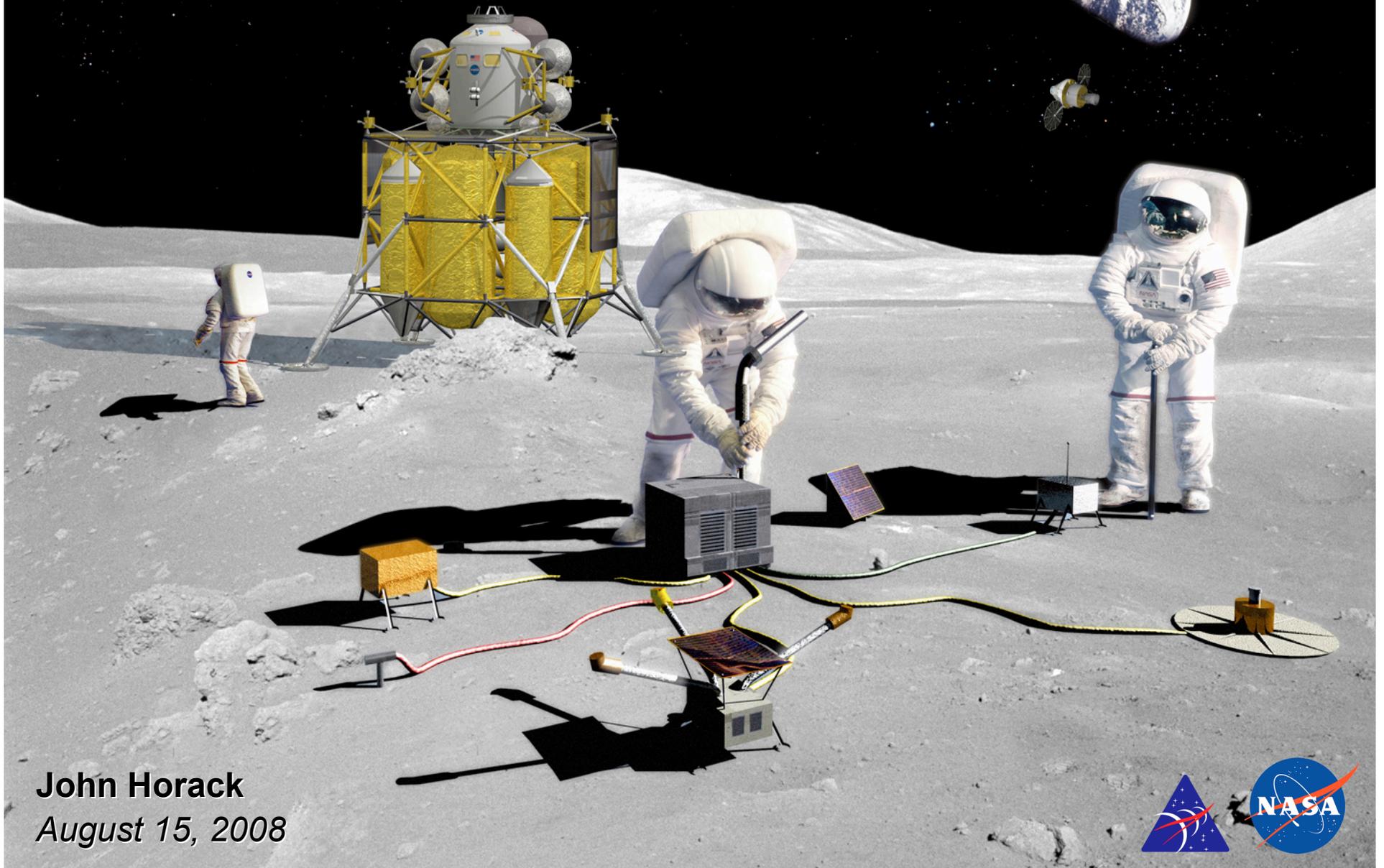
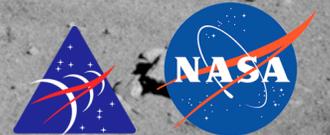


