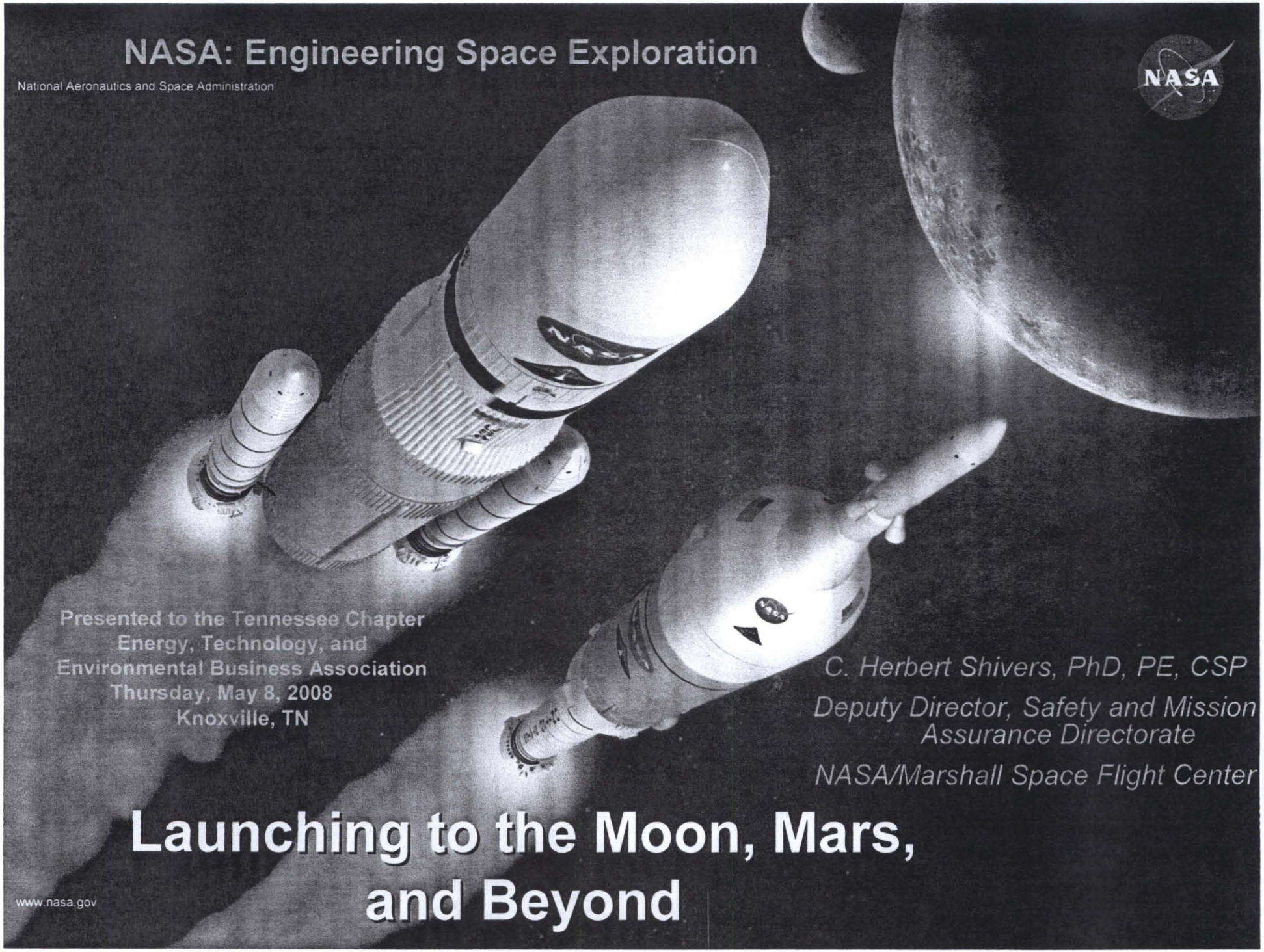
MSFC - 822


NASA: Engineering Space Exploration
National Aeronautics and Space Administration
NASA
Presented to the Tennessee Chapter
Energy, Technology, and
Environmental Business Association
Thursday, May 8, 2008
Knoxville, TN
C. Herbert Shivers, PhD, PE, CSP
Deputy Director, Safety and Mission Assurance Directorate
NASA/Marshall Space Flight Center
Launching to the Moon, Mars, and Beyond
www.nasa.gov

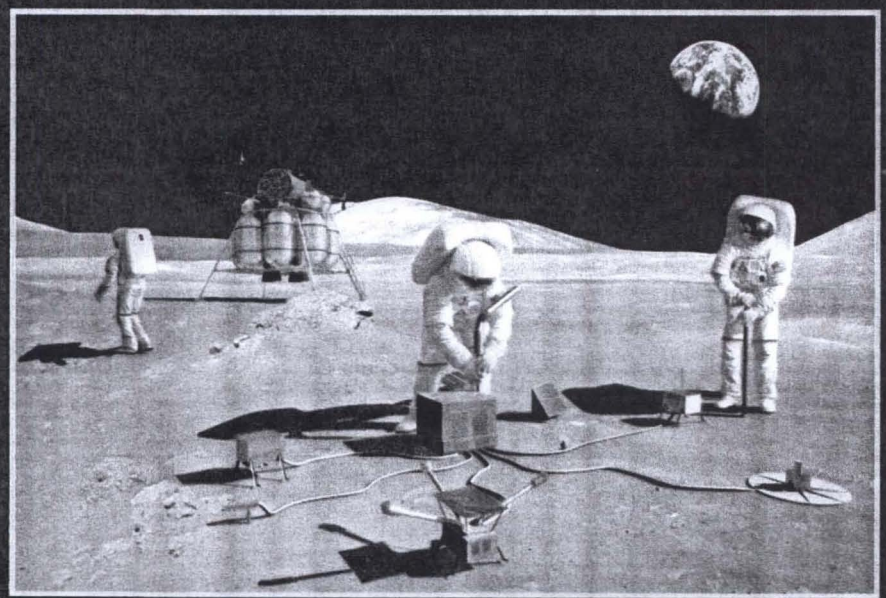
Today's Journey

- What is NASA's mission?
- Why do we explore?
- What is our timeline?
- Why the Moon first?
- What will the vehicles look like?
- What progress have we made?
- Who will be doing the work?
- What are the benefits of space exploration?

MSFC LEGACY

What is NASA's Mission?

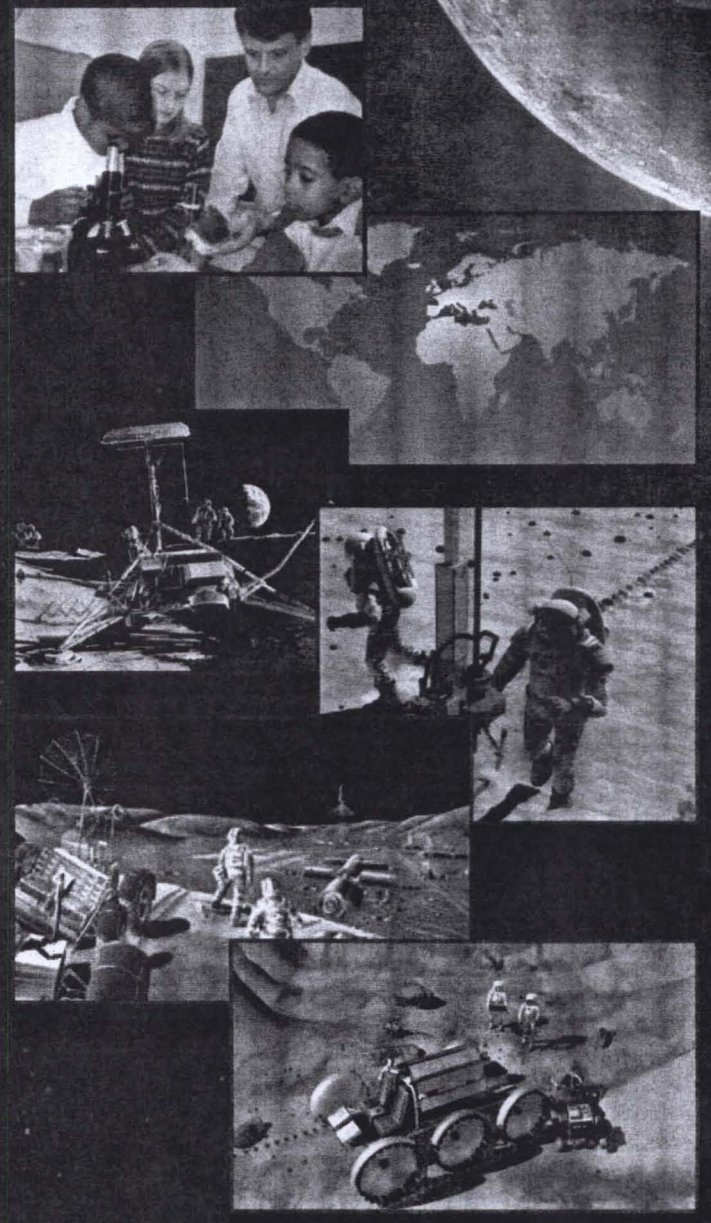
- Safely fly the Space Shuttle until 2010
- Complete the International Space Station
- Develop a balanced program of science, exploration, and aeronautics
- Develop and fly the Orion Crew Exploration Vehicle (CEV)
- Return to the Moon no later than 2020
- Promote international and commercial participation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



