Space Launch System Status

Todd A. May, Program Manager
Garry M. Lyles, Chief Engineer

May 2012
“To reach for new heights... and reveal the unknown so that what we do and learn will benefit all humankind.”

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
The Future of Exploration

Development
- Proven capabilities
- Proven market potential
- Understood risks and hazards
- Known costs
- Predictable return on investment
- Refining known engineering
- Using existing technology
- Existing infrastructure
- Mature research infrastructure

Exploration
- New capabilities
- Undetermined market potential
- Undefined risks and hazards
- Indeterminate costs
- Indeterminate (or zero) ROI on indeterminate timeline
- Engineering existing hardware for new environment or developing new technologies
- No infrastructure
- Unique, groundbreaking research

Low Earth Orbit / International Space Station

Moon
Lagrange Points
Near-Earth Asteroid
Mars
Outer Planets

Commercial partners

Government
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.

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

- **Extending Reach Beyond LEO**
  - Cislunar Space
  - Geostationary Orbit
  - High-Earth Orbit
  - Lunar Flyby & Orbit

- **Into the Solar System**
  - Interplanetary Space
  - Initial Near-Earth Asteroid Missions
  - Lunar Surface

- **Exploring Other Worlds**
  - Low-Gravity Bodies
  - Full-Capability Near-Earth Asteroid Missions
  - Phobos/Deimos

- **Planetary Exploration**
  - Mars
  - Solar System

- **Mars**: 33,900,000 mi / 54,556,000 km

- **Moon**: 237K mi / 381K km

- **ISS**: 237 mi / 381 km

**SLS — Going Beyond Earth’s Orbit**
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
- SLS Block 1: two 5-segment SRBs, four RS-25 core stage engines
- Interim Cryogenic Propulsion Stage (ICPS)
- Launch from Kennedy Space Center (KSC) Launch Complex (LC) 39B

EM-2 no later than 2021
- Crewed lunar orbit mission
- Mission duration 10–14 days
- SLS Block 1
- ICPS
- KSC LC 39B

www.nasa.gov/sls
SLS Architecture Block Upgrade Approach

Starting with Available Assets and Evolving the Design

- **Launch Abort System**
- **Orion**
- **Interim Cryogenic Propulsion Stage (ICPS)**
- **Solid Rocket Boosters**
- **Core Stage**
  - RS-25 Core Stage Engines (Space Shuttle Main Engines)
- **Advanced Boosters**
- **Upper Stage with J-2X Engines**
- **Payload Fairings**

**Weights and Heights**
- **70 t 321 ft.**
- **105 t 314 ft.**
- **130 t 384 ft.**
- **27.5 ft. (8.4 m)**

[www.nasa.gov/sls](http://www.nasa.gov/sls)
SLS 70 Metric Tons: First Flight 2017

INITIAL CAPABILITY, 2017–21

70 t
321 ft.

Launch Abort System

Orion Multi-Purpose Crew Vehicle (MPCV)

Interim Cryogenic Propulsion Stage (ICPS)
- MPCV Stage Adapter
- Launch Vehicle Stage Adapter

5-Segment Solid Rocket Booster (SRB) (ATK)

Core Stage Engines (RS-25) (PWR)

Core Stage/Avionics (Boeing)
Exploration Flight Test-1 Mission Overview

- Upper Stage Disposal
- Orion Translation Burn
- LANDING & RECOVERY
- LAUNCH SLC-37B
- Launch Abort System (LAS) Jettison
- Upper Stage Engine Burns
- Orion/Upper Stage Separation
SLS will launch from Kennedy Space Center in 2017
Space Shuttle Main Engine packed into a container for shipment to Stennis Space Center
Space Shuttle Main Engines being received at Stennis Space Center, Mississippi
Solid Rocket Booster awaiting Development Motor Test 3 at ATK’s Promontory, Utah Test Site, September 8, 2011
Motor casings for Qualification Motor 1 are inspected at ATK’s facility in Brigham City, Utah.
Avionics and controls for SLS booster readying for Flight Control Test 1 at ATK’s test facility in Promontory, Utah
Subscale solid rocket motor test performed at Marshall Space Flight Center, Alabama to evaluate new nozzle insulation material
J-2X Upper Stage Engine readying for testing at Stennis Space Center
First J-2X development engine on the A-2 Test Stand at Stennis Space Center
J-2X Upper Stage Engine test at Stennis Space Center, Mississippi
J-2X Upper Stage Engine subscale injector test at Marshall Space Flight Center, Alabama

www.nasa.gov/sls
J-2X Upper Stage Engine
Powerpack test, Stennis
Space Center, Mississippi
Barrel section buckling test, Marshall Space Flight Center, Alabama
Design for Orion Multi-Purpose Crew Vehicle Stage Adapter completed for EFT-1 mission

www.nasa.gov/sls
Orion MPCV Stage Adapter
First ring forging preparation by ATI/Ladish Forging, Cudahy, Wisconsin
Future Missions – Exploration
Future Missions – Exploration
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Future Missions – Exploration
Future Missions – Exploration
Future Missions – Planetary
Future Missions – Planetary
Future Missions – Planetary
Future Missions – Planetary
Future Missions – Solar
Future Missions – Astronomy
Future Missions – Astronomy
Future Missions – Astronomy
For More Info: www.nasa.gov/sls

Building a Platform for Global Space Exploration
Somewhere, something incredible is waiting to be known.
— Carl Sagan