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VISION FOR SPACE EXPLORATION

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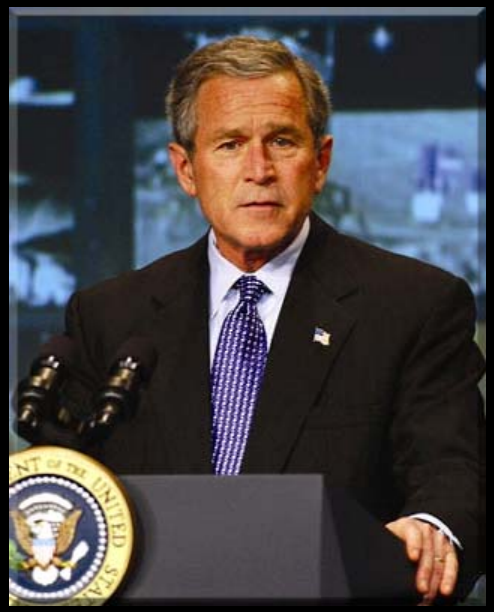
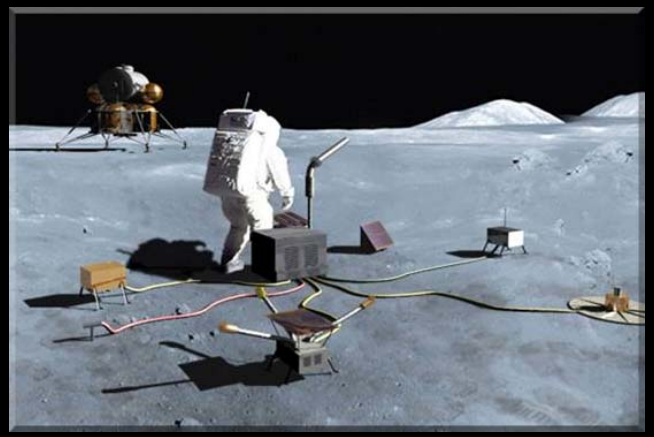
A Bold Vision for Space Exploration

- **Complete the International Space Station**
- **Safely fly the Space Shuttle until 2010**
- **Develop and fly the Crew Exploration Vehicle (by 2014)**
- **Return to the moon (by 2020)**
- **Sustained and affordable human and robotic program**
- **Develop innovative technologies, knowledge, and infrastructures**
- **Promote international and commercial participation**