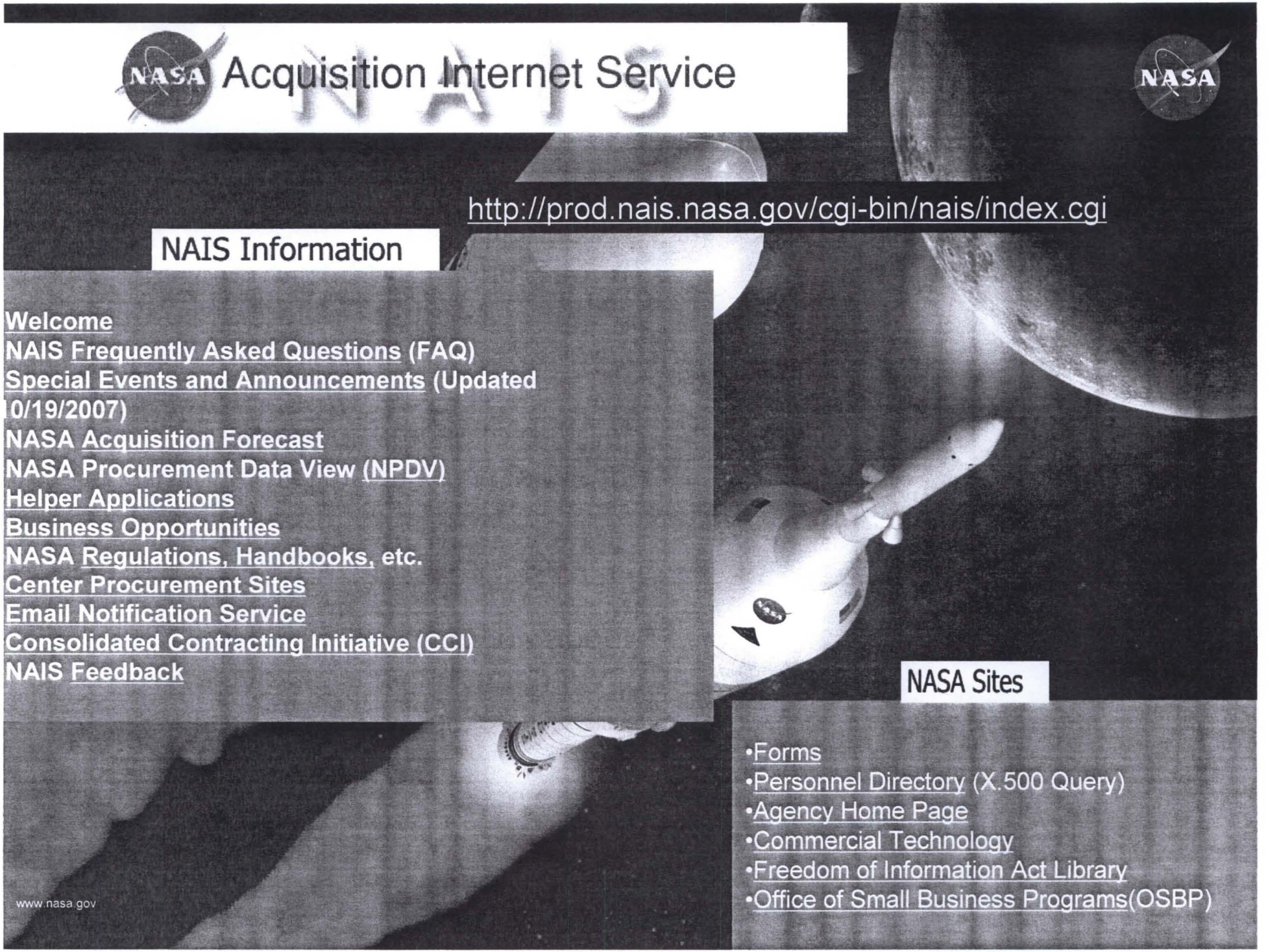
"The next steps in returning to the Moon and moving onward to Mars, the near-Earth asteroids, and beyond, are crucial in deciding the course of future space exploration. We must understand that these steps are incremental, cumulative, and incredibly powerful in their ultimate effect."

– NASA Administrator Michael Griffin
October 24, 2006

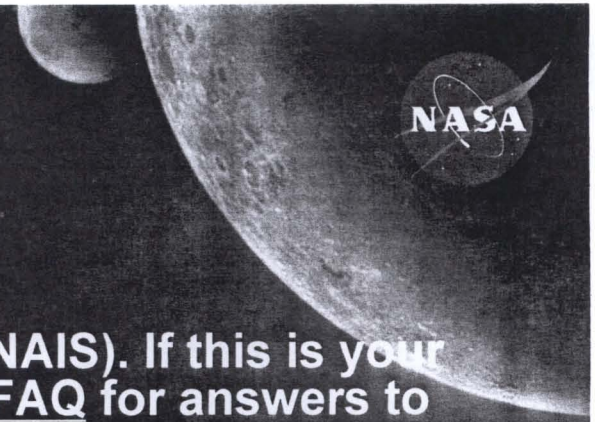
Why Do We Explore?



- **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


Acquisition Internet Service
NAIS
NASA
http://prod.nais.nasa.gov/cgi-bin/nais/index.cgi
NAIS Information
Welcome
NAIS Frequently Asked Questions (FAQ)
Special Events and Announcements (Updated 10/19/2007)
NASA Acquisition Forecast
NASA Procurement Data View (NPDV)
Helper Applications
Business Opportunities
NASA Regulations, Handbooks, etc.
Center Procurement Sites
Email Notification Service
Consolidated Contracting Initiative (CCI)
NAIS Feedback
NASA Sites
•Forms
•Personnel Directory (X.500 Query)
•Agency Home Page
•Commercial Technology
•Freedom of Information Act Library
•Office of Small Business Programs(OSBP)
www.nasa.gov

NAIS Welcome Page



- Welcome to the NASA Acquisition Internet Service (NAIS). If this is your first time visiting, you may want to look at the NAIS FAQ for answers to frequently asked questions. After you've browsed the NAIS pages, fill out the NAIS Feedback form so we can better serve your needs.
- NAIS Business Opportunities are posted by Date and by Classification. You can Personalize the Business Opportunities page to show you just what interests you. You can also use the NAIS Search to find Business Opportunities by date, classification, center, or key word. If you don't want to visit these pages every day looking for new business opportunities, then the E-Mail Notification Service is for you! Choose the Center and/or Classification Codes you want, and you will receive an electronic mail message every time NASA releases a synopsis, solicitation, amendment, or other document in the categories you've selected.
- NASA's Procurement Reference Library provides tools such as a Search of the Federal Acquisition Regulations (FAR) and the NASA FAR Supplement (NFS). Visit Center Procurement Sites to view Center-specific procurement information such as Center Points of Contact and small business information. The Tabs at the top of each NAIS page points you to our most popular links. Use them to move quickly from one area of NAIS to the other. If you have any specific questions about NAIS, please click the Technical Support link at the bottom of the page.

Annual Procurement Reports

- NASA Annual Procurement Report for Fiscal Year 2007

Fiscal Year 2007 - NASA's procurements totaled $14,363.3 million. The number of procurement actions totaled 36,251.

TRENDS IN PROCUREMENT OBLIGATIONS VS.TOTAL NASA OBLIGATIONS *
FISCAL YEARS 2003 - 2007
(MILLIONS OF DOLLARS)

Fiscal Year	Total NASA Obligations	Procurement Obligations Amount	% of Total Obligations
2007	$17,651.4	$14,363.3	81.4%
2006	17,773.4	15,846.3	89.2%
2005	18,069.1	15,342.4	84.9%
2004	16,049.9	13,472.4	83.9%
2003	15,657.7	13,273.7	84.8%

*Total NASA obligations include salaries, benefits and travel of NASA employees, as well as 121,730 credit card purchases in the amount of $80.5 million.

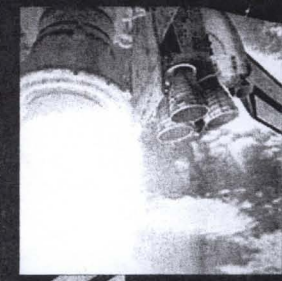
Michoud Assembly Facility
Manufacturing Support and Facility Operations Contract

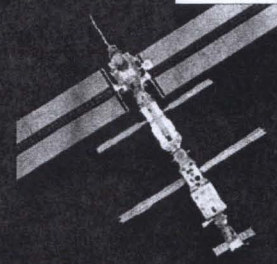
- **Status Update - April 5, 2008**

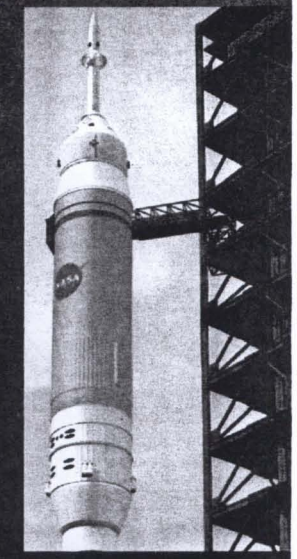
- **Preparation of solicitation documents for the Michoud Assembly Facility (MAF) Manufacturing Support and Facility Operations Contract (MSFOC) continues and the following information is provided to assist industry in planning for the upcoming procurement.**
  - A) Release of the MSFOC Draft Request for Proposal (DRFP) is scheduled for no earlier than April 10, 2008.
  - B) A pre-solicitation conference is scheduled to begin the morning of Monday, April 21, 2008, and conclude the afternoon of Wednesday, April 23, 2008. The pre-solicitation conference will be held at Michoud Assembly Facility in New Orleans, LA. The details of the pre-solicitation conference including agenda, registration, and MAF access will be provided with the release of the DRFP.
- Any questions concerning this status notice should be directed to Mark A. York, Office of Procurement, PS43, Marshall Space Flight Center, AL 35812. The phone number is 256-544-4028.

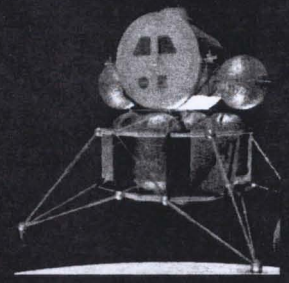
MAJOR NASA PROGRAMS

- **Space Shuttle**
- **International Space Station**
- **Constellation Program (Future)**
  - Crew Launch Vehicle
  - Cargo Launch Vehicle
  - Crew Exploration Vehicle
  - Crew Service Module
  - Earth Departure Stage
  - Altair Lunar Lander
  - Mars Transfer Vehicle
  - Mars Descent/Ascent Vehicle

