

Materials in NASA's Space Launch System: The Stuff Dreams Are Made Of
National Space & Missile Materials Symposium
Tampa, FL

Abstract

Mr. Todd May, Program Manager for NASA's Space Launch System, will showcase plans and progress the nation's new super-heavy-lift launch vehicle, which is on track for a first flight to launch an Orion Multi-Purpose Crew Vehicle around the Moon in 2017. Mr. May's keynote address will share NASA's vision for future human and scientific space exploration and how SLS will advance those plans. Using new, in-development, and existing assets from the Space Shuttle and other programs, SLS will provide safe, affordable, and sustainable space launch capabilities for exploration payloads starting at 70 metric tons (t) and evolving through 130 t for entirely new deep-space missions. Mr. May will also highlight the impact of material selection, development, and manufacturing as they contribute to reducing risk and cost while simultaneously supporting the nation's exploration goals.

June 25, 2012



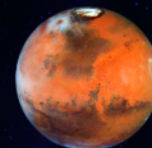
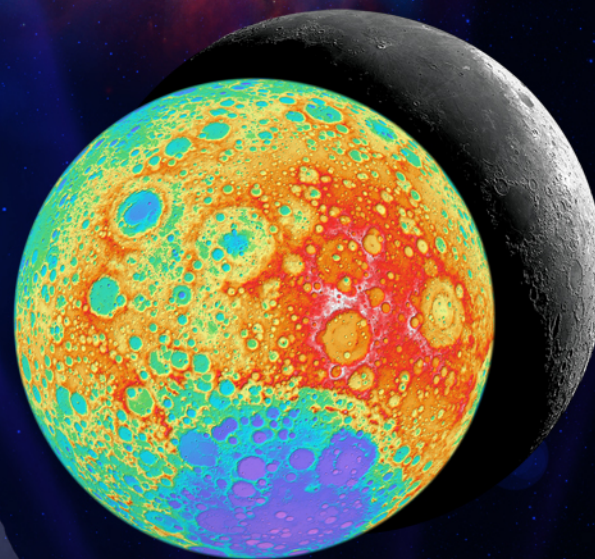
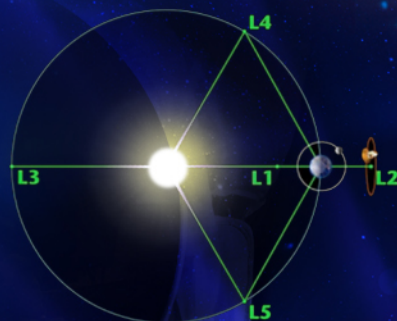
Materials in NASA's Space Launch System: *The Stuff Dreams Are Made Of*

Todd A. May, Program Manager

June 2012

“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.*
- *Expand scientific understanding of the Earth and the universe in which we live.*

