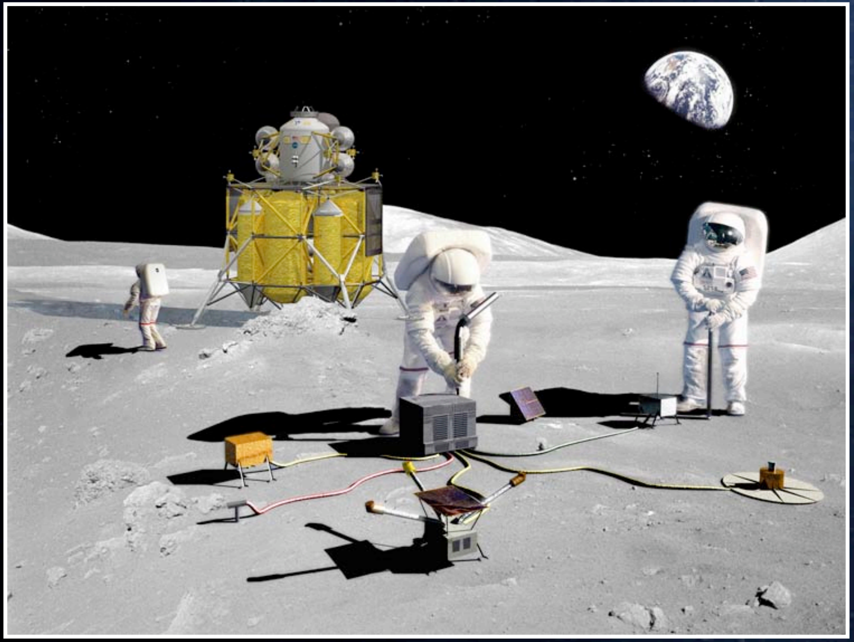

National Aeronautics and Space Administration
NASA
Launching to the Moon and Beyond
www.nasa.gov
042408