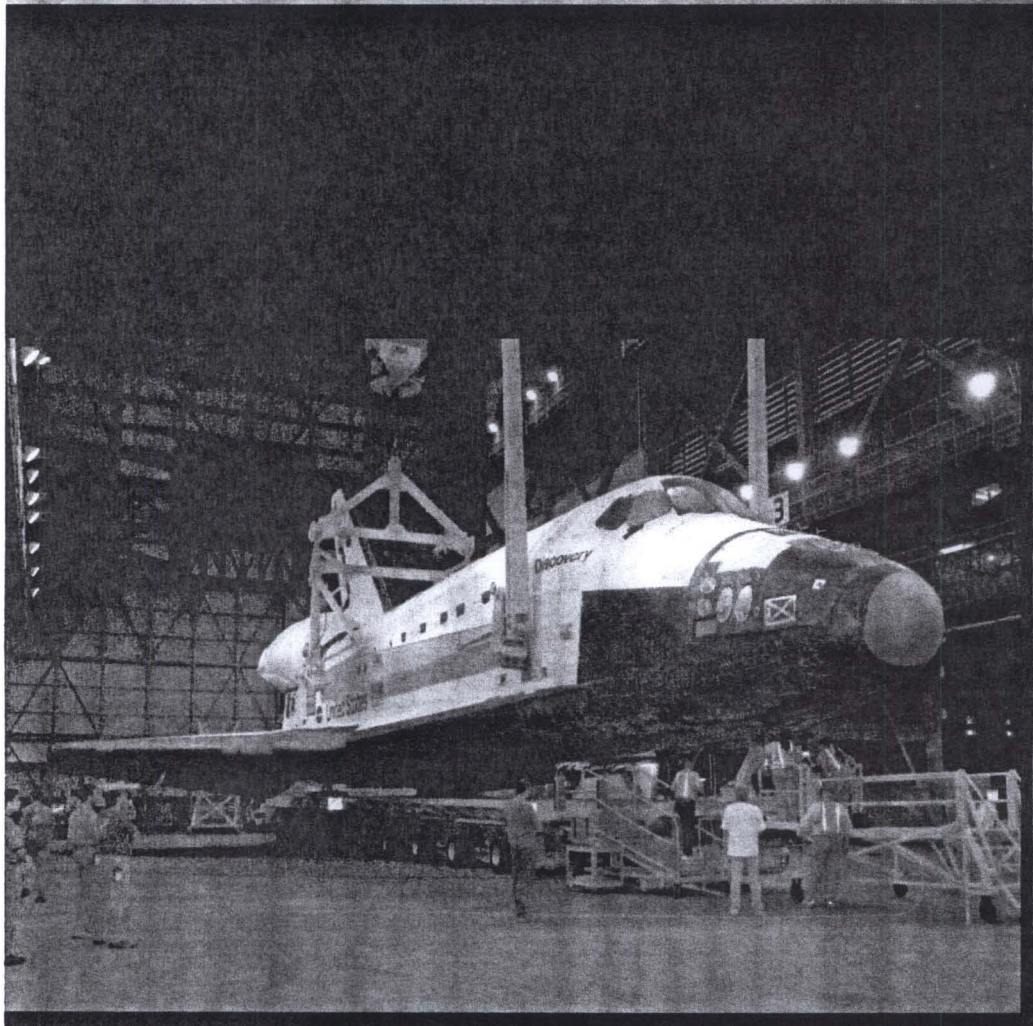


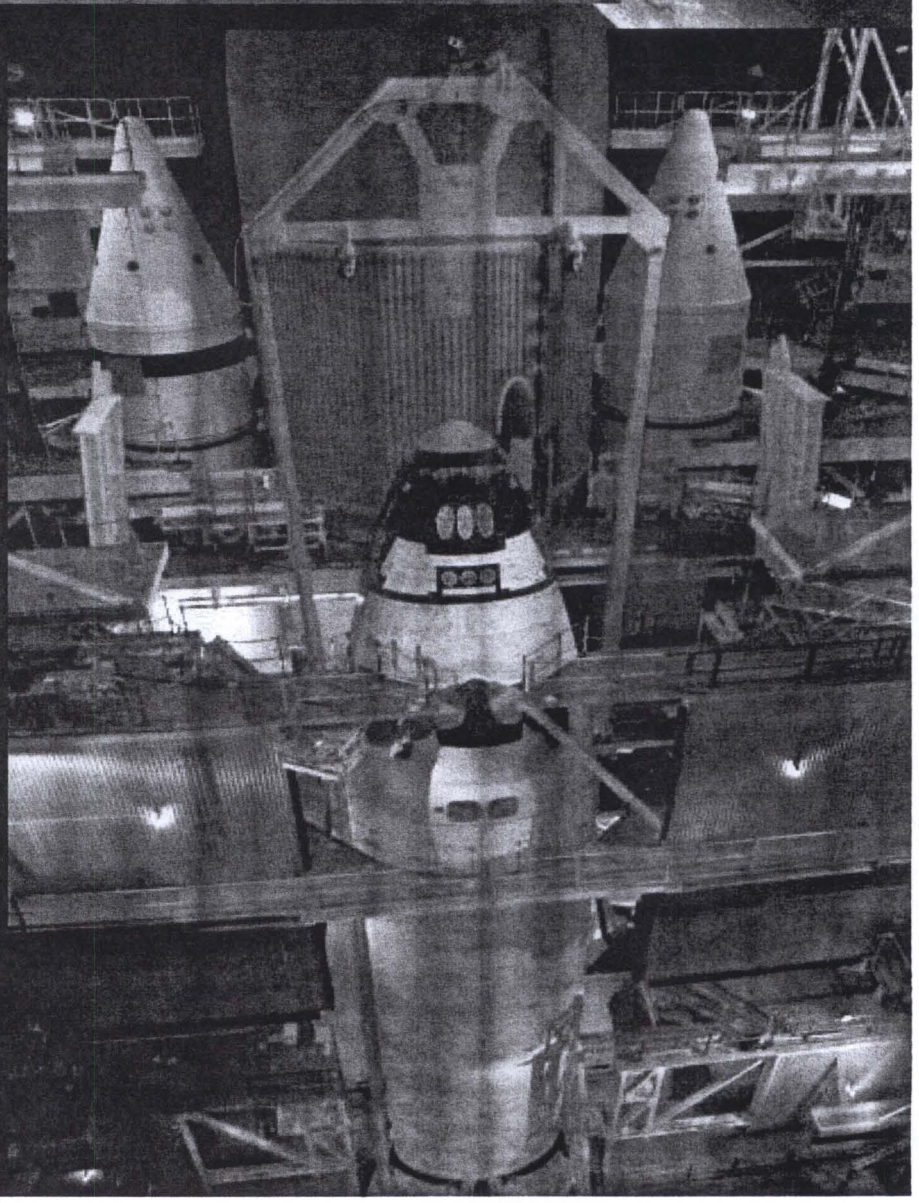


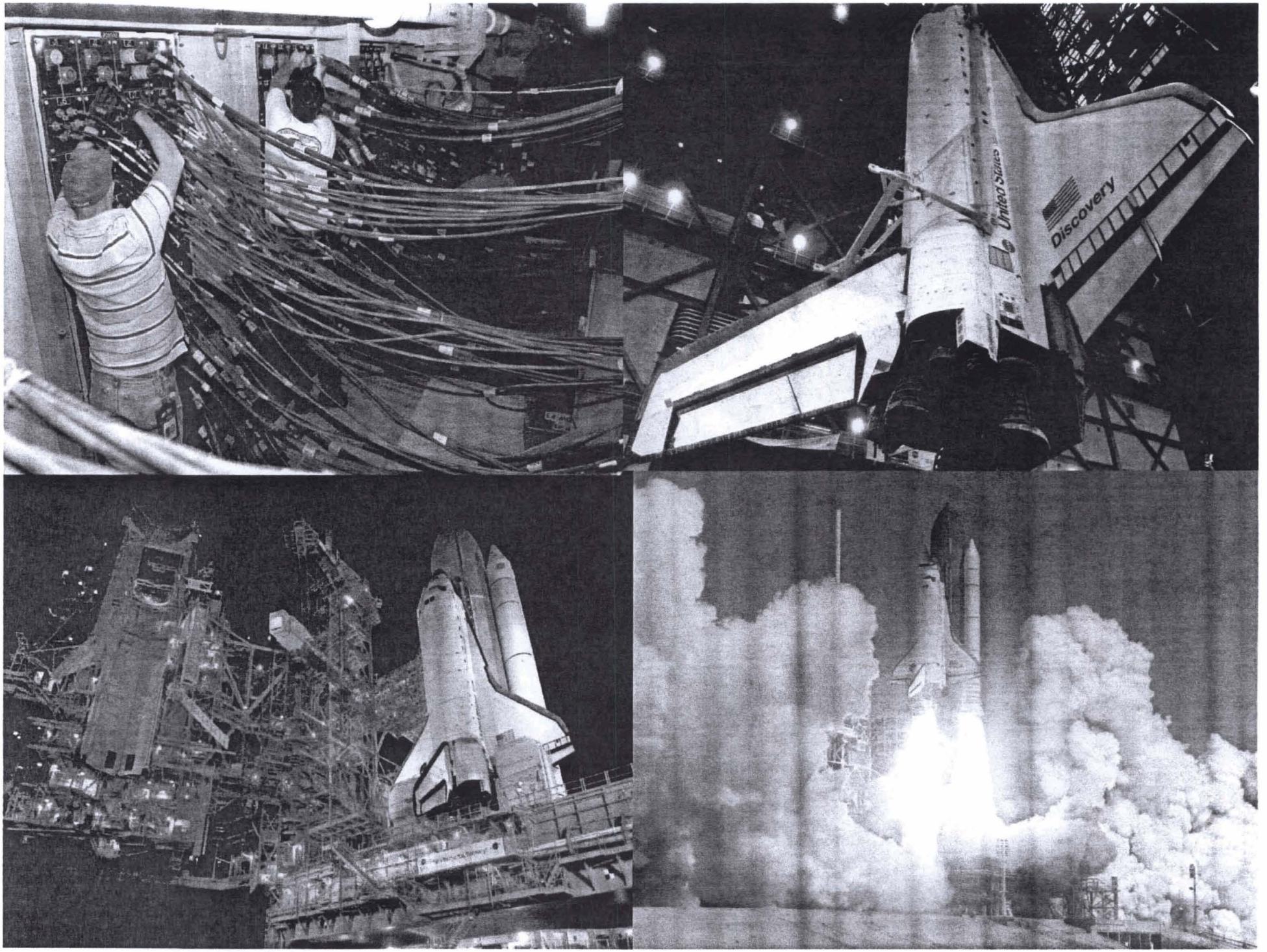




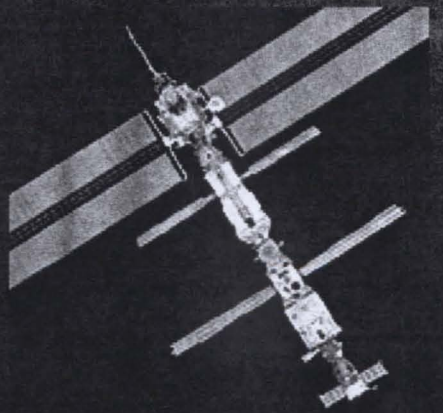
Shuttle Processing

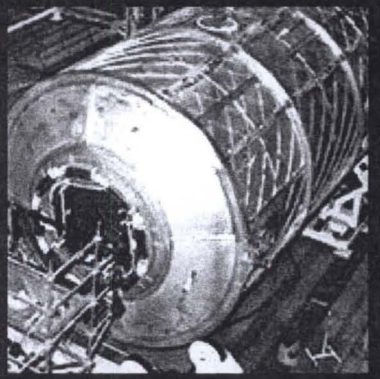




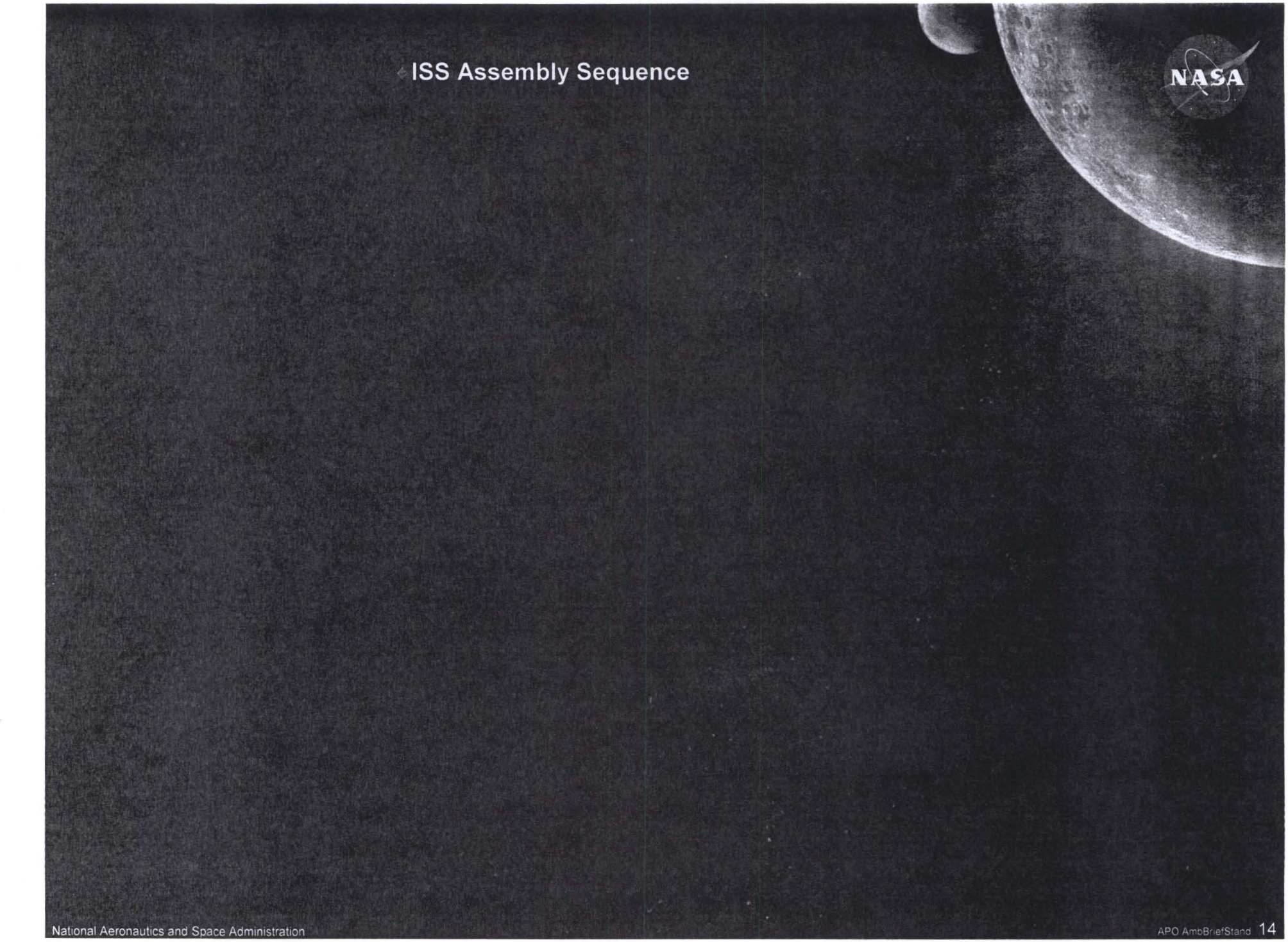

United States
Discovery

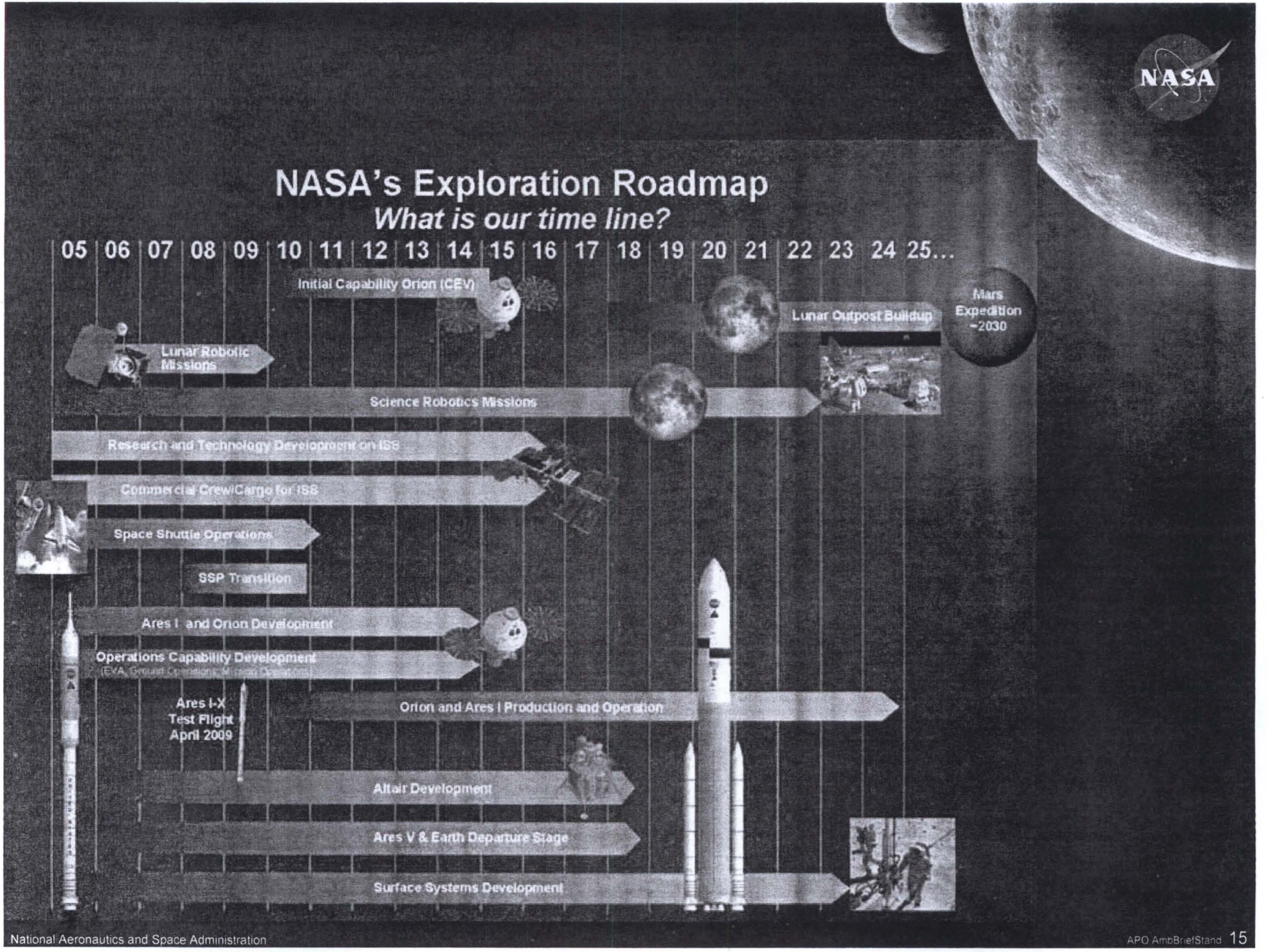
International Space Station





ISS Assembly Sequence

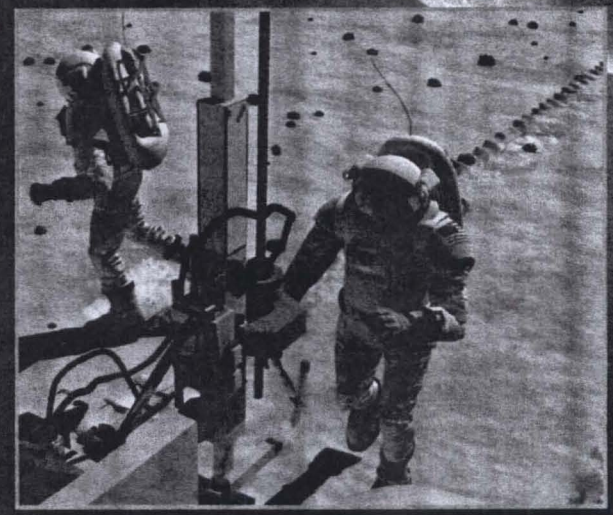


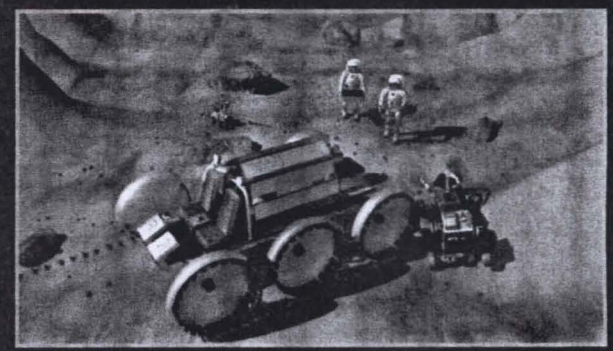

NASA
NASA's Exploration Roadmap
What is our time line?
05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25...