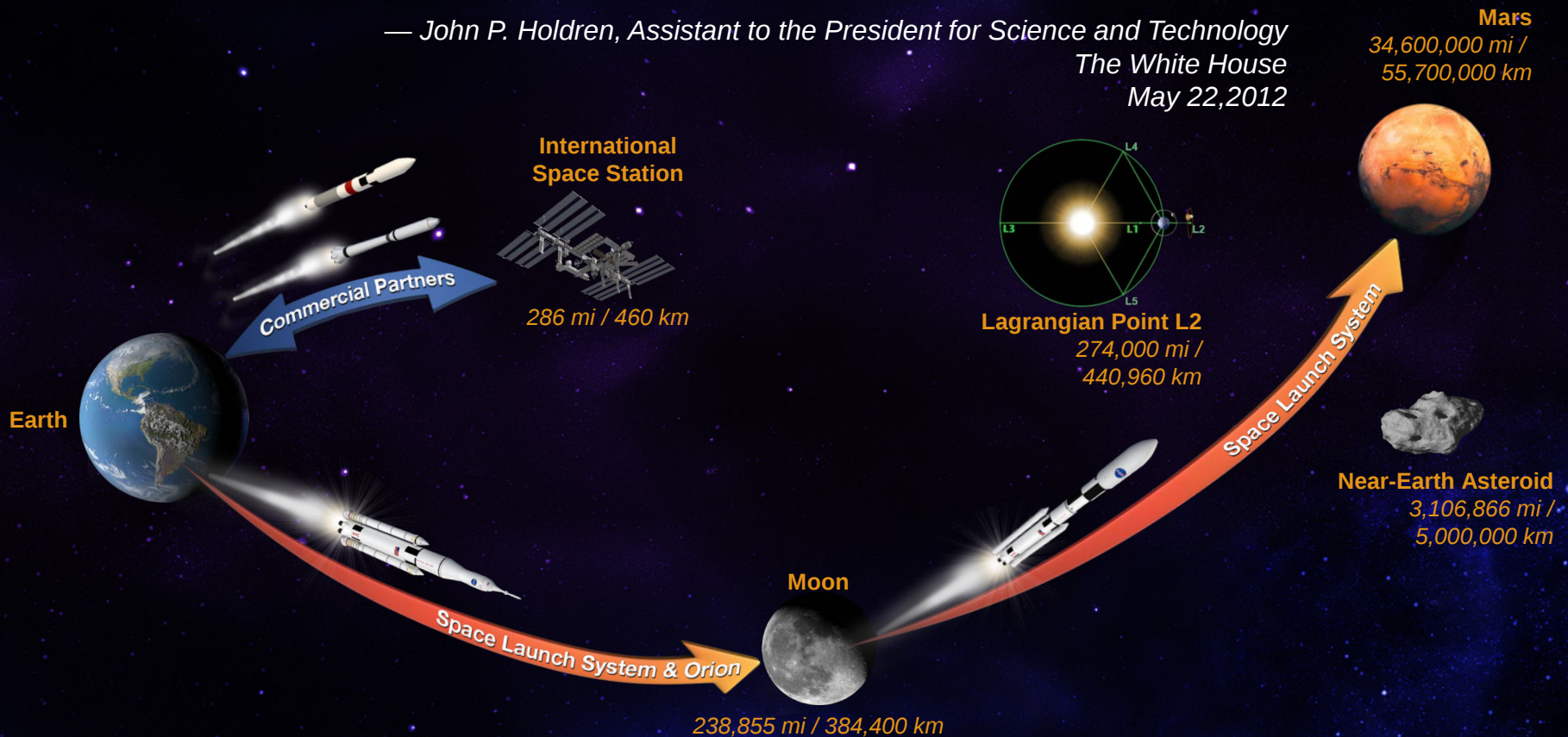
NASA 2011 Strategic Plan



The Future of Exploration

“This expanded role for the private sector will free up more of NASA’s resources to do what NASA does best — tackle the most demanding technological challenge in space, including those of *human space flight beyond low-Earth orbit*.”

— John P. Holdren, Assistant to the President for Science and Technology
The White House
May 22, 2012



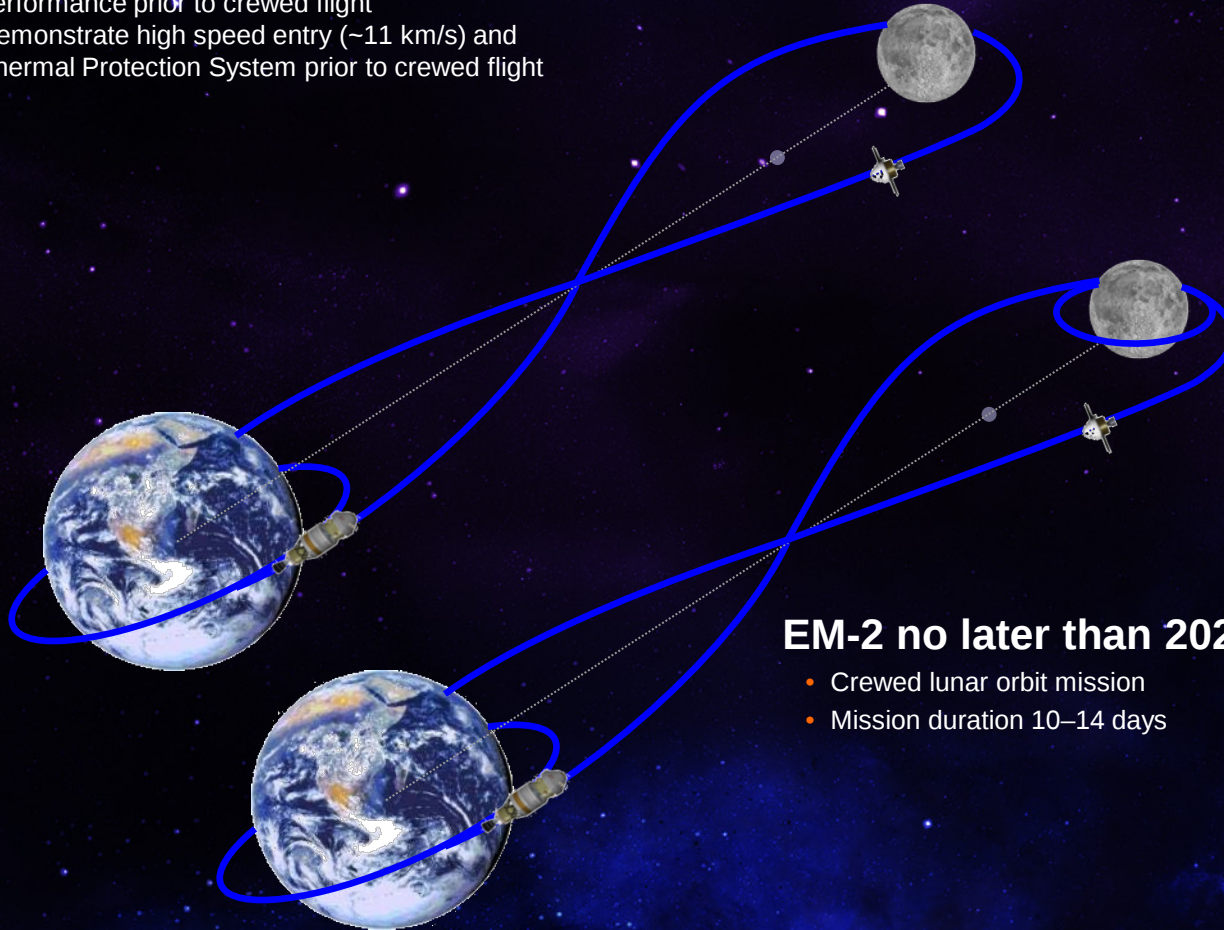
My desire is to work more closely with the human spaceflight program so we can take advantage of synergy.... We think of the SLS as the human spaceflight program, but it could be hugely enabling for science.

