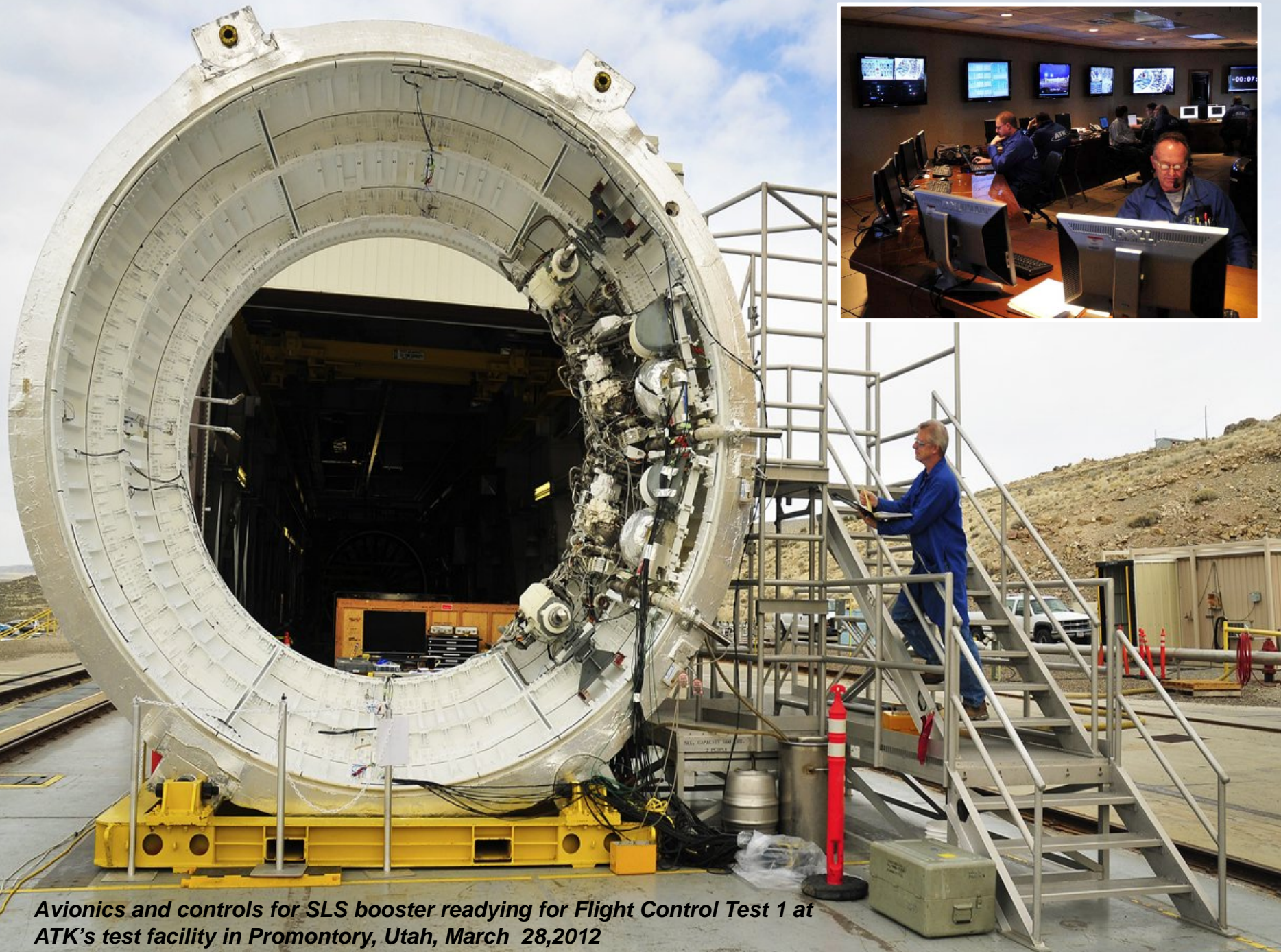


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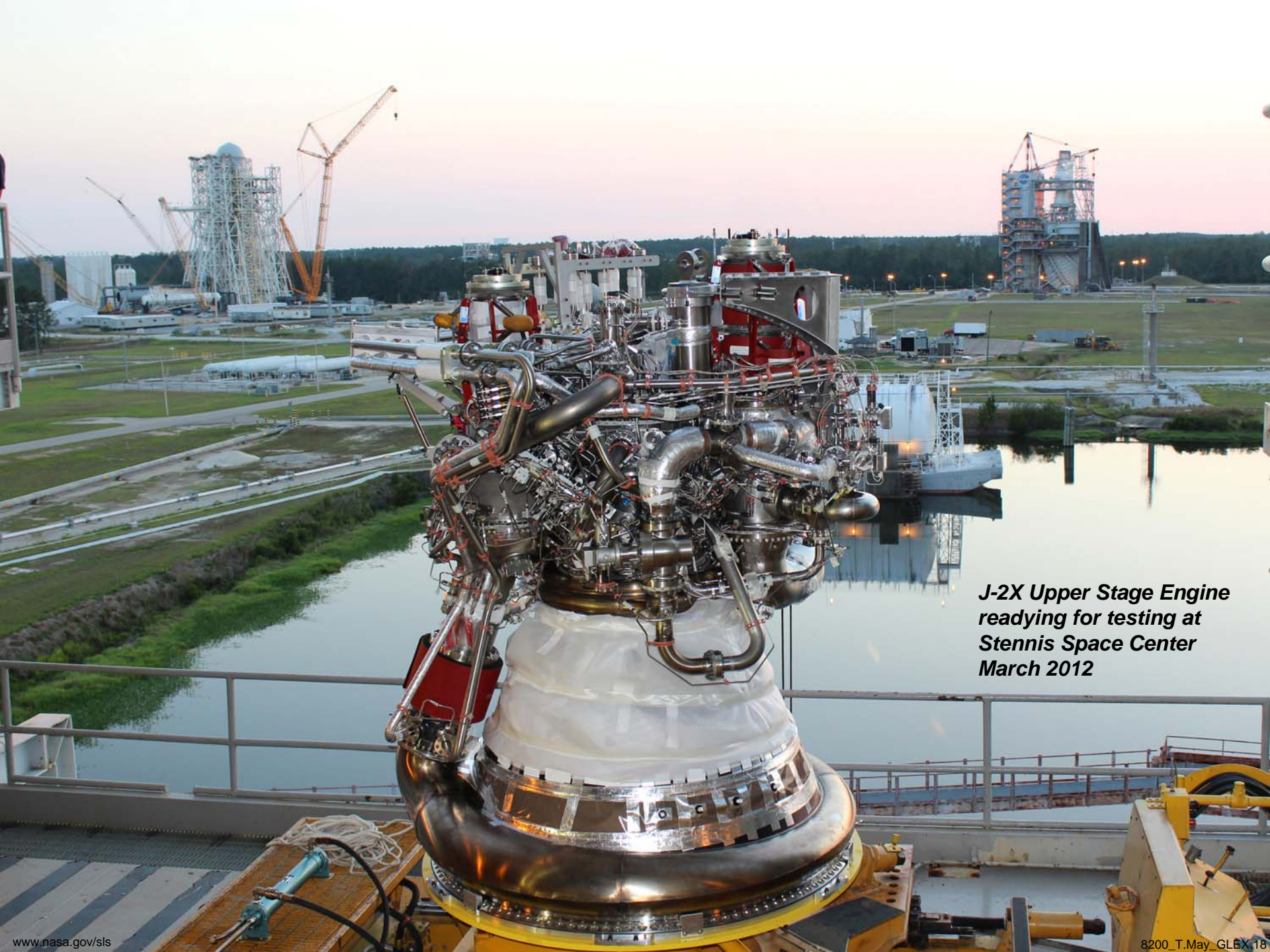
