MSFC-502-Abstract

Title: Launching to the Moon, Mars, and Beyond Presentation

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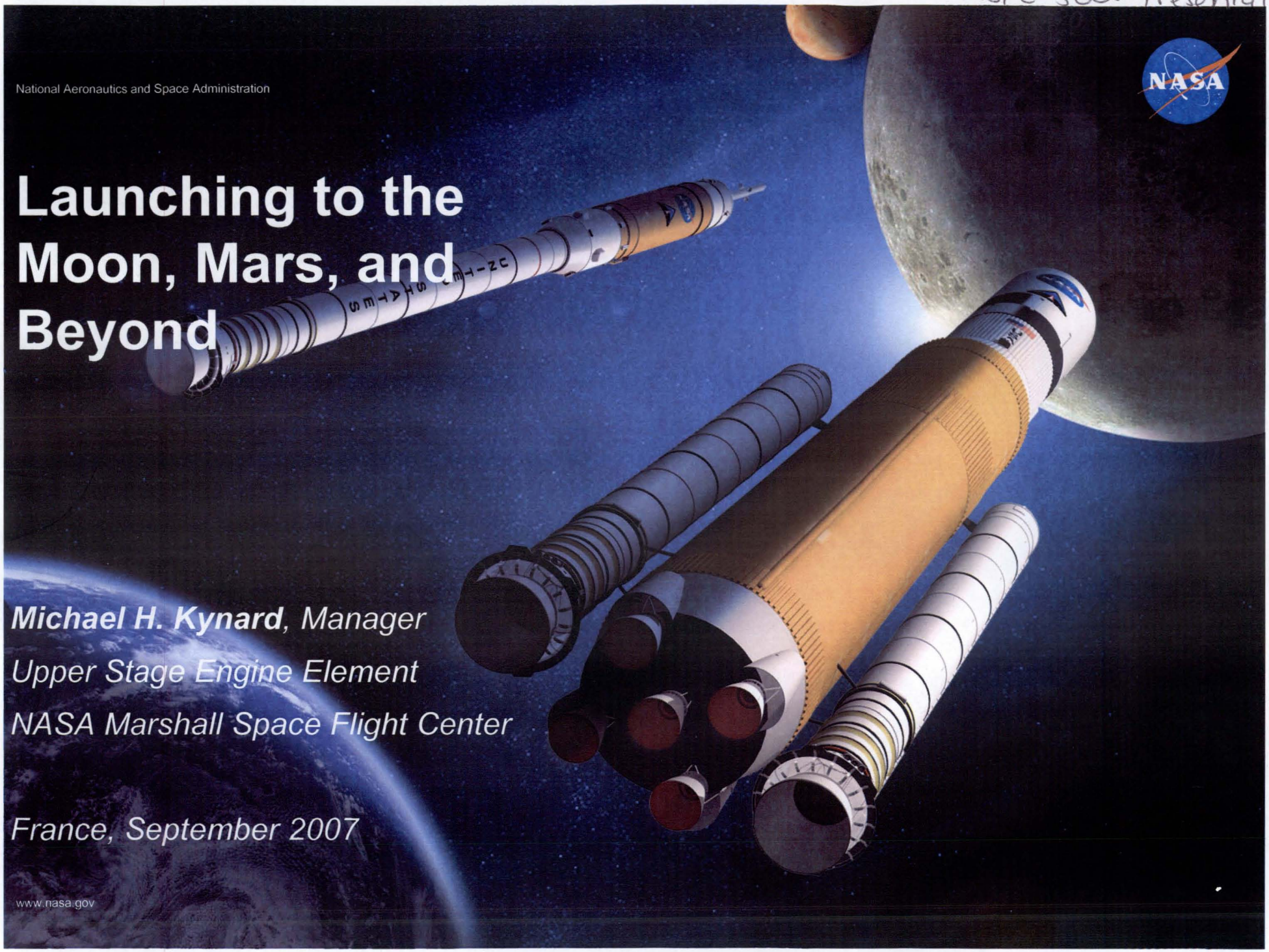
Date: September 21, 2007

Presented To: An internal audience at Snecma Propulsion Solid (SPS) in Bordeaux, France, an aerospace contractor that manufactures rocket engine nozzles.

Abstract: This presentation presents the goals of the Vision for Space Exploration. It gives a general overview of the Ares I and Ares V launch vehicles and shows how they enable NASA's lunar exploration missions. It explains how space exploration can inspire the next generation of explorers.