Initial Capability Orion (CEV)
Lunar Outpost Buildup
Mars Expedition ~2030
Lunar Robotic Missions
Science Robotics Missions
Research and Technology Development on ISS
Commercial Crew/Cargo for ISS
Space Shuttle Operations
SSP Transition
Ares I and Orion Development
Operations Capability Development
(EVA, Ground Operations, Mission Operations)
Ares I-X Test Flight April 2009
Orion and Ares I Production and Operation
Altair Development
Ares V & Earth Departure Stage
Surface Systems Development

The Moon

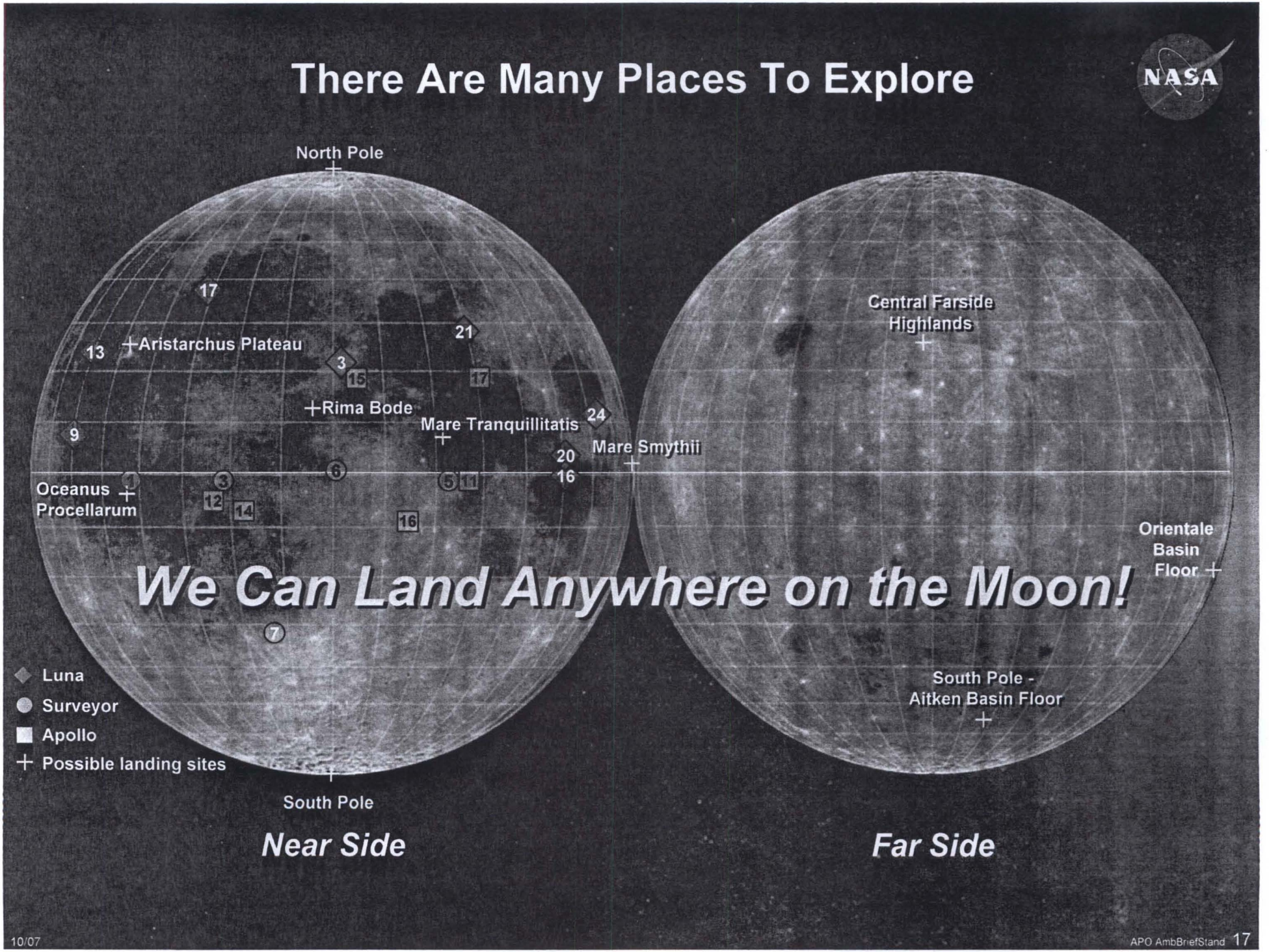
Lunar missions allow us to:

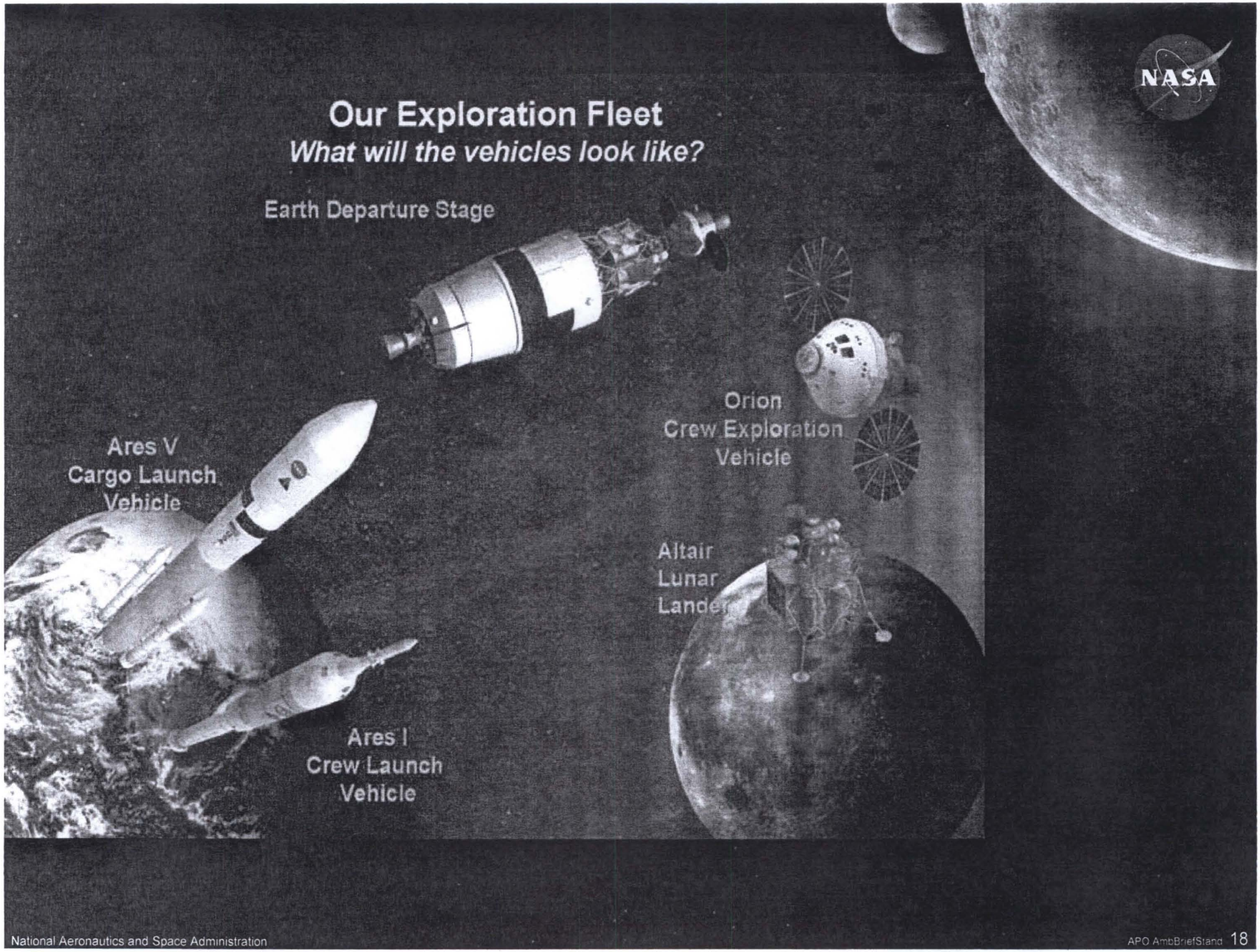
- Gain exploration experience
  - Space no longer a short-term destination
  - Will test human support systems
  - Use Moon to prove ability to build and repair long-duration space assets
- Develop exploration technologies
  - Launch and exploration vehicles
  - *In-situ* resource utilization
  - Power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



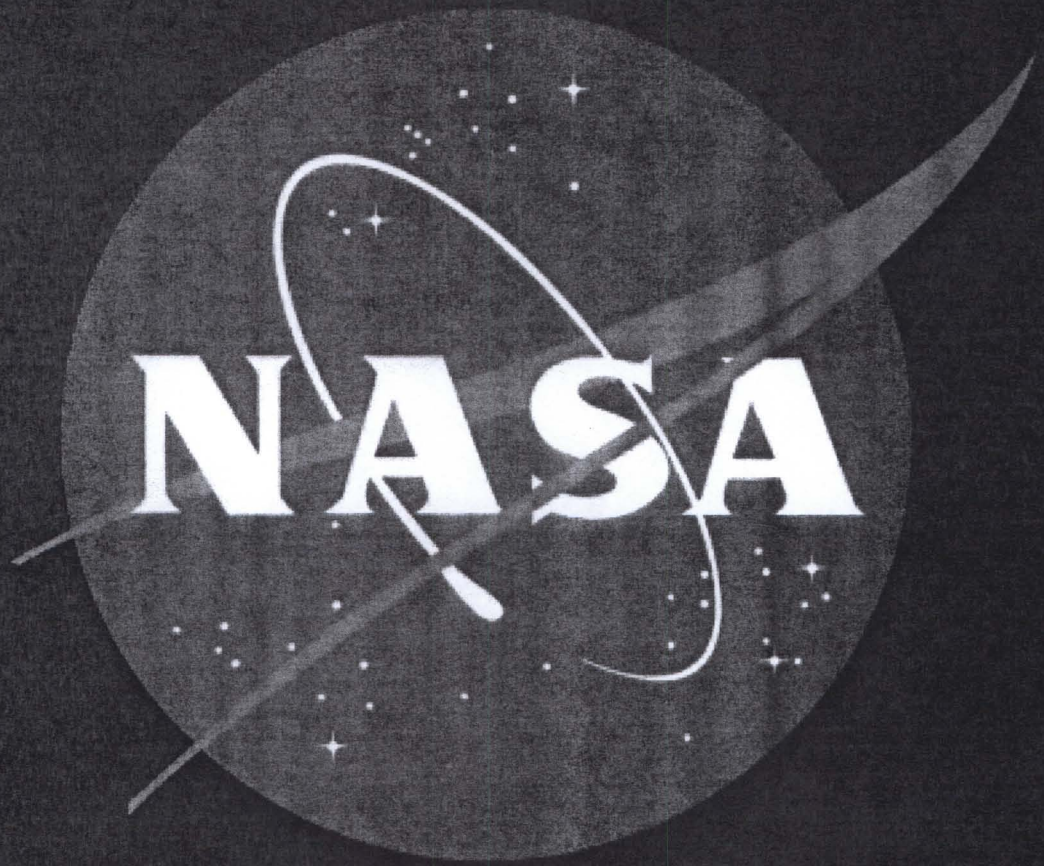


Next Step in Fulfilling Our Destiny as Explorers


There Are Many Places To Explore
NASA
North Pole
17
13
Aristarchus Plateau
21
3
15
17
Rima Bode
Mare Tranquillitatis
24
9
20
16
Mare Smythii
Oceanus Procellarum
1
3
6
5
11
12
14
16
Central Farside Highlands
Orientale Basin Floor
We Can Land Anywhere on the Moon!
7
Luna
Surveyor
Apollo
Possible landing sites
South Pole - Aitken Basin Floor
South Pole
Near Side
Far Side

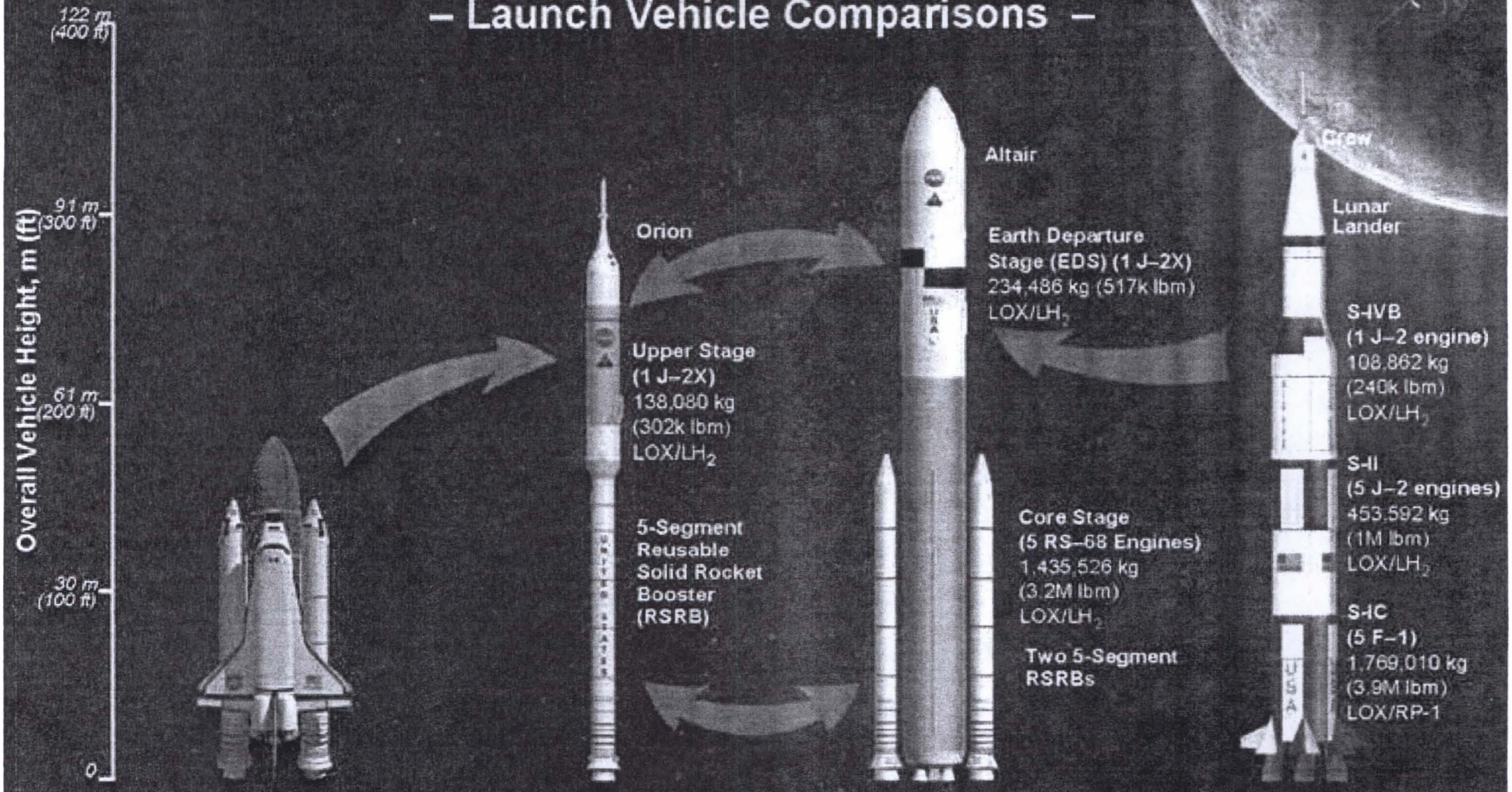

Our Exploration Fleet
What will the vehicles look like?
Earth Departure Stage
Orion
Crew Exploration
Vehicle
Ares V
Cargo Launch
Vehicle
Altair
Lunar
Lander
Ares I
Crew Launch
Vehicle

