



National Aeronautics and Space Administration



Launching to the Moon and Beyond

Agenda



- ◆ **What is NASA's mission?**
- ◆ **Why do we explore?**
- ◆ **What is our time line?**
- ◆ **Why the Moon first?**
- ◆ **What will the vehicles look like?**
- ◆ **What progress have we made?**
- ◆ **Who is on our team?**
- ◆ **What are the benefits of space exploration?**

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**



Why Do We Explore?



◆ Inspiration

- Inspire students to explore, learn, contribute to our nation's economic competitiveness, and build a better future



◆ Innovation

- Provide opportunities to develop new technologies, new jobs, and new markets



◆ Discovery

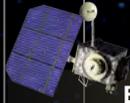
- Discover new information about ourselves, our world, and how to manage and protect it



NASA's Exploration Roadmap



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Exploration and Science Lunar Robotics Missions



Lunar Outpost Buildup

Research and Technology Development on ISS

Commercial Orbital Transportation Services for ISS



Space Shuttle Operations

SSP Transition

Ares I and Orion Development

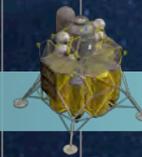
Operations Capability Development
(EVA Systems, Ground Operations, Mission Operations)



Orion and Ares I Production and Operation

Ares I-X
Test Flight
October 2009

Altair Development



Ares V & Earth Departure Stage

Surface Systems Development

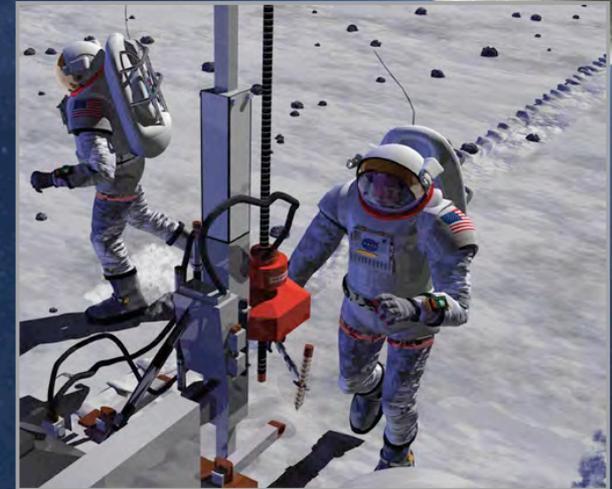


The Moon



◆ Lunar missions allow us to:

- Gain exploration experience
 - Space no longer a short-term destination
 - Will test human support systems
 - Use Moon to prove ability to build and repair long-duration space assets
- Develop exploration technologies
 - Launch and exploration vehicles
 - In-situ resource utilization
 - Power and robotic systems
- Conduct fundamental science
 - Astronomy, physics, astrobiology, geology, exobiology



The Next Step in Fulfilling Our Destiny as Explorers



There Are Many Places To Explore



Our Exploration Fleet

What Will the Vehicles Look Like?