Today’s Journey

- 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



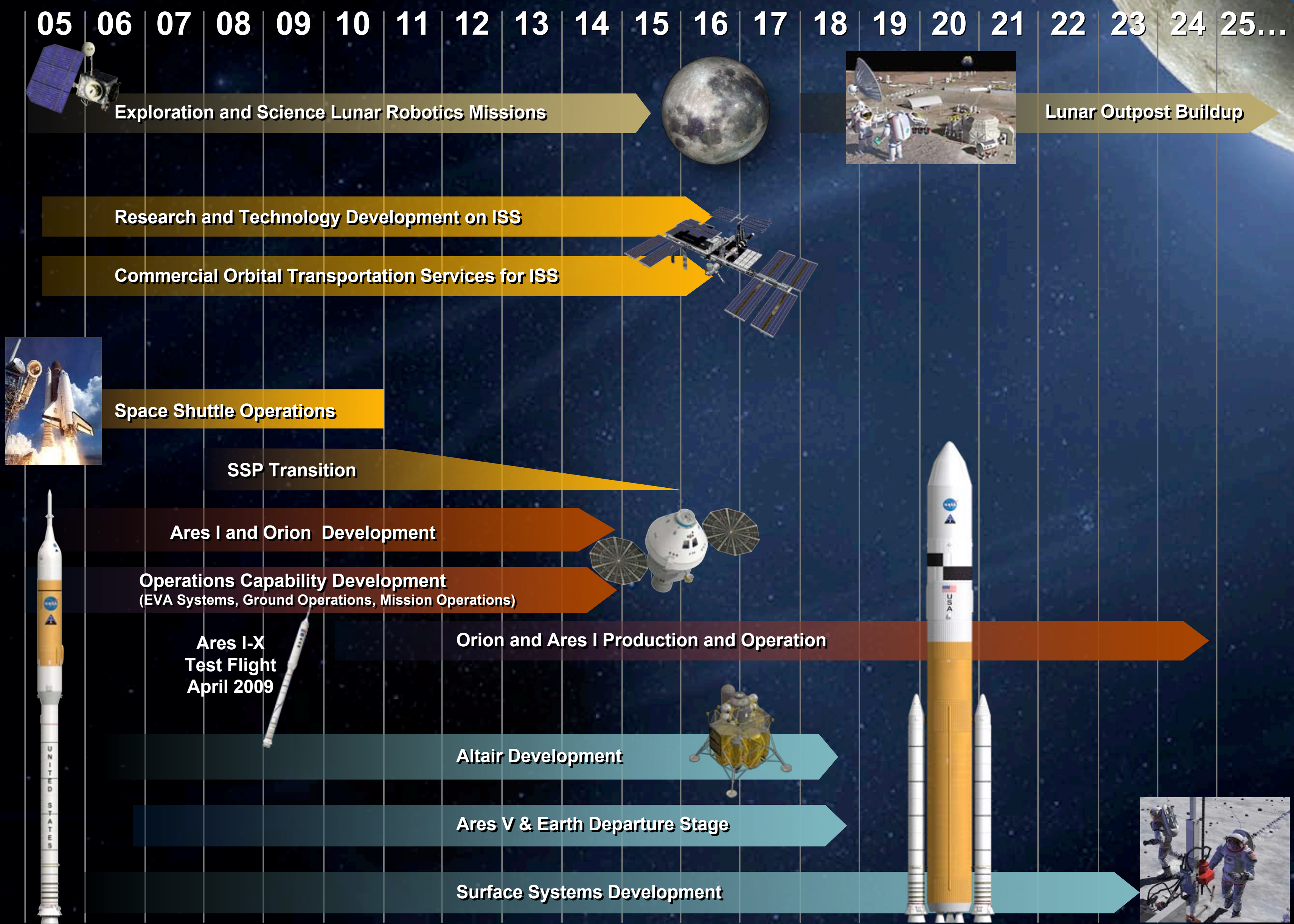
"The next steps in returning to the Moon and moving onward to Mars, the near-Earth asteroids, and beyond, are crucial in deciding the course of future space exploration. We must understand that these steps are incremental, cumulative, and incredibly powerful in their ultimate effect."

– NASA Administrator Michael Griffin
October 24, 2006

Why Do We Explore?

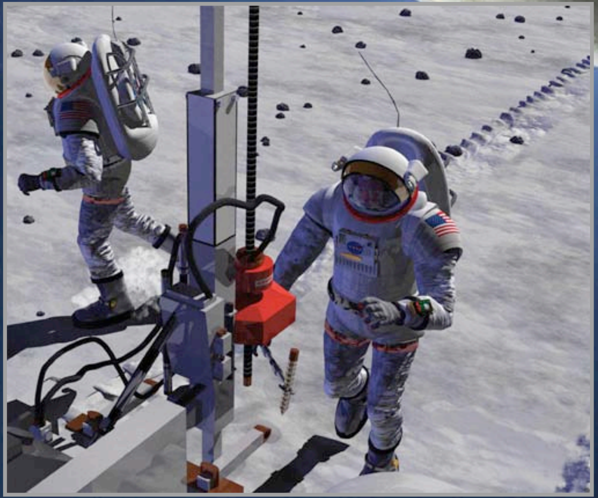
- **Inspiration**
  - Inspire students to explore, learn, contribute to our nation's economic competitiveness, and build a better future
- **Innovation**
  - Provide opportunities to develop new technologies, new jobs, and new markets
- **Discovery**
  - Discover new information about ourselves, our world, and how to manage and protect it

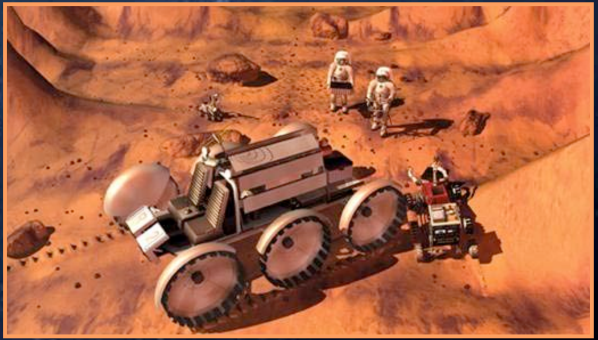
NASA's Exploration Roadmap



Why the Moon Next?