Journey to the Moon



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

NASA



Space Shuttle
Height: 56.1 m (184.2 ft)
Gross Liftoff Mass:
2,041,166 kg (4.5M lbm)

25 MT (55k lbm)
to Low Earth Orbit (LEO)

Ares I
Height: 99.1 m (325 ft)
Gross Liftoff Mass:
927,114 kg (2.0M lbm)

25.6 MT (56.5k lbm)
to LEO

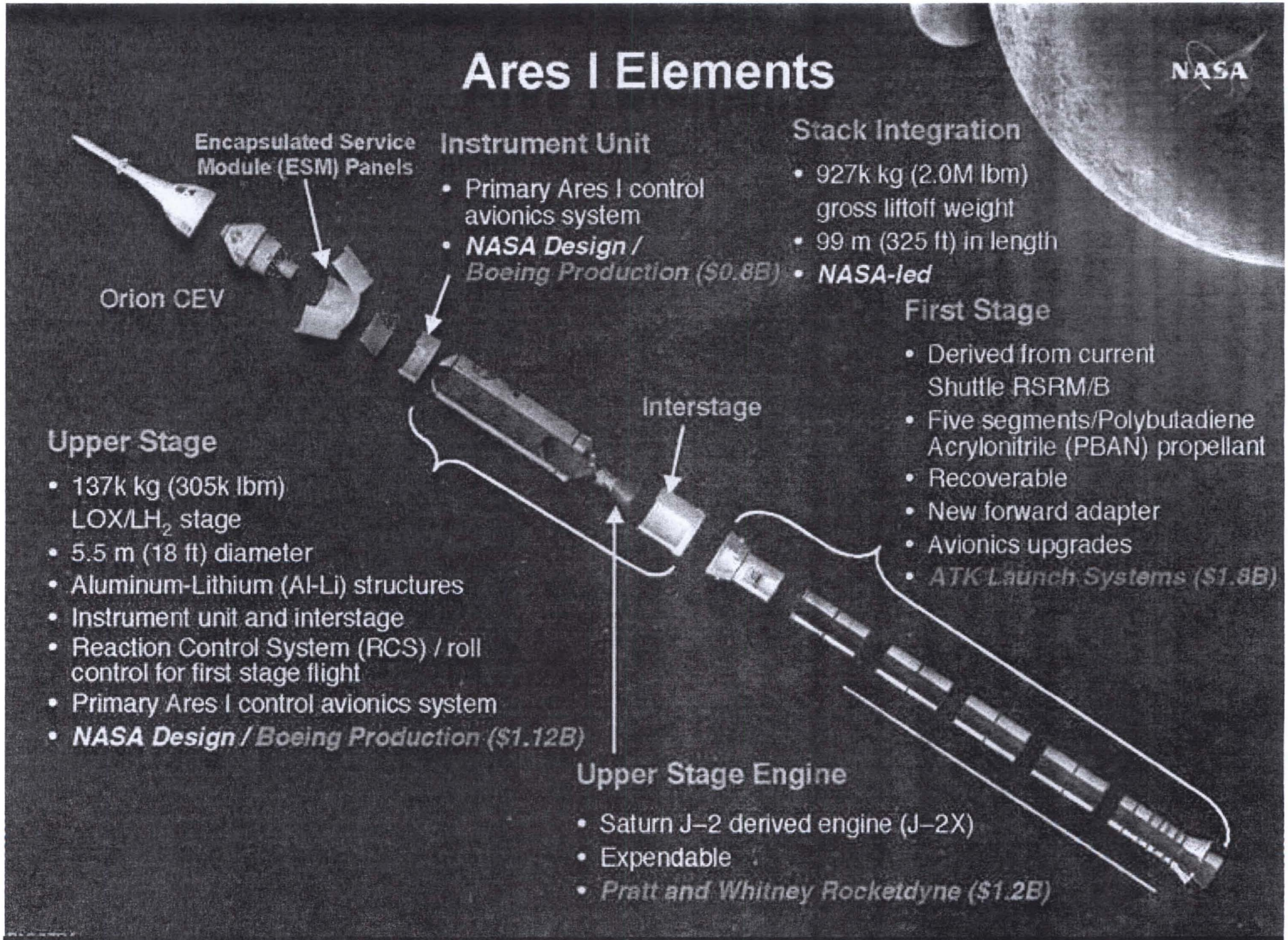
Ares V
Height: 109.7 m (360.5 ft)
Gross Liftoff Mass:
3,374,875 kg (7.4M lbm)

63.6 MT (140.2k lbm) to TLI (with Ares I)
55.9 MT (123k lbm) to Direct TLI
~143.4 MT (316k lbm) to LEO

Saturn V
Height: 110.9 m (364 ft)
Gross Liftoff Mass:
2,948,350 kg (6.5M lbm)

45 MT (99k lbm) to TLI
119 MT (262k lbm) to LEO

Ares I Elements



Instrument Unit

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

Stack Integration

- 927k kg (2.0M lbm) gross liftoff weight
- 99 m (325 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 ($1.8B)***

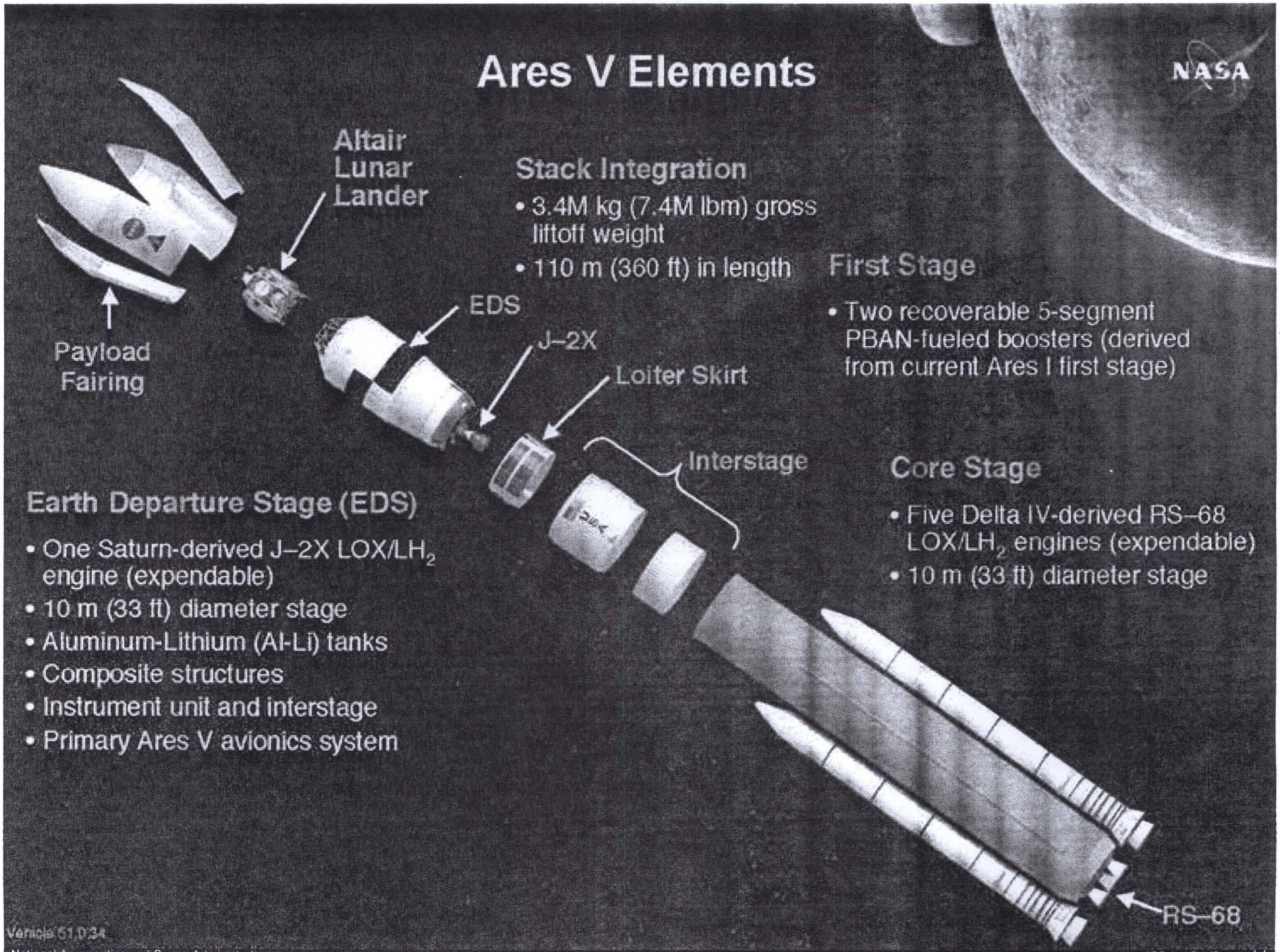
Upper Stage

- 137k kg (305k lbm) LOX/LH_2 stage
- 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 ($1.12B)***