MSFC-502-Presentation

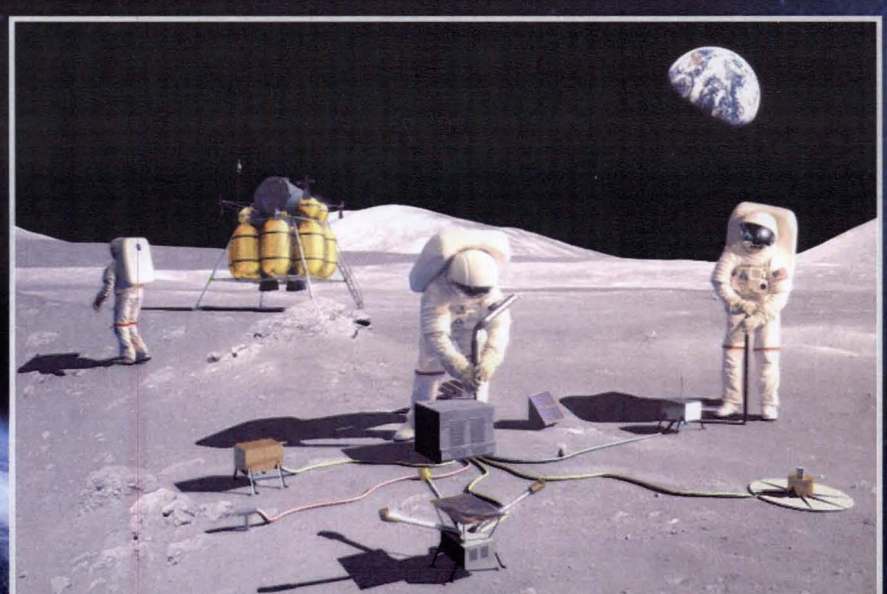


Today's Journey

- What NASA's mission is today, as defined by the National Space Policy and Global Exploration Strategy
- Why explore
- Timeline
- Why the Moon first
- Vehicle descriptions
- Progress toward launch
- Who will be doing the work to get us there
- Benefits of space exploration

NASA's Mission

- Safely fly the Space Shuttle until 2010
- Complete the International Space Station
- Develop a balanced program of science, exploration, and aeronautics
- Develop and fly the Crew Exploration Vehicle (CEV)
- Return to the Moon no later than 2020
- Promote international and commercial participation in exploration

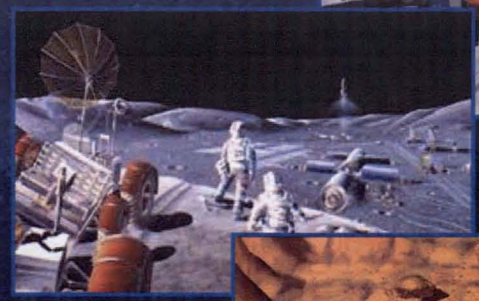


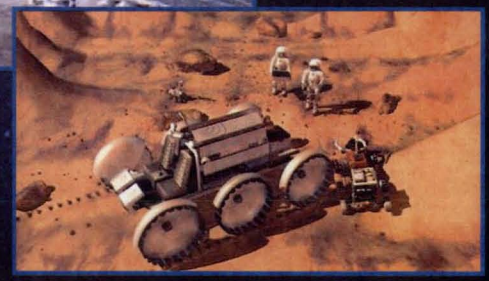
"The next steps in returning to the Moon and moving onward to Mars, the near-Earth asteroids, and beyond, are crucial in deciding the course of future space exploration. We must understand that these steps are incremental, cumulative, and incredibly powerful in their ultimate effect."

– NASA Administrator Michael Griffin
October 24, 2006

Why Explore?

- **Inspiration**
  - Inspire students to explore, learn, contribute to our nations 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

