National Aeronautics and Space Administration

NASA's Space Launch System

U.S. *Heavy-Lift Transportation for Exploration Beyond Earth Orbit*

Jerry Cook, Associate Manager

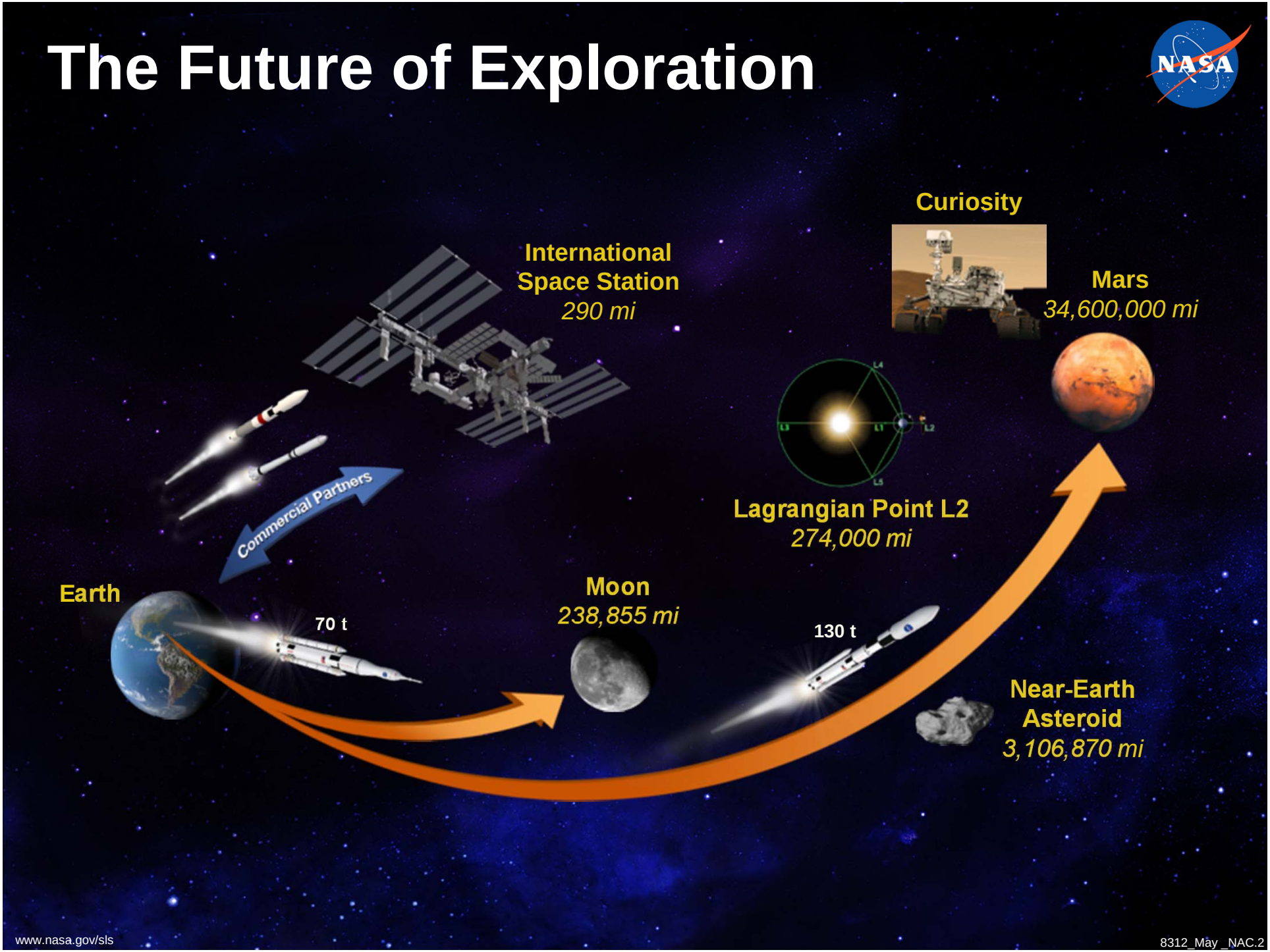
Space Launch System (SLS) Program

NASA Marshall Space Flight Center

November 2012

Space Launch System

The Future of Exploration



Advancing the U.S. Legacy of Human Exploration

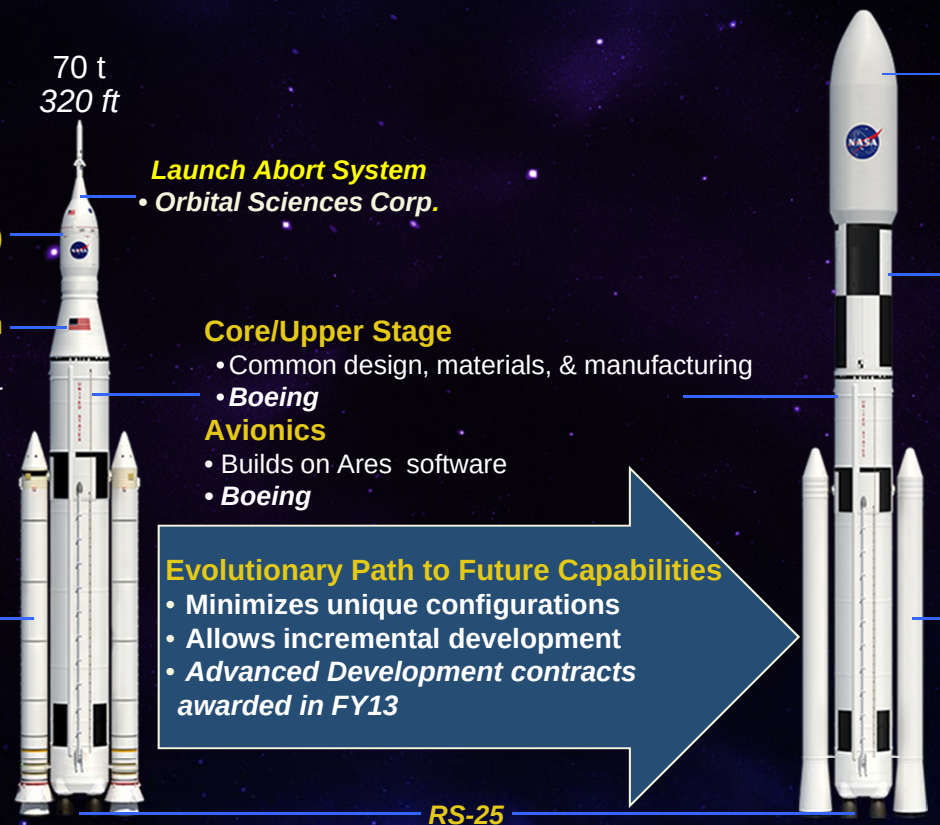
Building on the U.S. Infrastructure

INITIAL CAPABILITY, 2017–21

EVOLVED CAPABILITY, Post-2021

70 t
320 ft

130 t
384 ft



Launch Abort System
- ***Orbital Sciences Corp.***

Orion Multi-Purpose Crew Vehicle (MPCV)
- ***Lockheed Martin***

Interim Cryogenic Propulsion Stage
- Allows early flight certification for Orion
- Flexible for a range of payloads
- ***Boeing***

Core/Upper Stage
- Common design, materials, & manufacturing
- ***Boeing***

Avionics
- Builds on Ares software
- ***Boeing***

Fairings (27.5' or 33')
- Right-sized for the payload
- Seeking industry input in FY13

J-2X Upper Stage Engine
- Builds on Apollo Saturn J-2 heritage
- ***Pratt & Whitney Rocketdyne***

Evolutionary Path to Future Capabilities
- **Minimizes unique configurations**
- **Allows incremental development**
- ***Advanced Development contracts awarded in FY13***