Upper Stage Engine

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

Ares V Elements



Stack Integration

- 3.4M kg (7.4M lbm) gross liftoff weight
- 110 m (360 ft) in length

First Stage

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

Core Stage

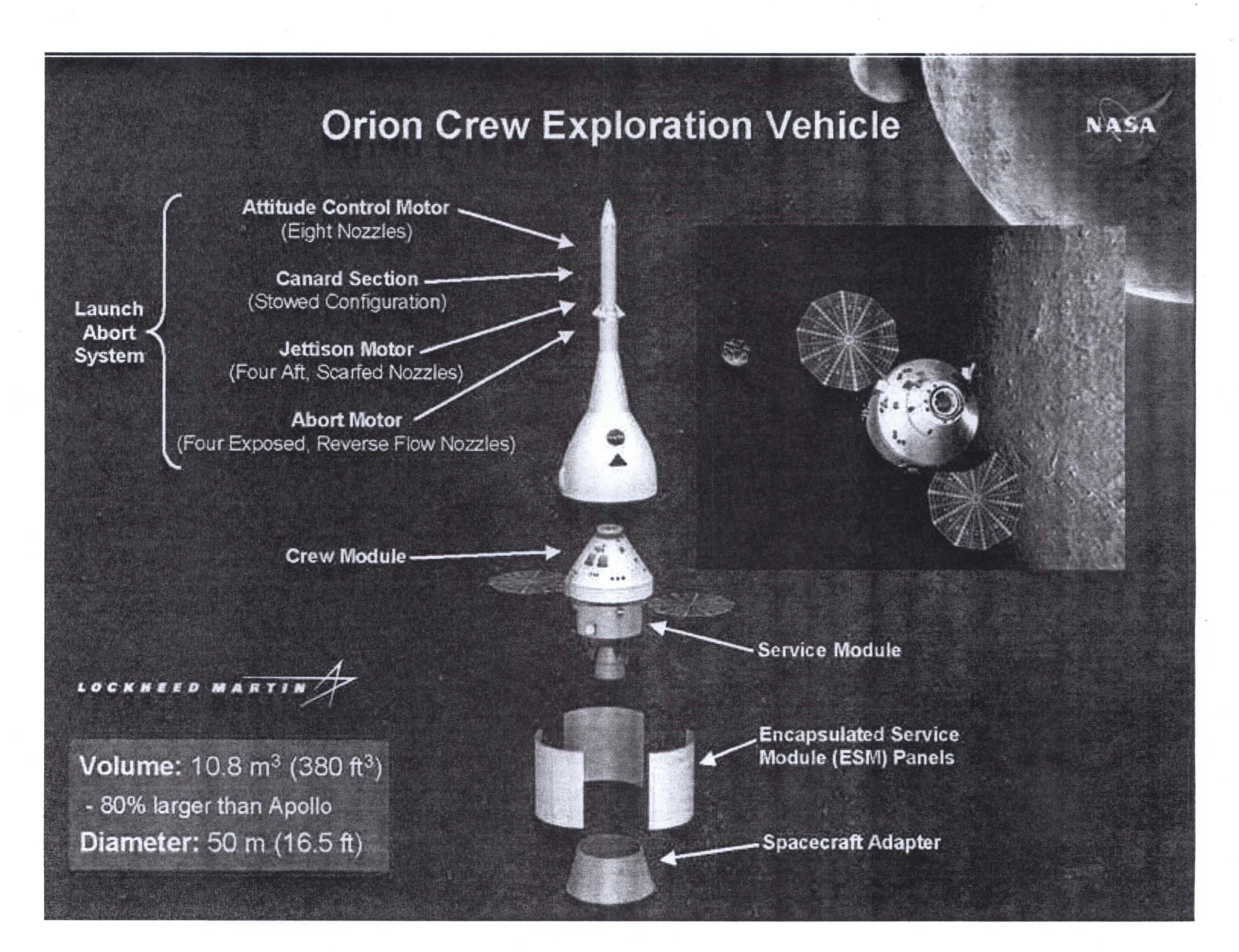
- Five Delta IV-derived RS–68 LOX/LH_2 engines (expendable)
- 10 m (33 ft) diameter stage

Earth Departure Stage (EDS)

- One Saturn-derived J–2X LOX/LH_2 engine (expendable)
- 10 m (33 ft) diameter stage
- Aluminum-Lithium (Al-Li) tanks
- Composite structures
- Instrument unit and interstage
- Primary Ares V avionics system

Orion Crew Exploration Vehicle

NASA



LOCKHEED MARTIN

Volume: 10.8 m^3 (380 ft^3)

- 80% larger than Apollo

Diameter: 50 m (16.5 ft)

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

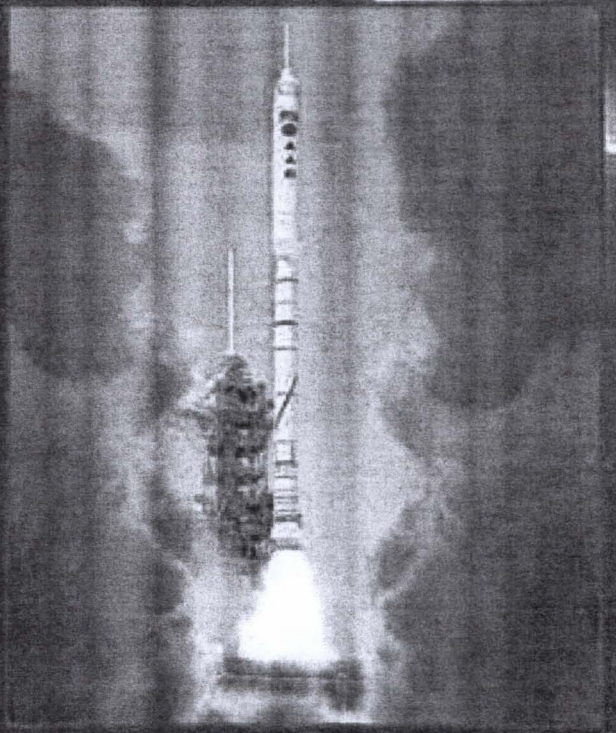
Ares Progress Recap
2006 - 2007

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

Ares I–X Test Flight

NASA

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



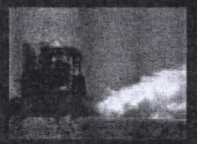
- **Performance Data:**

	Ares I–X	Ares I
First Stage Max. Thrust (vacuum):	14.1M N (3.13M lbf)	15.8M N (3.5M lbf)
Max. Speed:	Mach 4.7	Mach 5.84
Staging Altitude:	39,624 m (130,000 ft)	57,453 m (188,493 ft)
Liftoff Weight:	834k kg (1.8M lbm)	927k kg (2.0M lbm)
Length:	99.1 m (327 ft)	99 m (325 ft)
Max. Acceleration:	2.46 g	3.79 g

Ares Nationwide Team

Who will be doing the work?

ATK Launch Systems



Marshall

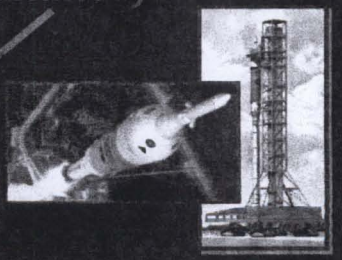
Glenn

Ames

Langley

Pratt & Whitney Rocketdyne

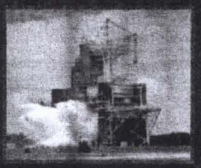
Kennedy



Johnson

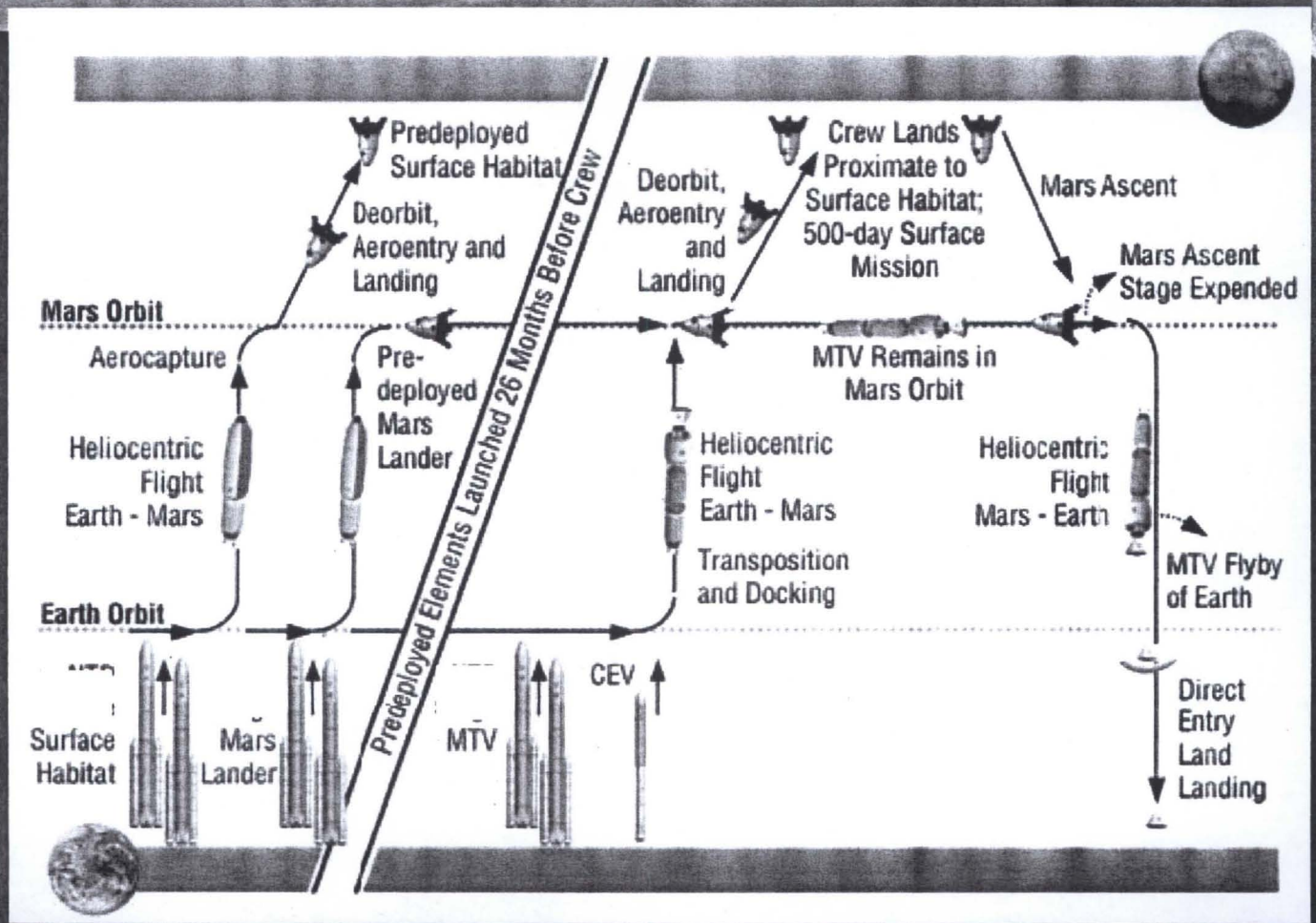
Michoud Assembly Facility

Stennis



Boeing

Concept - MARS Mission

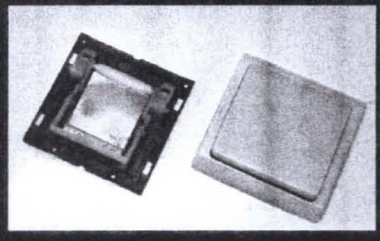


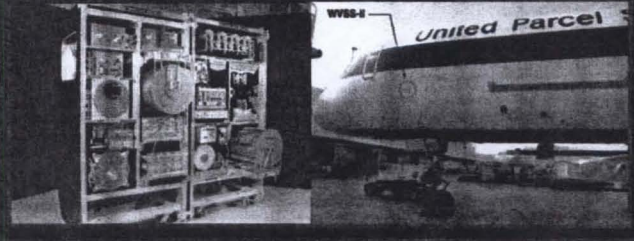
Transfer to and from Mars in about 6 months – Mars surface stay about 18 months. Each human mission to Mars is comprised of three vehicle sets, two cargo vehicles, and one round-trip piloted vehicle. Planned 2.5-year mission