Constellation Overview

Ares V Solar System Science Workshop



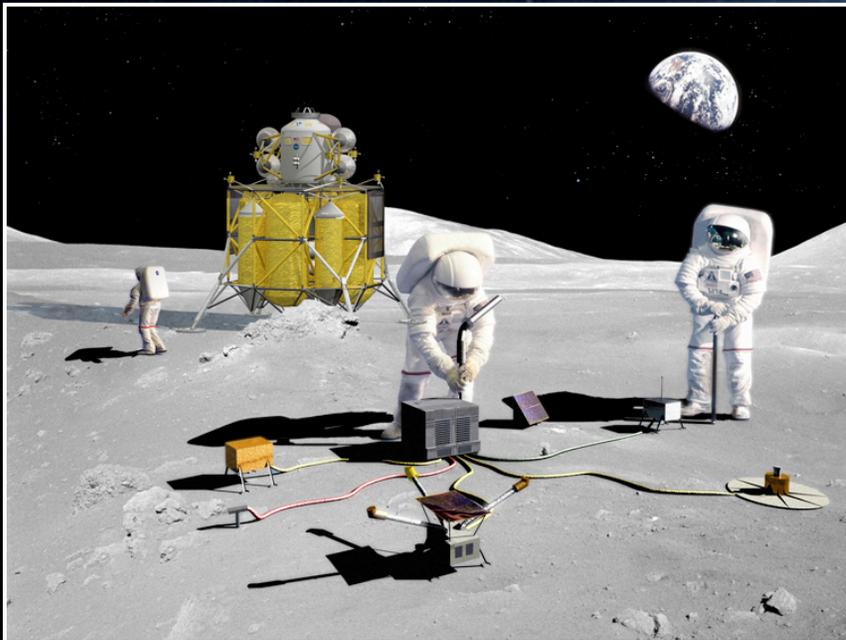
John Horack
August 15, 2008



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 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



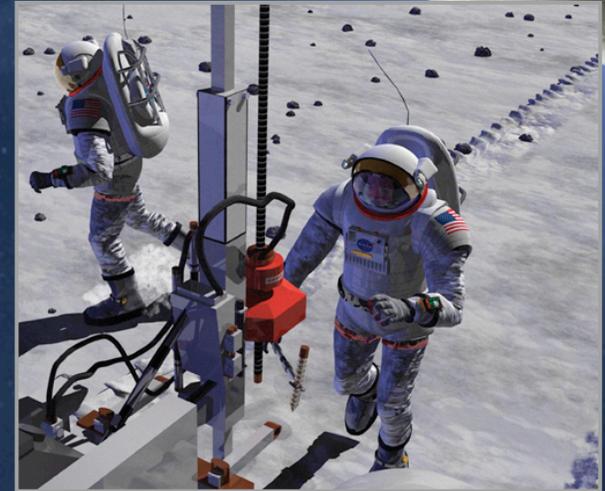
“The next steps in returning to the Moon and moving onward to Mars, the near-Earth asteroids, and beyond are crucial in deciding the course of future space exploration. We must understand that these steps are incremental, cumulative, and incredibly powerful in their ultimate effect.”

*– NASA Administrator Michael Griffin
October 24, 2006*

Why the Moon Next?

