Project Orion Overview

2nd Space Exploration Conference

Cleon Lacefield
Lockheed Martin
Project Orion Vice President and Program Manager

December 6, 2006
Orion - Crew Exploration Vehicle

Orion is the next generation crew piloted spacecraft
- Human access to Low Earth Orbit …
- … and to the Moon and Mars

Development will be managed by a diverse government - industry team
- Project Manager located at Johnson
- Project Management Office elements at Johnson, Langley and Glenn
- Technical involvement by 9 NASA Centers
- Lockheed Martin Team formally selected to be the industry partner

Targeting first mission to ISS no later than 2014h
Orion Lockheed Martin Industry Team

**Hamilton Sundstrand**
- Environmental Control & Life Support
- Active Thermal Control
- System Power Management

**LM GRC**
- SM Liaison Office

**Orbital**
- Launch Abort System
- Safety & Mission Assurance

**LM LaRC**
- LAS Liaison Office

**KSC**
- Final Assembly
- Checkout
- Acceptance Test
- Sustaining Engineering
- Spacecraft Refurbishment

**Michoud**
- CM and SM Structures

**Lockheed Martin**
- Systems & Design Engineering Support
- Propulsion
- Avionics
- Integrated System Health Management
- Crew Interface
- Mission Ground Ops Support
- Program Management
- Systems Integration
- Crew & Service Module Development
- Qualification Test
- Software Development
- Operator Interfaces
- Ground Processing
- Mission Flight Planning
- Software Development
- Environmental Control & Life Support
- Active Thermal Control
- System Power Management
- SM Liaison Office
- LAS Liaison Office
- Final Assembly
- Checkout
- Acceptance Test
- Sustaining Engineering
- Spacecraft Refurbishment
- CM and SM Structures

Implementing the Vision
**Orion Spacecraft General Arrangement**

### Mission Summary
- **No. Crew**: 4 (lunar), 6 (ISS)
- **Crewed Mission Duration**: 18 days (lunar)
- **Quiescent Duration**: 210 days
- **Total ΔV**: 6250 ft/s

### Configuration Summary
- **Diameter (CM & SM)**: 16.5 ft
- **Pressurized Volume (Total)**: 691.8 ft³
- **Habitable Volume (Net)**: 361 ft³
- **SM Propellant**: MMH/N₂O₄
- **CM Propellant**: GO₂/GCH₄
- **Payload (Lunar Return)**: 220 lbs

### Block 2 Mass Properties Summary
- **GLOW**: 62031.5 lb
- **EMO (1/6 LAS Partial)**: 50684.6 lb
Flight Test Schedule – Latest Look

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>2007</td>
<td>PDR 3/08</td>
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<tr>
<td>2008</td>
<td>Eng Dev Struct 7/08</td>
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<td>2009</td>
<td>Pad Abort (PA 1) 10/08</td>
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<td>2009</td>
<td>SM Prop System Hot Fire Tests Series</td>
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<td>System Qualification (Qual)</td>
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<tr>
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<td>Ascent Abort (AA 4) 2/12</td>
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<td>Ares 1-2 (OFT 1) 9/12</td>
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<td>2011</td>
<td>Crewed Flight (Orion-Ares 1) 9/13</td>
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<td>2014</td>
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Exploration Development Lab in Houston Is Operational

787 Flight Computer Architecture

Nozzle Actuators

LM Command Select

RCS Simulator

Full-Scale CM Mockup
Integrated with Avionics Lab

Integrated Docking Simulator

Ergonomics

Focused Team Investment on Reducing Flight Software & Avionics Risk

Implementing the Vision
Orion Advances the Human Exploration Vision

• Orion is our country’s next generation crew piloted spacecraft and is critical to the future of human space exploration
  – Enables ISS research operations after Shuttle retirement
  – Provides core transportation for lunar and Mars human research and exploration missions

• We have assembled a diverse and talented workforce to build CEV which utilizes unique personnel and facility strengths from across NASA and industry

• We have built a management team experienced in meeting spacecraft development and operations challenges
Step into the future.