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

Initial Orion (CEV) Capability

Lunar Robotic Missions

Lunar Outpost Buildup

Science Robotic Missions

Mars Expedition

Commercial Crew/Cargo for ISS

Space Shuttle Ops

Orion Development

Ares I Development

Ares I-X Test Flight April 2009

Orion I 1st Crewed Test Flight 2013

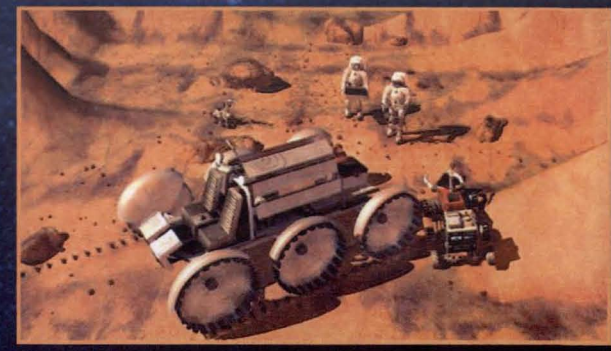
Lunar Lander Development

Ares V & Earth Departure Stage

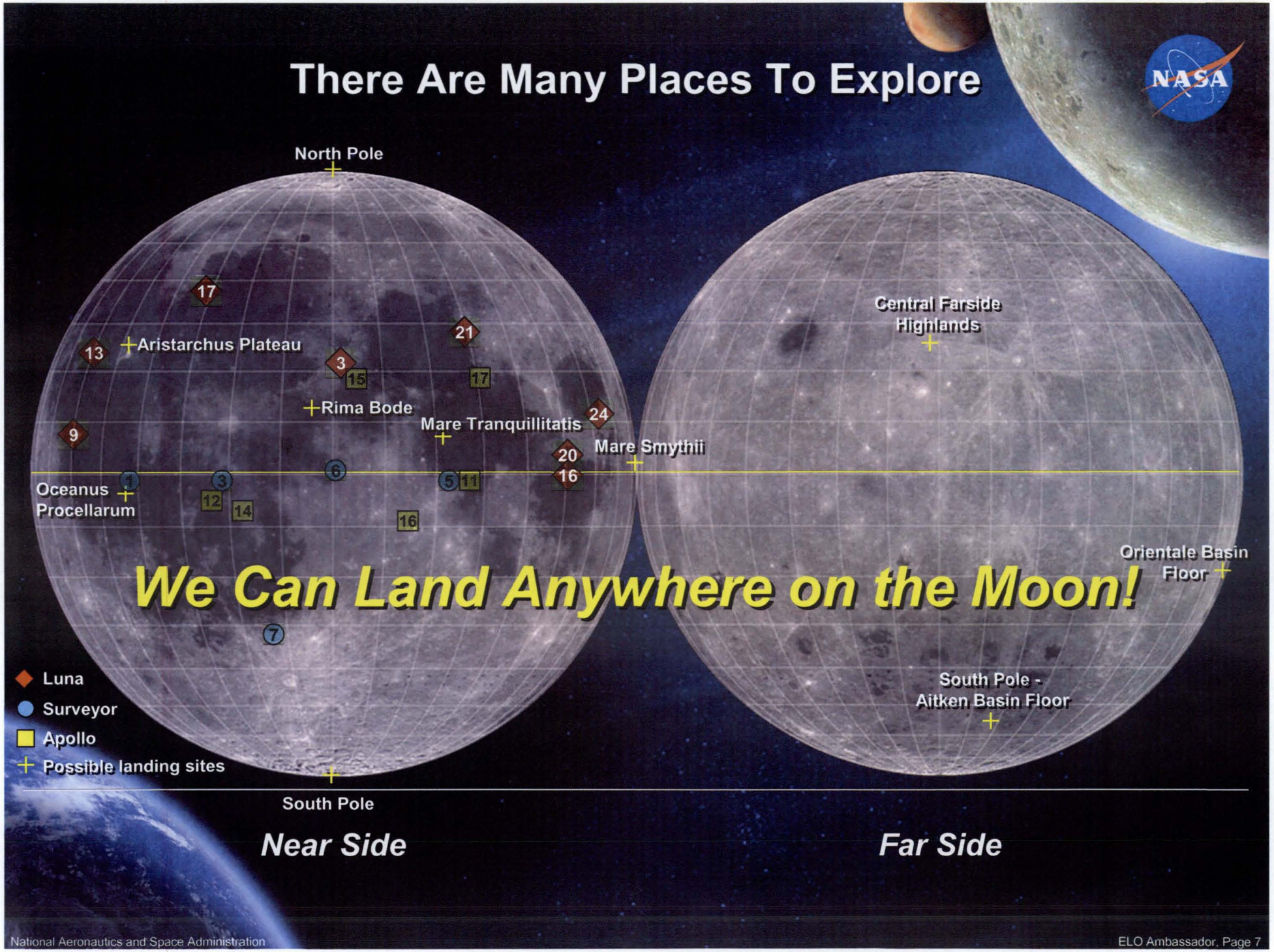