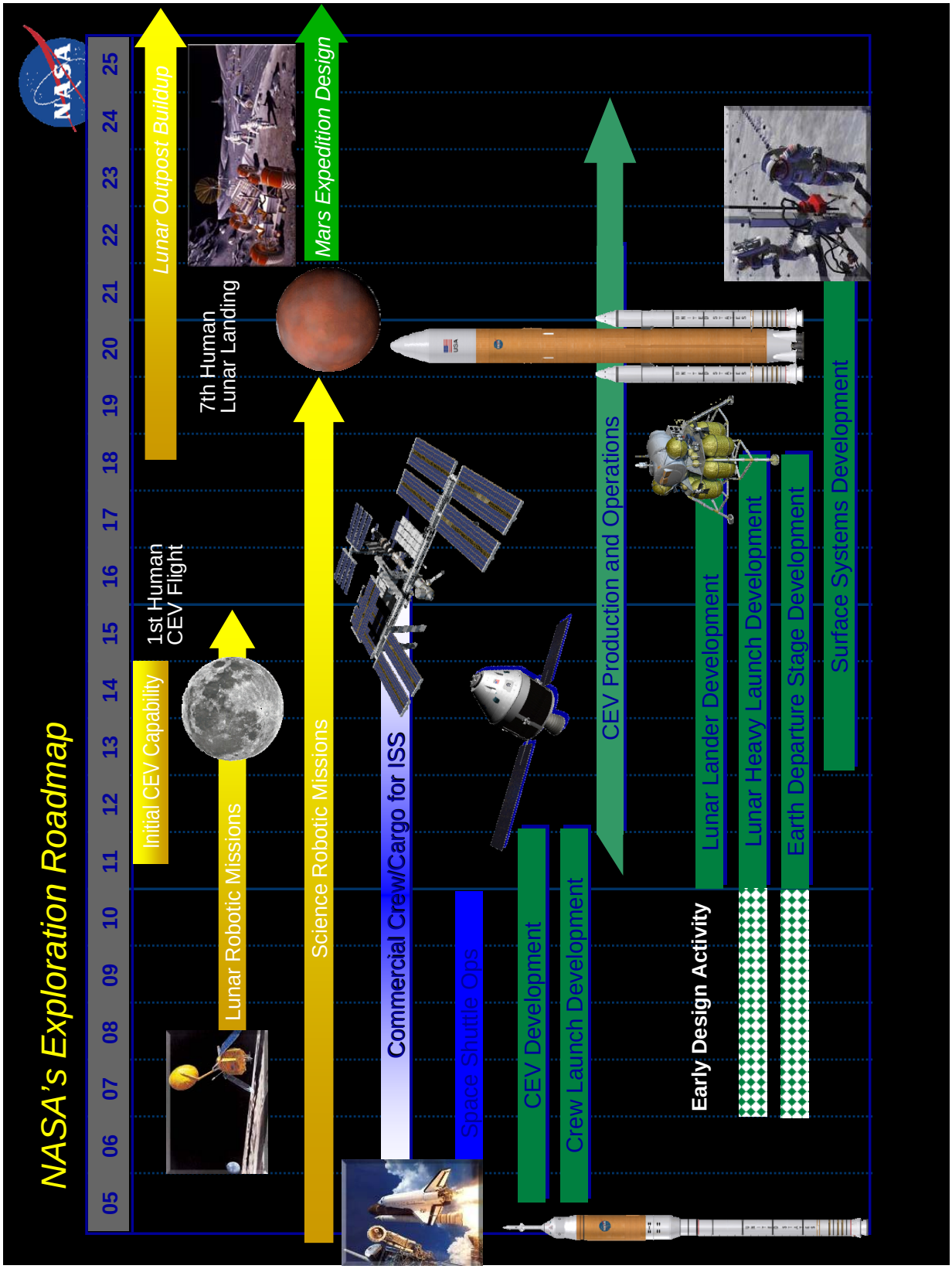




"It is time for America to take the next steps.

Today I announce a new plan to explore space and extend a human presence across our solar system. We will begin the effort quickly, using existing programs and personnel. We'll make steady progress – one mission, one voyage, one landing at a time."

