National Aeronautics and Space Administration

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

Todd A. May, Program Manager
Garry M. Lyles, Chief Engineer
Joan (Jody) A. Singer, Deputy Program Manager
David E. Beaman, Spacecraft and Payload Integration Manager
Stephen D. Creech, Strategic Development Manager

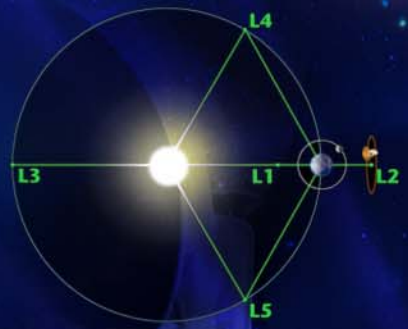
May 2012

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.”

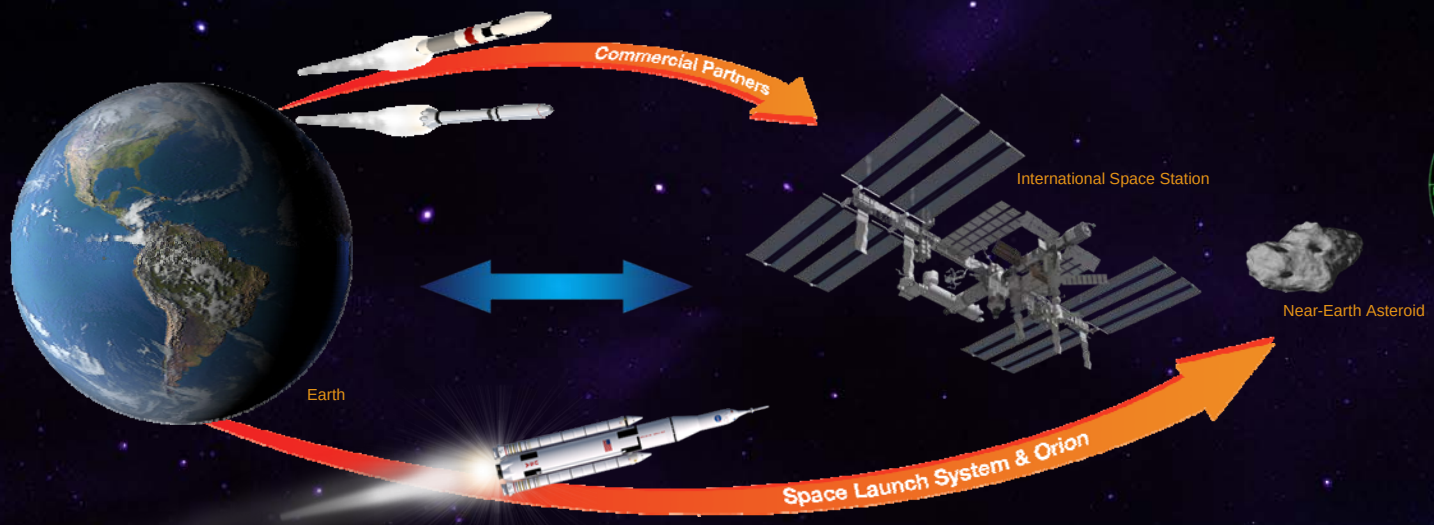
National Aeronautics and Space Administration



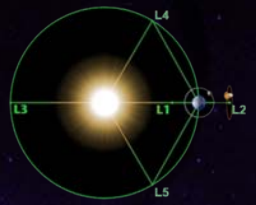
SLS Launches in 2017

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

The Future of Exploration




Mars



Lagrange Points


Moon


Saturn


Jupiter

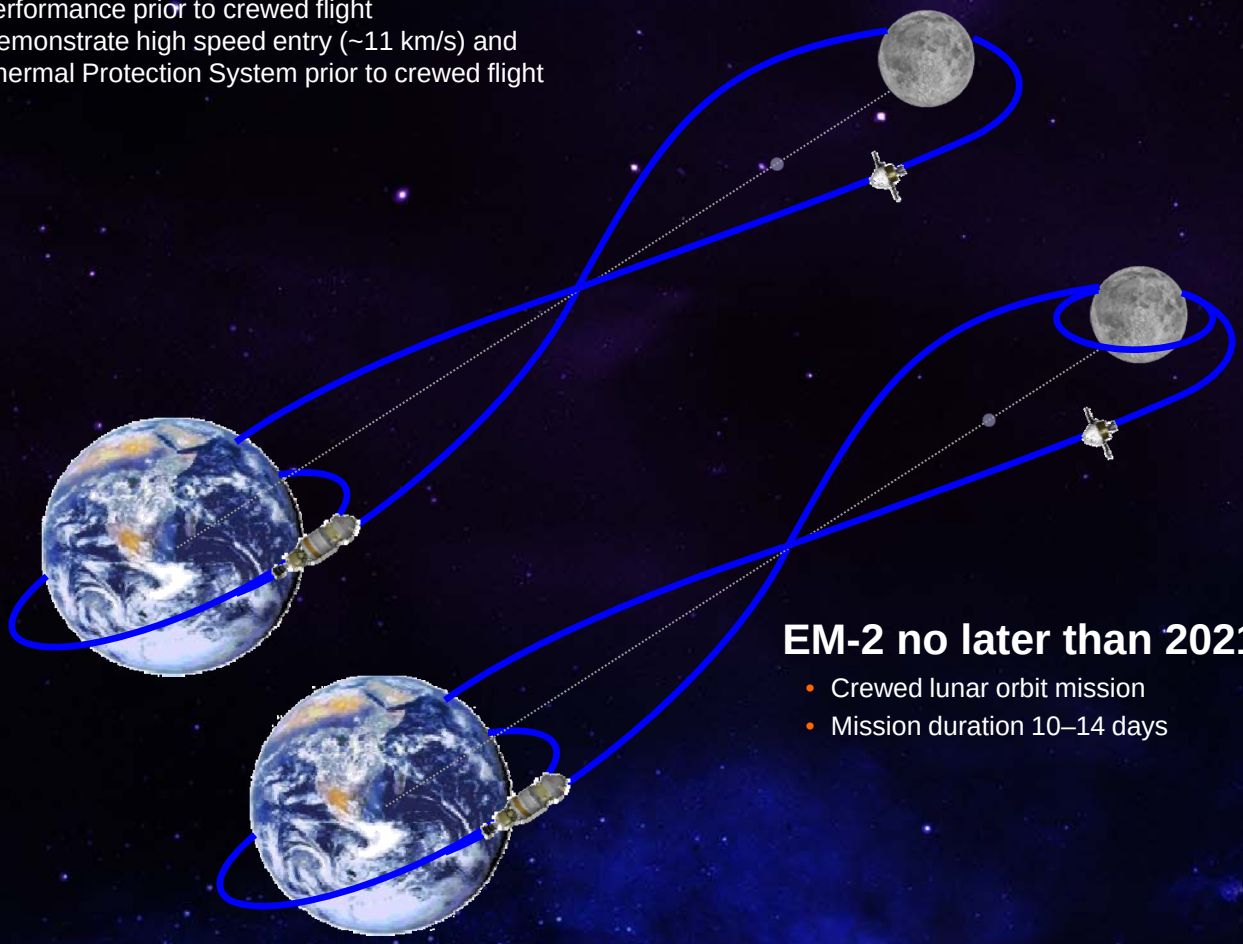
My desire is to work more closely with the human spaceflight program so we can take advantage of synergy…. We think of the SLS as the human spaceflight program, but it could be hugely enabling for science.

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

Initial Exploration Missions (EM)