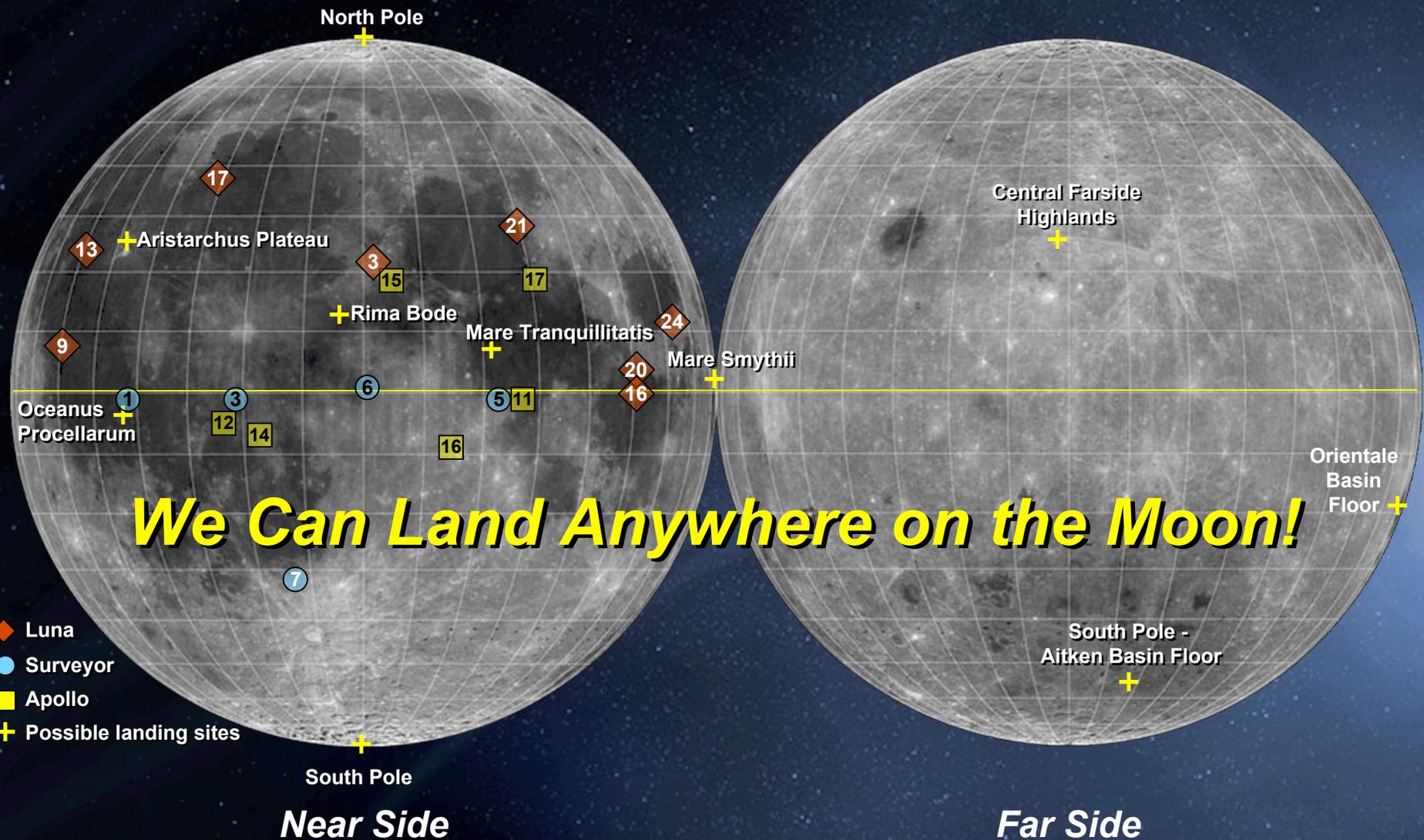


- ◆ It is close (3 days) and accessible – as near as Geosynchronous Earth Orbit (GEO)
- ◆ Alien yet familiar; Earth is visible to crew and TV audiences
- ◆ Moon can be reached with existing or derived launch systems
- ◆ Transport system to Moon can also access GEO, cis-Lunar, Earth-Sun Lagrangians, and 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