— 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



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)**

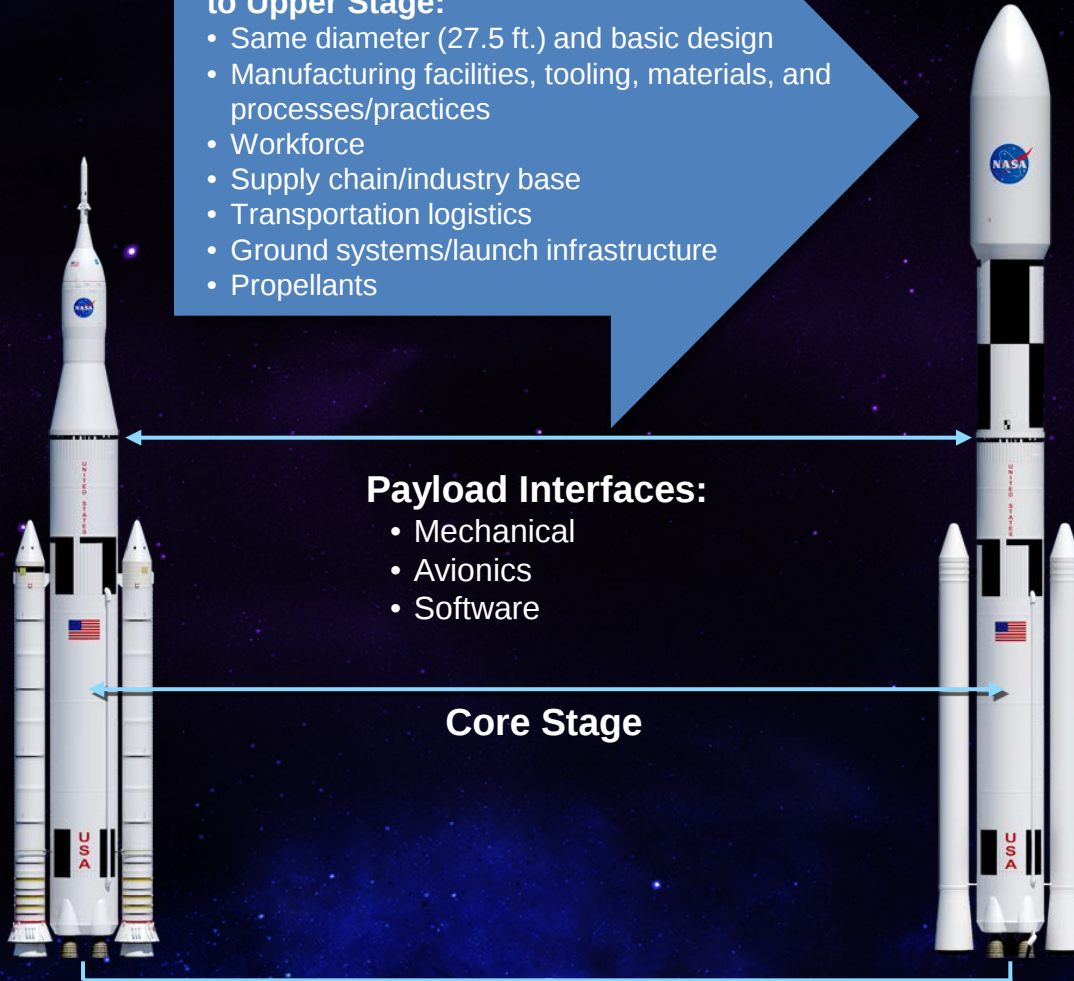
Payload Interfaces:

- Mechanical
- Avionics
- Software

**130 ton Payload
(Block 2)**

Core Stage

RS-25 Core Stage Engines



Advancing the U.S. Legacy of Human Exploration



SLS: Being Built Today in the USA!



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.