Surface Systems Development

The Moon
The First Step to Mars and Beyond

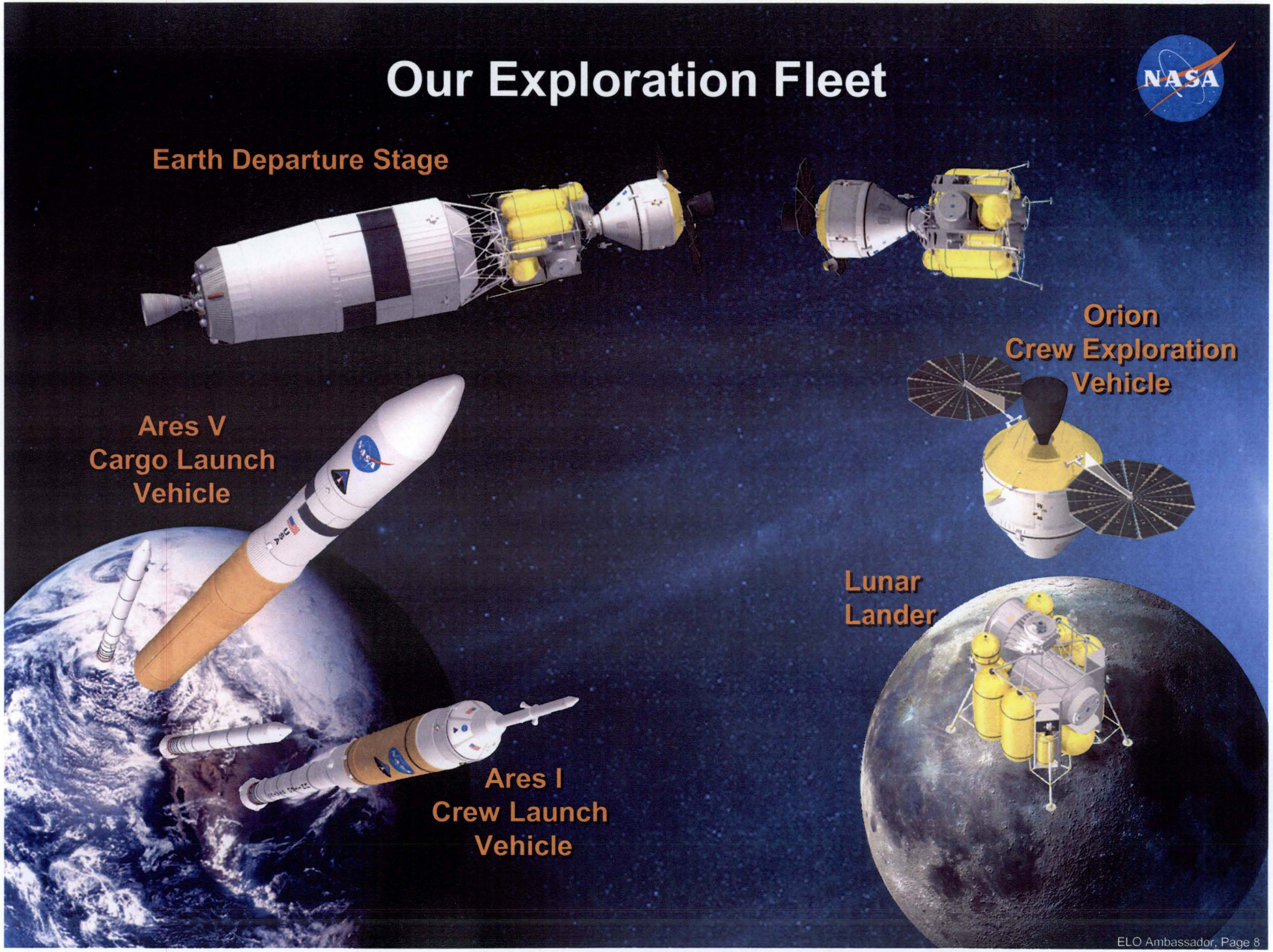
- **Lunar missions allow us to gain exploration experience**
  - Space no longer a short-term destination
  - Will test human support systems
  - Use Moon to prove ability to build and repair long-duration space assets
- **Developing exploration technologies**
  - Launch and exploration vehicles
  -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