Earth Departure Stage



**Orion
Crew Exploration
Vehicle**



**Ares V
Cargo Launch
Vehicle**



**Altair
Lunar
Lander**

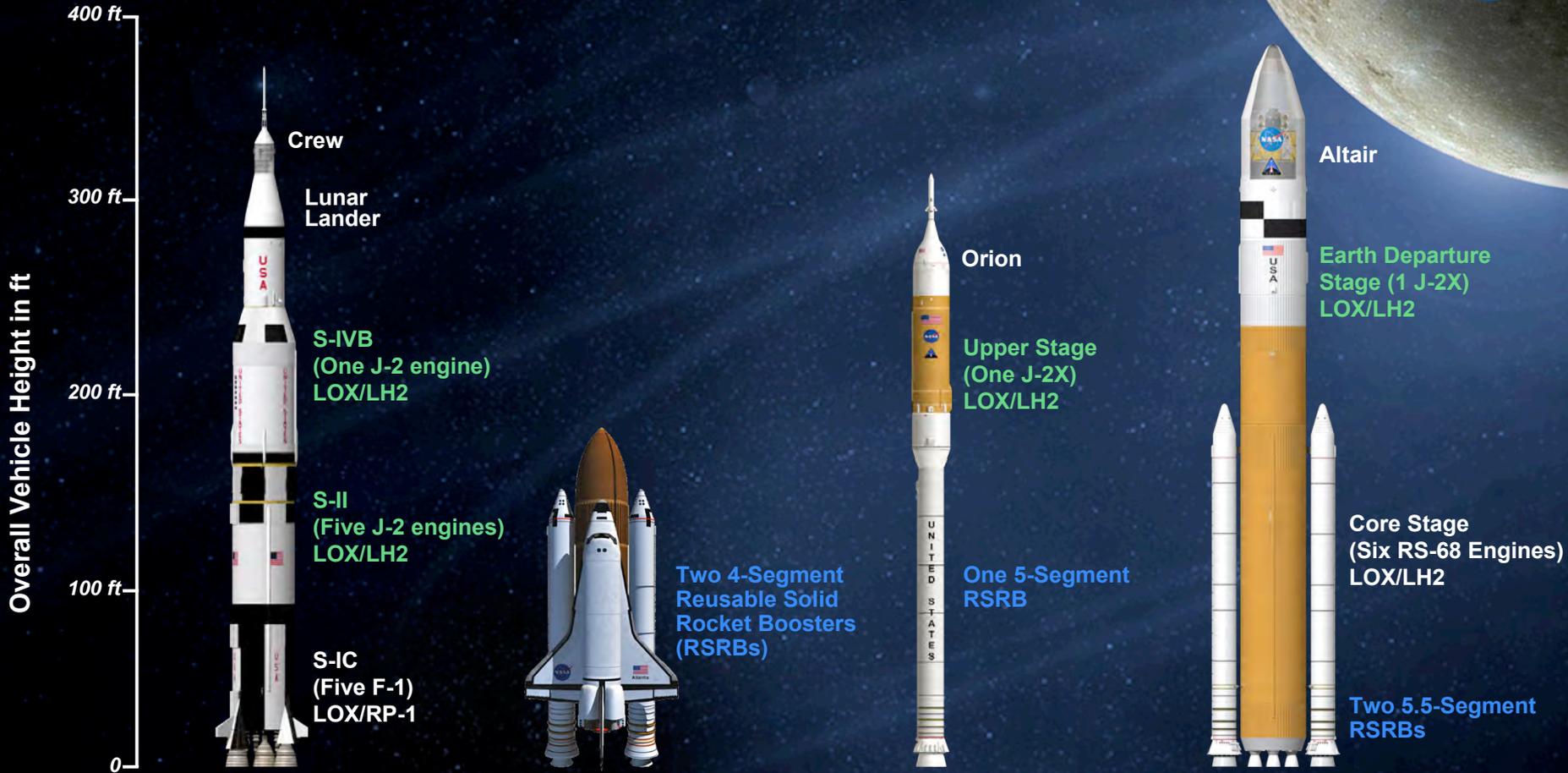


**Ares I
Crew Launch
Vehicle**



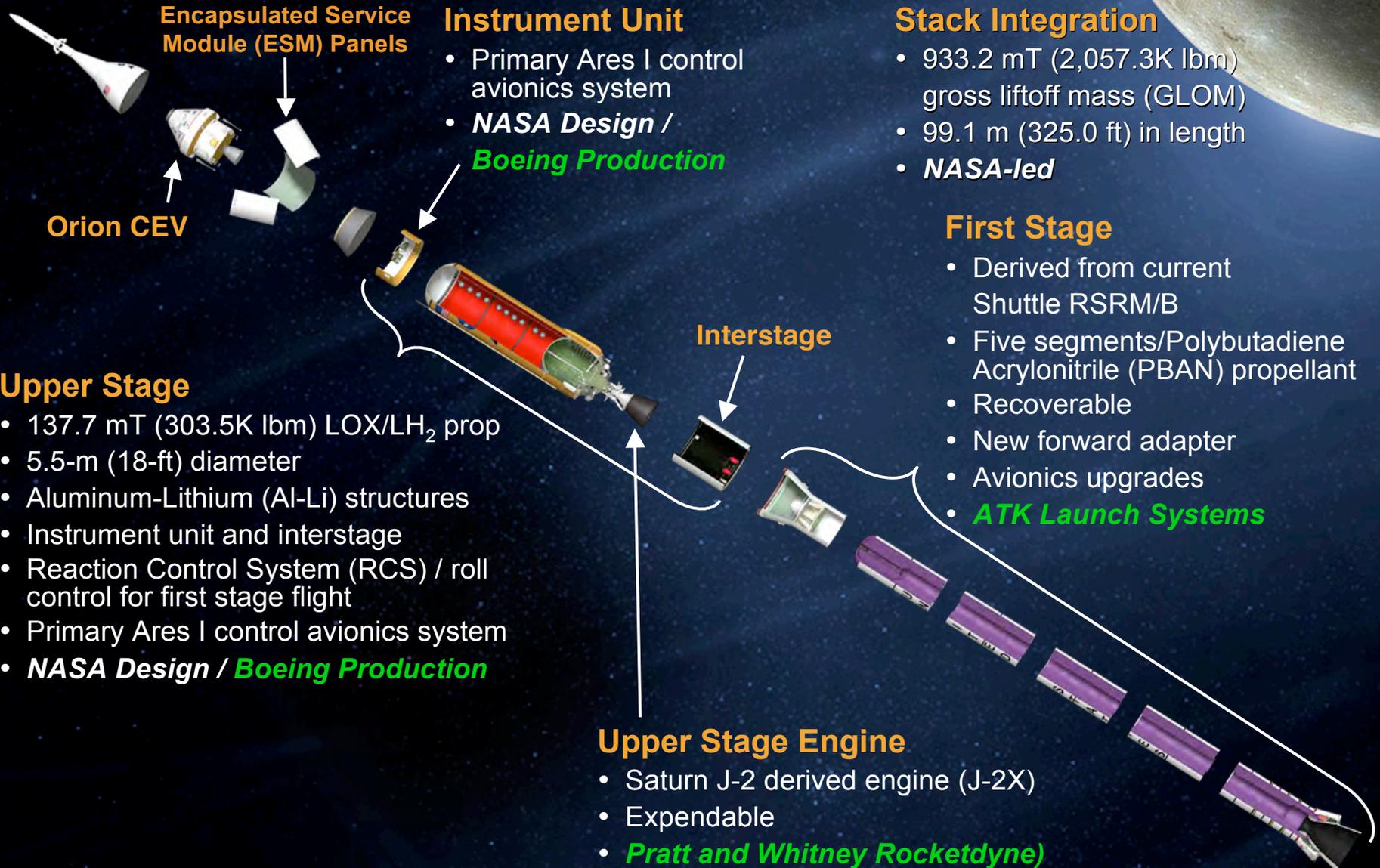
Building on a Foundation of Proven Technologies

- Launch Vehicle Comparisons -



	Saturn V: 1967–1972	Space Shuttle: 1981–Present	Ares I: First Flight 2015	Ares V: First Flight 2018
Height	360 ft	184.2 ft	325.0 ft	381.1 ft
Gross Liftoff Mass (GLOM)	2,948.4 mT (6,500K lbm)	2,041.1 mT (4,500.0K lbm)	933.2 mT (2,057.3K lbm)	3,704.5 mT (8,167.1K lbm)
Payload Capability	99.0K lbm to TLI 262.0K lbm to LEO	55.1K lbm to LEO	54.9K lbm to LEO	156.7K lbm to TLI with Ares I 413.8K lbm to LEO

Ares I Elements



Encapsulated Service Module (ESM) Panels

Instrument Unit

Stack Integration

Orion CEV

Upper Stage

Interstage

First Stage

- 137.7 mT (303.5K lbm) LOX/LH₂ prop
- 5.5-m (18-ft) 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**