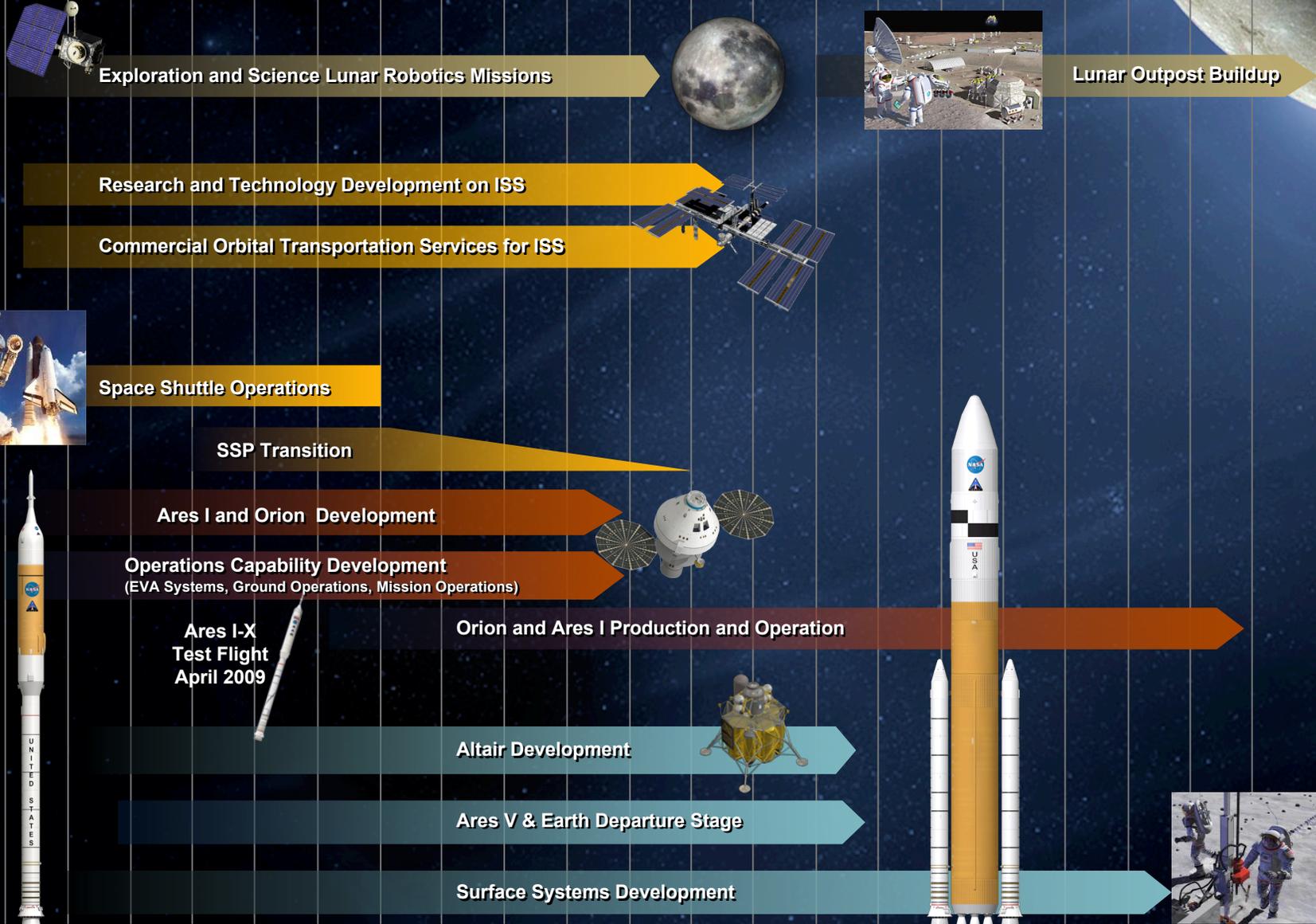
There Are Many Places To Explore



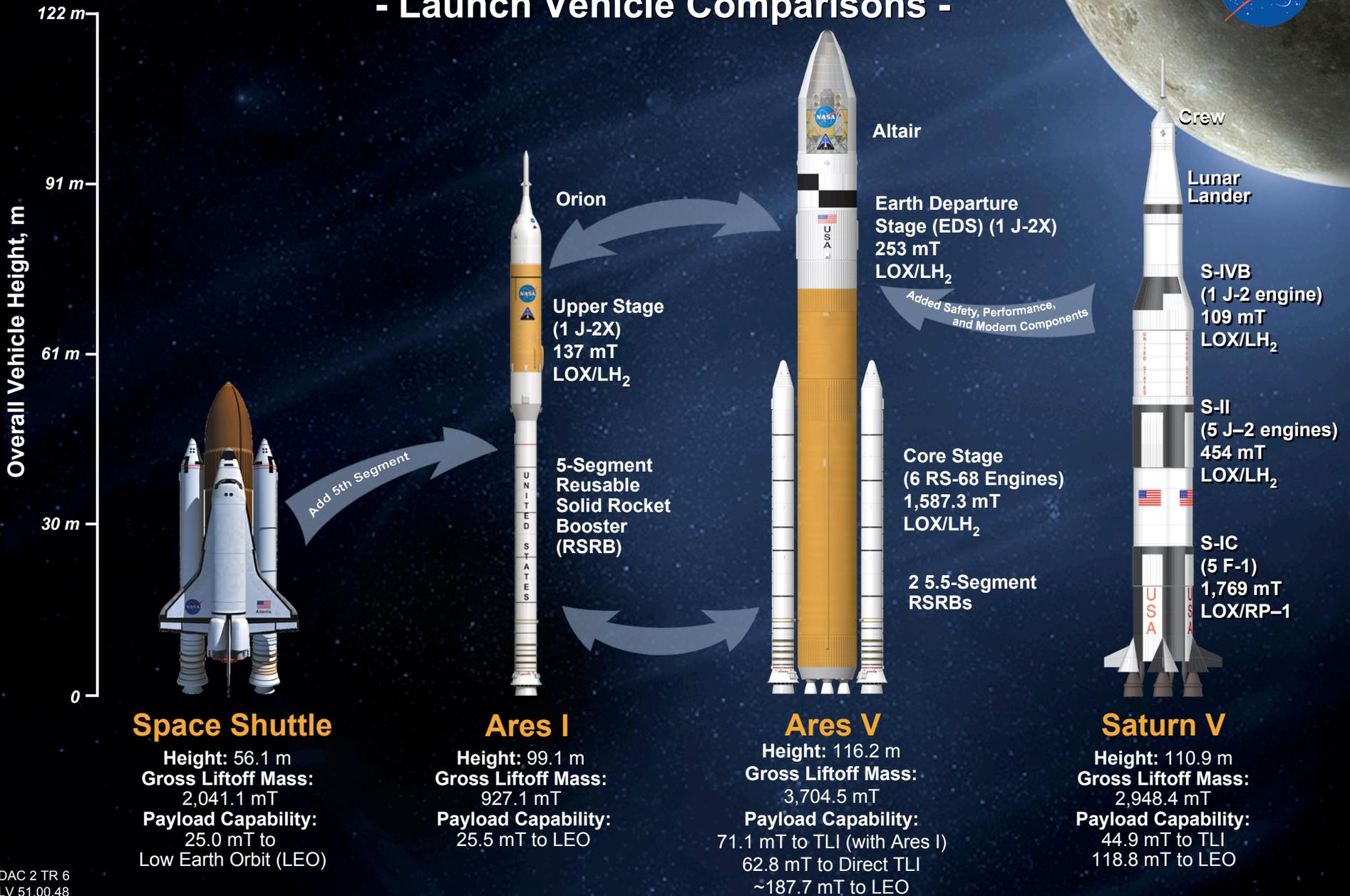
NASA's Exploration Roadmap



05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25...



Building on a Foundation of Proven Technologies - Launch Vehicle Comparisons -



Ares Nationwide Team





Ares I Elements

Encapsulated Service Module (ESM) Panels

Orion CEV

Instrument Unit