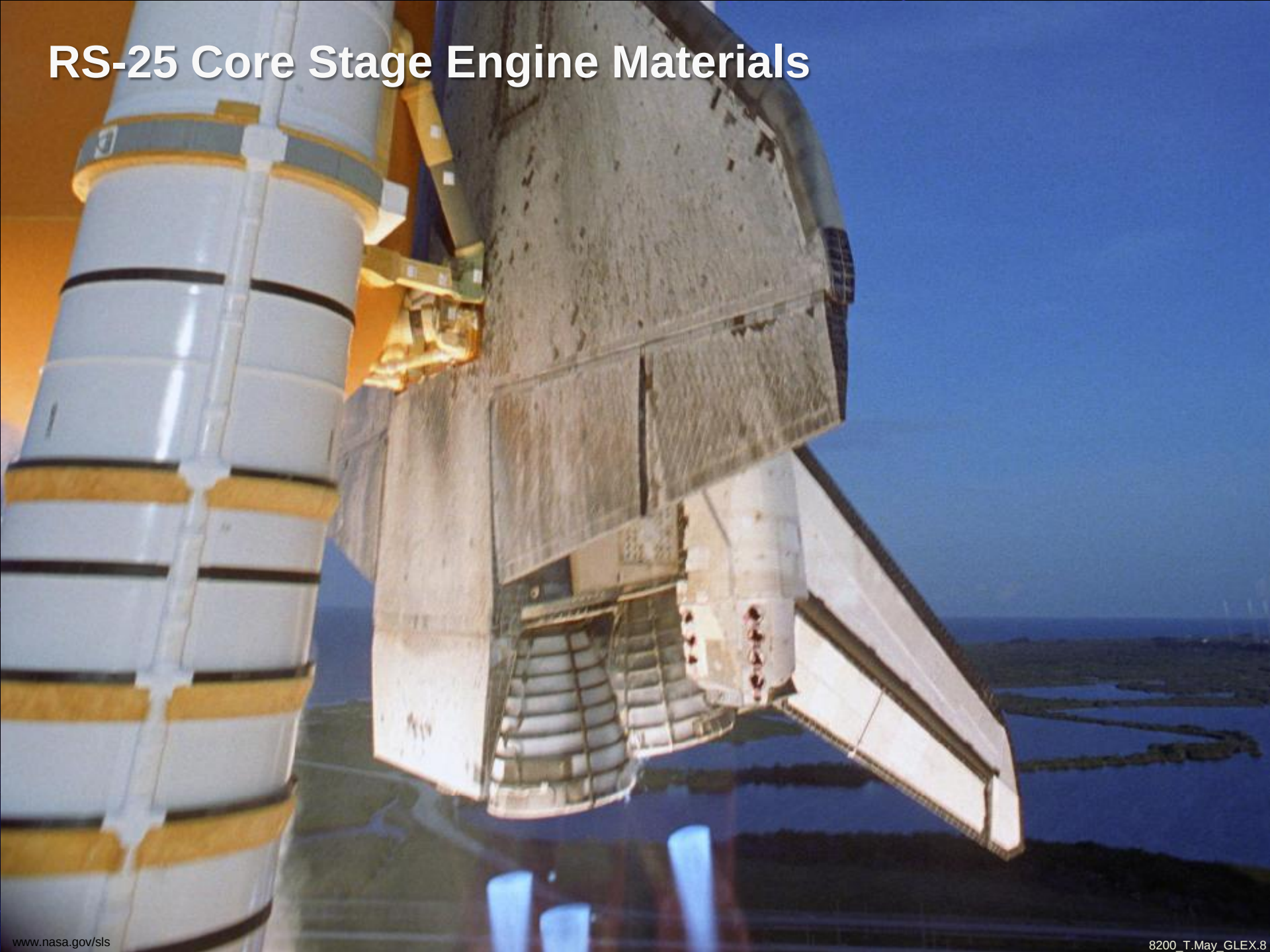


J-2X Upper Stage Engine powerpack test, Stennis Space Center (SSC), MS, Feb 2012.