- It's 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

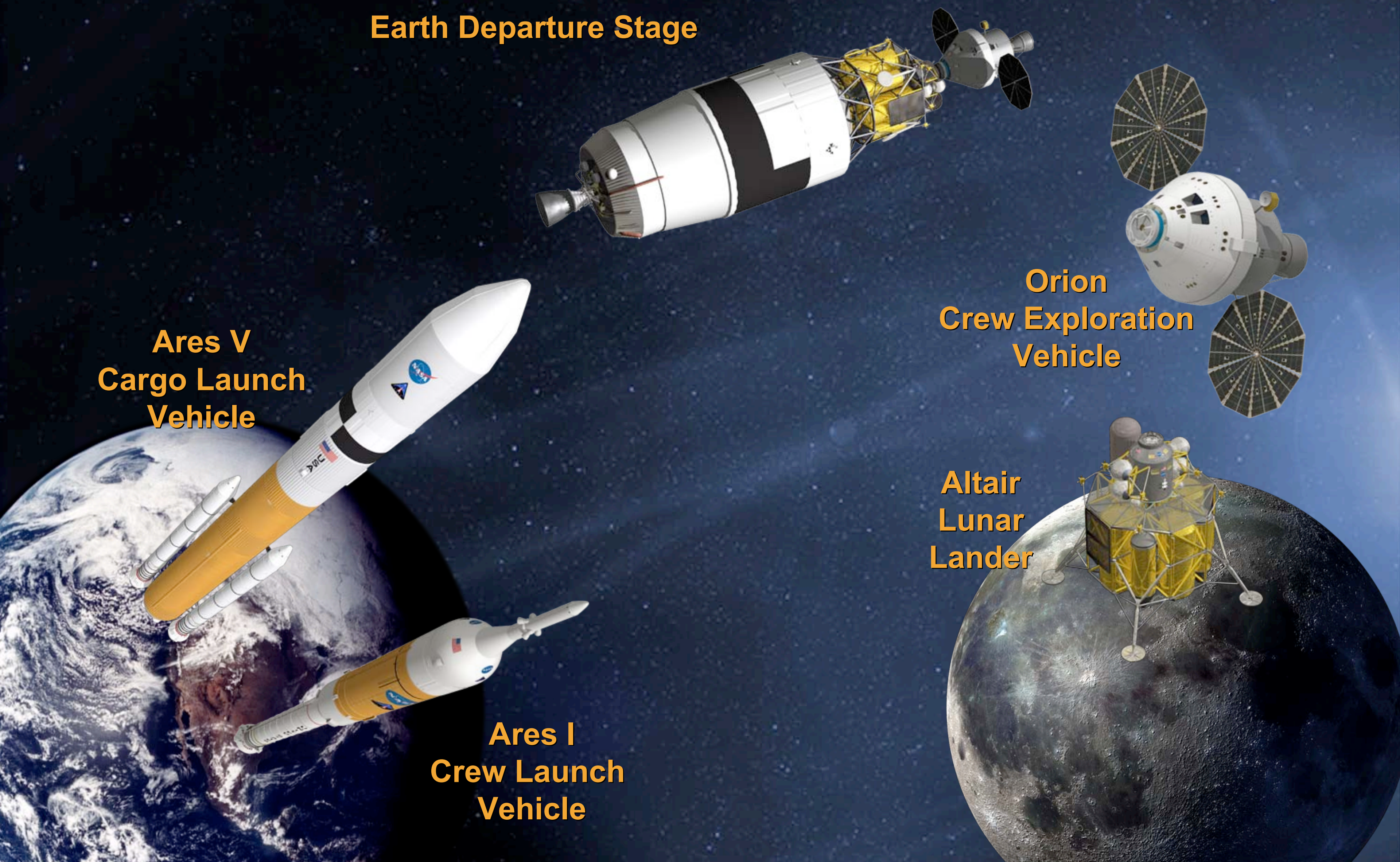




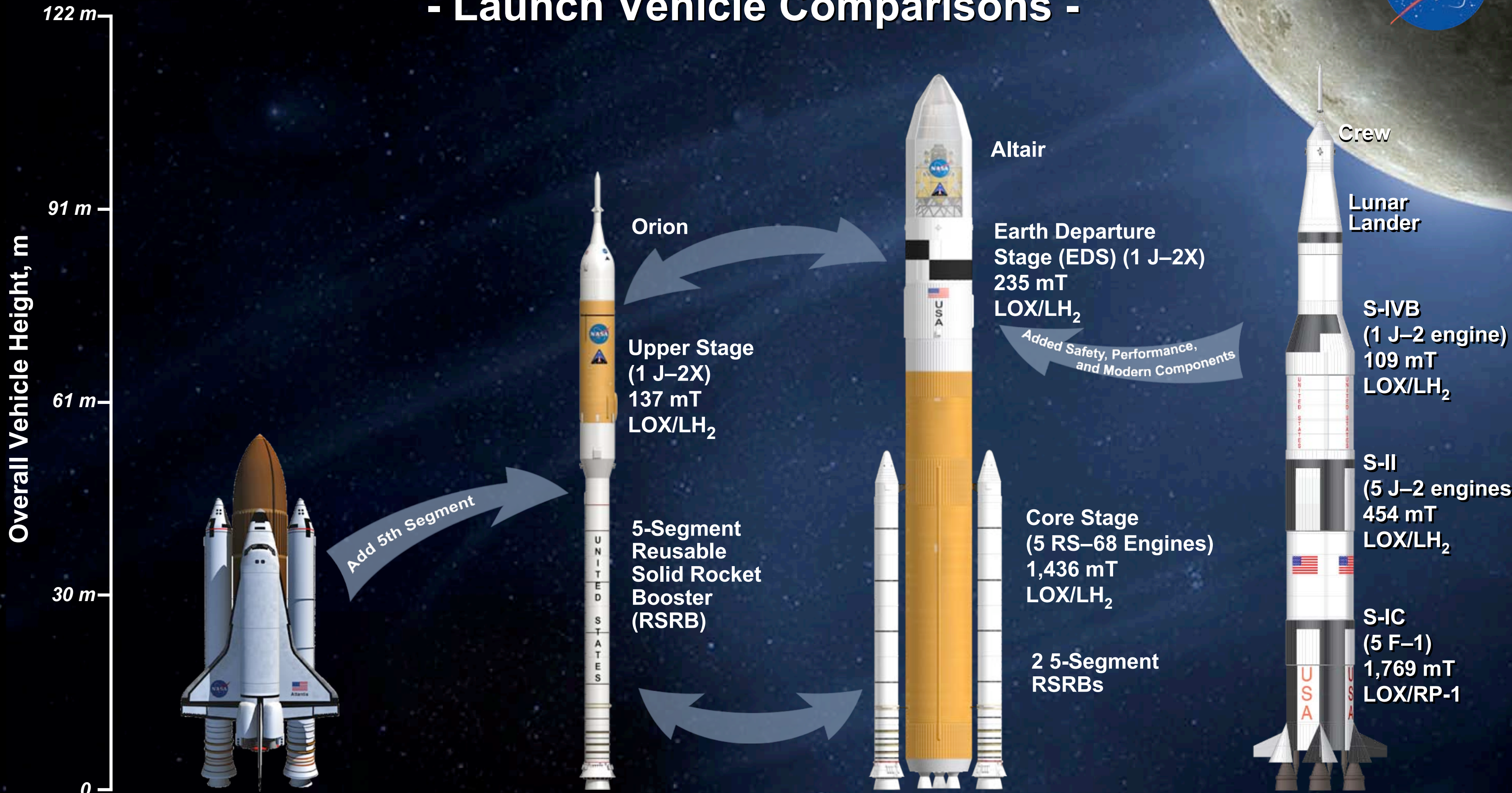
There Are Many Places To Explore