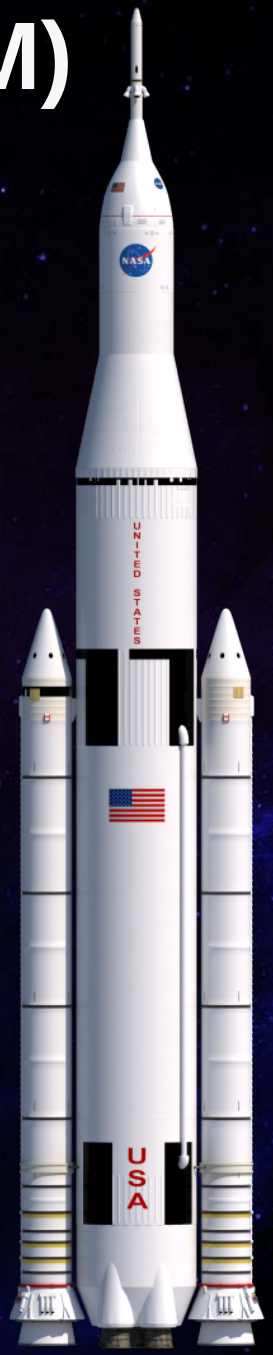
EM-1 in 2017

- 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

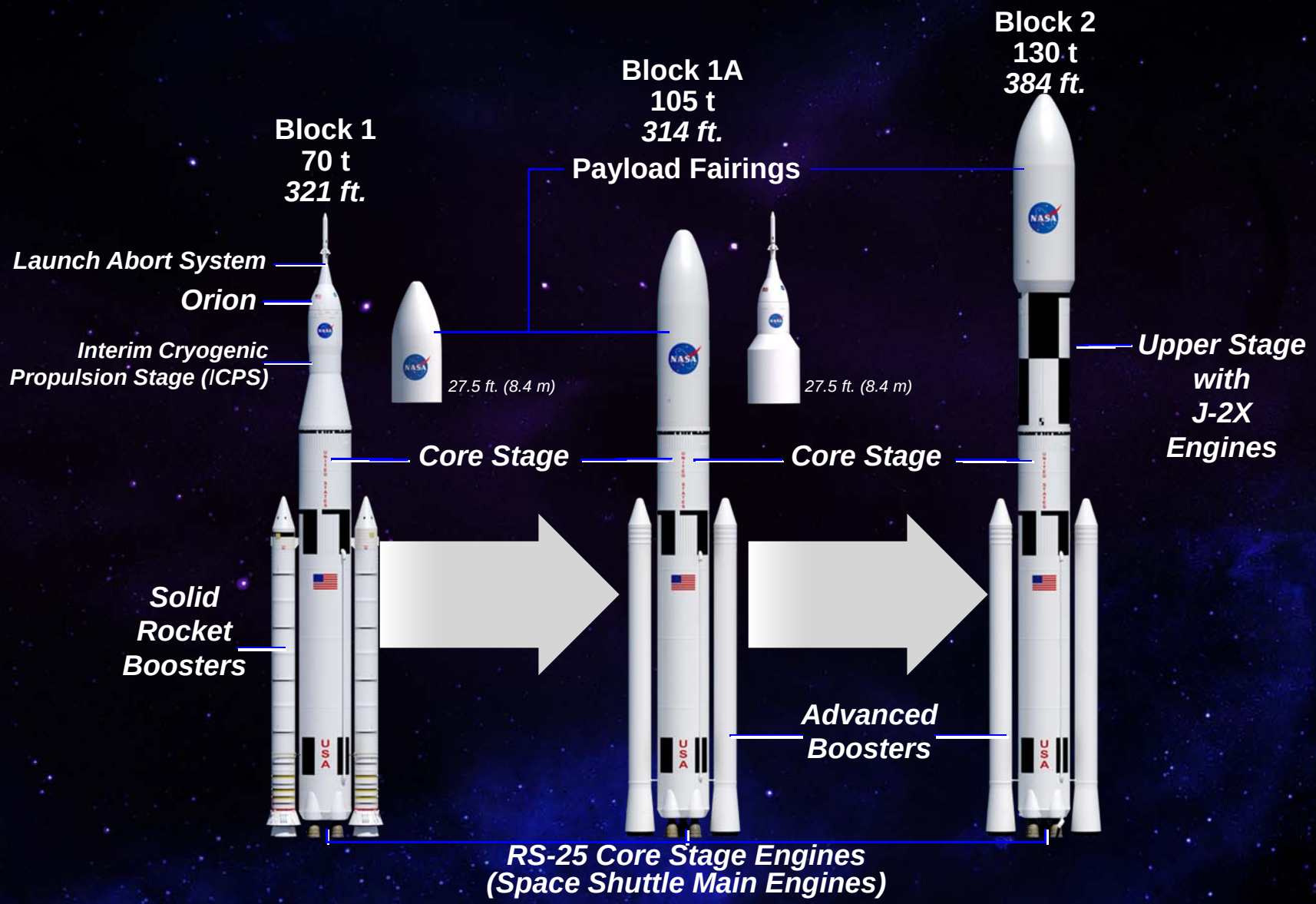
- ***Vital to NASA's exploration strategy and the Nation's space agenda.***
- **Key tenets: safety, affordability, and sustainability**
- **System Requirements Review/ System Definition Review in progress**
- **Partnerships with NASA Exploration Systems Development (Headquarters), Orion and Ground Operations Programs, and Centers**
- **Prime contractors on board, engaging the U.S. aerospace workforce and specialized infrastructure**

On Track for First Flight in 2017

- **Turning plans into progress: Design and development work moving forward today, to deliver an unsurpassed capability that launches in 2017**

Garry Lyles, Chief Engineer
The SLS Design

SLS Architecture Block Upgrade Approach



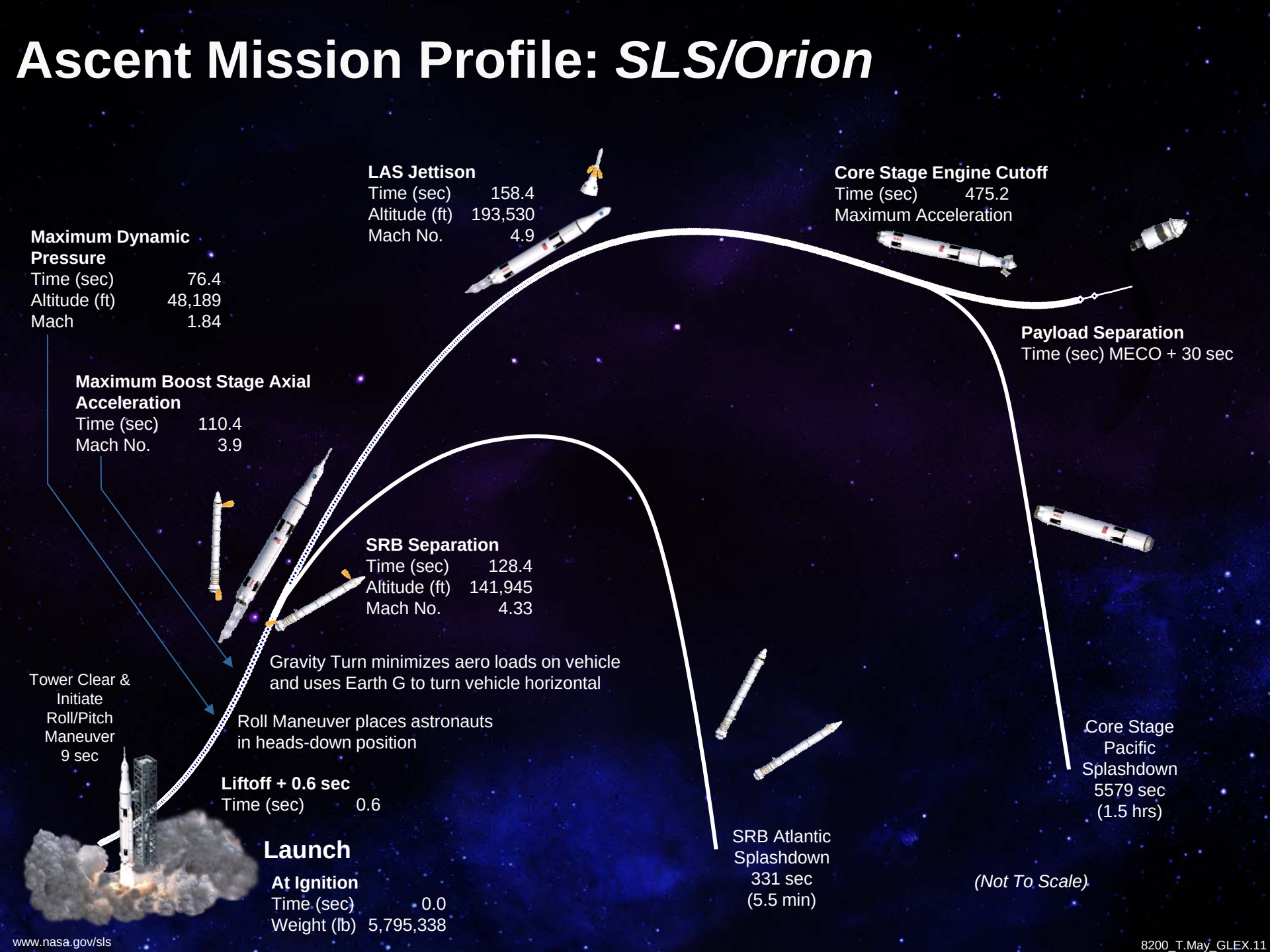
Starting with Available Assets and Evolving the Design

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*



8200_T.May_GLEX.11

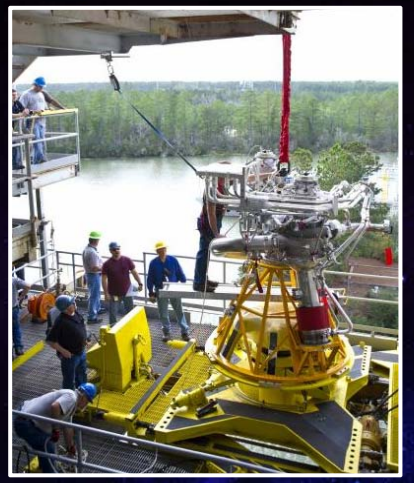
SLS: *Being Built Today*

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.

