SPACE LAUNCH SYSTEM

DEEP-SPACE DEPLOYMENT FOR SMALLSATS

Andrew Schorr
NASA Space Launch System
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Overview

- Initial configuration of vehicle optimized for near-term heavy-lift capability
- Completed Critical Design Review in July 2015

Secondary Payloads

On Exploration Mission-1, SLS will include thirteen 6U payload locations of up to 14kg per CubeSat

SLS Block 1

- **Capability:** >70 metric tons
- **Height:** 322 feet (98 meters)
- **Weight:** 5.75 million pounds (2.6 million kg)
- **Thrust:** 8.8 million pounds (39.1 million Newtons)
- **Available:** 2019
<table>
<thead>
<tr>
<th>Bus Stops</th>
<th>Distance (approx.)</th>
<th>Flight Time (approx.)</th>
<th>Approx. Temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26,700 km</td>
<td>3 Hrs. &amp; 34 Min.</td>
<td>13°C (55°F)</td>
</tr>
<tr>
<td>2</td>
<td>64,500 km</td>
<td>7 Hrs. &amp; 51 Min.</td>
<td>-7°C (20°F)</td>
</tr>
<tr>
<td>3</td>
<td>192,300 km</td>
<td>3 Days, 6 Hrs. &amp; 12 Min.</td>
<td>-29°C (-20°F)</td>
</tr>
<tr>
<td>4</td>
<td>384,500 km</td>
<td>6 Days, 11 Hrs. &amp; 57 Min.</td>
<td>-26°C (-15°F)</td>
</tr>
<tr>
<td>5</td>
<td>411,900 km</td>
<td>7 Days, 0 Hrs. &amp; 16 Min.</td>
<td>-29°C (-20°F)</td>
</tr>
</tbody>
</table>

**Bus Stops Description**

1. First opportunity for deployment, cleared 1st radiation belt
2. Clear both radiation belts plus ~1 hour
3. Half way to the moon
4. At the moon, closest proximity (~250 km from surface)
5. Past the moon plus ~12 hours (lunar gravitational assist)

**Note:** All info based on a 6.5 day trip to the moon.
CUBESAT DEPLOYMENT
ONE LAUNCH, MULTIPLE DISCIPLINES

Moon
- Lunar Flashlight (NASA)
- Lunar IceCube (Morehead State University)
- LunaH-Map (Arizona State University)
- OMOTENASHI (JAXA)

Earth
- EQUULEUS (JAXA)
- Skyfire (Lockheed Martin)

Asteroid
- NEA Scout

Sun
- CuSP (Southwest Research Institute)

And Beyond
- Biosentinel (NASA)
- ArgoMoon (ESA/ASI)
- Three Centennial Challenge Winners (TBD)
PROGRESS TOWARDS LAUNCH

- Core Stage production at Michoud
- Booster testing at Orbital ATK
- Engine testing at Stennis Space Center
- Upper stage prep at Cape Canaveral
- Structural testing at Marshall
- Ongoing work for Block 1B
SLS BLOCK 1B CONFIGURATION

OVERVIEW

• Replaces Interim Cryogenic Propulsion Stage with human-rated Exploration Upper Stage
• EUS has completed checkpoint prior to Preliminary Design Review

UTILIZATION

• Supports launch of Orion and co-manifested exploration systems in “Proving Ground” of cislunar space
• With large 8.4-meter fairing, can launch game-changing science missions and other high-priority payloads

SLS Block 1B

- Capability: >105 metric tons
- Height: 364 feet
- Weight: 6 million pounds
- Thrust: 8.8 million pounds
- Available: No earlier than 2021
BLOCK 1 & BLOCK 1B COMPARISON

BLOCK 1B ACCOMMODATIONS

BLOCK 1 ACCOMMODATIONS
VOLUME AND MASS RANGE

1U Football

6U 14kg

12U 25kg

27U 54kg

Ring Payload Interface (Notional) ~180kg

10 cm

1 cm
Summary

• SLS provides a unique opportunity for the CubeSat/smallsat community
  • Enables access to Earth, Moon, Sun & Deep Space
  • Opportunity to manifest payloads from 6U/12U/27U to ESPA-Class
• First Flight (EM-1) hardware production in-progress
  • Block 1B initiating procurement/production activities

More Information

• SLS Mission Planner’s Guide (ESD 30000)
  • Provides future payload developers/users with information to support preliminary SLS mission planning
  • Covers Block 1B (105mT*) & Block 2 (130mT*) configurations
• Copies can be requested by email to:
  NASA-slspayloads@mail.nasa.gov

* Payload Mass to Low Earth Orbit