Our Exploration Fleet

What will the vehicles look like?



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



Space Shuttle
Height: 56.1 m
Gross Liftoff Mass:
2,041 mT

25 mT to
Low Earth Orbit (LEO)

Ares I
Height: 99.1 m
Gross Liftoff Mass:
927 mT

25.6 mT to LEO

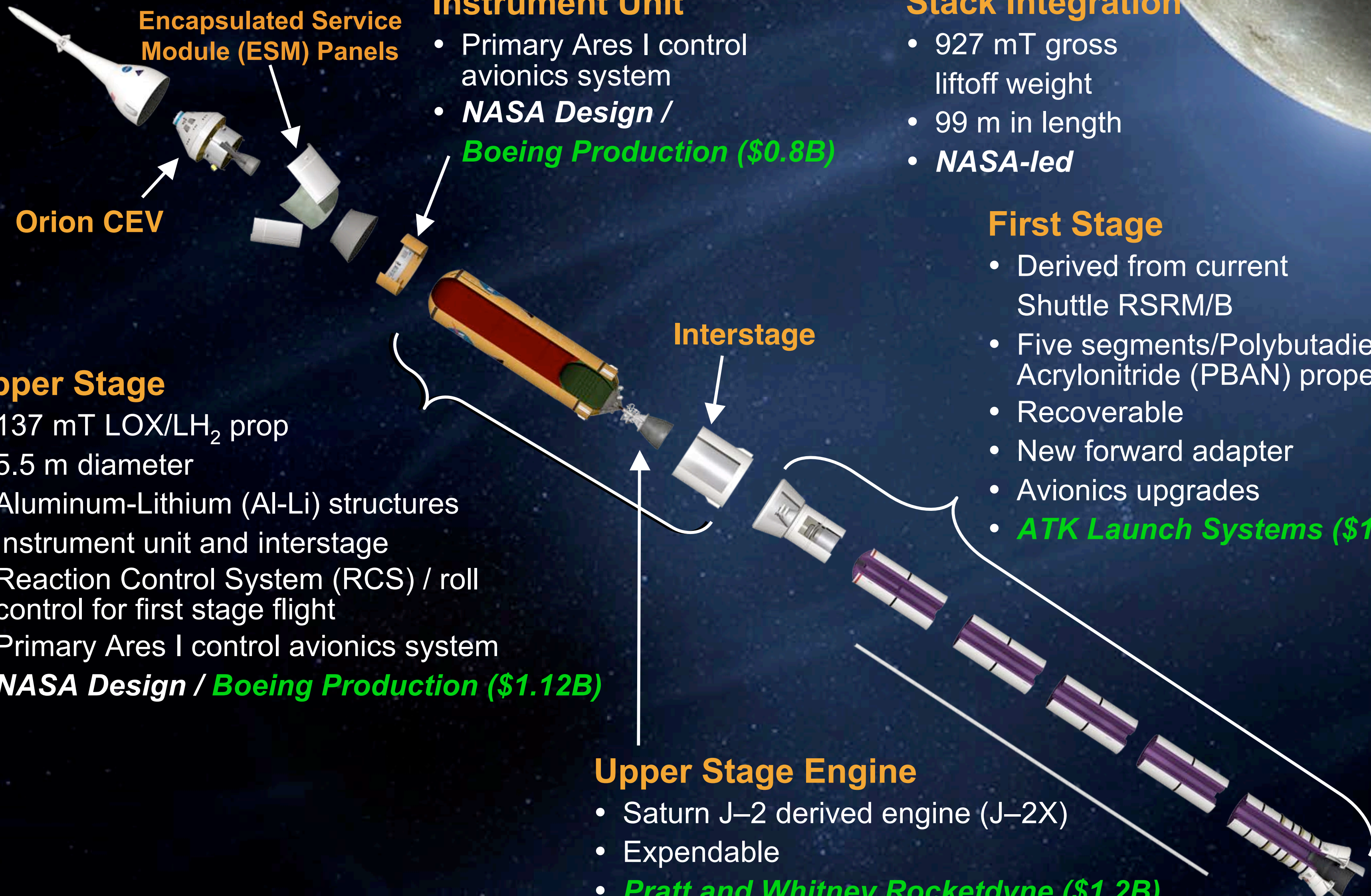
Ares V
Height: 109.7 m
Gross Liftoff Mass:
3,375 mT