Next Step in Fulfilling Our Destiny As Explorers


There Are Many Places To Explore
NASA
North Pole
Aristarchus Plateau
Rima Bode
Mare Tranquillitatis
Mare Smythii
Oceanus Procellarum
Central Farside Highlands
Orientale Basin Floor
South Pole - Aitken Basin Floor
We Can Land Anywhere on the Moon!
Luna
Surveyor
Apollo
Possible landing sites
South Pole
Near Side
Far Side

Our Exploration Fleet



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

Space Shuttle

Height: 184.2 ft
Gross Liftoff Mass: 4.5M lb

55k lbm to LEO

Ares I

Height: 328 ft
Gross Liftoff Mass: 2.0M lb

52k lbm to LEO
(effective)

Ares V

Height: 362 ft
Gross Liftoff Mass: 7.3M lb

133-144k lbm* to TLI in Dual-Launch Mode with Ares I

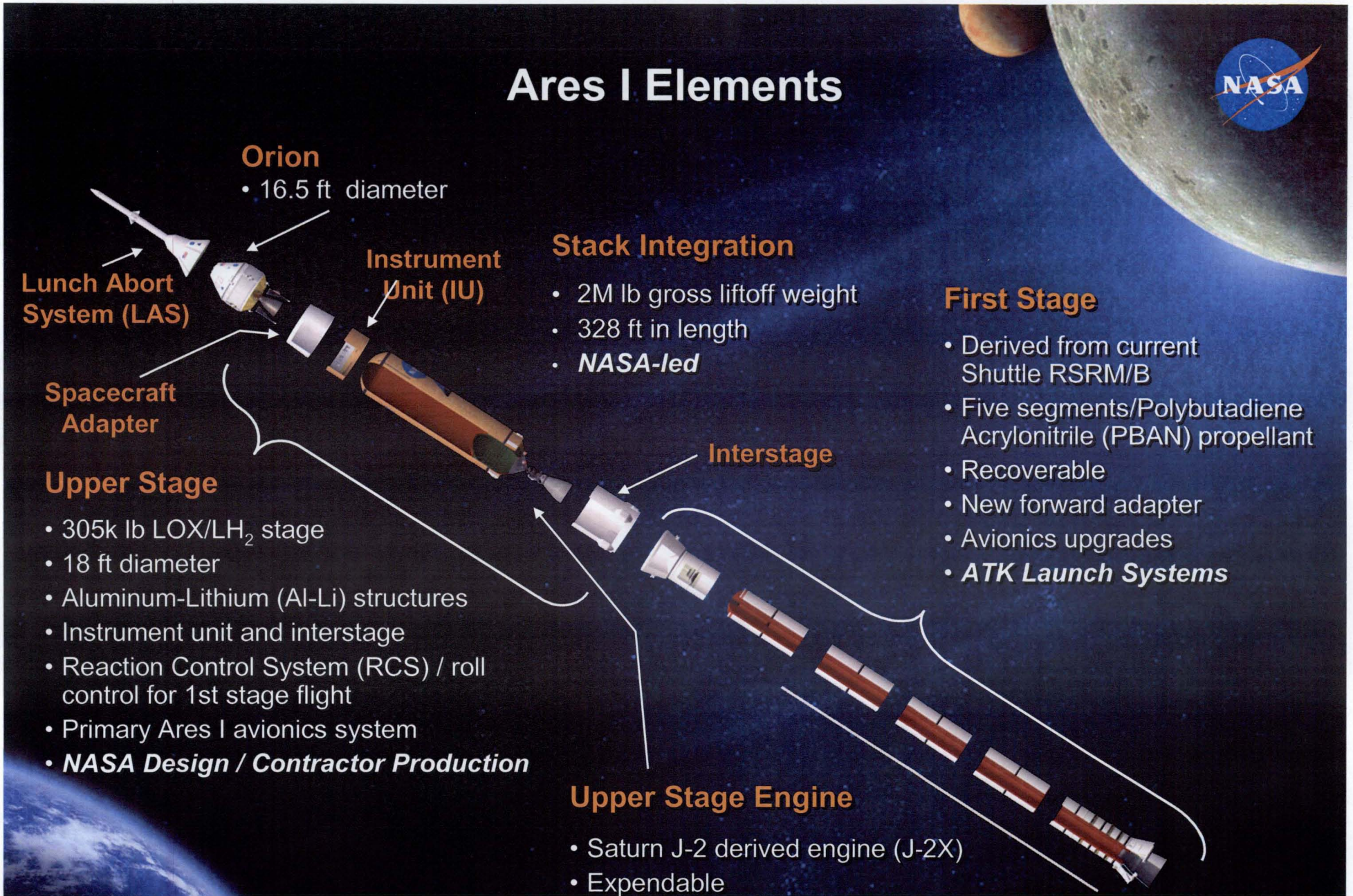
Saturn V

Height: 364 ft
Gross Liftoff Mass: 6.5M lb

99k lbm to TLI
262k lbm to LEO

Note: Depending on length of on-orbit LEO loiter time

Ares I Elements



Orion
- 16.5 ft diameter

Lunch Abort System (LAS)

Instrument Unit (IU)

Spacecraft Adapter

Stack Integration
- 2M lb gross liftoff weight
- 328 ft in length
- ***NASA-led***

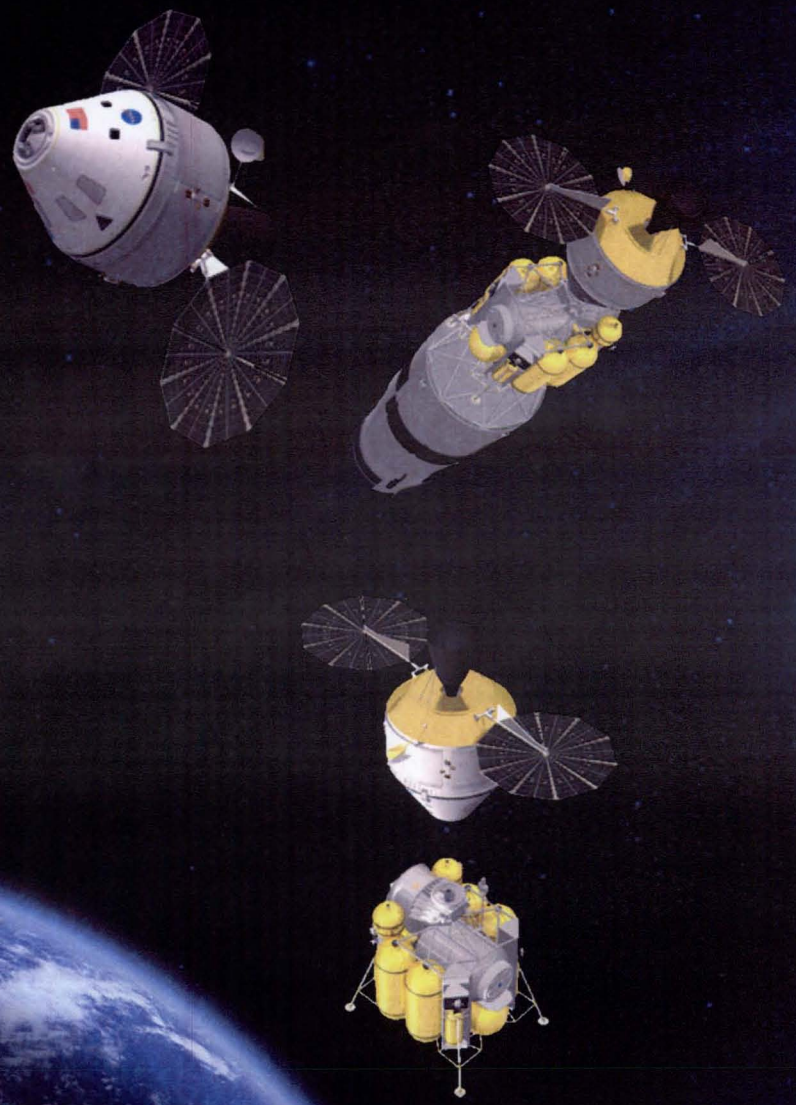
First Stage
- Derived from current Shuttle RSRM/B
- Five segments/Polybutadiene Acrylonitrile (PBAN) propellant
- Recoverable
- New forward adapter
- Avionics upgrades
- ***ATK Launch Systems***

Interstage

Upper Stage
- 305k lb LOX/LH_2 stage
- 18 ft diameter
- Aluminum-Lithium (Al-Li) structures
- Instrument unit and interstage
- Reaction Control System (RCS) / roll control for 1st stage flight
- Primary Ares I avionics system
- ***NASA Design / Contractor Production***