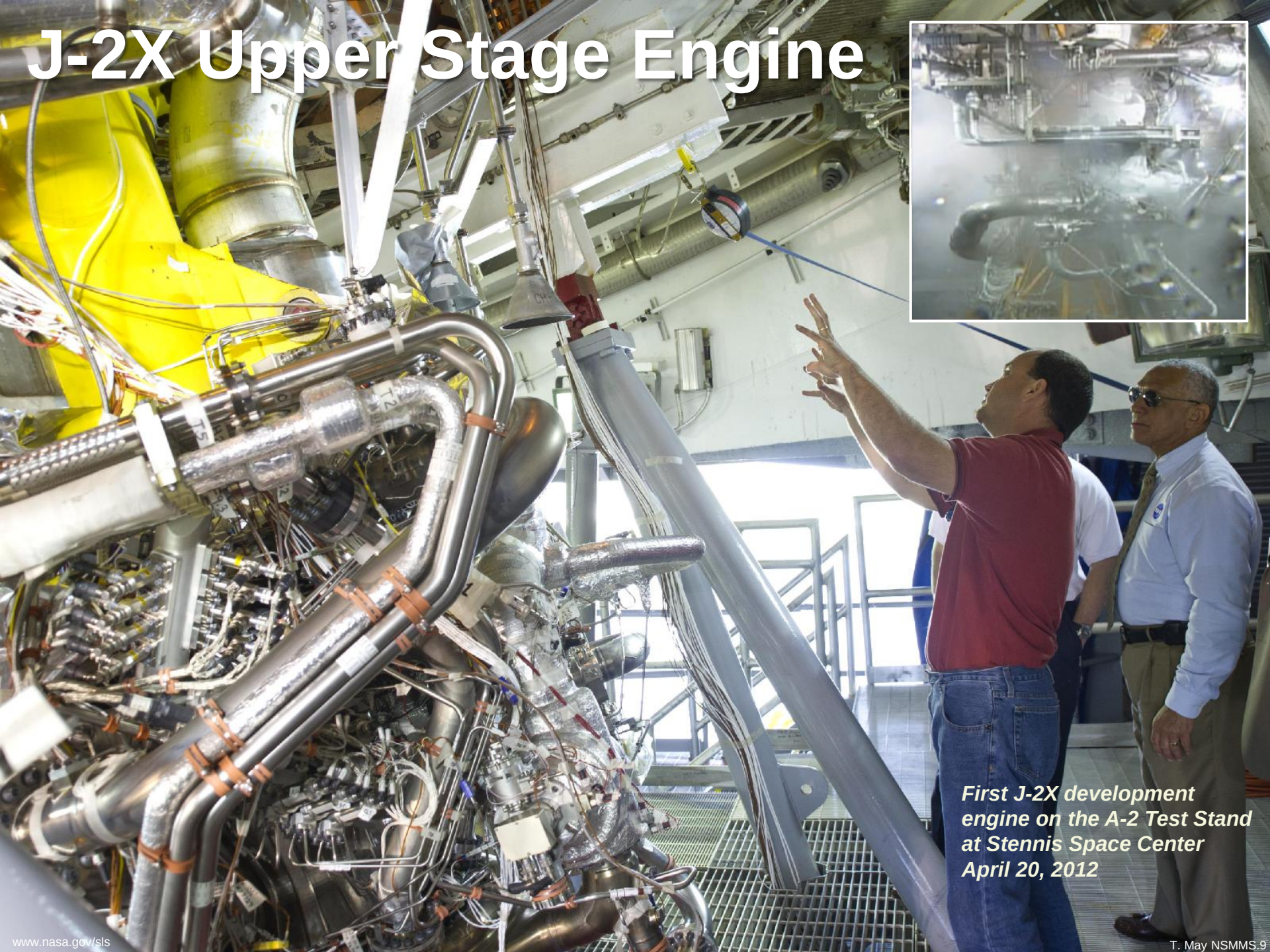


Meeting with Space Campers at U.S. Space & Rocket Center, Huntsville, AL, Feb 2012.

RS-25 Core Stage Engine Materials



J-2X Upper Stage Engine



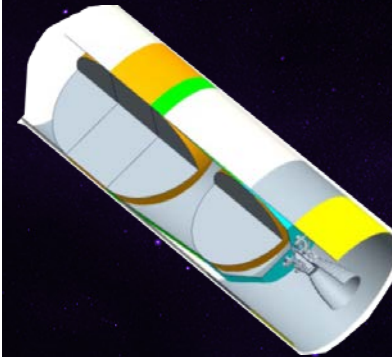
First J-2X development engine on the A-2 Test Stand at Stennis Space Center April 20, 2012