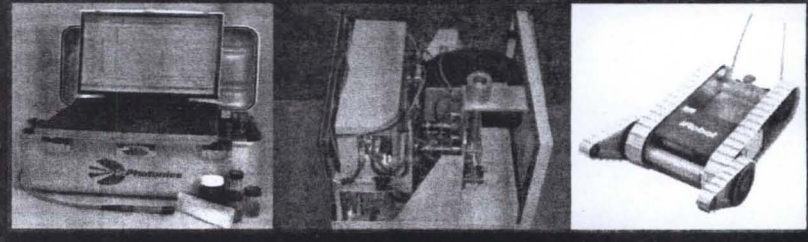
Down-to-Earth Benefits from the Space Economy

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

- **Personal Health**
  - Eye tracker for LASIK surgery
  - Breast biopsy system
  - 3D Imaging for surgery
- **Consumer Products**
  - Wireless light switch
  - Remote appliance programmer
  - Global Positioning Systems (GPS)
- **Environmental**
  - Water Filtration system
  - Environmentally friendly chemical cleanup
- **Security**
  - Stair-climbing tactical robot
  - Crime scene video enhancement







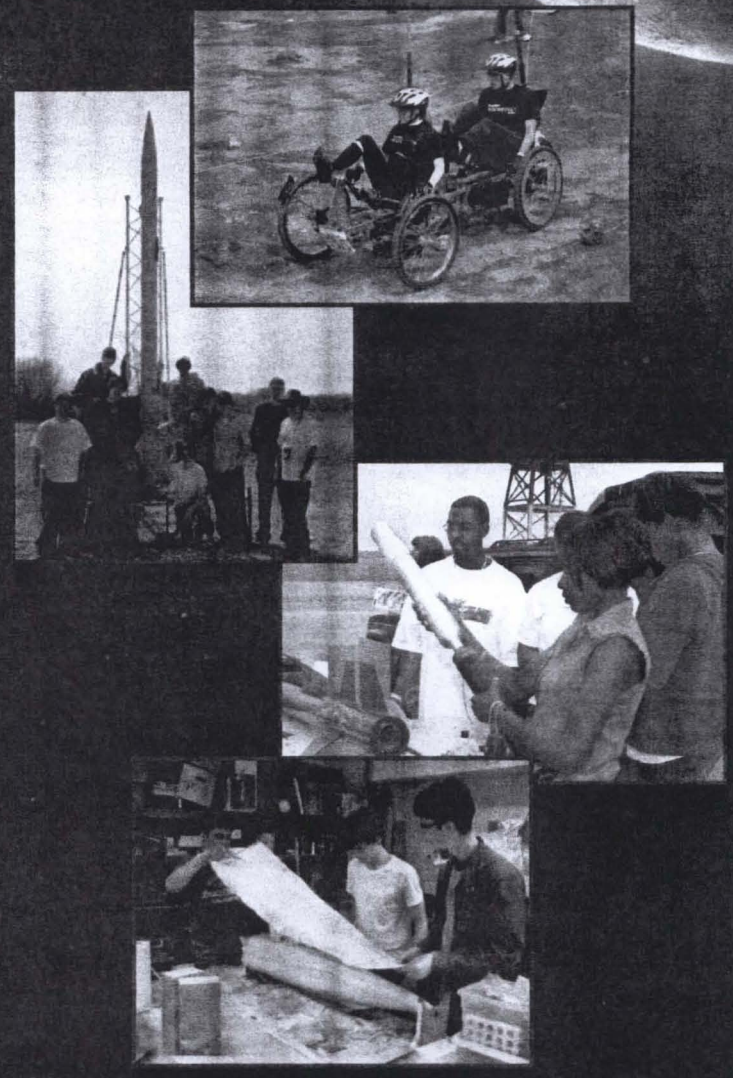
For more information see
http://technology.jsc.nasa.gov

Every Dollar Invested in Space is Spent on Earth

NASA Explores for Answers that Power Our Future

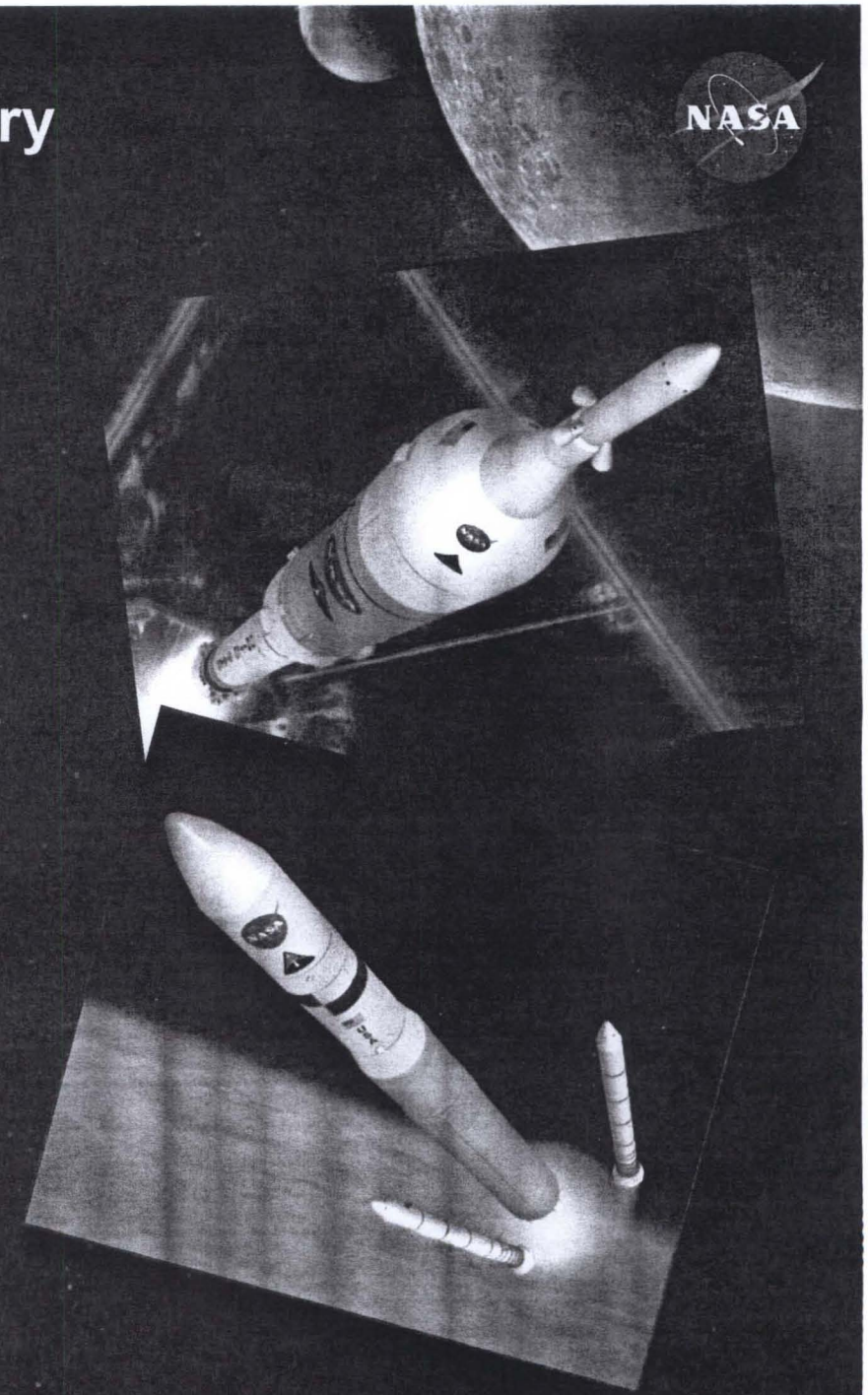
NASA powers inspiration that encourages future generations to explore, learn, and build a better future

- **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
- **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 on board and making good progress – the Ares I-X test flight is on schedule for April 2009.



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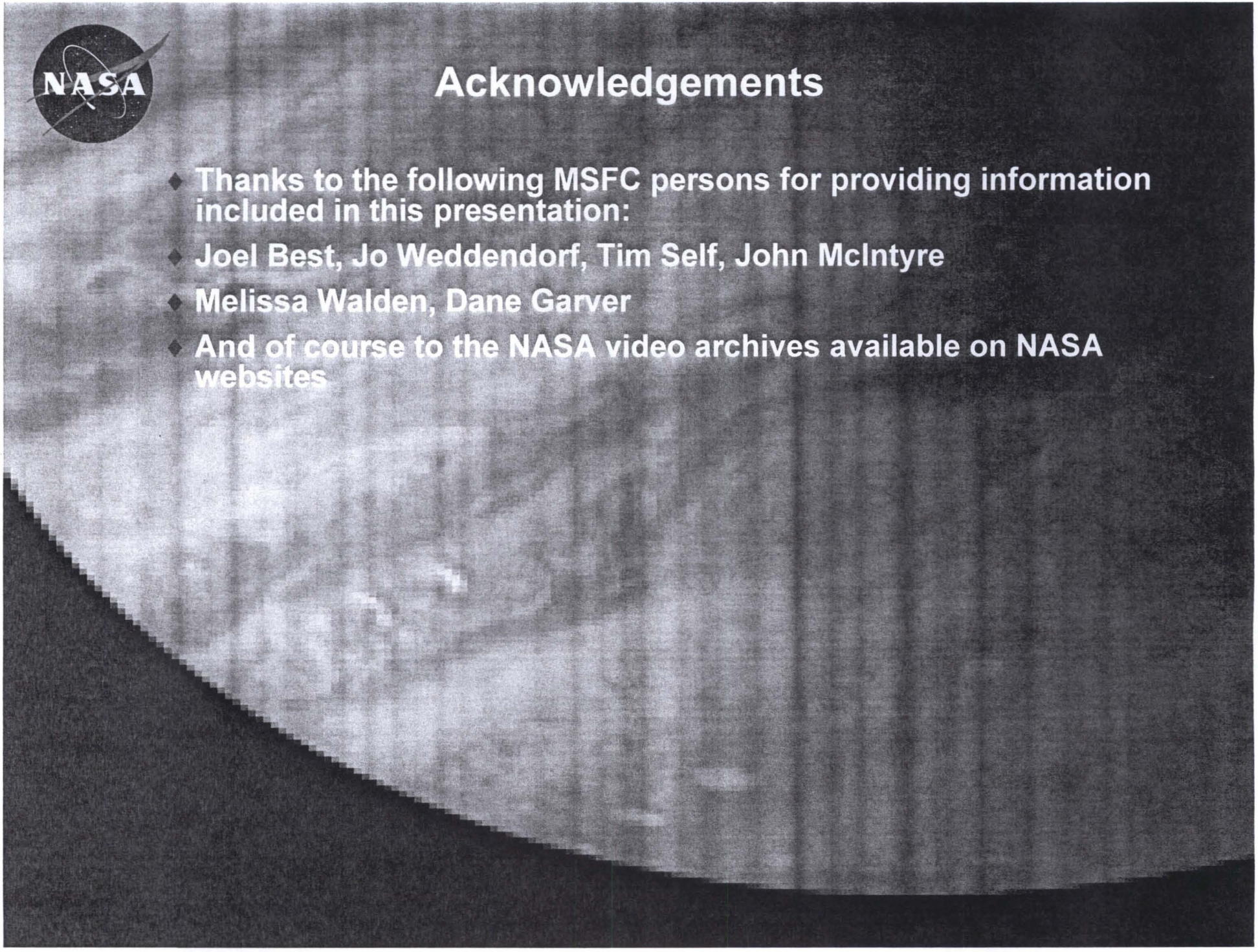

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