5-Segment Solid Rocket Boosters
- Upgrading Shuttle heritage hardware
- ***ATK***

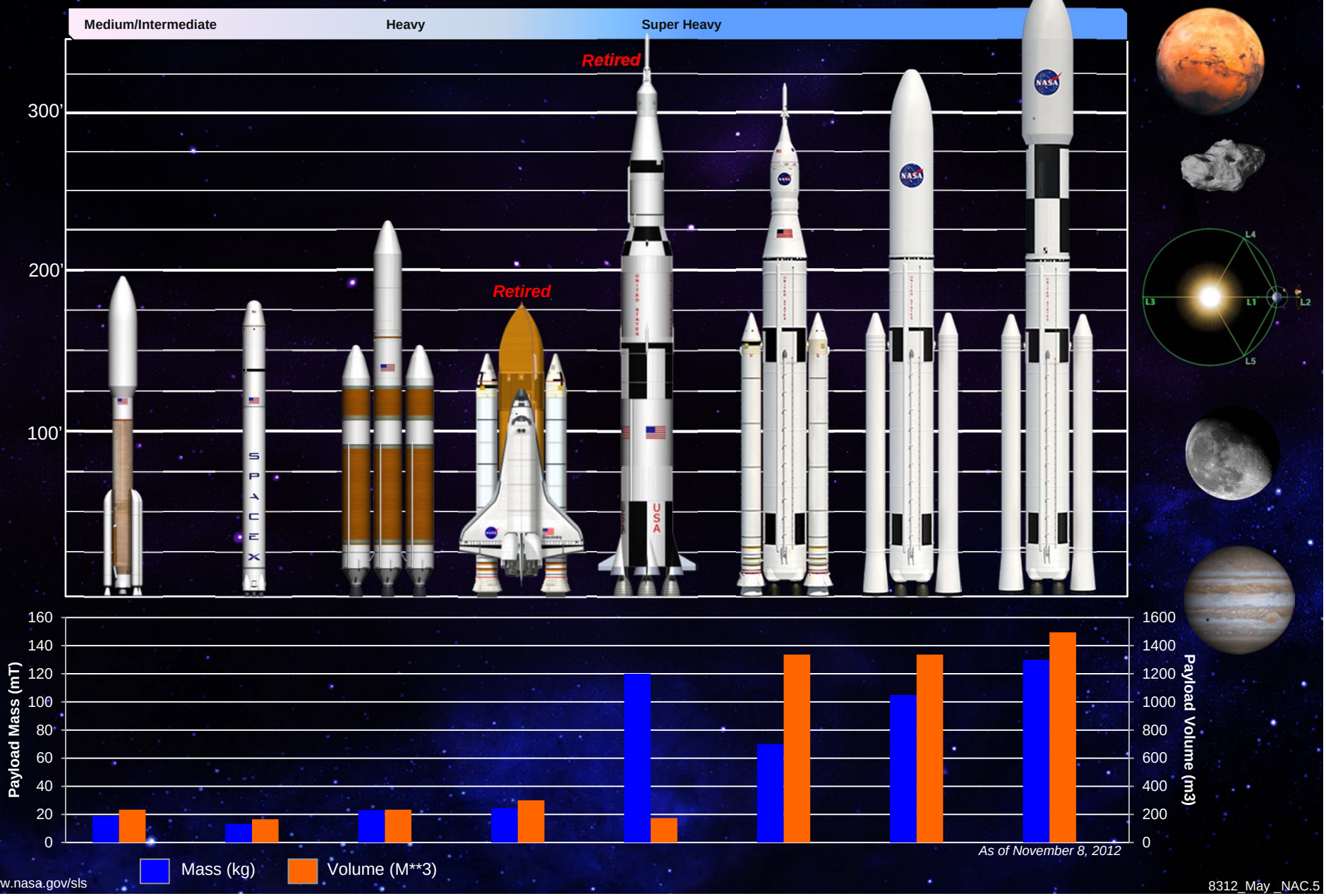
Advanced Boosters
- Competitive opportunities for affordable upgrades
- ***Risk-reduction contracts awarded in FY13***