5-Segment Solid Rocket Booster



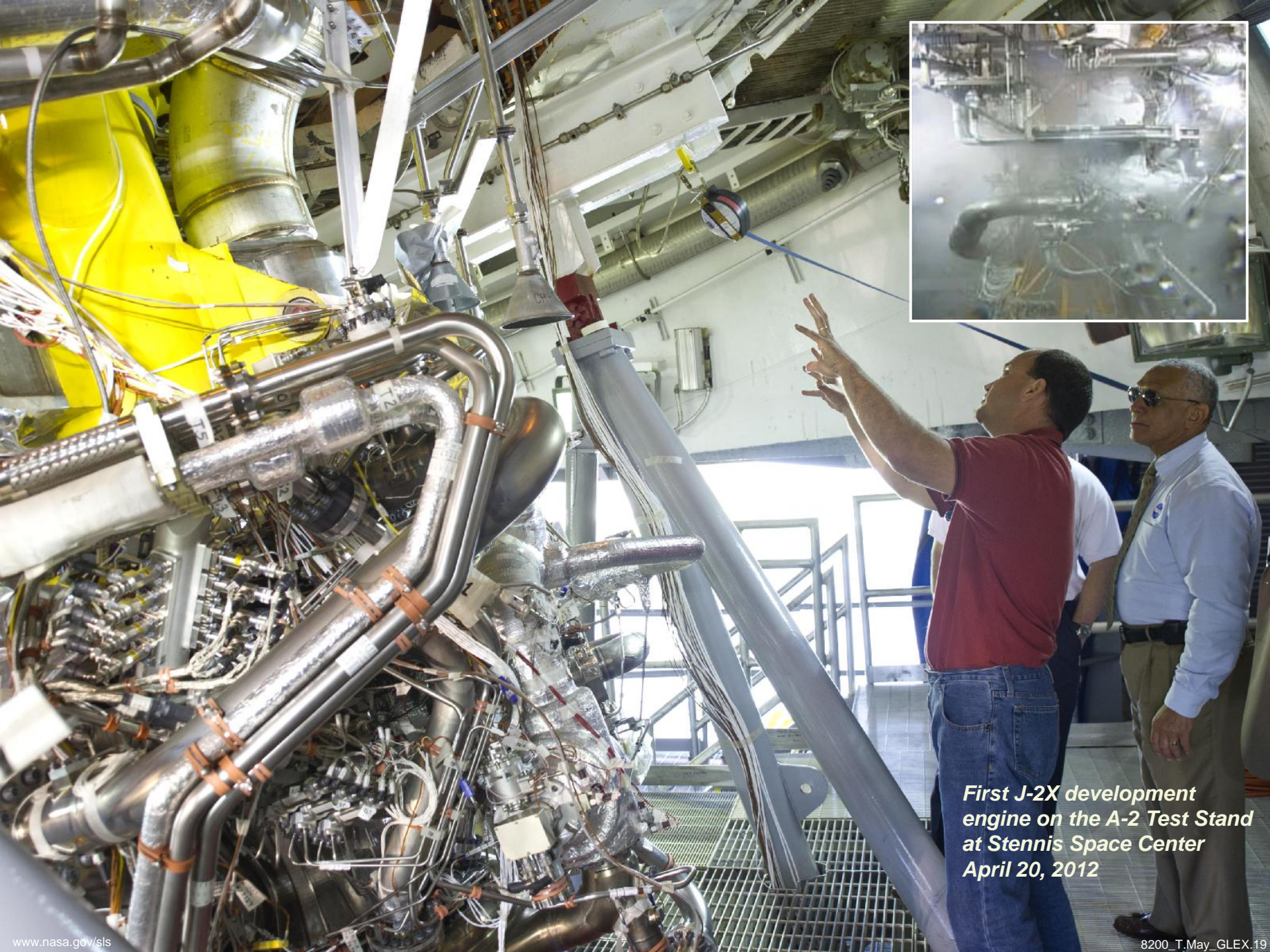
Development Motor Test 3
ATK Promontory, Utah
Test Site, September 8, 2011