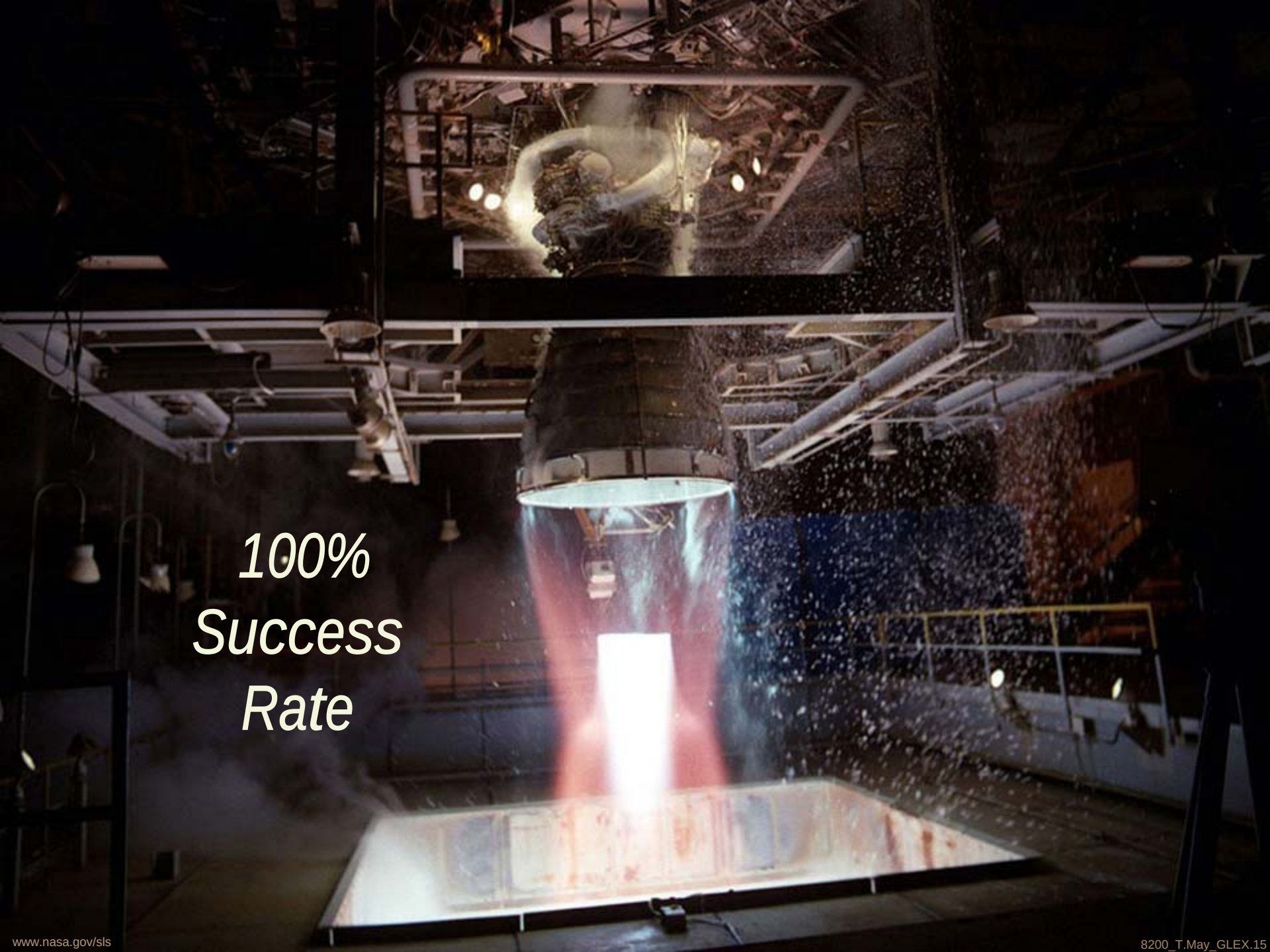
RS-25 Core Stage Engine in the KSC Engine Processing Facility, 2011.

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.

Jody Singer, Deputy Program Manager
Hardware Progress

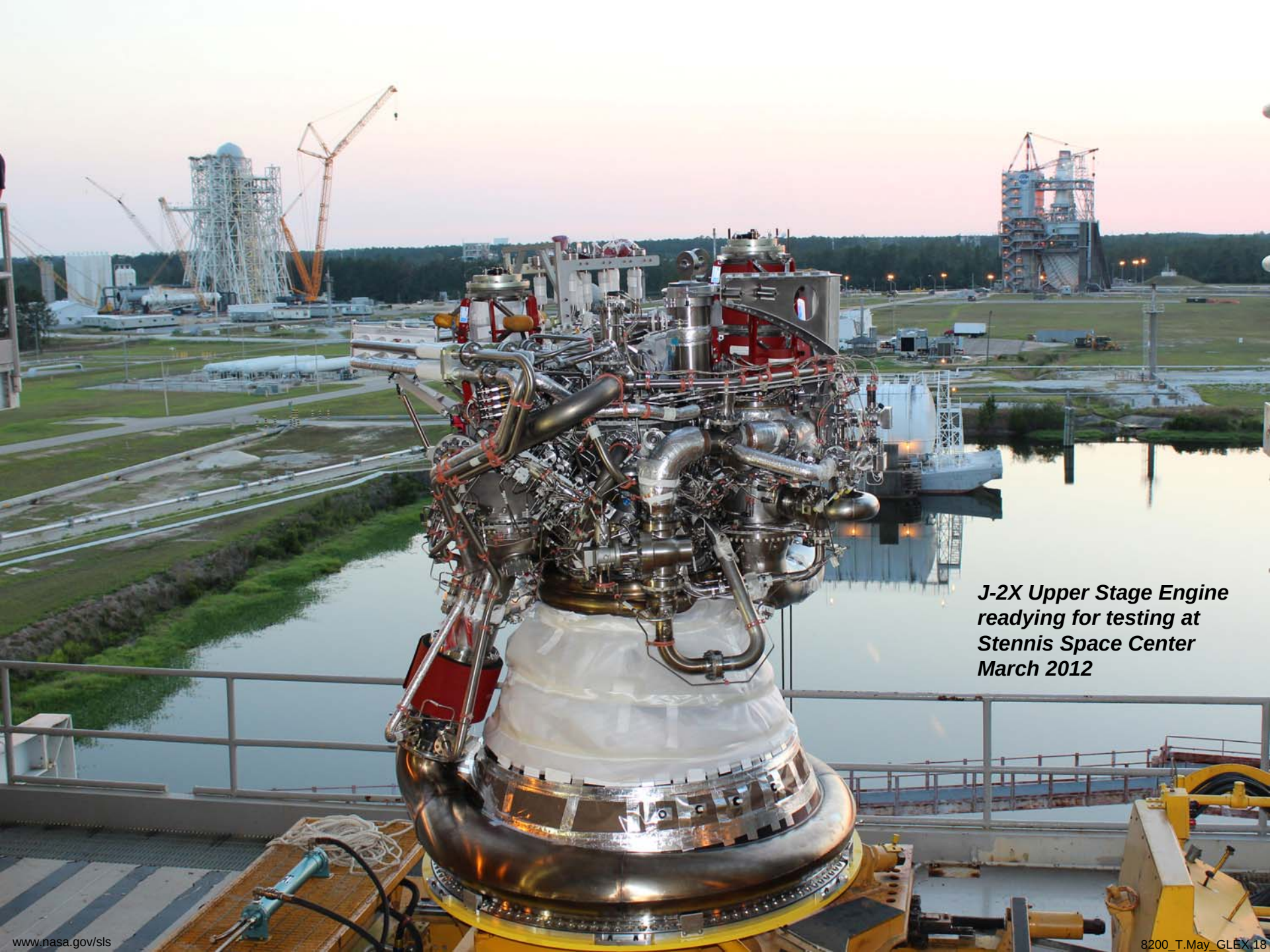
RS-25 Engines received at Stennis Space Center April 2012