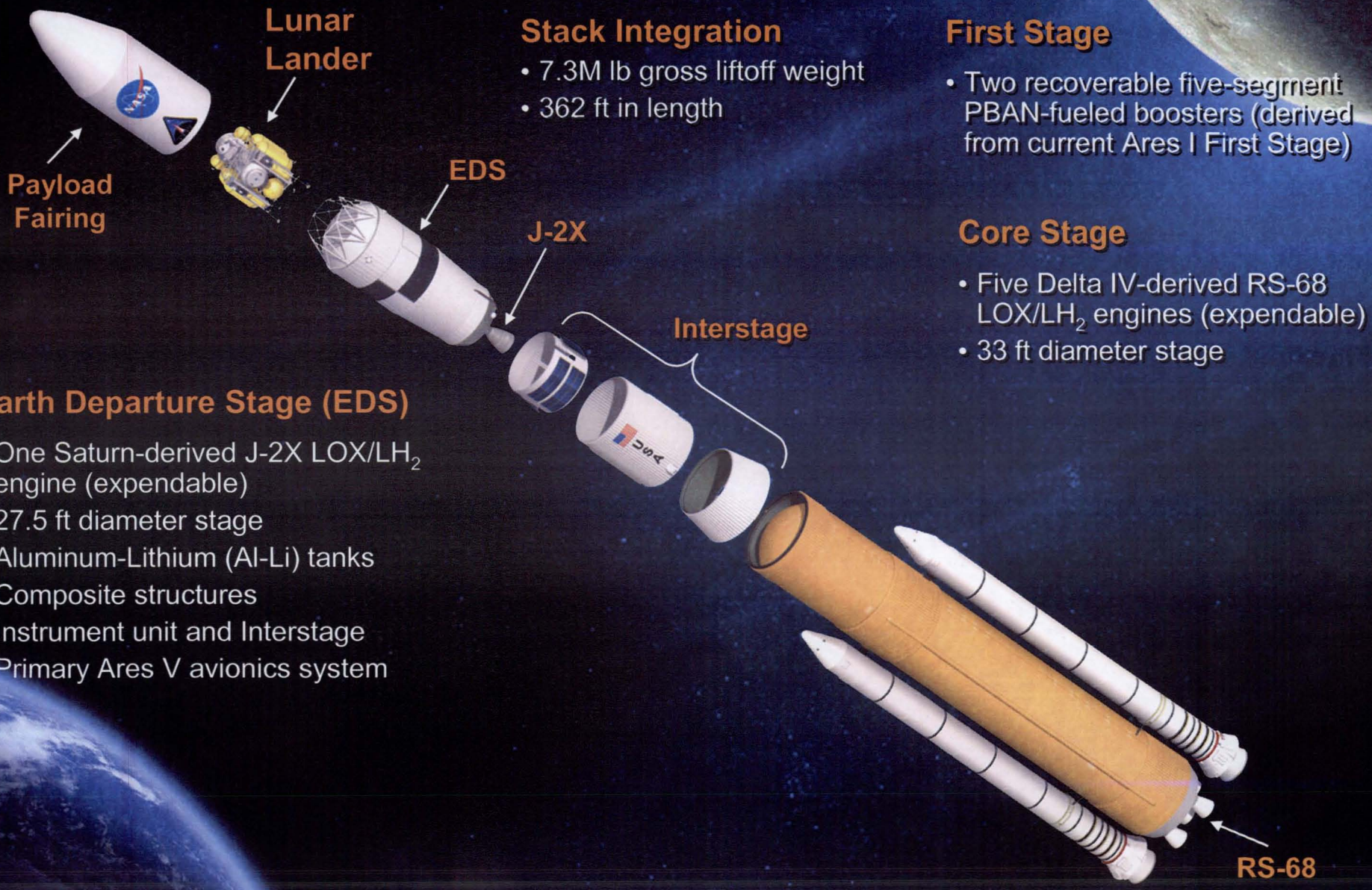
Upper Stage Engine
- Saturn J-2 derived engine (J-2X)
- Expendable
- ***Pratt and Whitney Rocketdyne***

Orion Crew Exploration Vehicle



- Crew Module modeled after Apollo Command Module, but twice the volume
- Transports six crew members to International Space Station or four to the Moon
- Uninhabited while crew descends to the Moon in Lunar Lander
- Can lift away from Ares booster via Launch Abort System in emergencies
- Capable of land or water landing

Ares V Elements



Stack Integration

- 7.3M lb gross liftoff weight
- 362 ft in length

First Stage

- Two recoverable five-segment PBAN-fueled boosters (derived from current Ares I First Stage)