Avionics and controls for SLS booster readying for Flight Control Test 1 at ATK's test facility in Promontory, Utah, March 28,2012



***J-2X Upper Stage Engine
readying for testing at
Stennis Space Center
March 2012***



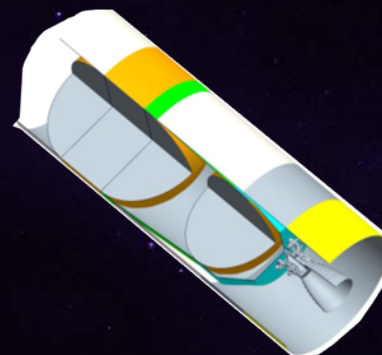
First J-2X development engine on the A-2 Test Stand at Stennis Space Center April 20, 2012

Marshall Space Flight Center's Michoud Assembly Facility

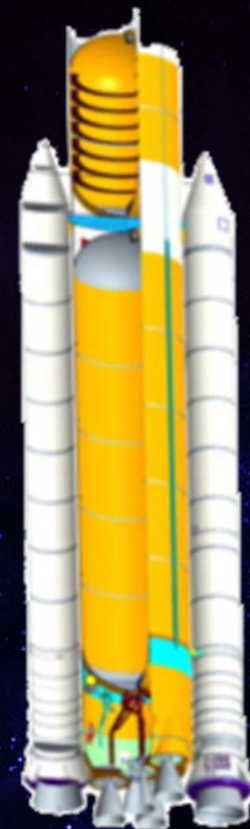


One-of-a-Kind Infrastructure Asset

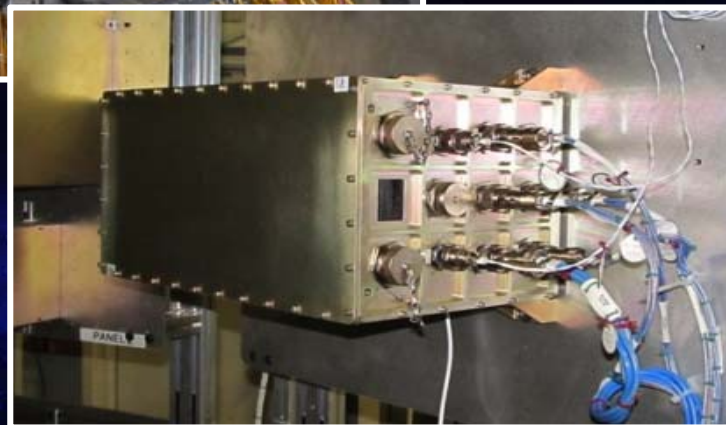
Stages and Avionics



Upper Stage



Core Stage



SLS Commonalities

Core Stage work directly applies to Upper Stage:

- Same diameter (27.5 ft.) and basic design
- Manufacturing facilities, tooling, materials, and processes/practices
- Workforce
- Supply chain/industry base
- Transportation logistics
- Ground systems/launch infrastructure
- Propellants

70 ton Payload
(Block 1)



Payload Interfaces:


- Mechanical
- Avionics
- Software

130 ton Payload
(Block 2)