RS-25

Core Stage Engines
- Using Space Shuttle Main Engine inventory assets
- Building on the U.S. state of the art in liquid oxygen/hydrogen
- ***Initial missions: Pratt & Whitney Rocketdyne***
- ***Future missions: Agency is determining acquisition strategy***

Working with Industry Partners to Develop America's Heavy-Lift Rocket

Most Capable U.S. Launch Vehicle



www.nasa.gov/sls

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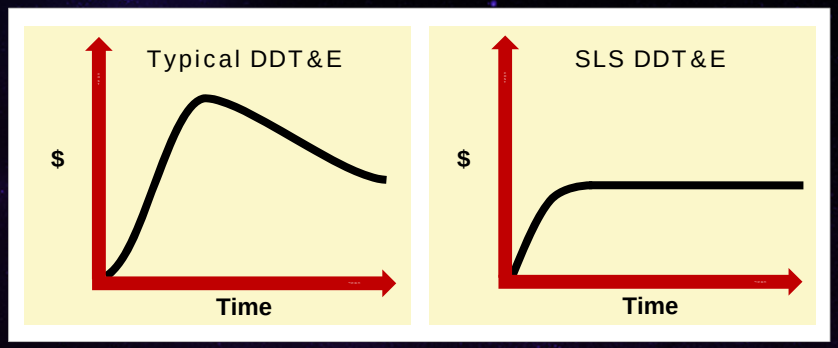
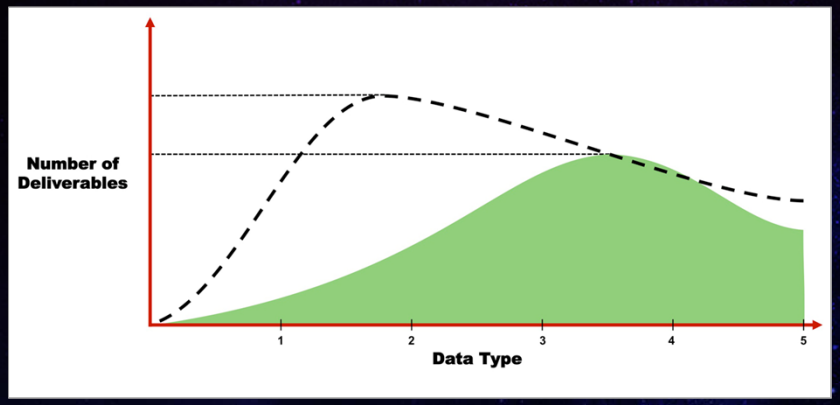
Pursuing Affordability Solutions

- Lean, Integrated Teams with Accelerated Decision Making
- Robust Designs and Margins
- Risk-Informed Government Insight/Oversight Model
- Right-Sized Documentation and Standards
- Evolvable Development Approach
- Hardware Commonality





Focuses on the Data Content and Access to the Data

Sustainability through Life-Cycle Affordability

The Road to First Flight in 2017

NASA Life Cycle Phases	Approval for Formulation	FORMULATION		Approval for Implementation	IMPLEMENTATION		
Program Life Cycle Phases	Pre-Phase A: Concept Studies	Phase A: Concept & Technology Development	Phase B: Preliminary Design & Technology Completion	Phase C: Final Design & Fabrication	Phase D: System Assembly, Int. & Test, Launch & Checkout	Phase E: Operations & Sustainment	Phase F: Closeout
Program Life Cycle Gates and Major Events	KDP A ✔	KDP B ✔	KDP C	EFT-1 Launch	KDP D KDP E EM-1 Launch	KDP F EM-2 Launch	
Human Space Flight Project Reviews	MCR ✔ **2011**	SRR/SDR ✔ **2012**	PDR **2013**	CDR **2015**	SR **2016** FRR **2017**	**2021**	