63.6 mT to TLI (with Ares I)
55.9 mT to Direct TLI
~143.4 mT to LEO

Saturn V
Height: 110.9 m
Gross Liftoff Mass:
2,948 mT

45 mT to TLI
119 mT to LEO

Ares I Elements



Instrument Unit

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

Stack Integration

- 927 mT gross liftoff weight
- 99 m in length
- ***NASA-led***

First Stage

- Derived from current Shuttle RSRM/B
- Five segments/Polybutadiene Acrylonitride (PBAN) propellant
- Recoverable
- New forward adapter
- Avionics upgrades
- ***ATK Launch Systems ($1.8B)***

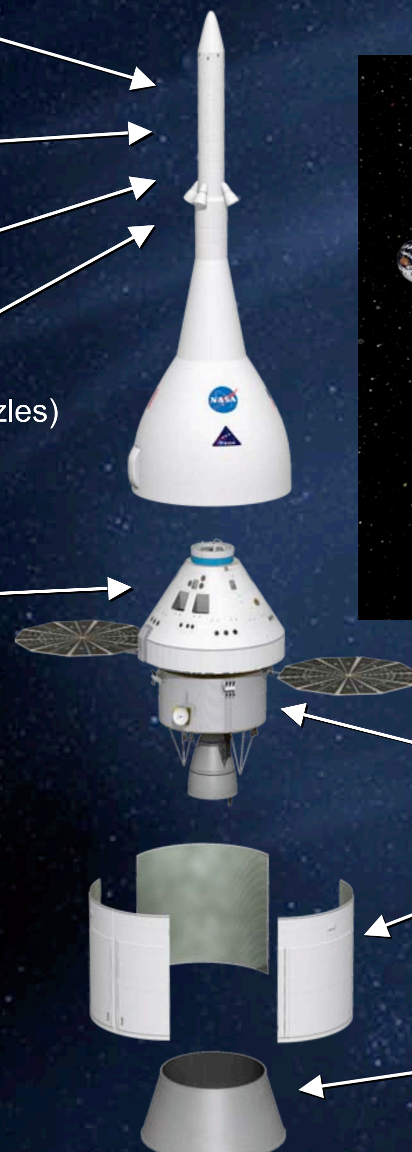
Upper Stage

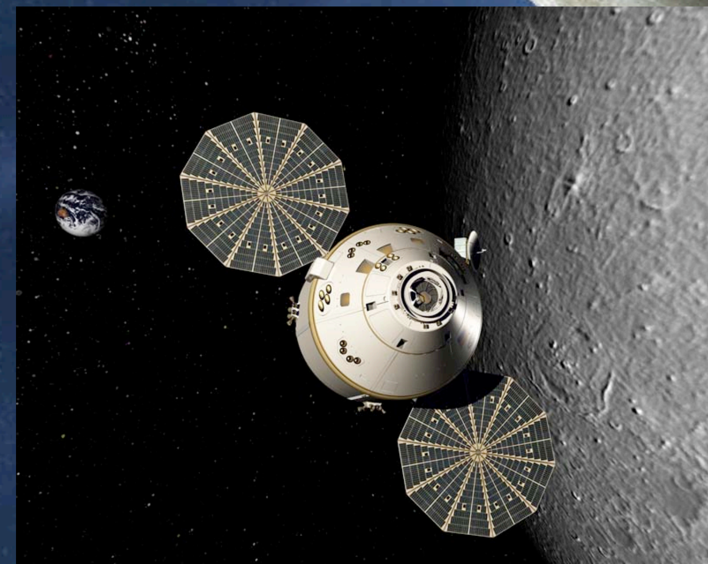
- 137 mT LOX/LH_2 prop
- 5.5 m diameter
- Aluminum-Lithium (Al-Li) structures
- Instrument unit and interstage
- Reaction Control System (RCS) / roll control for first stage flight
- Primary Ares I control avionics system
- ***NASA Design / Boeing Production ($1.12B)***