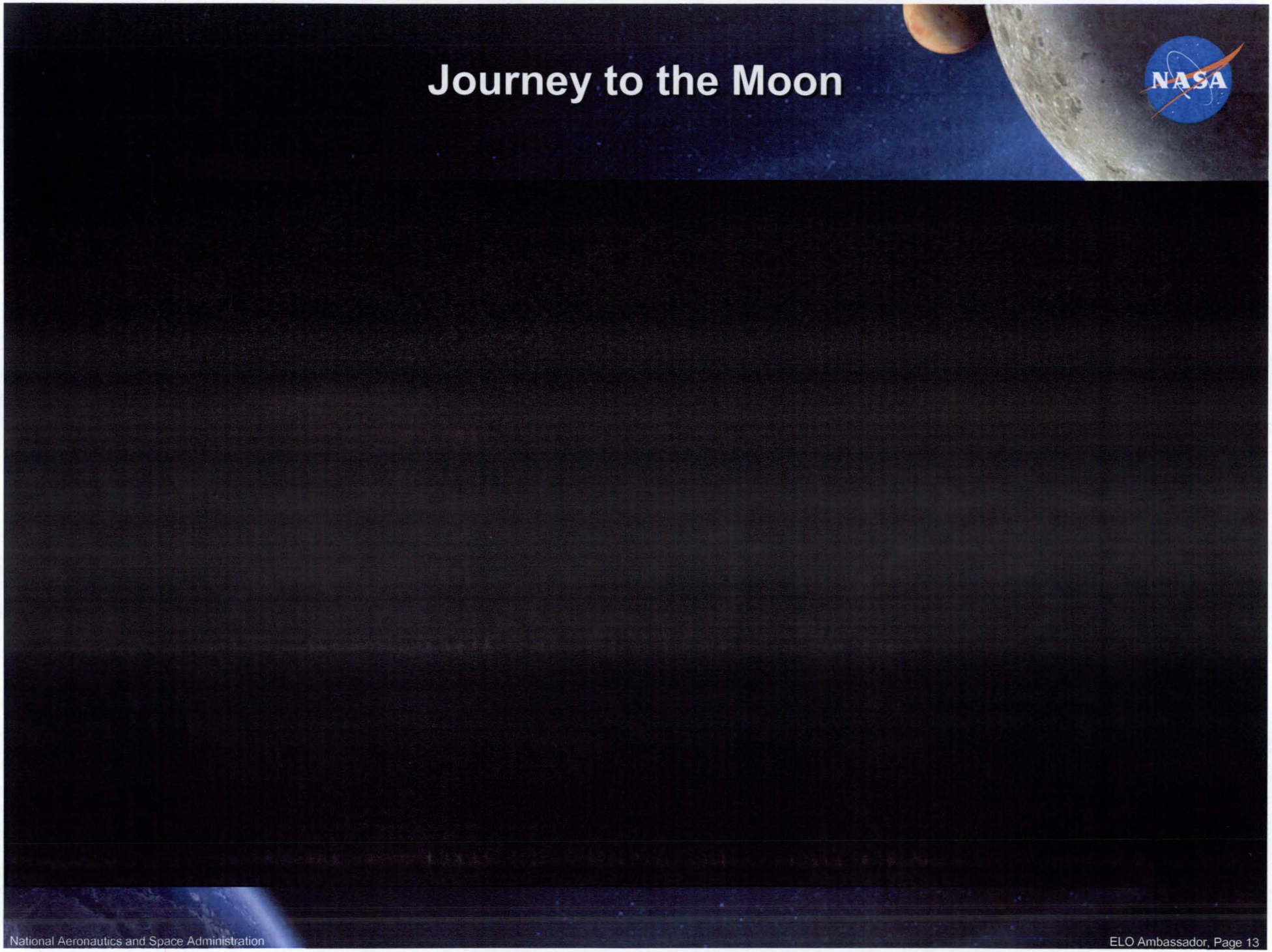
Core Stage

- Five Delta IV-derived RS-68 LOX/LH_2 engines (expendable)
- 33 ft diameter stage

Earth Departure Stage (EDS)

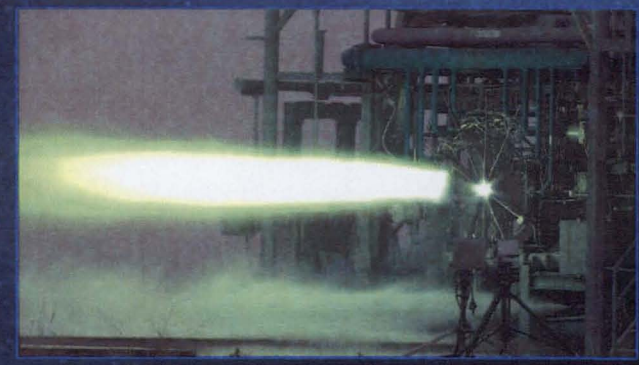
- One Saturn-derived J-2X LOX/LH_2 engine (expendable)
- 27.5 ft diameter stage
- Aluminum-Lithium (Al-Li) tanks
- Composite structures
- Instrument unit and Interstage
- Primary Ares V avionics system

Journey to the Moon



Progress Toward Launch

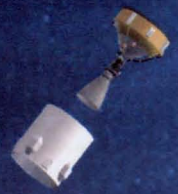
- **Programmatic Milestones**
  - Completed Ares I System Requirements Reviews
  - Contracts awarded for building First Stage, J-2X Engine, and Orion; other Ares I awards in process
  - Ares I System Design Review preparations in progress
  - Ares I-X test flight scheduled for April 2009
- **Technical Accomplishments**
  - First Stage parachute testing and nozzle development
  - J-2X Test Stand to be constructed at the Stennis Space Center
  - J-2X injector testing and powerpack test preparation
  - Upper Stage initial design analysis cycle
  - Ares I-X hardware fabrication