FOCUSED TOWARD

CDR: Critical Design Review

EM: Exploration Mission

EFT: Exploration Flight Test

FRR: Flight Readiness Review

KDP: Key Decision Point

MCR: Mission Concept Review

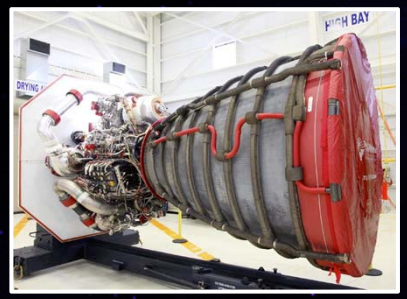
PDR: Preliminary Design Review

SIR: System Integration Review

SDR: System Definition Review

SRR: System Requirements Review

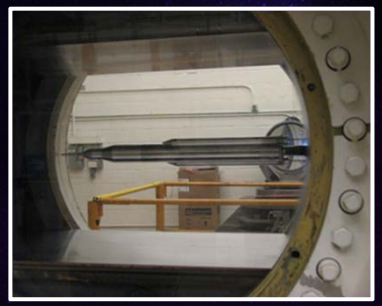
SLS: Being Built Today in the USA

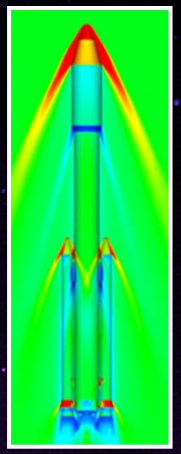


RS-25 Core Stage Engine
KSC Engine Processing Facility 2011

Kennedy Launch Center Complex 39B

Wind Tunnel Testing
July 2012



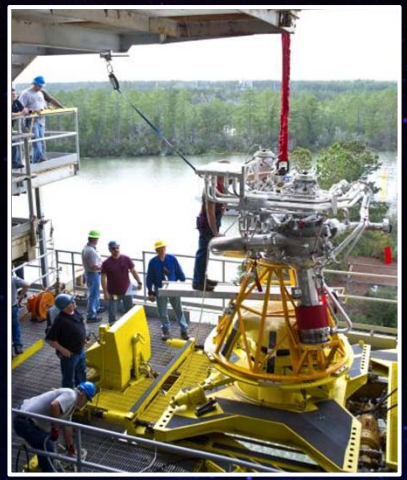


Systems Engineering and Integration

Ring Milling for Multi-Purpose Crew Vehicle-to-Stage Adapter (MSA) for 2014 Exploration Flight Test
June 2012