Upper Stage Engine

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

Orion Crew Exploration Vehicle





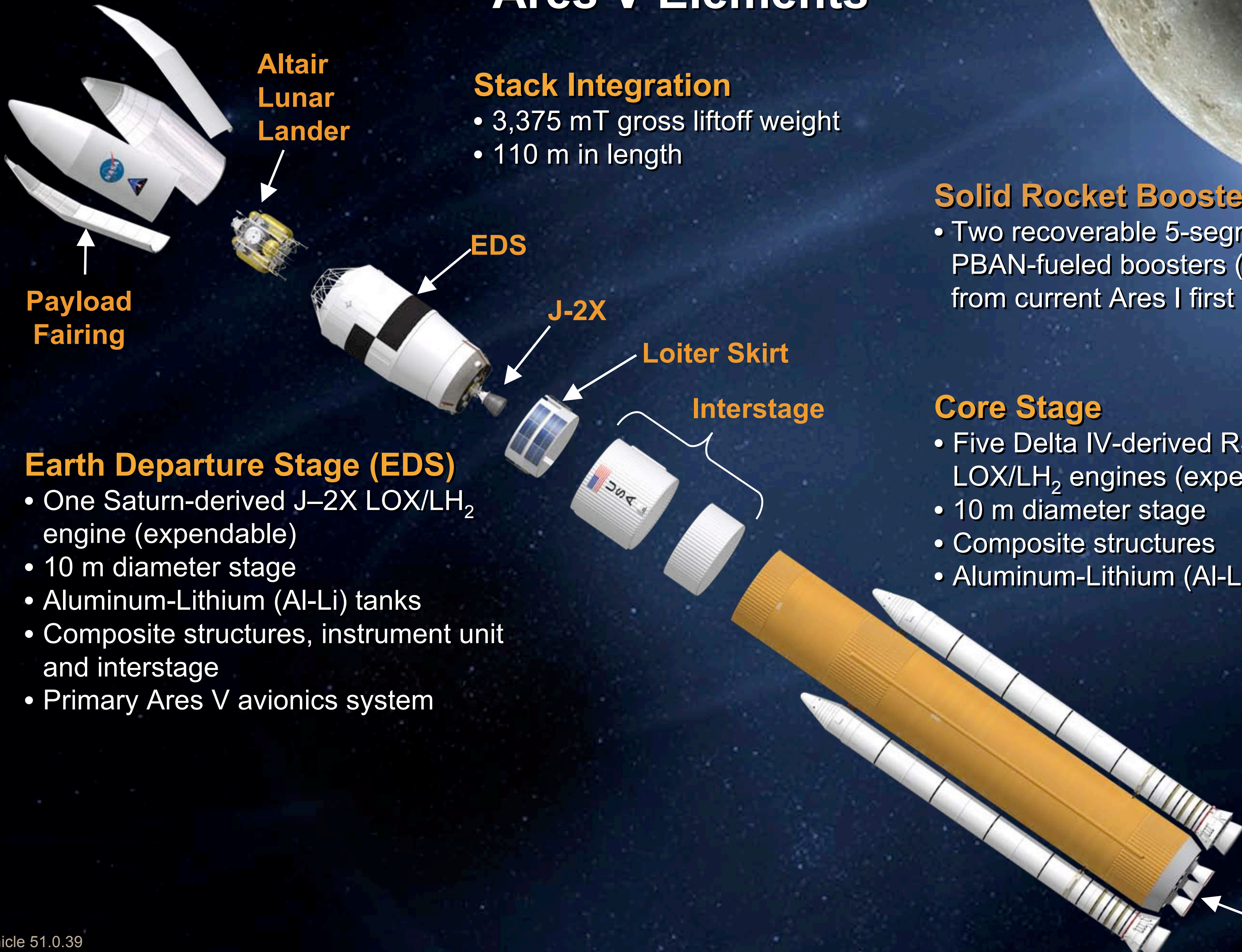
LOCKHEED MARTIN

Volume: 115.8 m^3

- 80% larger than Apollo

Diameter: 5.5 m

Ares V Elements



Stack Integration

- 3,375 mT gross liftoff weight
- 110 m in length

Solid Rocket Boosters

- Two recoverable 5-segment PBAN-fueled boosters (derived from current Ares I first stage)

Earth Departure Stage (EDS)

- One Saturn-derived J–2X LOX/LH_2 engine (expendable)
- 10 m diameter stage
- Aluminum-Lithium (Al-Li) tanks
- Composite structures, instrument unit and interstage
- Primary Ares V avionics system

Core Stage

- Five Delta IV-derived RS–68 LOX/LH_2 engines (expendable)
- 10 m diameter stage
- Composite structures
- Aluminum-Lithium (Al-Li) tanks

Vehicle 51.0.39

What Progress Have We Made?

♦ Programmatic Milestones

- Completed Ares I System Requirements Reviews
- Contracts awarded for building the first stage, J–2X engine, upper stage, instrument unit, and Orion
- Completed Ares I System Definition Review
- Ares I–X test flight scheduled for April 2009

♦ Technical Accomplishments

- Testing first stage parachutes and developing nozzles