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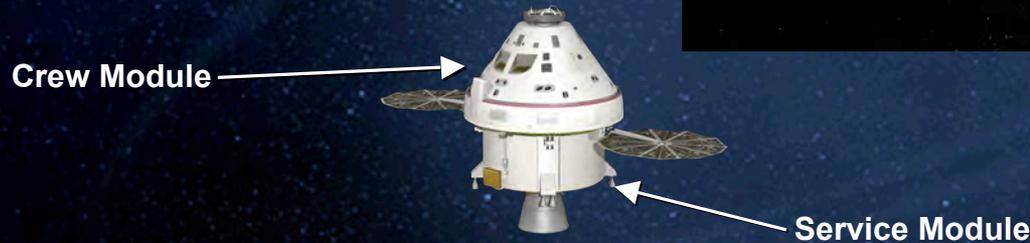
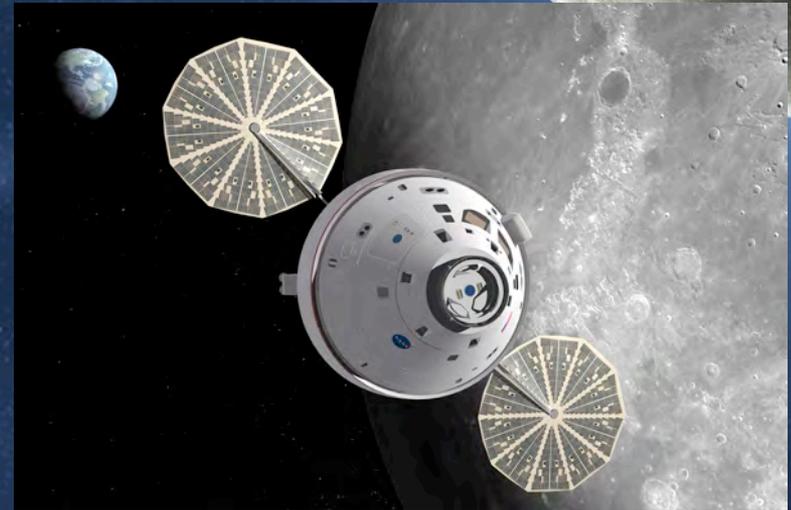
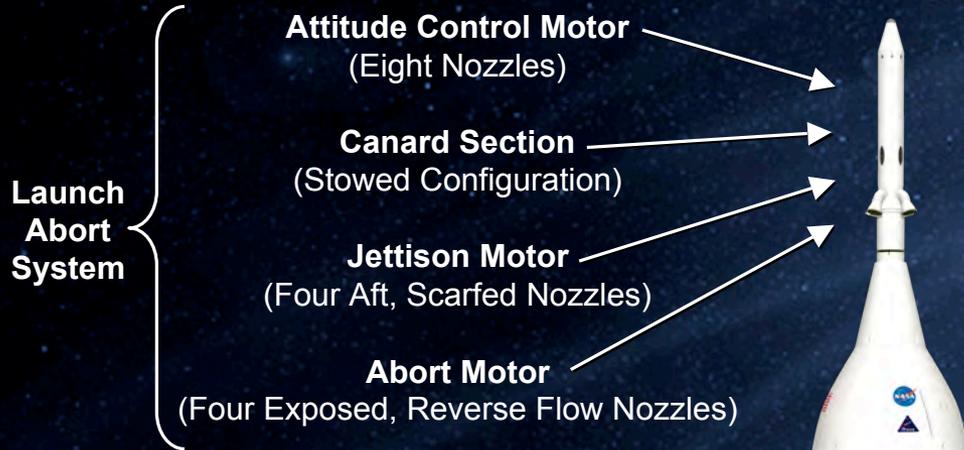
- 933.2 mT (2,057.3K lbm) gross liftoff mass (GLOM)
- 99.1 m (325.0 ft) in length
- **NASA-led**

- Derived from current Shuttle RSRM/B
- Five segments/Polybutadiene Acrylonitrile (PBAN) propellant
- Recoverable
- New forward adapter
- Avionics upgrades
- **ATK Launch Systems**

Upper Stage Engine

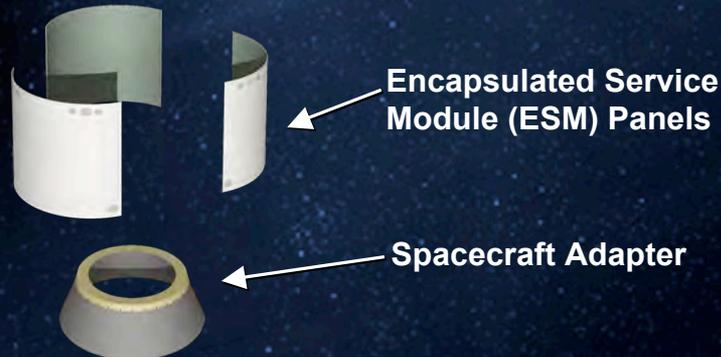
- Saturn J-2 derived engine (J-2X)
- Expendable
- **Pratt and Whitney Rocketdyne**