100%
Success
Rate

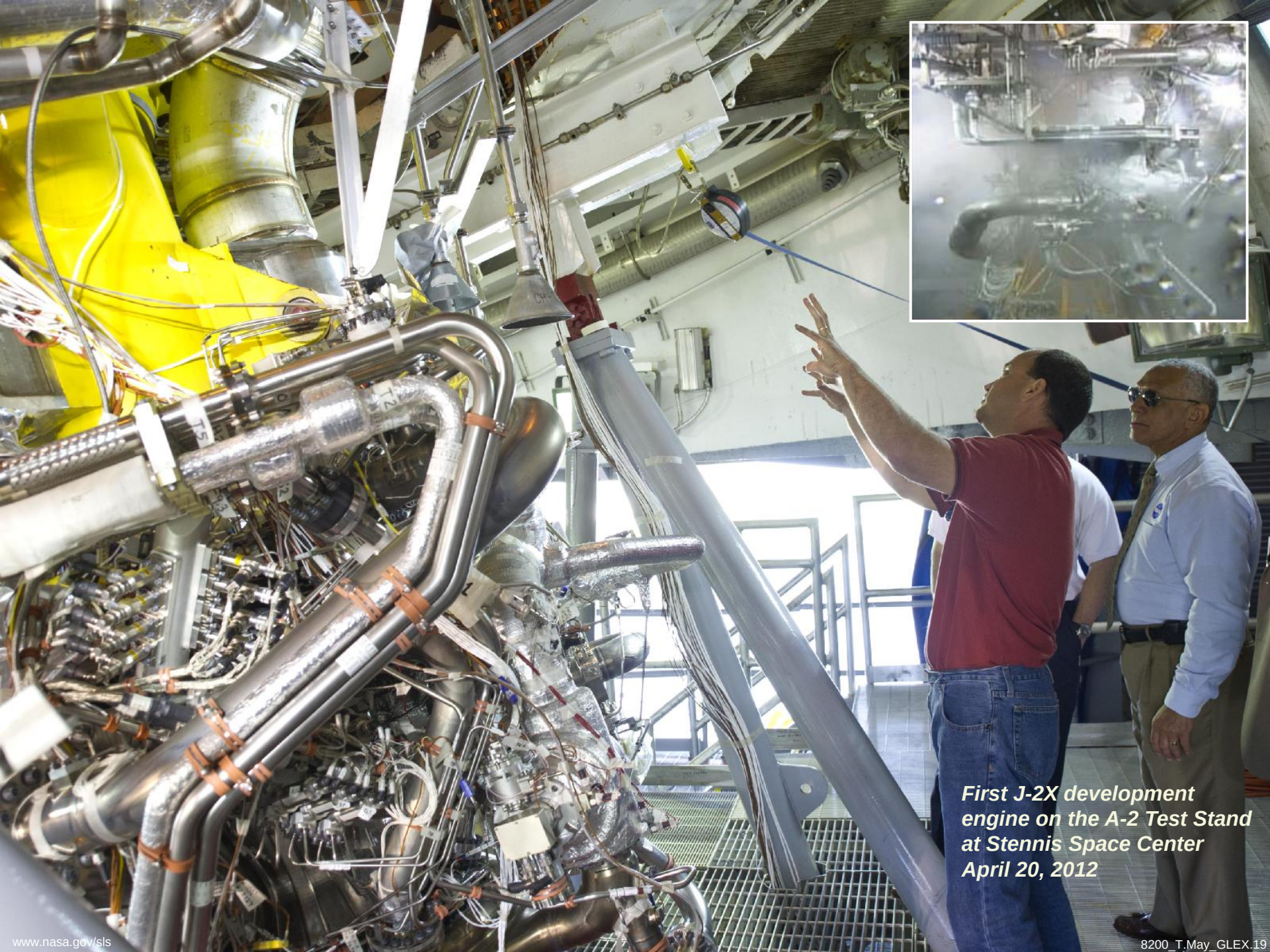
5-Segment Solid Rocket Booster

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

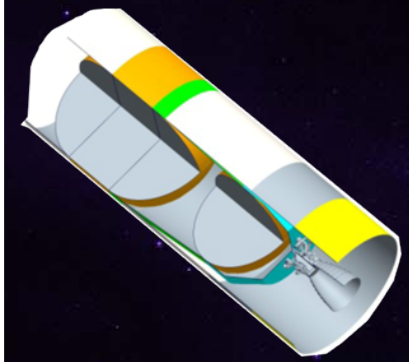


First J-2X development engine on the A-2 Test Stand at Stennis Space Center April 20, 2012

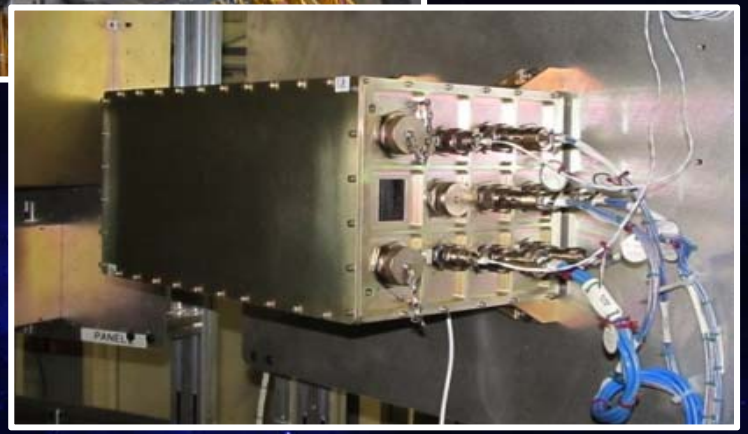
Marshall Space Flight Center's Michoud Assembly Facility

