DAWN OF A NEW ERA
SPACE LAUNCH SYSTEM (SLS)

Block 1 (70t)
- MPCV
- ICPS
- 27.6’ Dia Fairing
- 27.6’ Core
- 3-5 x RS-25D
- 2 x 5 seg PBAN

Block 1A (105t)
- Advanced Boosters (LRB or SRB)
- 3-5 x RS-25E

Block 2 (130t)
- 2 x J-2X US
- 33’ Dia Fairing
- 5 x RS-25E

National Aeronautics and Space Administration
The Orion design divides critical functions among multiple modules to maximize the performance of the integrated spacecraft design.

**Crew Module**
- Provide safe habitat from launch through landing and recovery
- Conduct reentry and landing as a stand alone module

**Launch Abort System**
- Provide protection for the CM from atmospheric loads and heating during first stage flight
- Safely jettison after successful pad operations and first stage flight

**Service Module**
- Provide support to the CM from launch through CM separation to missions with minimal impact to the CM

**Spacecraft Adapter**
- Provide structural connection to the launch vehicle from ground operations through CM Separation
- Provide protection for SM components from atmospheric loads and heating during first stage flight
Orion
Propellants: Hypers
CM, SM Mass: 53,405 lbm
LAS: 16,300 lbm
# Engines / Type: 1 / STS OMS
Total Mass: 73,738 lbm

iCPS
Propellants: LOX/LH2 / Hypers
Propellant Mass: 58,643 lbm
Dry Mass: 9,275 lbm
Adapters: 11,287 lbm
# Engines / Type: 1 / RL10-B2
Total Mass: 79,205 lbm

Boosters
Propellants: PBAN
Propellant (ea): 1,385,437 lbm
Burnout Mass (ea): 218,967 lbm
# Boosters / Type: 2 / 5 Segment Steel
Total Mass (2): 3,210,032 lbm

Core Stage
Propellants: LOX/LH2
Propellant: 2,178,481 lbm
Dry Mass: 211,614 lbm
# Engines / Type: 4 / RS-25D
Total Core Mass: 2,390,095 lbm

Total Wet Masses
Orion: 73,738 lbm
iCPS: 79,205 lbm
Boosters: 3,210,032 lbm
Core: 2,390,095 lbm
Total (GLOW): 5,753,070 lbm
Rollout Mass: 3,515,946 lbm
Vehicle Integration and Launch

Command, Control, Communications, and Range

Offline Spacecraft Processing

Core Stage Processing

Offline SRB Processing

Vehicle Integration and Launch

Landing & Recovery

SLS / MPCV Concept of Operations
MOBILE LAUNCHER

National Aeronautics and Space Administration

GSDO
Vehicle Assembly Building

National Aeronautics and Space Administration
SPACECRAFT OFFLINE PROCESSING
KSC LC-39 may support Medium lift to Super-Heavy lift vehicles
Environmental provides SLS and commercial launch programs a fully permitted environmental launch facility with unencumbered land and energy, operations and maintenance savings opportunities.

Infrastructure focus is on improvements and enhancements of infrastructure systems critical to payload processing and launch operations.
End to End
Command and Control

Advanced Ground Systems
Maintenance

Communications Systems

Range Systems

COMMAND CONTROL COMMUNICATIONS & RANGE

National Aeronautics and Space Administration
<table>
<thead>
<tr>
<th>Year</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
</table>
| GSDO Program Office Stand Up 15Jun | | | | | | - 
| MCR Board 30Nov | | | | | EFT-1 Dec |
| KDP-A 17JAN | | | | | |
| SRR/SDR Board 30AUG | | | | | |

**Program Progress**

- **2009**
  - Lightning Protection Completed at Launch Pad 39B
  - Orion Access Demonstration at Multi-Purpose Processing Facility (MPPF)

- **2010**
  - Mobile Launcher Construction
  - Service Structures Demolition at Launch Pad 39B

- **2011**
  - Fire Room 1 Complete at Launch Control Center (LCC)
  - Refurbishment Complete at Launch Equipment Test Facility (LETF)

- **2012**
  - Orion CM-2 Arrival at Multi-Purpose Processing Facility (MPPF)
  - Morpheus Flight Testing at Shuttle Landing Facility (SLF)

- **2013**
  - Exploration Flight Test (EFT-1) at SLC-37B
  - Mobile Launcher Rollout Interface Test at LC-39B
Jacking, Equalization and Leveling (JEL) Cylinders (16)

Shear Webs Reinforcement (complete)

Roller Bearings (88)