Orion Crew Exploration Vehicle



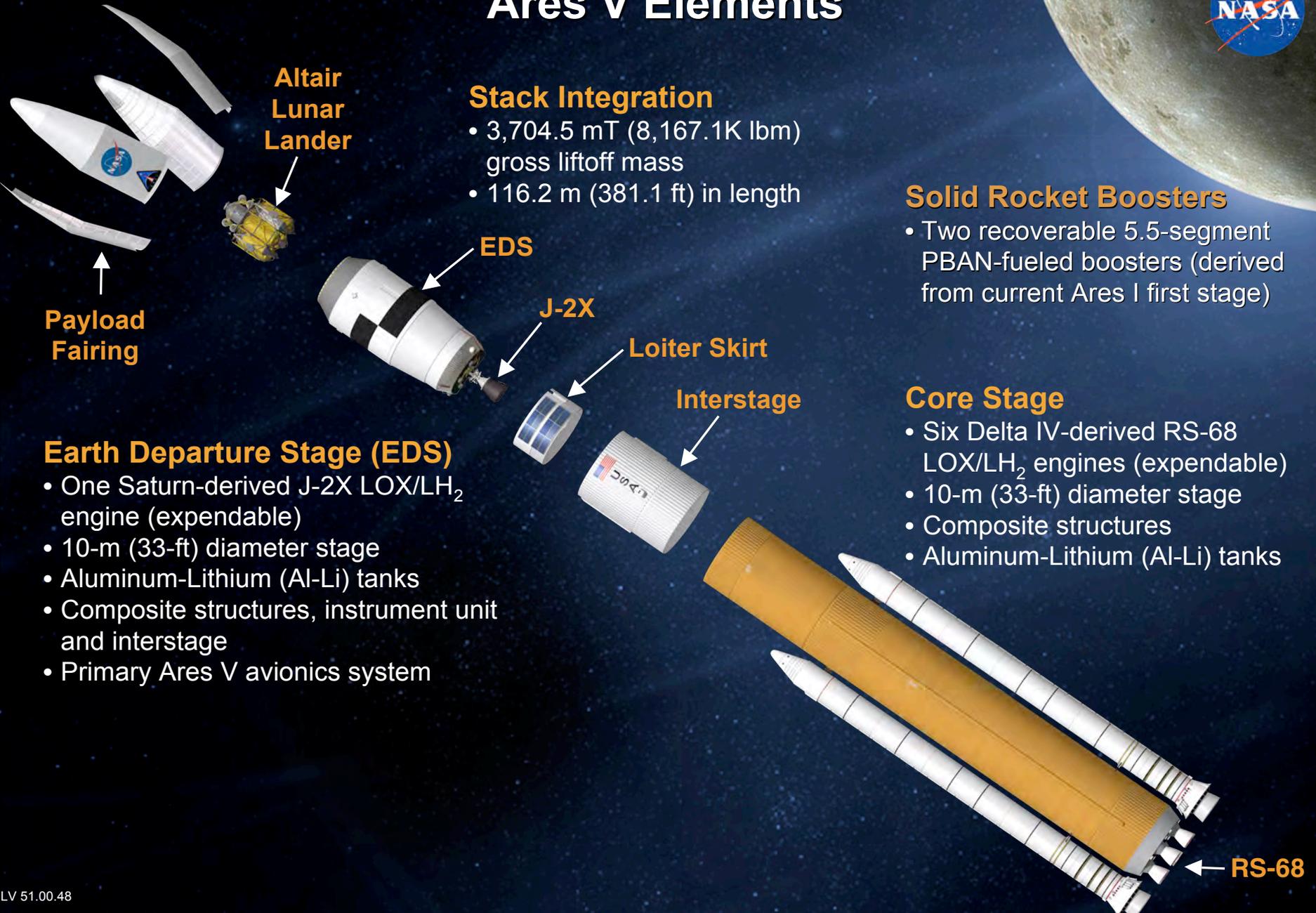
Lockheed Martin Design/Production

Volume: 19.6 m³ (690.6 ft³)
- 80% larger than Apollo
Diameter: 5.0 m (16.4 ft)





Ares V Elements



Altair Lunar Lander

Stack Integration

- 3,704.5 mT (8,167.1K lbm) gross liftoff mass
- 116.2 m (381.1 ft) in length

Payload Fairing

Earth Departure Stage (EDS)

- One Saturn-derived J-2X LOX/LH₂ engine (expendable)
- 10-m (33-ft) 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 (33-ft) diameter stage
- Composite structures
- Aluminum-Lithium (Al-Li) tanks

RS-68

Journey to the Moon



What Progress Have We Made?