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

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)*

Upper Stage

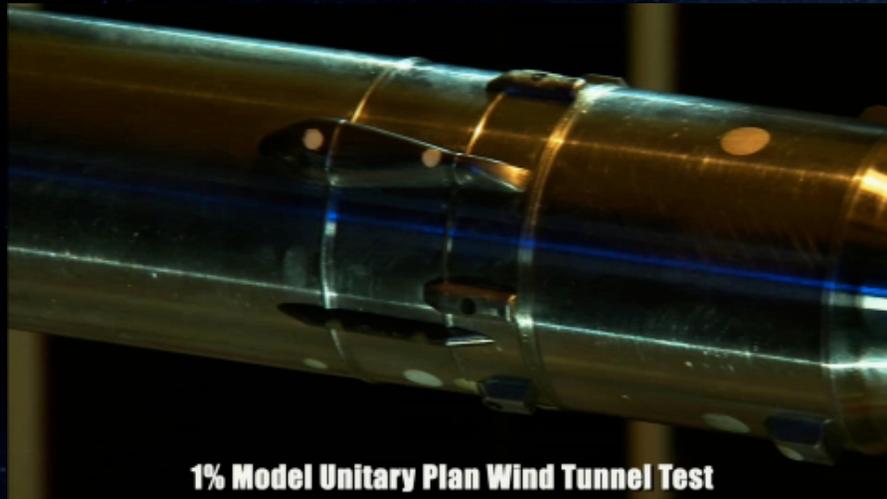
- 137.1 mT LOX/LH₂ prop
- 5.5-m diameter
- Aluminum-Lithium (Al-Li) structures
- Instrument unit and interstage
- Reaction Control System (RCS) / roll control for first stage flight
- Primary Ares I control avionics system
- *NASA Design / Boeing Production (\$1.12B)*