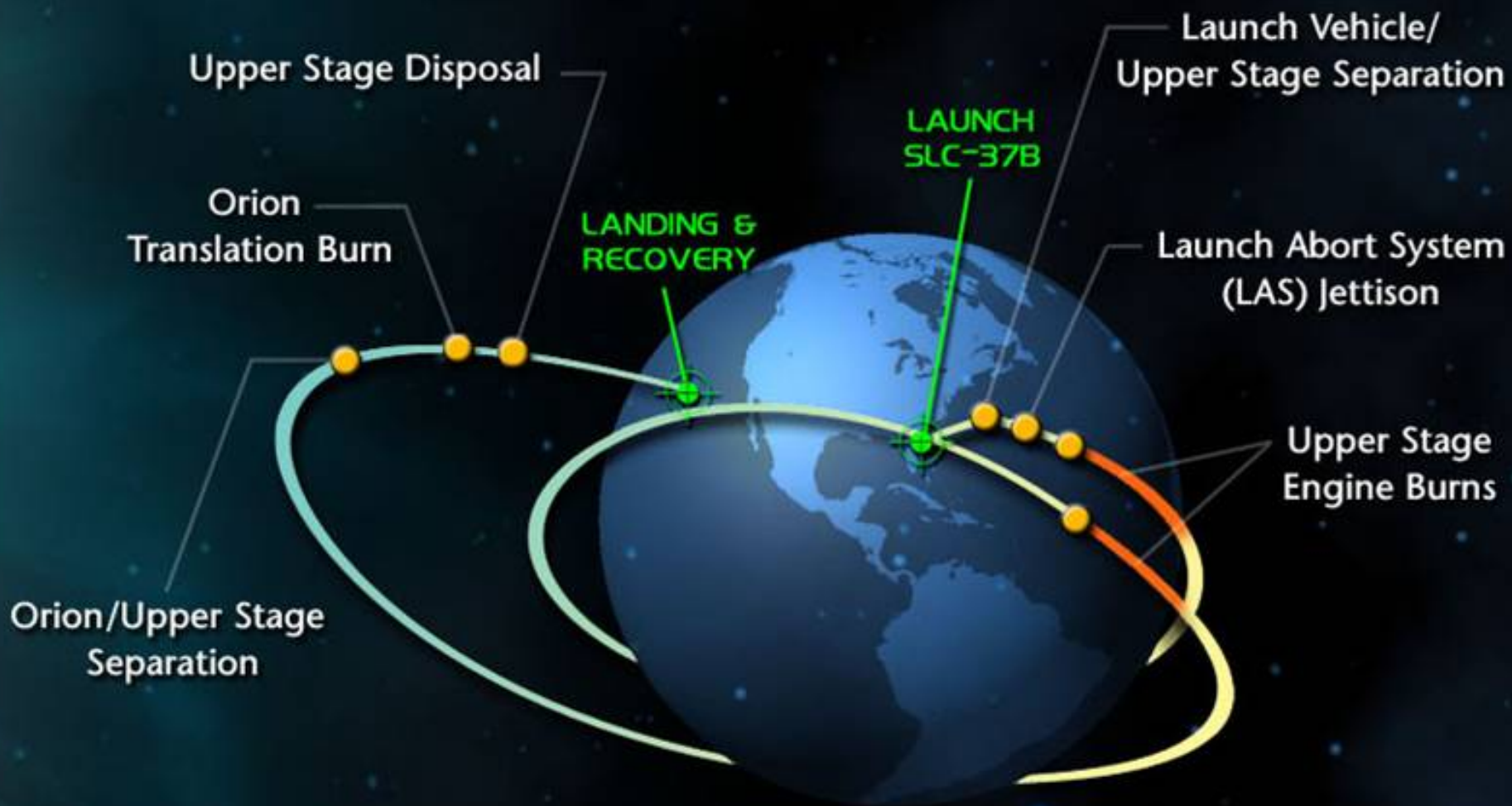
Core Stage

RS-25 Core Stage Engines

A composite image of space featuring the sun, Earth, Mars, a satellite, and asteroids. The sun is a large, bright yellow-orange sphere in the upper left. Earth is a blue and white sphere in the center. Mars is a reddish-orange sphere on the right. A satellite with solar panels is visible between Earth and Mars. Numerous brown, rocky asteroids of various sizes are scattered in the foreground and middle ground. The background is a dark blue space filled with stars.

David Beaman, Spacecraft and
Payload Integration Manager
Adapters and Fairings

Exploration Flight Test-1 Mission Overview



Orion MPCV Stage Adapter

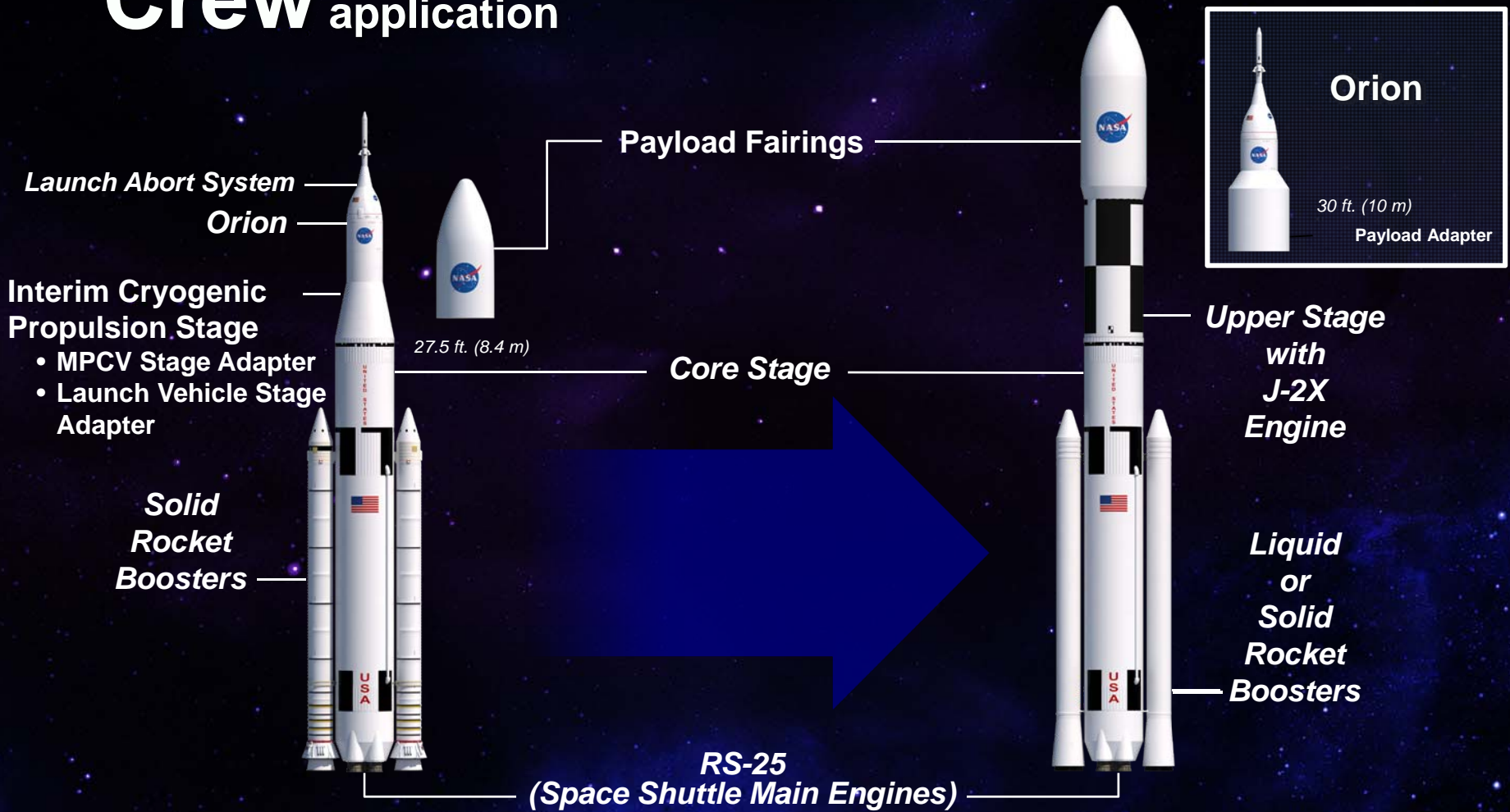




*First ring forging preparation by
ATI/Ladish Forging, Cudahy,
Wisconsin, April 2012*