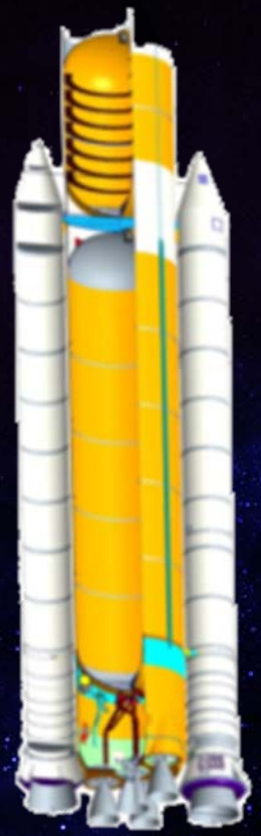
One-of-a-Kind Infrastructure Asset

Stages and Avionics



Upper Stage



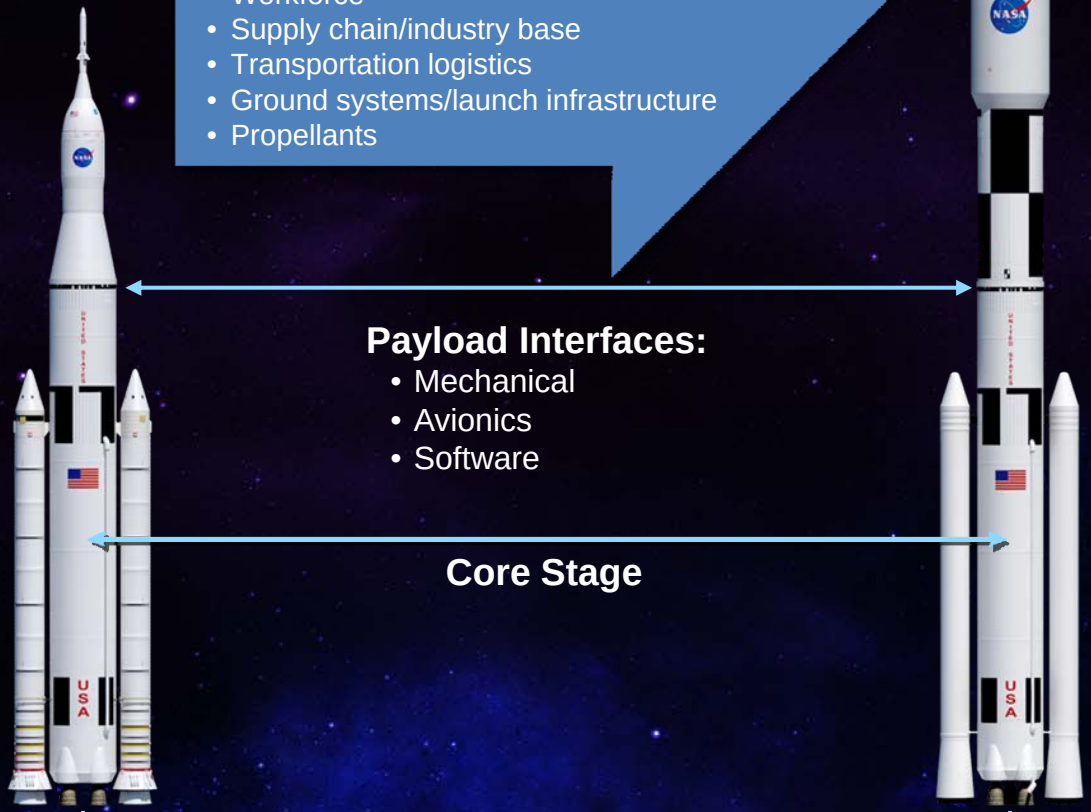


Core Stage

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

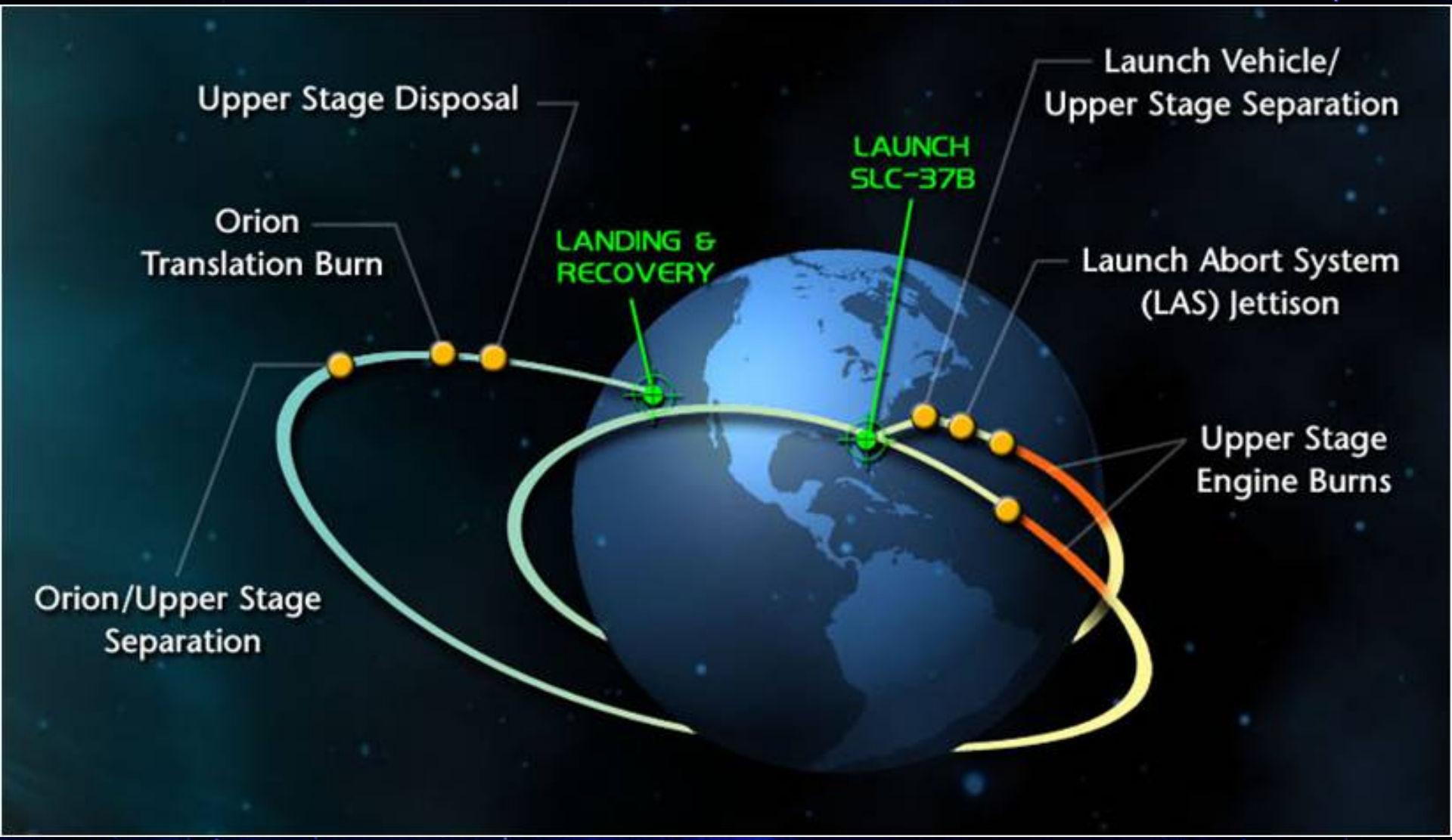
130 ton Payload (Block 2)