Brakes (16)
1500 kW AC Generators (2)
OLD JEL Design

Spherical Bearing Cracks
OLD Design

NEW Design

Brakes from Hydraulic to Pneumatic
CRAWLER TRANSPORTER MODS

OLD Roller Bearing Design

NEW Roller Bearing Design

Mule
Shear Webs Internal Steel Reinforcement

Crack Repair
<table>
<thead>
<tr>
<th>Item</th>
<th>CT-2</th>
<th>CT-1</th>
<th>Spares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking/Service (Upgrade) - From Hydraulic to Pneumatic</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Vibration Isolation Pads for</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>ALCO/Generators</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>VFD Upgrade</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Onan Engine Upgrade</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>ACTD Refurbishment</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Replace Armature Cables &amp; Cable Trays</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Replace DC Generator Flex. Copper Bus Bars/Brush Holders/Insulators</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>JEL Valve Replacement</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Spare JEL &amp; Steering Motor Refurbishment</td>
<td>Y</td>
<td>Y</td>
<td>Spares</td>
</tr>
<tr>
<td>Replace Propel Electronic Cards</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>DC Generator Pedestal Electrical Isolators</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Replace Control Room Consoles</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>New Display Units</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>PLC System Improvements</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>New Laser System</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>ALCO E1 &amp; E2 Engine Panel Upgrade</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Fire System Wiring</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Upper Cable Trays</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Guide Tube Corrosion Control</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>9J Update 5&amp;T</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>PROCURE New Generator Sets (E3 &amp; E4) &amp; Installation Hardware Engines</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>AC Gen Sets CT-2 &amp; CT-1</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Inspect ALCO Oil Coolers</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Inspect ALCO Turbochargers</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Drain/Clean Fuel Oil Tank</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Upgrade Starters/Oilers</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Redundant Height XDCR</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Replace Manometer Sight Glass Mechanisms</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Guide Tube Steering System Upgrade</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Tubing Upgrade</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Retube - Air supply lines, hydraulic lines, lubrication</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Belt Pin Lube System</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Cab Console Refurbishment</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Field Device Wiring</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Instrumentation Upgrade</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>New Scope - Corrosion Control &amp; Misc</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Mods/procurements</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Closed circuit TV and Security System</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Gear Box Refurb</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Provide Four (4) Tread Belts</td>
<td>Y</td>
<td>Y</td>
<td>Spares</td>
</tr>
<tr>
<td>Procure DCC Cabinet Instrumentation</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>DCC Cab Instrumentation</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Procure New Steering Corner Valves</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Steering Corner Valves</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Lighting Upgrades</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Work Stands</td>
<td>Y</td>
<td>Y</td>
<td>Spares</td>
</tr>
<tr>
<td>JEL Cylinder Upgrades</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Roller Bearing Upgrades</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Shear Web Modifications CT-1 &amp; CT-2</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>
Key Points:

• The Ground Systems Development and Operations (GSDO) Program Vision: Launching the world’s most powerful, advanced launch vehicles and spacecraft.

• The GSDO Program Mission: To be the driving force that transforms Kennedy Space Center into the world’s premier multi-user launch and landing spaceport.

Background Info:

• The Ground System Development and Operations (GSDO) program was established to develop and use the complex equipment required to safely handle rockets and spacecraft during assembly, transport and launch.

• The program’s mission is to prepare the center to process and launch the next generation of rockets and spacecraft in support of NASA’s exploration objectives by developing the necessary ground systems, infrastructure and operational approaches.

• For more info visit: http://www.nasa.gov/pdf/638587main_20120425_GSDO.pdf
Key Points:

- GSDO is supporting the President’s direction for space exploration, by developing ground systems that support the new Space Launch System (SLS) launch vehicle and Multi-Purpose Crew Vehicle (MPCV) spacecraft.

- This marks a new era in space exploration, as this launch vehicle and spacecraft replace the Space Shuttles.
Key Points:

• TBD
Key Points:

- TBD
Key Points:

• TBD
Key Points:

• This chart shows the current path that each part of the vehicle and spacecraft will take during build-up for launch.

• This includes the solid rocket boosters (SRBs), core stage, and Orion spacecraft.
Key Points:

• GSDO consists of three major components. The first is Vehicle Integration & Launch (VIL).

• The **Vehicle Integration and Launch** team focuses on the equipment, management and operations required to safely connect a spacecraft with a rocket, move the launch vehicle to the launch pad and successfully send it into space.

• VIL includes vehicle integration, a mobile launcher platform to support build-up and launch, transportation to the pad via the crawler transporter, and a launch pad.

• Also Kennedy Space Center is developing small class vehicle capability to support commercial users.
Key Points:

- The Vehicle Assembly Building (VAB) is the place where the vehicle is assembled on the Mobile Launcher, prior to rollout and launch.
- The VAB consists of four high-bays and multiple low-bays and at one time was the largest building.
- The figure on the left shows the SLS/MPCV in the high-bay, on the Mobile Launcher.
- The figure on the right shows the SLS with a cargo payload.
Key Points:

- The SLS Mobile Launcher is used for stacking the vehicle, transporting the vehicle to the pad, and as a launch platform.
- The mobile launcher consists of a base and a tower and provides all commodities to the vehicle prior to launch.
Key Points:

- TBD
**Key Points:**

- GSDO currently has two launch pads.
- Launch Pad 39B is for SLS/MPCV and commercial users.
- Launch Pad 39A is available for other commercial vehicles.
Key Points:

- TBD
Key Points:

- TBD
Key Points:

- TBD
Key Points:

- This chart shows potential launch vehicles and launch complexes (pad locations).
- LC-39 (Launch Complex 39) is capable of supporting Medium lift to Super-Heavy lift vehicles.
Key Points:

- TBD
Key Points:

- The **Offline Processing and Integration** team will develop ways to handle the Orion spacecraft, rocket stages and launch abort system before they are all assembled into one vehicle.
Key Points:

• TBD
Key Points:

• The Command Control Communications and Range systems team is creating systems that can handle several different kinds of spacecraft and rockets. The team will use computers, antennas and software meant to reduce the need for a large launch team.
Key Points:

- TBD
Key Points:

• TBD
Key Points:

- TBD
Key Points:

- TBD
Key Points:

- TBD
Key Points:

• TBD
Key Points:
• TBD
Key Points:
• TBD
Key Points:

- TBD
The End.