◆ Programmatic Milestones

- Completed Ares I System Requirements Reviews, System Definition Review and Preliminary Definition Review
- All Ares I Prime contractors on board
- Ares I-X test flight scheduled for October 2009



Workhorse Gas Generator Test

◆ Technical Accomplishments

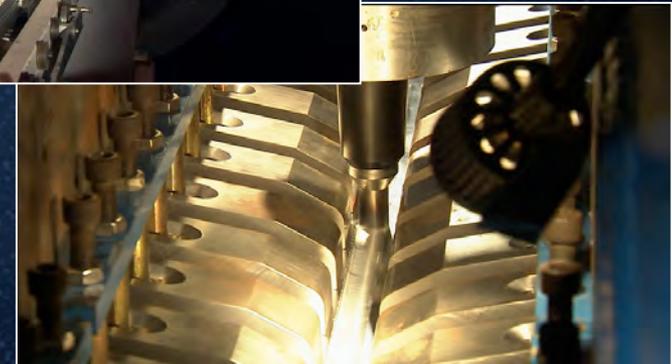
- Testing first stage parachutes and DM-1
- Constructing new J-2X test stand at Stennis Space Center
- Performing J-2X injector tests and power pack tests
- Extensive testing on upper stage fuel tank panels
- Full-scale upper stage demonstration hardware under construction
- Testing in wind tunnels
- Ares I-X stacked at Kennedy Space Center



Nozzle Burnthrough Test



Inert Forward Segment X-Ray



Tank Barrel Structural Test

For more information go to www.nasa.gov/ares

Ares I-X Test Flight



◆ **Demonstrate and collect key data to inform the Ares I design:**

- Vehicle integration, assembly, and KSC 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 5.84
Staging Altitude:	39,600 m (130K ft)	57,700 m (188K ft)
Liftoff Weight:	816 mT (1,799K lbm)	927 mT (2,044K lbm)
Length:	99.7 m (327 ft)	99.1 m (325 ft)
Max. Acceleration:	2.46 g	3.79 g

Ares Nationwide Team



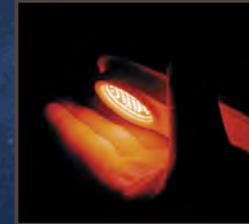
Down-to-Earth Benefits from the Space Economy



NASA powers innovation that creates new jobs, new markets, and new technologies.

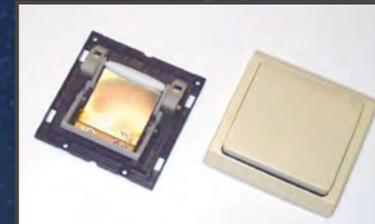
◆ Personal Health

- Eye tracker for LASIK surgery
- Breast biopsy system



◆ Consumer Products

- Wireless light switch
- Remote appliance programmer
- Global Positioning Systems (GPSs)



◆ Environmental

- Water Filtration system
- Environmentally friendly chemical cleanup



◆ Security

- Stair-climbing tactical robot
- Crime scene video enhancement



For more information see <http://technology.jsc.nasa.gov>

Every Dollar Invested in Space is Spent on Earth.

NASA Explores for Answers that Power Our Future



NASA powers inspiration that encourages future generations to explore, learn, and build a better future

- ◆ **NASA relies on a well-educated U.S. workforce to carry out missions of scientific discovery that improve life on Earth**
- ◆ **America's technological edge is diminishing**
 - Fewer engineering graduates from U.S. colleges and universities
 - More engineering and science graduates in other countries
- ◆ **The global marketplace is increasingly competitive and technology-driven**
- ◆ **Students need motivating goals and teachers with information to share**
- ◆ **NASA continues to develop educational tools and experiences that inspire, educate, and motivate**
- ◆ **Space exploration offers new economic opportunities through technology and resource development**



Summary



- ◆ **The Ares family will provide the U.S. with unprecedented exploration capabilities**
 - Can inject almost 60% more mass to the Moon than Apollo/Saturn
- ◆ **The Ares team has made significant progress since its inception in October 2005**
 - Full team is onboard
 - All major milestones met to-date, with CDR scheduled for 2011
 - Ares I-X test flight scheduled for October 2009
- ◆ **We are making extensive use of lessons learned to minimize cost, technical, and schedule risks**
- ◆ **The NASA-led/Contractor partnership is very effective in developing the Ares I**





www.nasa.gov/ares