- Constructing new J–2X test stand at Stennis Space Center
- Performing J–2X injector tests and power pack tests
- Fabricating Ares I–X hardware
- Testing in wind tunnels

Nozzle Process Simulation Article

Powerpack 1A Testing

Dome Gore Panel Fabrication

“Roughing” of 1% Model

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	15.6 MN
Max. Speed:	Mach 4.7	Mach 5.84
Staging Altitude:	39,600 m	57,400 m
Liftoff Weight:	816 mT	907 mT
Length:	99.7 m	99 m
Max. Acceleration:	2.46 g	3.79 g

Ares Nationwide Team

Down-to-Earth Benefits from the Space Economy

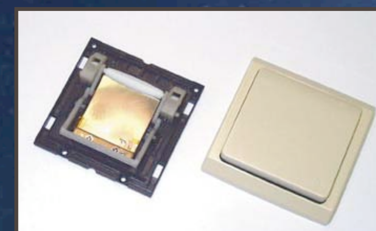
NASA powers innovation that creates new jobs, new markets, and new technologies.

Personal Health

- Eye tracker for LASIK surgery
- Breast biopsy system

Consumer Products

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

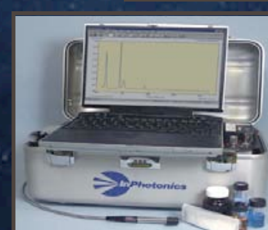


Environmental

- 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.**

Summary

- Human beings will explore the Moon, Mars, 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.
- Exploring the Moon will help us reach Mars and beyond.
- Team is onboard and making good progress—the Ares I–X test flight is on schedule for April 2009.

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