Cargo application

Crew application



INITIAL CAPABILITY, 2017-21

EVOLVED CAPABILITY, Post-2021

A composite image of space featuring the sun, Earth, Mars, a satellite, and asteroids. The sun is a large, bright yellow-orange sphere in the upper left. Earth is a blue and white sphere in the center. Mars is a reddish-orange sphere on the right. A satellite is visible near Earth. Numerous brown, rocky asteroids are scattered in the foreground and middle ground. The background is a dark blue space filled with stars.

Steve Creech, Strategic Development Manager
Mission Capabilities

A National Asset for Stakeholders and Partners

Incremental steps to steadily build, test, refine, and qualify capabilities that lead to affordable flight elements and a deep space capability.

Moon: 237K mi / 381K km

Mars: 33,900,000 mi
54,556,000 km

Initial Exploration Missions

- International Space Station
- Space Launch System
- Orion Multi-Purpose Crew Vehicle
- Ground Systems Development & Operations
- Commercial Spaceflight Development

Into the Solar System

- Interplanetary Space
- Initial Near-Earth Asteroid Missions
- Lunar Surface

Extending Reach Beyond LEO

- Cis-Lunar Space
- Geostationary Orbit
- High-Earth Orbit
- Lunar Flyby & Orbit

Exploring Other Worlds

- Low-Gravity Bodies
- Full-Capability Near-Earth Asteroid Missions
- Phobos/Deimos

Planetary Exploration

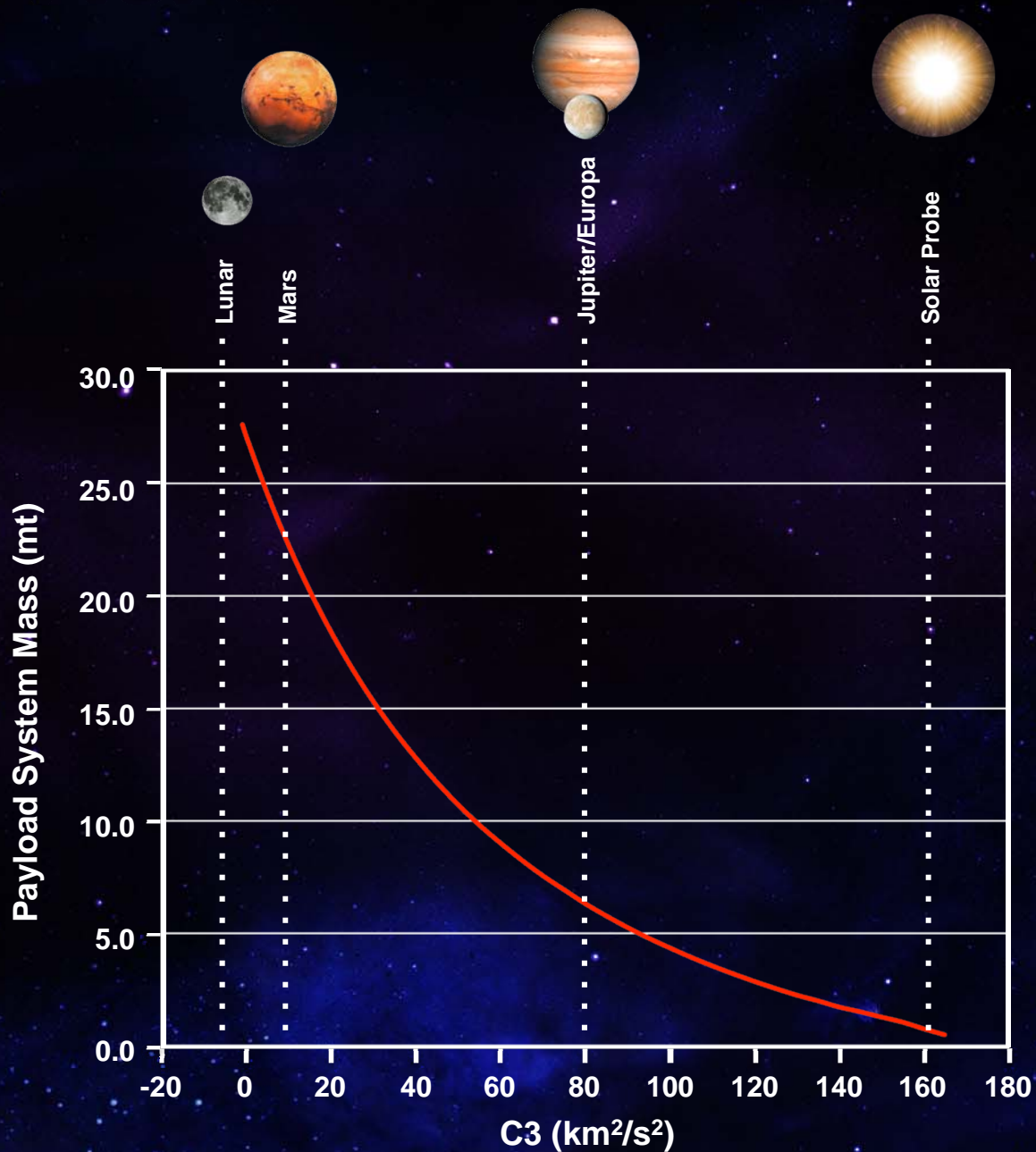
- Mars
- Solar System

ISS: 237 mi / 381 km

Surface Capabilities Needed
Advanced Propulsion Needed
High Thrust In-Space Propulsion Needed
Long Duration Habitat Needed