Ares Nationwide Team

ATK Launch Systems

Marshall



Glenn

Goddard

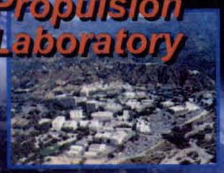
Ames

Dryden

Langley

Pratt and Whitney Rocketdyne

Jet Propulsion Laboratory



Johnson

Michoud Assembly Facility

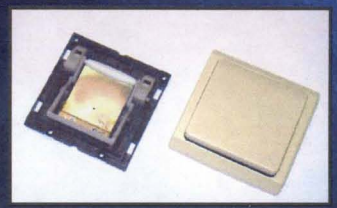
Stennis

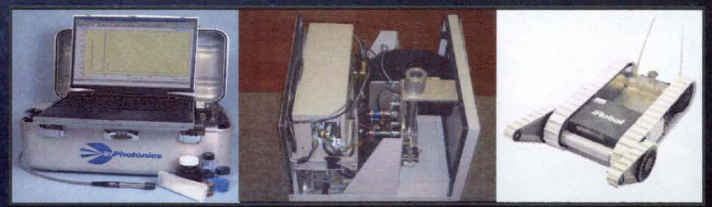
Kennedy

Down-to-Earth Benefits from Space Technologies

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

- **Personal Health**
  - Pain relief from Light-Emitting diode (LED) chips
  - Eye tracker for LASIK surgery
- **Consumer Products**
  - Wireless light switch
  - Remote appliance programmer
- **Environmental**
  - Water Filtration system
  - Environmentally friendly chemical cleanup
  - Real-time aircraft weather forecasting
- **Security**
  - Suspicious material sensor
  - Anthrax sensor
  - Stair-climbing tactical robot





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

Every Dollar Invested in Space is Spent on Earth

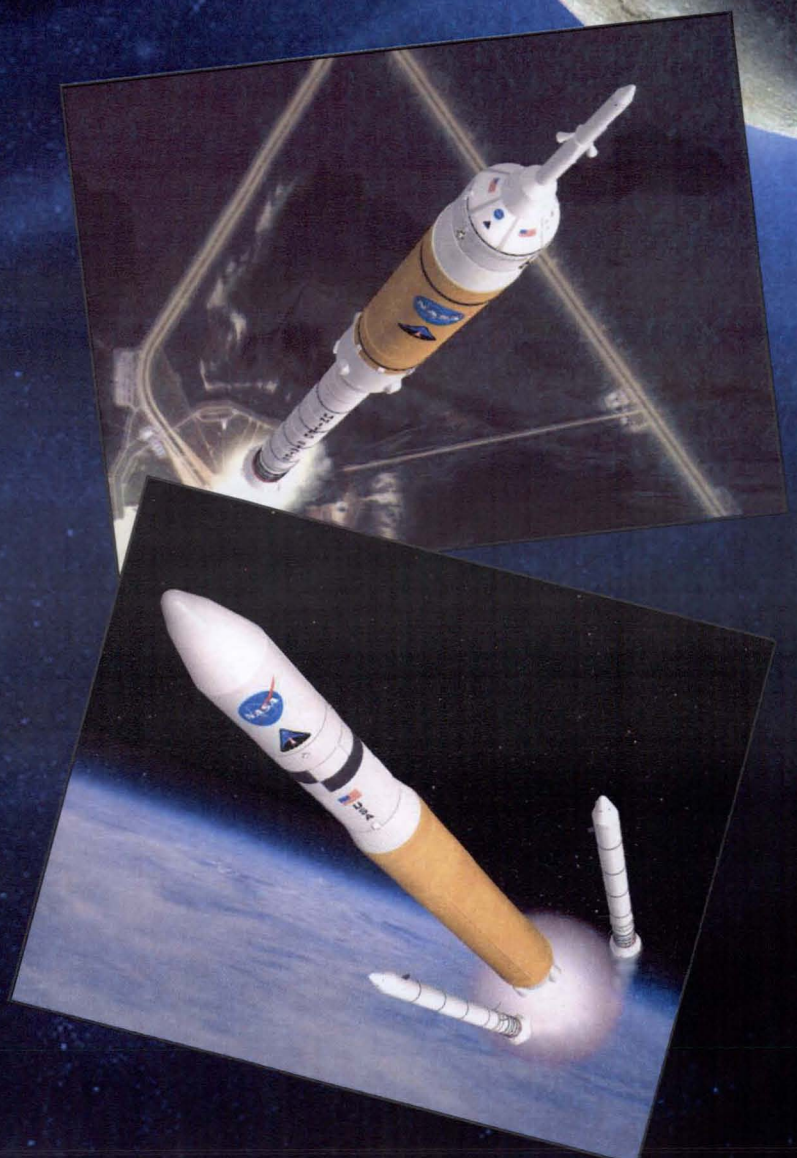
NASA Explores for Answers that Power Our Future

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
- **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
- To reach for Mars and beyond we must first reach for the Moon
- Team is on board and making good progress – the Ares I-X test flight is on schedule for April 2009

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www.nasa.gov/ares
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