Solid Rocket Booster Development Motor Test
Promontory, Utah, September 2011

First MSA Ring Forging,
Ladish, Cudahy, Wisconsin, April 2012



J-2X Upper Stage Engine Testing
Stennis Space Center, February 2012

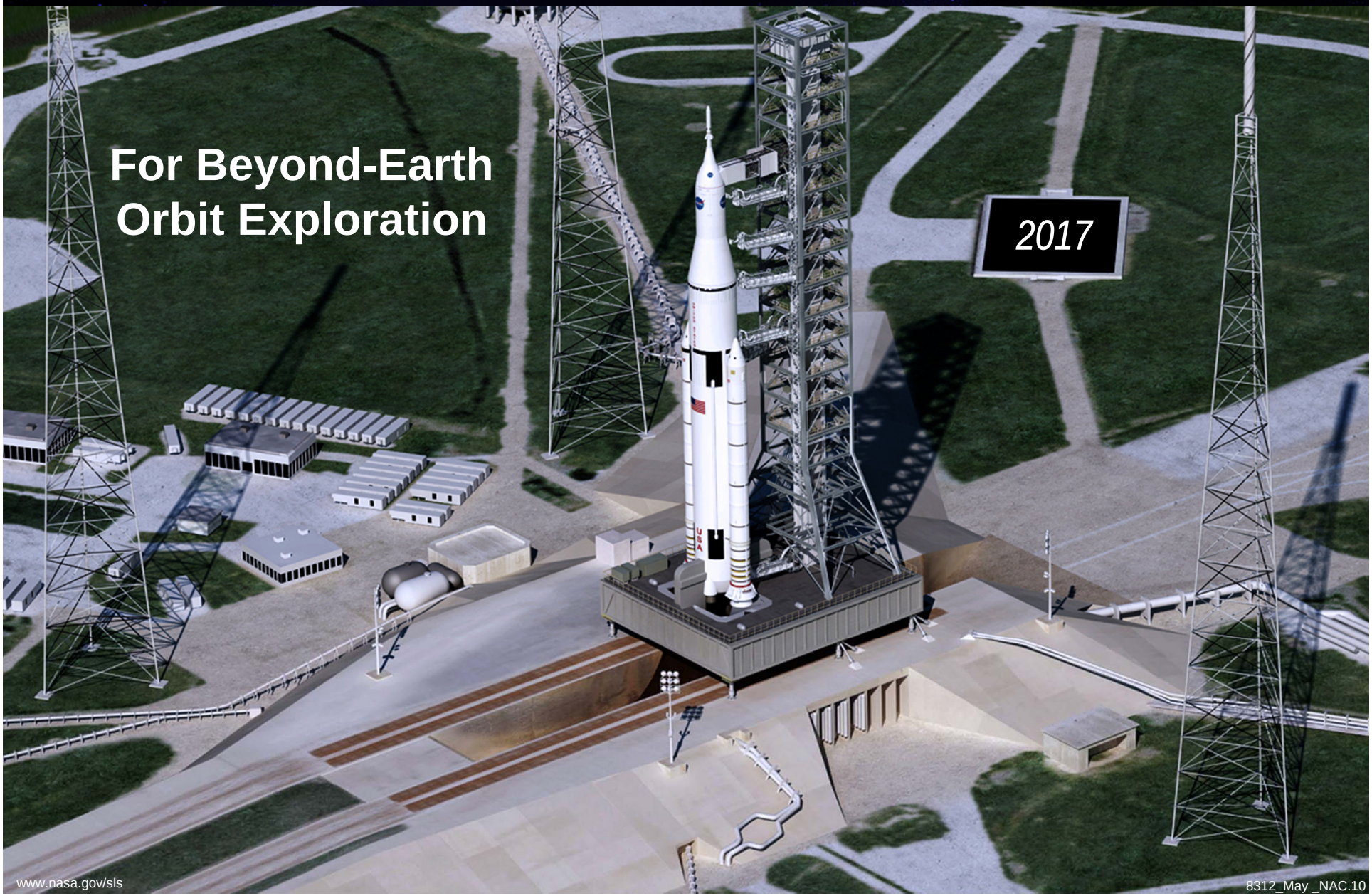
MSA Pathfinder Hardware
Marshall Space Flight Center, June 2012

Space Launch System Contractor Support

2011 Data

270 Subcontracts in 34 States

A National Infrastructure Asset



SLS: Sharing the "Why" & "How"

Pass the Torch Lecture at U.S. Space & Rocket Center
February 2, 2012

Advanced Rocketry Workshop at MSFC
July 2012

National Space Symposium with
Dr. Neil deGrasse Tyson
April 16 – 19 2012

Oct 1, 2011 – Sep 30, 2012

Reached over 70,000
students, educators, partners, and general public audiences.

- *400 Teachers at Space Shuttle Discovery Celebration at Intrepid Museum in New York City*
- *100 Congressional and Industry Partners at Space Transportation Association in DC*
- *200 General Public at "All Space Considered" Panel at Griffith Observatory in Los Angeles*
- *200 Small Business Reps at Michoud Industry Facility in New Orleans*
- *50 Students & Teachers at Advanced Rocketry Workshop in Huntsville*
- *100 International Partners at Global Space Exploration Conference in DC*
- *100 Aerospace Professionals at Joint Propulsion Conference in Atlanta*

Exploring Space for America's Future

For More Information

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