5-Segment Solid Rocket Booster

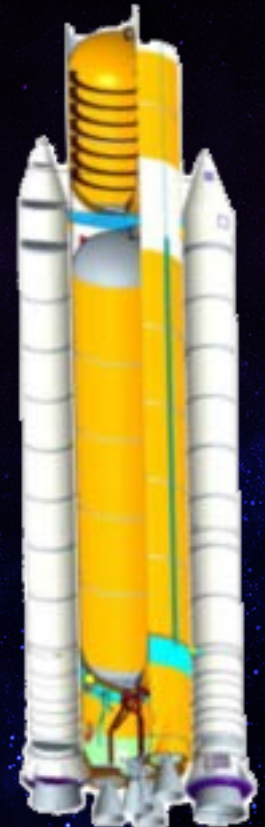


Development Motor Test 3
ATK Promontory, Utah
Test Site, September 8, 2011

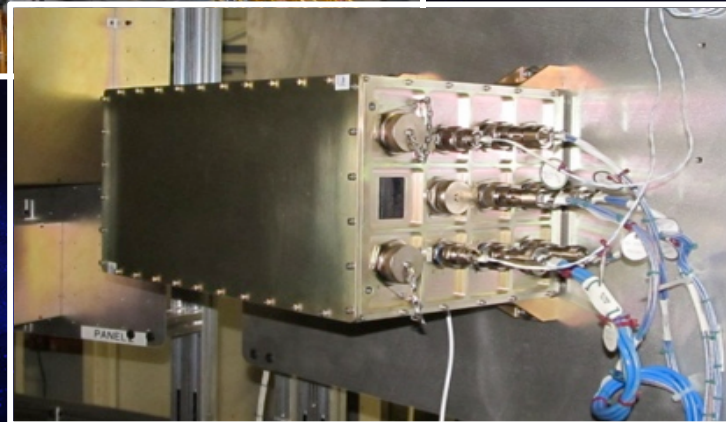
Stages and Avionics



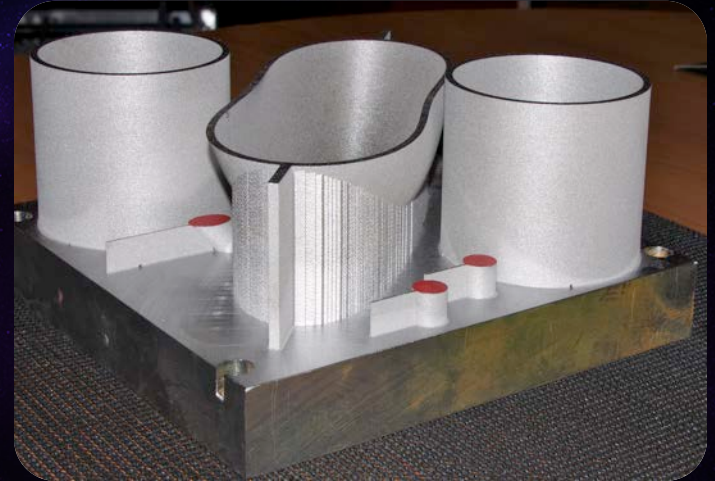
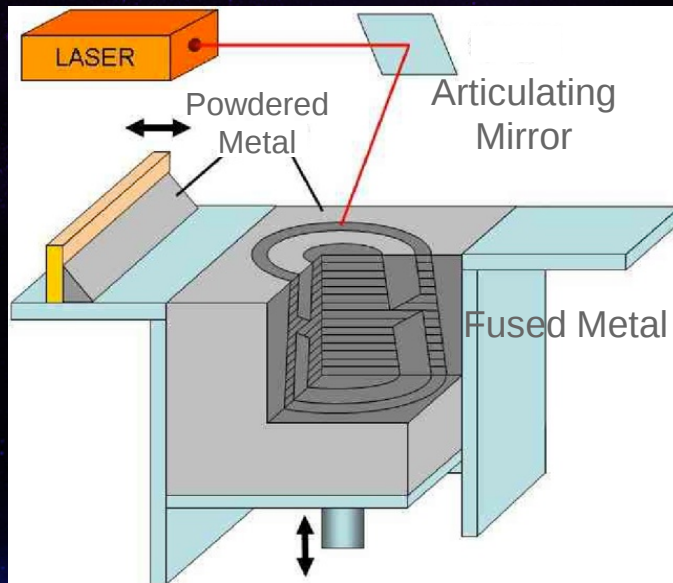
Upper Stage



Core Stage



J-2X Engine Manufacturing

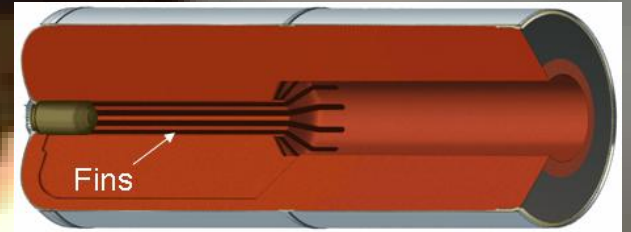


The same part as it looked part-way through the build process.
(The two tubes are for weld samples)

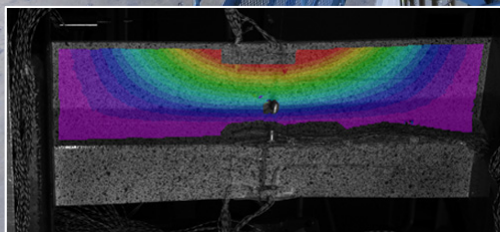


Completed Part

Booster Materials



Subscale motor material test at
Marshall Space Flight Center,
Alabama, March 14, 2012



Core Stage Materials



Marshall Space Flight Center's Michoud Assembly Facility



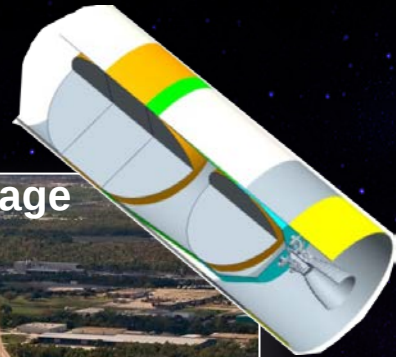
Vertical Assembly Center



Upper Stage



Core Stage



One-of-a-Kind Infrastructure Asset

Exploration Flight Test-1 (2014)