Interstage

Upper Stage Engine

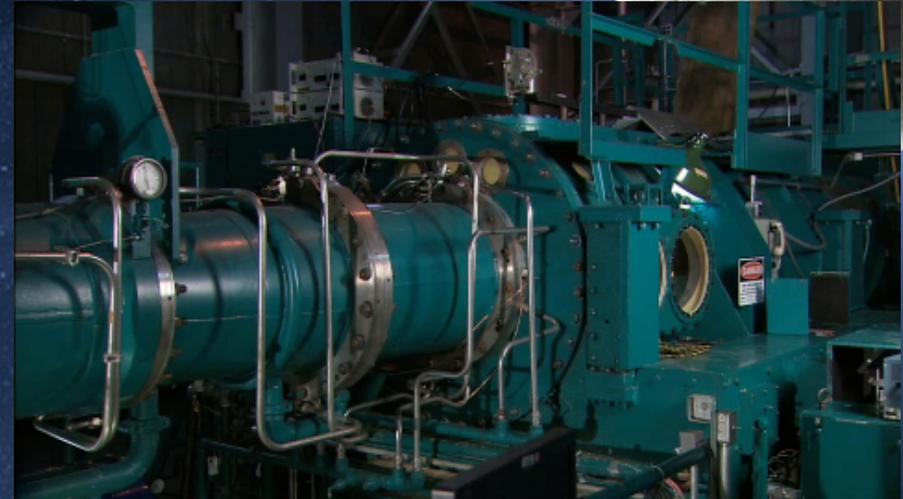
- Saturn J-2 derived engine (J-2X)
- Expendable
- *Pratt and Whitney Rocketdyne (\$1.2B)*

Vehicle Integration Accomplishments



1% Model Unitary Plan Wind Tunnel Test

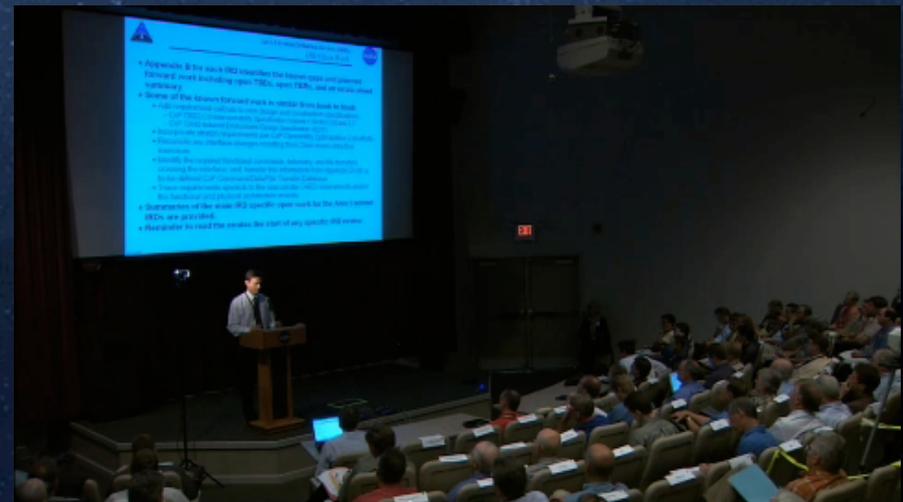
Wind Tunnel Testing – Boeing, Langley Research Center (LaRC), VA;
Ames Research Center (ARC), CA



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:

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

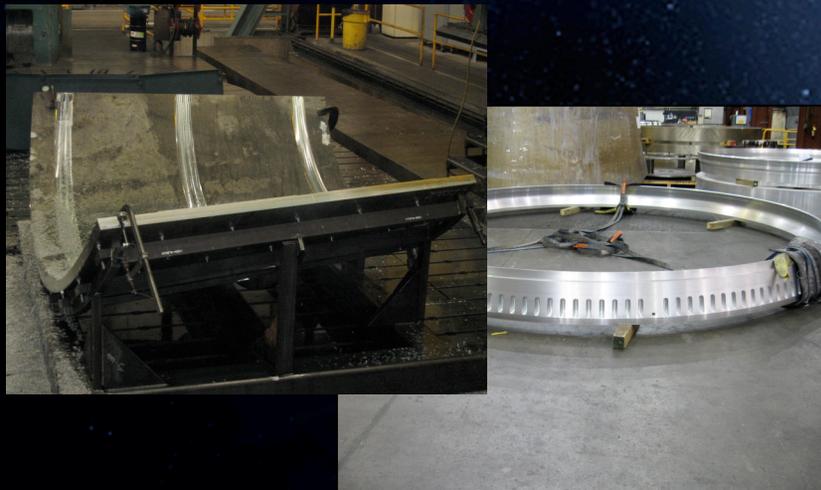
Ares I-X Accomplishments



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

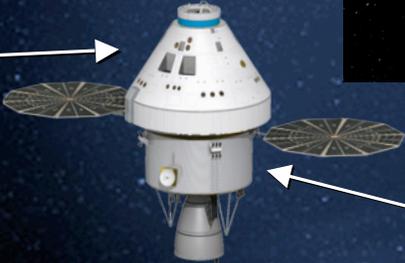


Launch Abort System

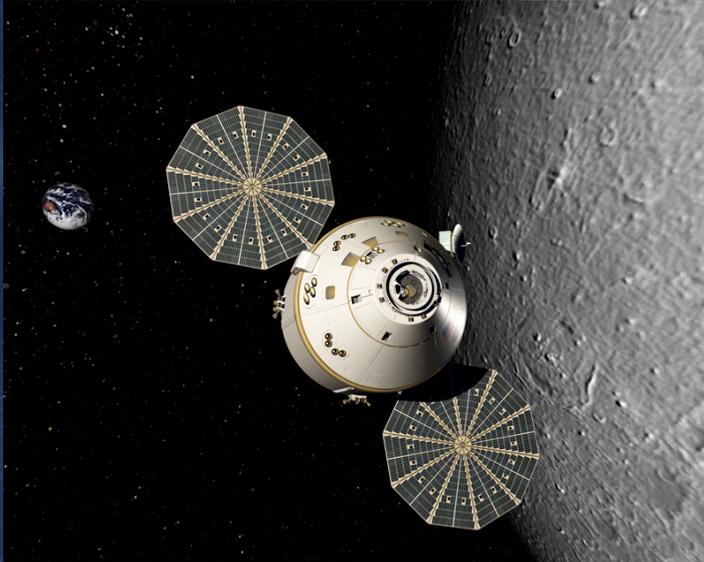
- Attitude Control Motor (Eight Nozzles)
- Canard Section (Stowed Configuration)
- Jettison Motor (Four Aft, Scarfed Nozzles)
- Abort Motor (Four Exposed, Reverse Flow Nozzles)



Crew Module



Service Module



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



ESM Panels

Spacecraft Adapter

Altair Lunar Lander

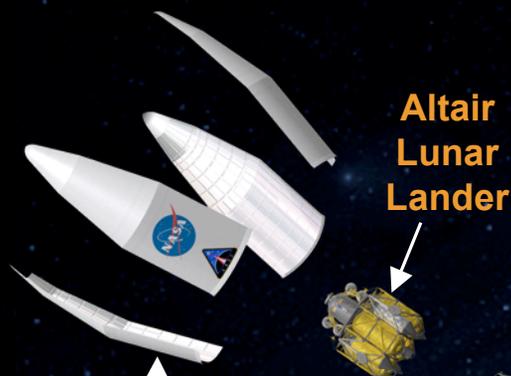


- ◆ **Transport 4 crew-members to and from the surface**
 - Visits start with 7 days on surface
 - Length of stays increases step-by-step
 - Builds up to 6 month lunar outpost crew rotations
- ◆ **Global access capability**
- ◆ **Return to Earth anytime**
- ◆ **Deliver approximately 16 metric tons of dedicated cargo**
- ◆ **Provide airlock for surface activities**
- ◆ **Descent stage:**
 - LOX/LH₂
- ◆ **Ascent stage:**
 - Storable propellants





Ares V Elements



Altair Lunar Lander

Payload Fairing

Stack Integration

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



EDS

J-2X

Loiter Skirt

Interstage



Solid Rocket Boosters

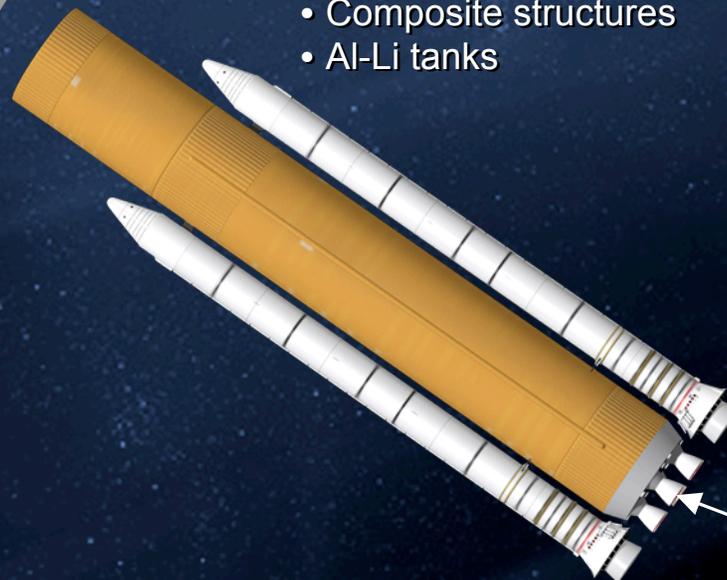
- Two recoverable 5.5-segment PBAN-fueled boosters (derived from current Ares I first stage)