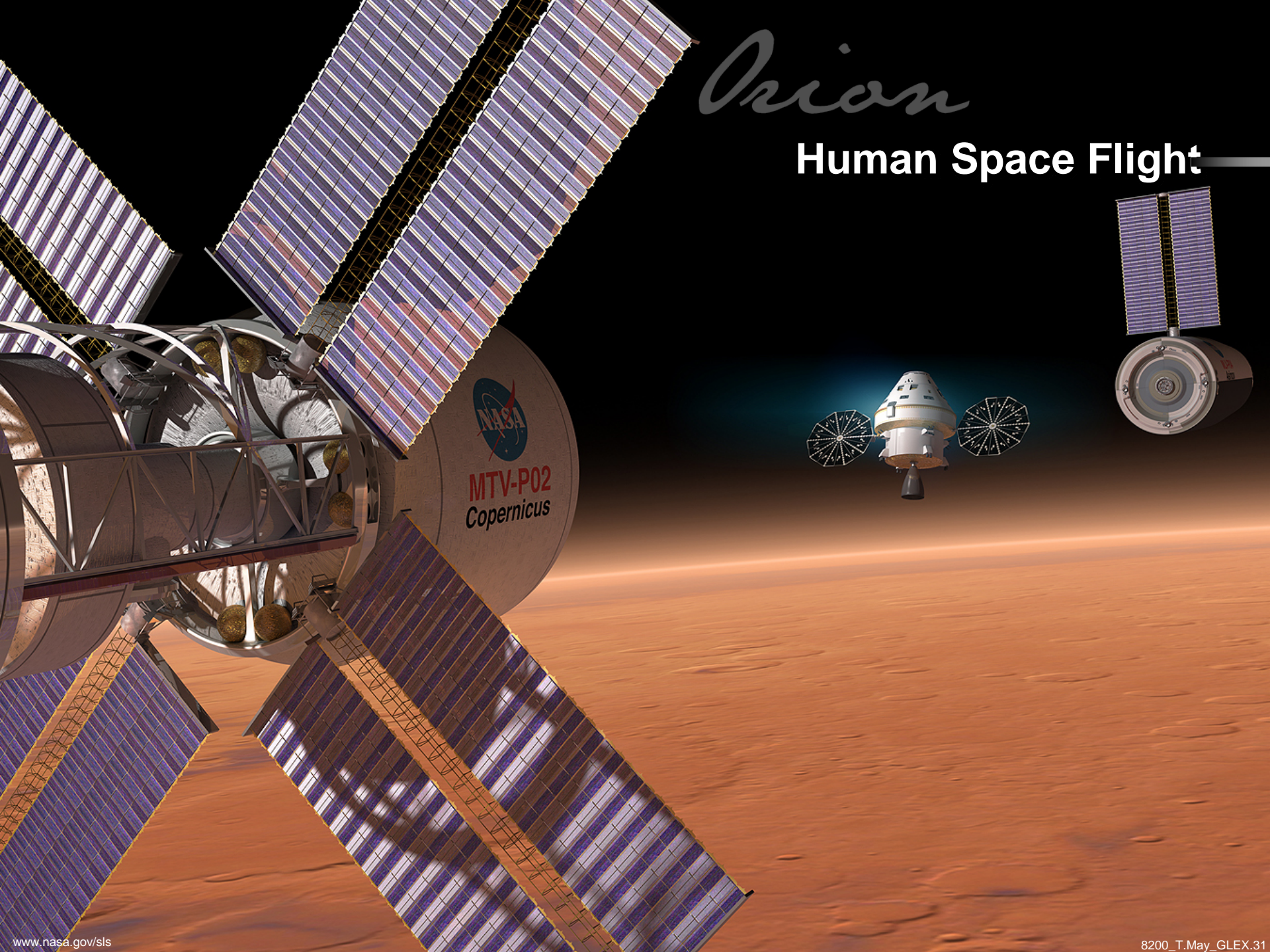
SLS — Going Beyond Earth's Orbit

Block 1 ICPS



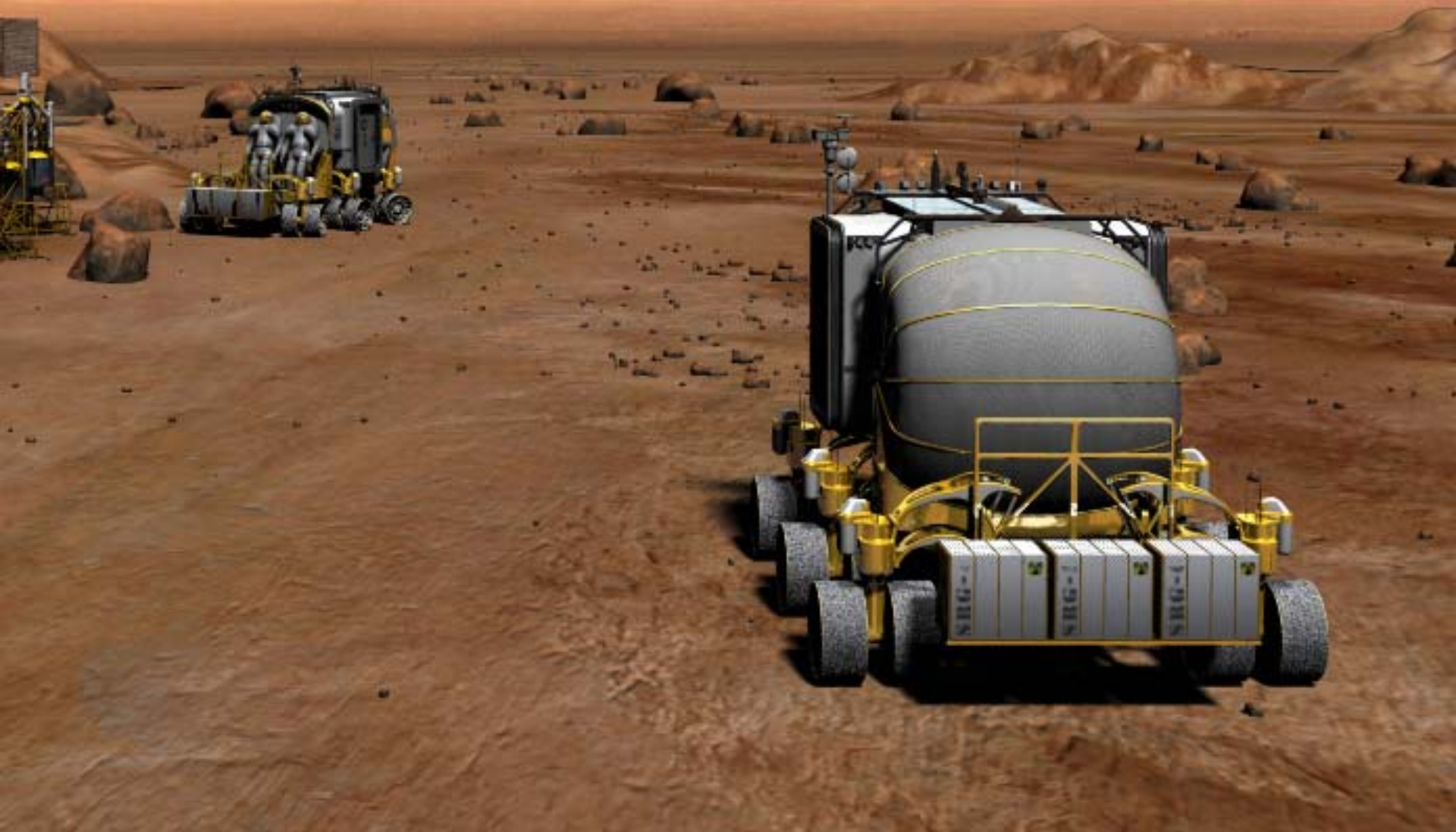
Orion

Human Space Flight



Mars

Human Mission to Mars



SLS Performance = Affordability

Less Risk



Increased lift capacity

Increased payload margin

Less Expensive Mission Operations



High energy orbit

Shorter trip times

Increased Design Simplicity



Volume and mass capability