Mission Overview

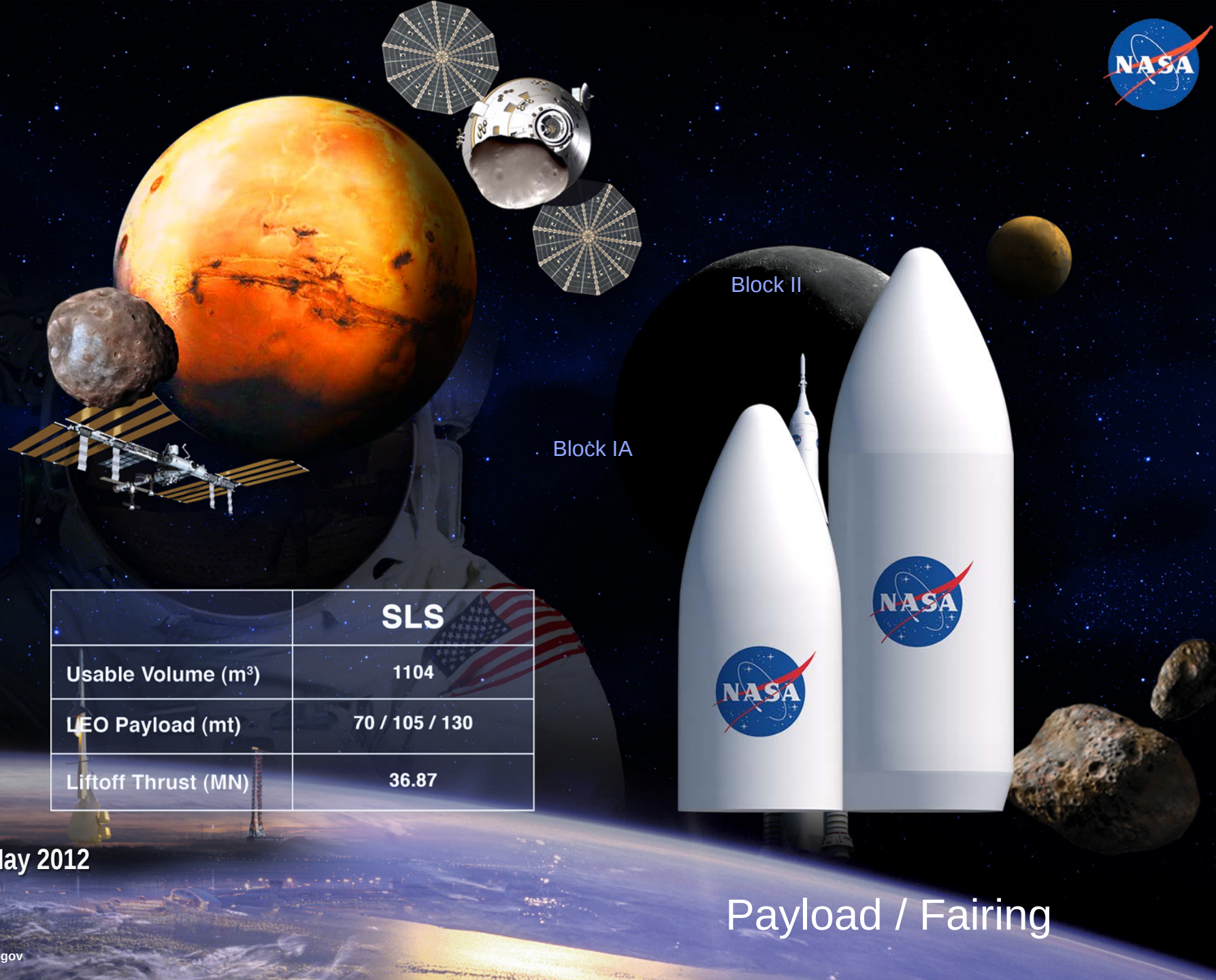


Exploration Flight Test-1 Orion Stage Adapter



*First ring forging,
ATI/Ladish,
Cudahy, WI,
April 2012*

*EFT-1 MPCV Stage Adapter
Design Review in March 2012*

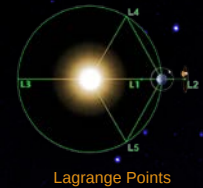


	SLS
Usable Volume (m ³)	1104
LEO Payload (mt)	70 / 105 / 130
Liftoff Thrust (MN)	36.87

May 2012

Payload / Fairing

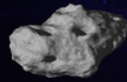
SLS Benefits for Exploration



Moon



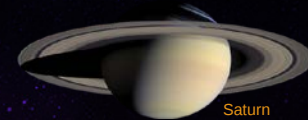
Mars



Near-Earth Asteroid



Jupiter



Saturn

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

Fewer origami-type payload designs needed to fit in the fairing

Increased Mission Reliability and Confidence



Volume and mass capability

Fewer deployments and critical operations

Safe, Affordable, Sustainable

Mars

Human Mission to Mars



MARS LANDING: HEADING FOR THE HIGH GROUND

by Dan Durda

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
- ◆ Materials science and engineering will continue to ensure the ongoing success of the vehicle
- ◆ Turning plans into progress: Design and development work moving forward today, to deliver an unsurpassed capability that launches in 2017