Core Stage

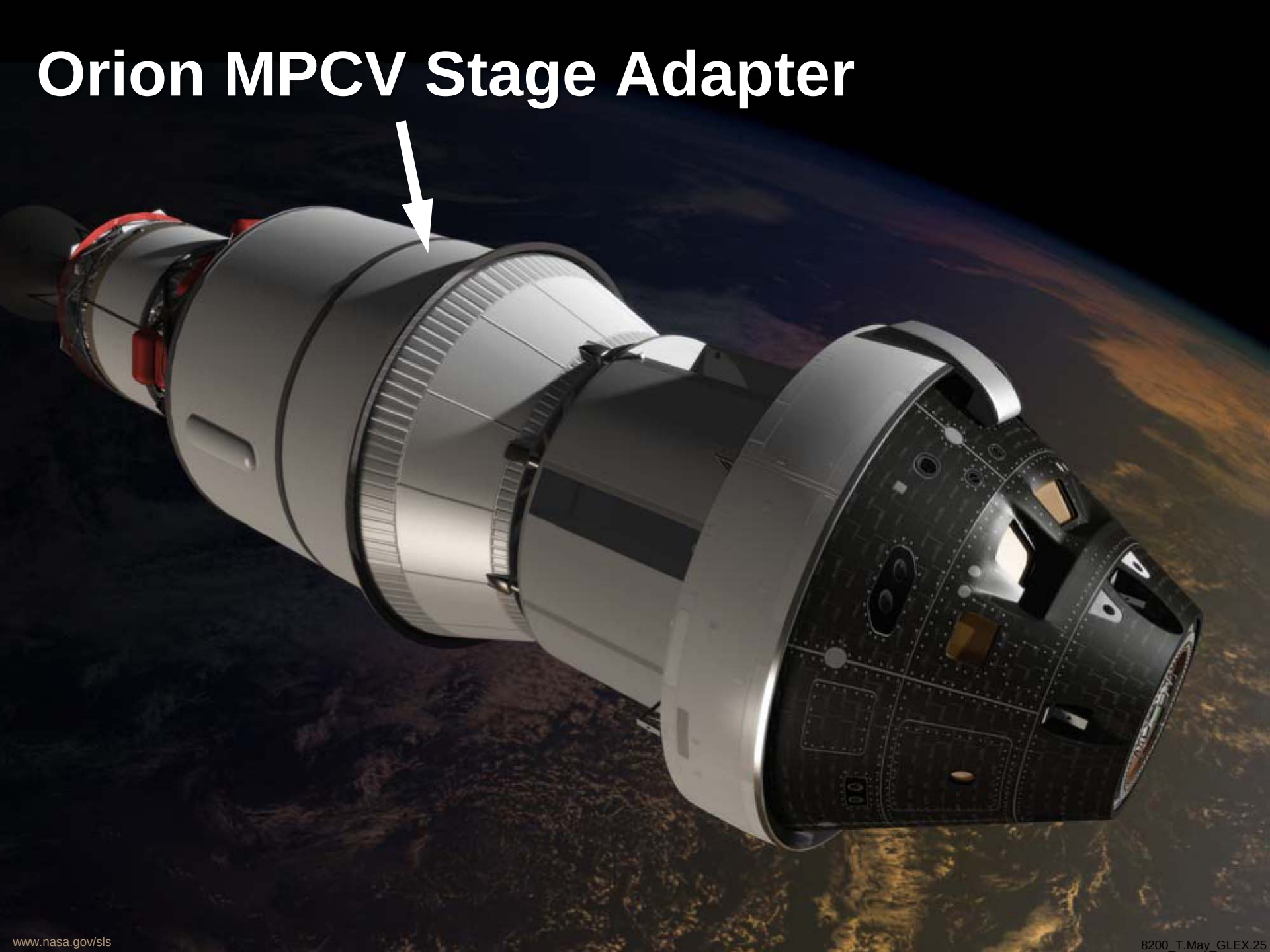
RS-25 Core Stage Engines


David Beaman, Spacecraft and
Payload Integration Manager
Adapters and Fairings

Exploration Flight Test-1 Mission Overview



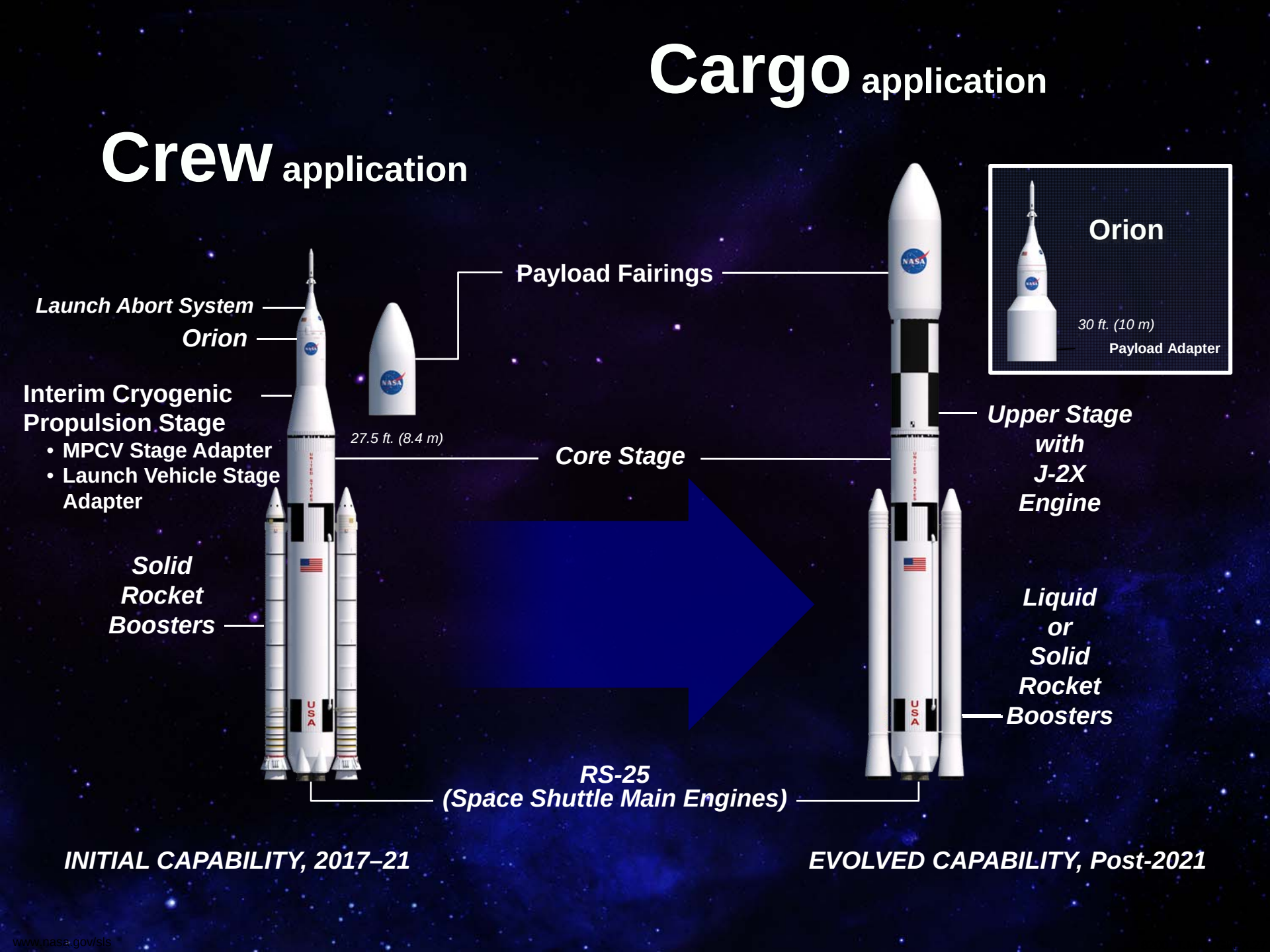
Orion MPCV Stage Adapter



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

Cargo application

Crew application

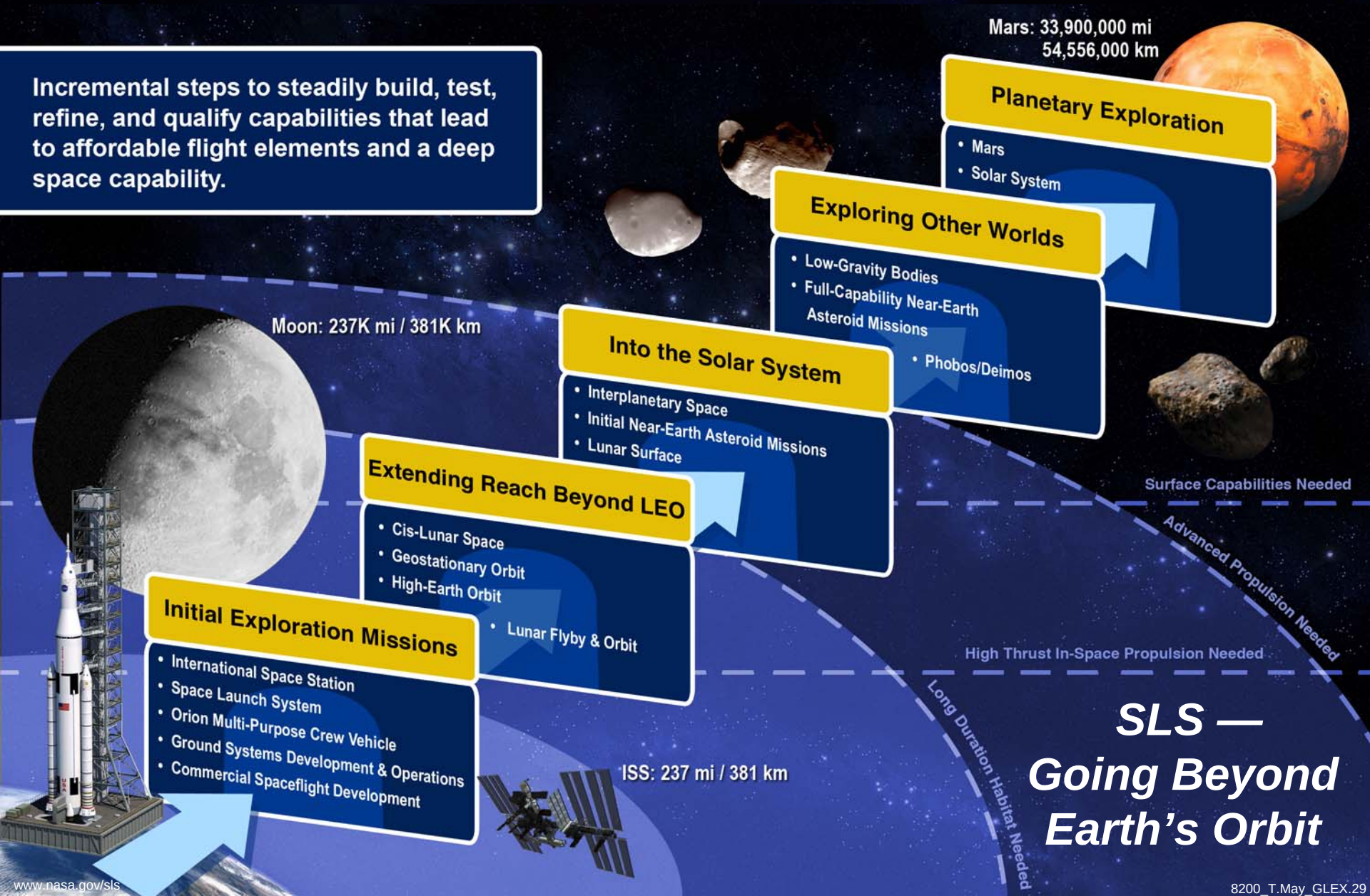


INITIAL CAPABILITY, 2017–21