Increased design simplicity

Increased Mission Reliability and Confidence



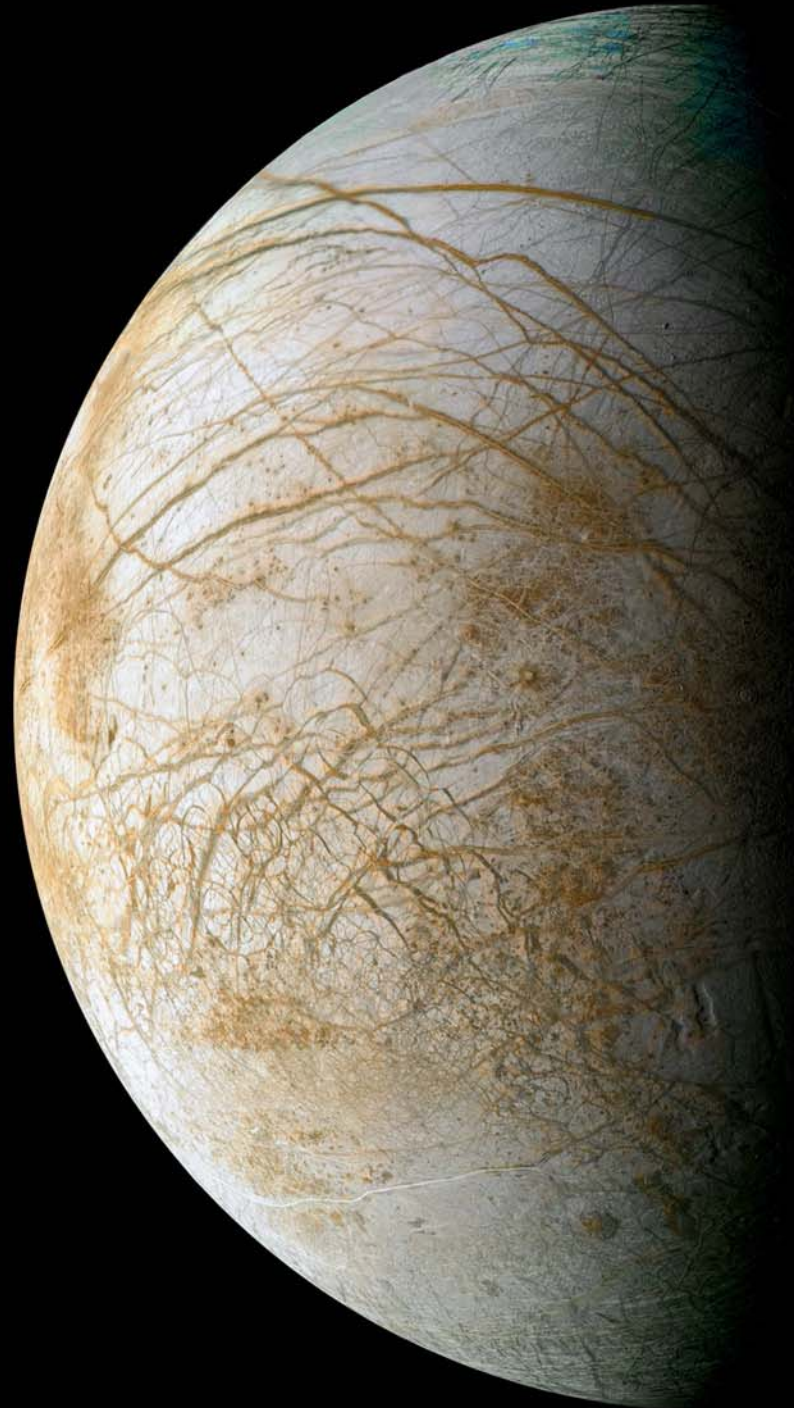
Volume and mass capability

Fewer deployments and critical operations

Safe, Affordable, Sustainable

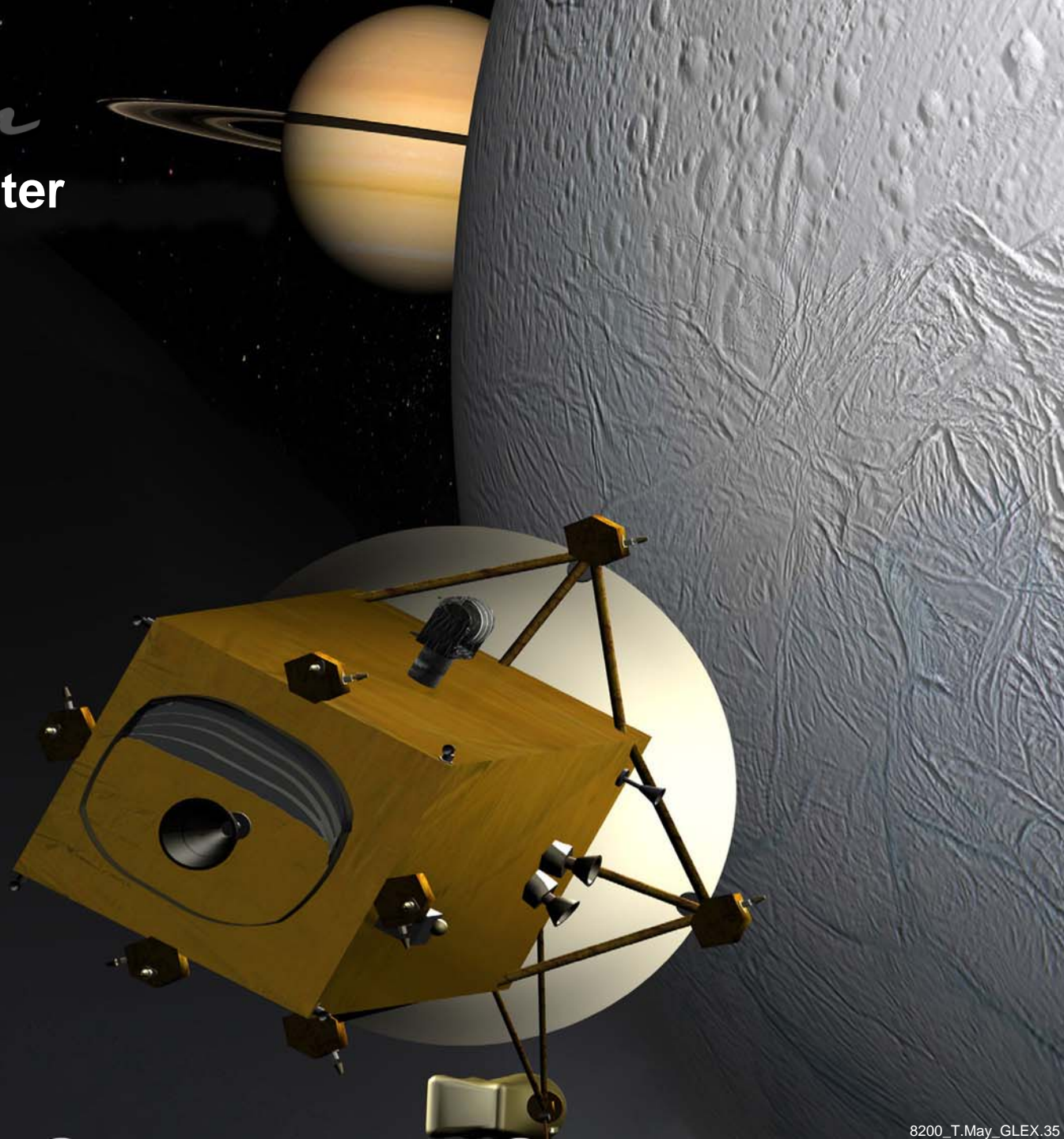
Jupiter

The Ice of Europa



Saturn


Enceladus Orbiter



For More Info: www.nasa.gov/sls



Building a Platform for Global Space Exploration

A composite image of the solar system. In the upper left, a bright yellow Sun glows. To its right, Earth is shown with blue oceans and white clouds, with a small satellite orbiting it. Further right, Mars is depicted in shades of orange and red, with a cratered surface. The foreground is filled with numerous brown, rocky asteroids of various sizes. The background is a deep blue space filled with stars.

*Somewhere, something incredible
is waiting to be known.*

— Carl Sagan