Core Stage

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

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



RS-68

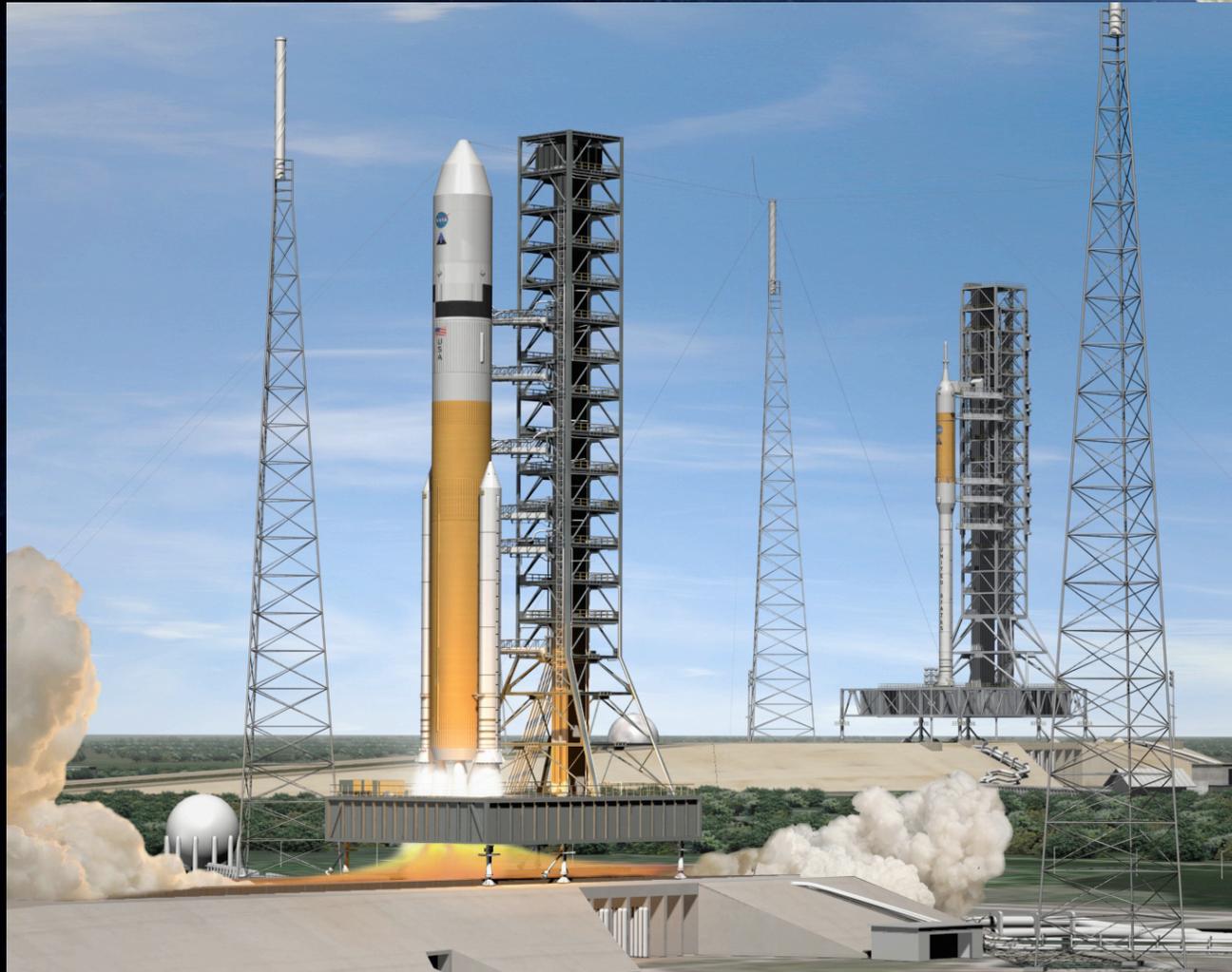
Summary



- ◆ 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