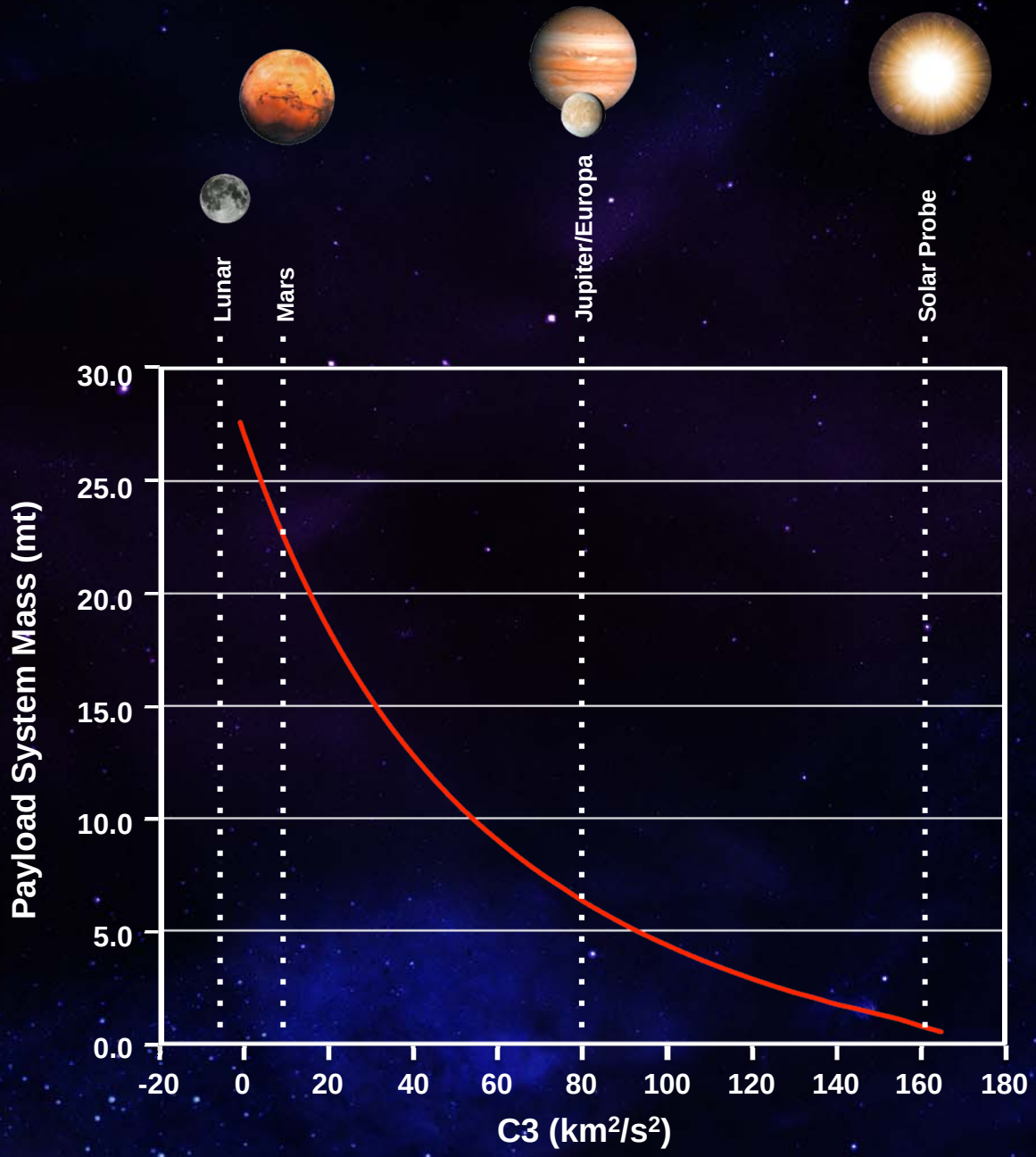
EVOLVED CAPABILITY, Post-2021

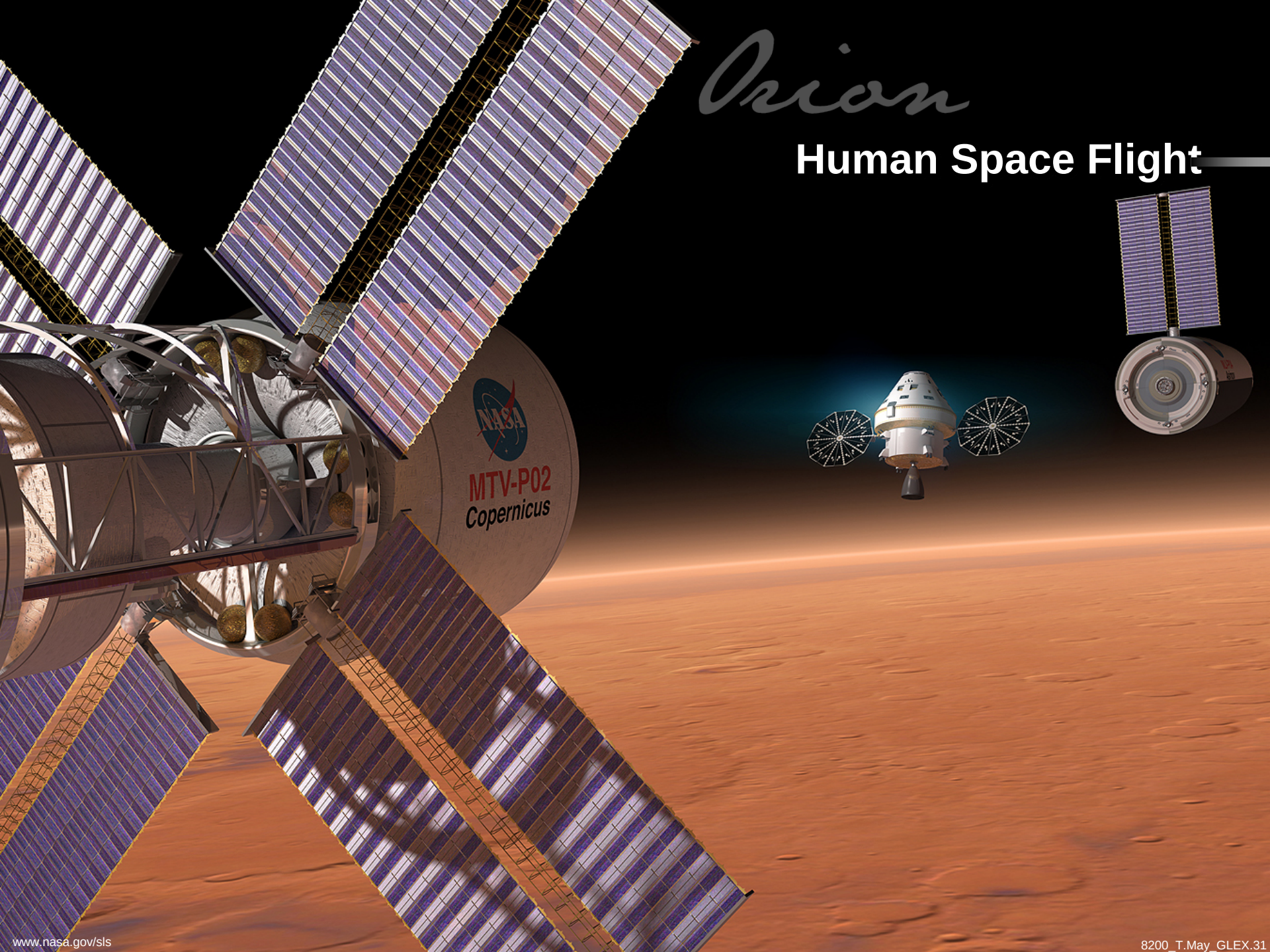
Steve Creech, Strategic Development Manager
Mission Capabilities

A National Asset for Stakeholders and Partners



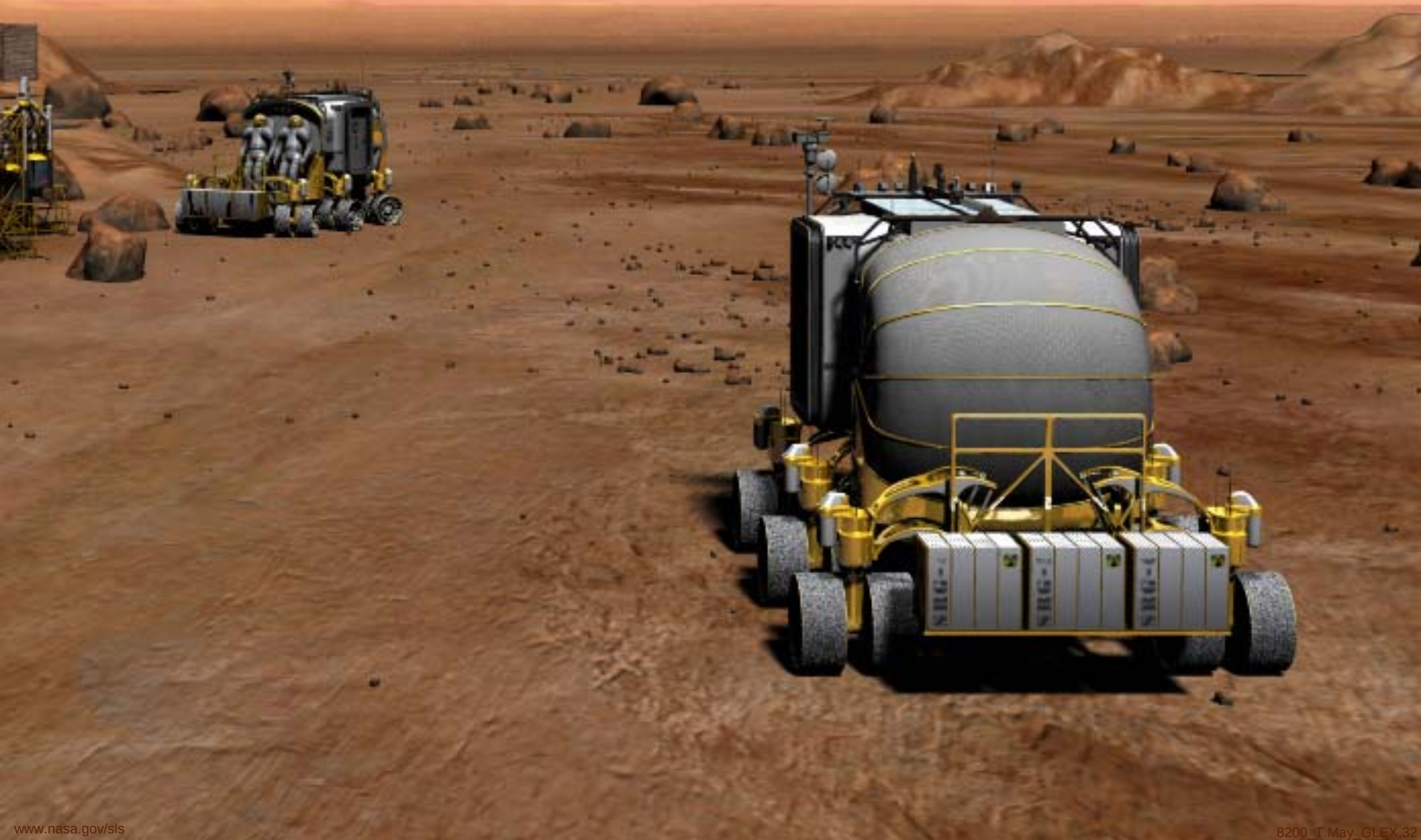
Block 1 ICPS


Lunar
Mars
Jupiter/Europa
Solar Probe
Payload System Mass (mt)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
-20
0
20
40
60
80
100
120
140
160
180
C3 (km²/s²)