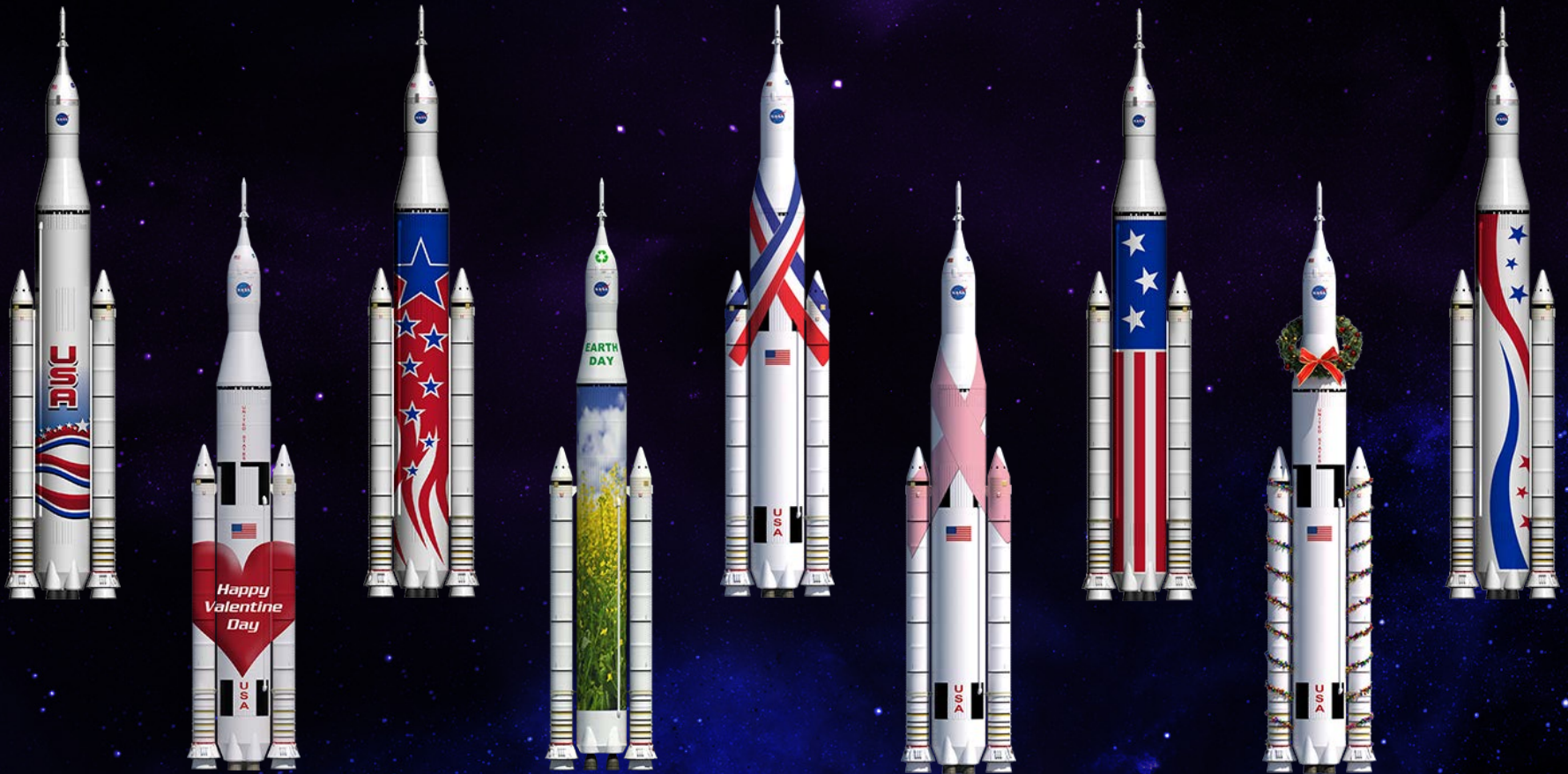


On Track for First Flight in 2017

The Next Design Challenges!

For More Information

www.nasa.gov/sls



Space Launch System: Future Frontier Video

http://www.nasa.gov/multimedia/videogallery/index.html?media_id=131955371

A composite image of outer space. In the upper left, a large, bright yellow Sun glows. To its right, the Earth is shown with blue oceans and white clouds. Further right, a small satellite with solar panels is visible. To the right of the Earth is a crescent moon. In the upper right, Mars is depicted with its characteristic reddish-orange surface and dark spots. To the right of Mars is another crescent moon. The foreground is filled with numerous brown, rocky asteroids of various sizes. The background is a deep blue space filled with distant stars.

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

— Carl Sagan