What is NASA’s Mission?

- Safely fly the Space Shuttle until 2010
- Complete the International Space Station (ISS)
- Develop a balanced program of science, exploration, and aeronautics
- Develop and fly the Orion Crew Exploration Exploration Vehicle (CEV)
  - Designed for exploration but will initially service ISS
- Land on the Moon no later than 2020
- Promote international and commercial participation in exploration

“The next steps in returning to the Moon and moving onward to Mars, the near-Earth asteroids, and beyond are crucial in deciding the course of future space exploration. We must understand that these steps are incremental, cumulative, and incredibly powerful in their ultimate effect.”

– NASA Administrator Michael Griffin
October 24, 2006
QuickTime™ and a Sorenson Video 3 decompressor are needed to see this picture.
Why the Moon Next?

- It is close (3 days) and accessible – as near as Geosynchronous Earth Orbit (GEO)
- Alien yet familiar; Earth is visible to crew and TV audiences
- Moon can be reached with existing or derived launch systems
- Transport system to Moon can also access GEO, cis-Lunar, Earth-Sun Lagrangians, and some asteroids
- Retire risk to future planetary missions by re-acquiring experience and testing with lunar missions
- Development of lunar resources has potential to be a major advancement in space logistics capability
- Advance science, improve engineering state-of-the-art, inspire country
There Are Many Places To Explore

There Are Many Places To Explore

We Can Land Anywhere on the Moon!

National Aeronautics and Space Administration
Building on a Foundation of Proven Technologies
- Launch Vehicle Comparisons -

Space Shuttle
- Height: 56.1 m
- Gross Liftoff Mass: 2,041.1 mT
- Payload Capability: 25.0 mT to Low Earth Orbit (LEO)

Ares I
- Height: 99.1 m
- Gross Liftoff Mass: 927.1 mT
- Payload Capability: 25.5 mT to LEO

Ares V
- Height: 116.2 m
- Gross Liftoff Mass: 3,704.5 mT
- Payload Capability: 71.1 mT to TLI (with Ares I)
  62.8 mT to Direct TLI
  ~187.7 mT to LEO

Saturn V
- Height: 110.9 m
- Gross Liftoff Mass: 2,948.4 mT
- Payload Capability: 44.9 mT to TLI
  118.8 mT to LEO
Ares Nationwide Team

- ATK Launch Systems
- Ames
- Marshall
- Glenn
- Langley
- Kennedy
- Pratt & Whitney Rocketdyne
- Michoud Assembly Facility
- Boeing
- Johnson
- Stennis

National Aeronautics and Space Administration
Ares I Elements

Upper Stage
- 137.1 mT LOX/LH₂ prop
- 5.5-m diameter
- Aluminum-Lithium (Al-Li) structures
- Instrument unit and interstage
- Reaction Control System (RCS) / roll control for first stage flight
- Primary Ares I control avionics system
- NASA Design / Boeing Production ($0.8B)

Instrument Unit
- Primary Ares I control avionics system
- NASA Design / Boeing Production ($0.8B)

Interstage
- Instrument unit and interstage
- Reaction Control System (RCS) / roll control for first stage flight
- Primary Ares I control avionics system
- NASA Design / Boeing Production ($1.12B)

Upper Stage Engine
- Saturn J-2 derived engine (J-2X)
- Expendable
- Pratt and Whitney Rocketdyne ($1.2B)

Stack Integration
- 927.1 mT gross liftoff weight
- 99.1 m in length
- NASA-led

First Stage
- Derived from current Shuttle RSRM/B
- Five segments/Polybutadiene Acrylonitrile (PBAN) propellant
- Recoverable
- New forward adapter
- Avionics upgrades
- ATK Launch Systems ($1.8B)
Vehicle Integration Accomplishments

Wind Tunnel Testing – Boeing, Langley Research Center (LaRC), VA; Ames Research Center (ARC), CA

3% First Stage Reentry Testing
Arnold Air Force Base, TN

Ares I-X Rigid Buffet Model
LaRC, VA

Ares I System Definition Review
Huntsville, AL
Ares I-X Test Flight

- Demonstrate and collect key data to inform the Ares I design:
  - Vehicle integration, assembly, and Kennedy Space Center launch operations
  - Staging/separation
  - Roll and overall vehicle control
  - Aerodynamics and vehicle loads
  - First stage entry dynamics for recovery

- Performance Data:

<table>
<thead>
<tr>
<th></th>
<th>Ares I-X</th>
<th>Ares I</th>
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<tbody>
<tr>
<td>First Stage Max. Thrust (vacuum):</td>
<td>14.1 MN</td>
<td>15.8 MN</td>
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<tr>
<td>Max. Speed:</td>
<td>Mach 4.7</td>
<td>Mach 5.75</td>
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<td>Staging Altitude:</td>
<td>39,600 m</td>
<td>57,700 m</td>
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<td>Liftoff Weight:</td>
<td>816 mT</td>
<td>927 mT</td>
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<tr>
<td>Length:</td>
<td>99.7 m</td>
<td>99.1 m</td>
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<tr>
<td>Max. Acceleration:</td>
<td>2.46 g</td>
<td>3.79 g</td>
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Ares I-X Accomplishments

Upper Stage Simulator Assembly
Glenn Research Center (GRC), OH

Roll Control System Test and Fabrication
Huntsville, AL and White Sands Test Facility (WSTF), NM

Forward Frustum Fabrication
Indianapolis, IN

First Stage Actuator Systems Testing
Marshall Space Flight Center (MSFC), AL
Orion Crew Exploration Vehicle

Launch Abort System

- Attitude Control Motor (Eight Nozzles)
- Canard Section (Stowed Configuration)
- Jettison Motor (Four Aft, Scarfed Nozzles)
- Abort Motor (Four Exposed, Reverse Flow Nozzles)

Crew Module

Volume: 115.8 m³
- 80% larger than Apollo
Diameter: 5.0 m

Service Module
ESM Panels
Spacecraft Adapter

National Aeronautics and Space Administration
Altair Lunar Lander

- Transport 4 crew-members to and from the surface
  - Visits start with 7 days on surface
  - Length of stays increases step-by-step
  - Builds up to 6 month lunar outpost crew rotations

- Global access capability
- Return to Earth anytime
- Deliver approximately 16 metric tons of dedicated cargo
- Provide airlock for surface activities
- Descent stage:
  - LOX/LH₂
- Ascent stage:
  - Storable propellants
Ares V Elements

Stack Integration
- 3,704.5 mT gross liftoff mass
- 116.2 m in length

Earth Departure Stage (EDS)
- One Saturn-derived J-2X LOX/LH₂ engine (expendable)
- 10-m diameter stage
- Aluminum-Lithium (Al-Li) tanks
- Composite structures, instrument unit and interstage
- Primary Ares V avionics system

Solid Rocket Boosters
- Two recoverable 5.5-segment PBAN-fueled boosters (derived from current Ares I first stage)

Core Stage
- Six Delta IV-derived RS-68 LOX/LH₂ engines (expendable)
- 10-m diameter stage
- Composite structures
- Al-Li tanks

Payload Fairing

Altair Lunar Lander

Interstage

Loiter Skirt
Summary

♦ Human beings will explore the Moon and beyond to encourage inspiration, innovation, and discovery.

♦ We must build beyond our current capability to ferry astronauts and cargo to low Earth orbit.

♦ We are starting to design and build new vehicles, using extensive lessons learned to minimize cost, technical, and schedule risks.

♦ Team is onboard and making good progress—the Ares IX test flight is on schedule for 2009.
Questions?

www.nasa.gov/ares