Orion
Human Space Flight
MTV-P02
Copernicus

Mars

Human Mission to Mars



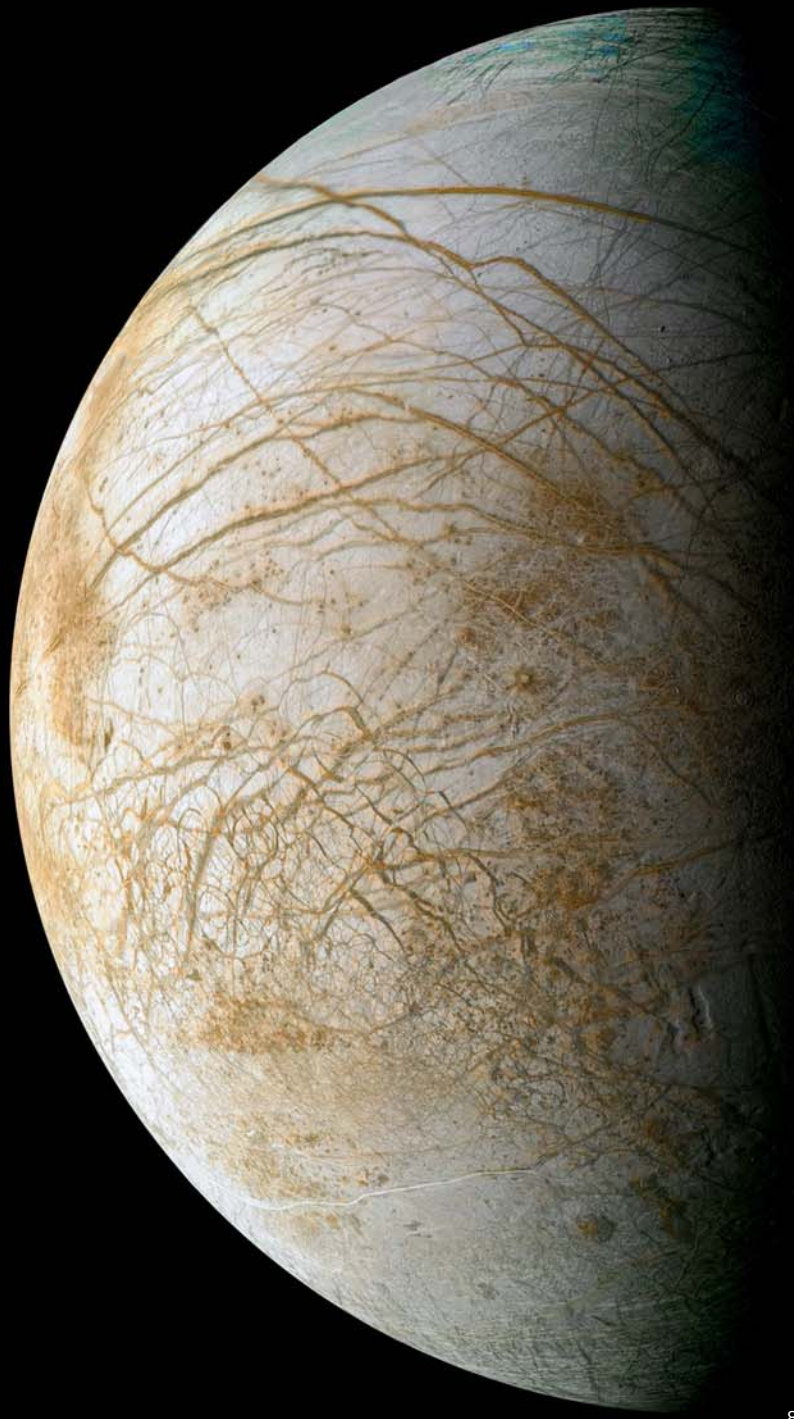
SLS Performance = Affordability

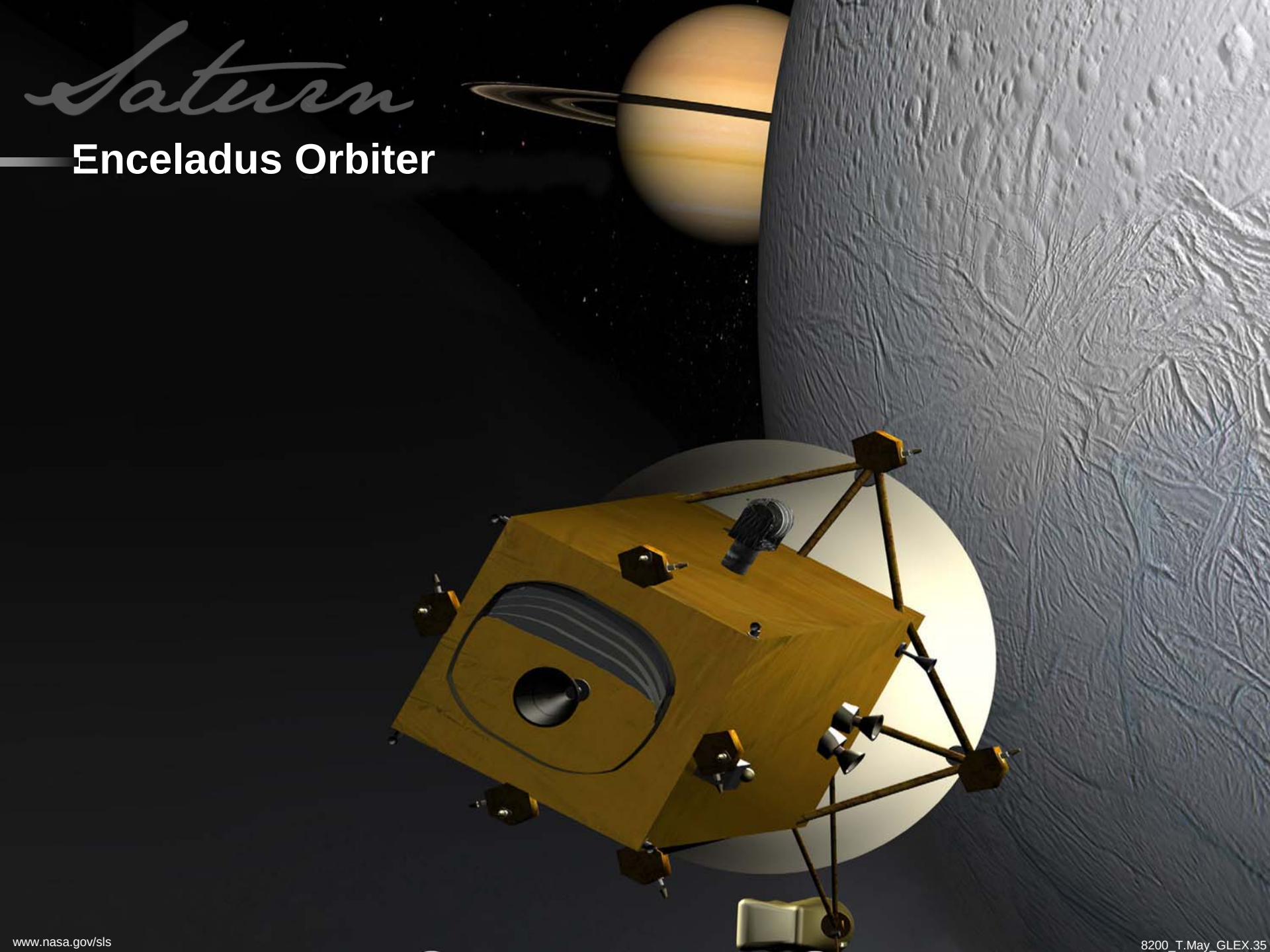
Less Risk	*Less Expensive Mission Operations*	*Increased Design Simplicity*	*Increased Mission Reliability and Confidence*
			
Increased lift capacity	High energy orbit	Volume and mass capability	Volume and mass capability
Increased payload margin	Shorter trip times	Increased design simplicity	Fewer 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