President George W. Bush – January 14, 2004


NASA's Exploration Roadmap
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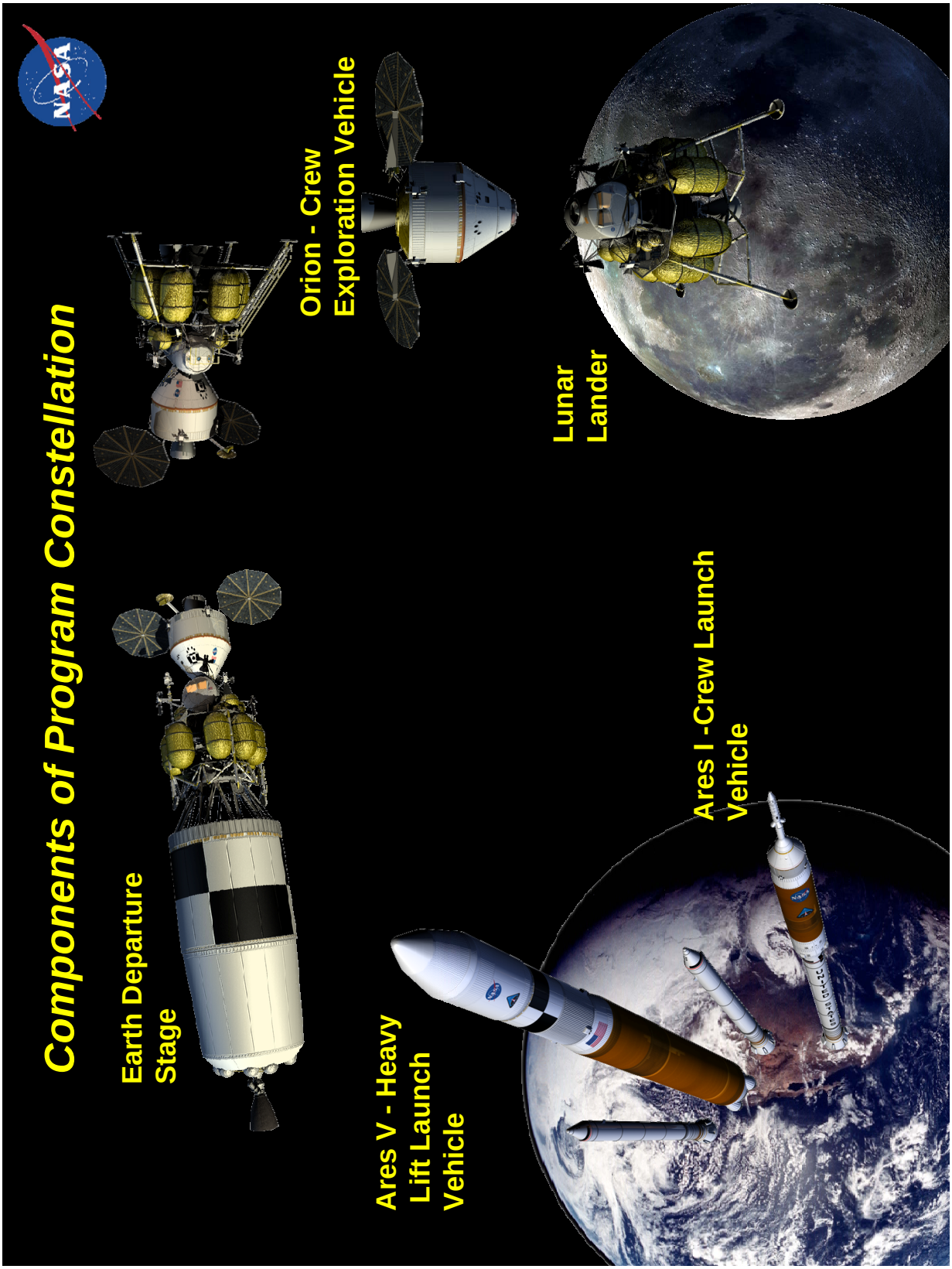
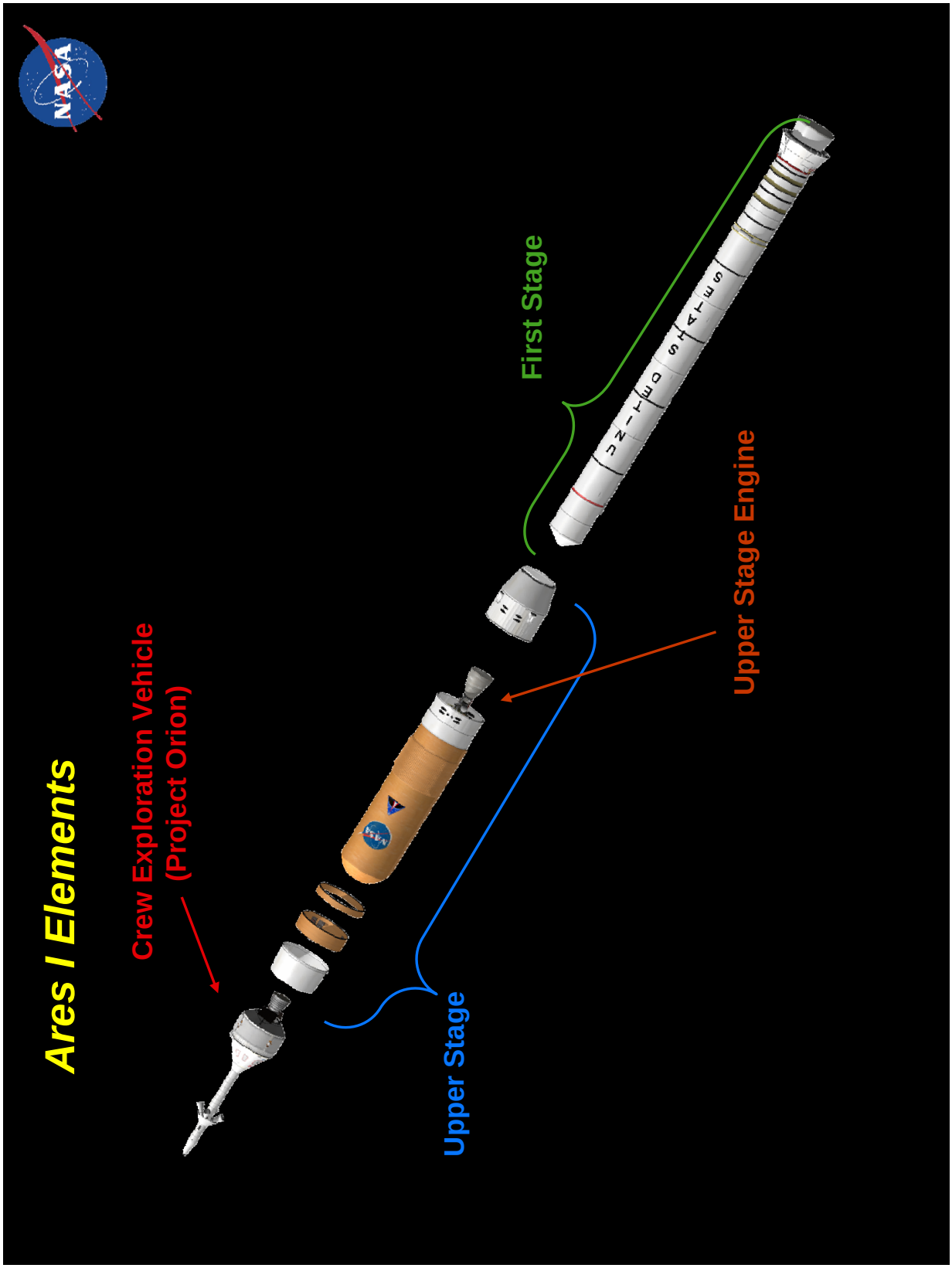
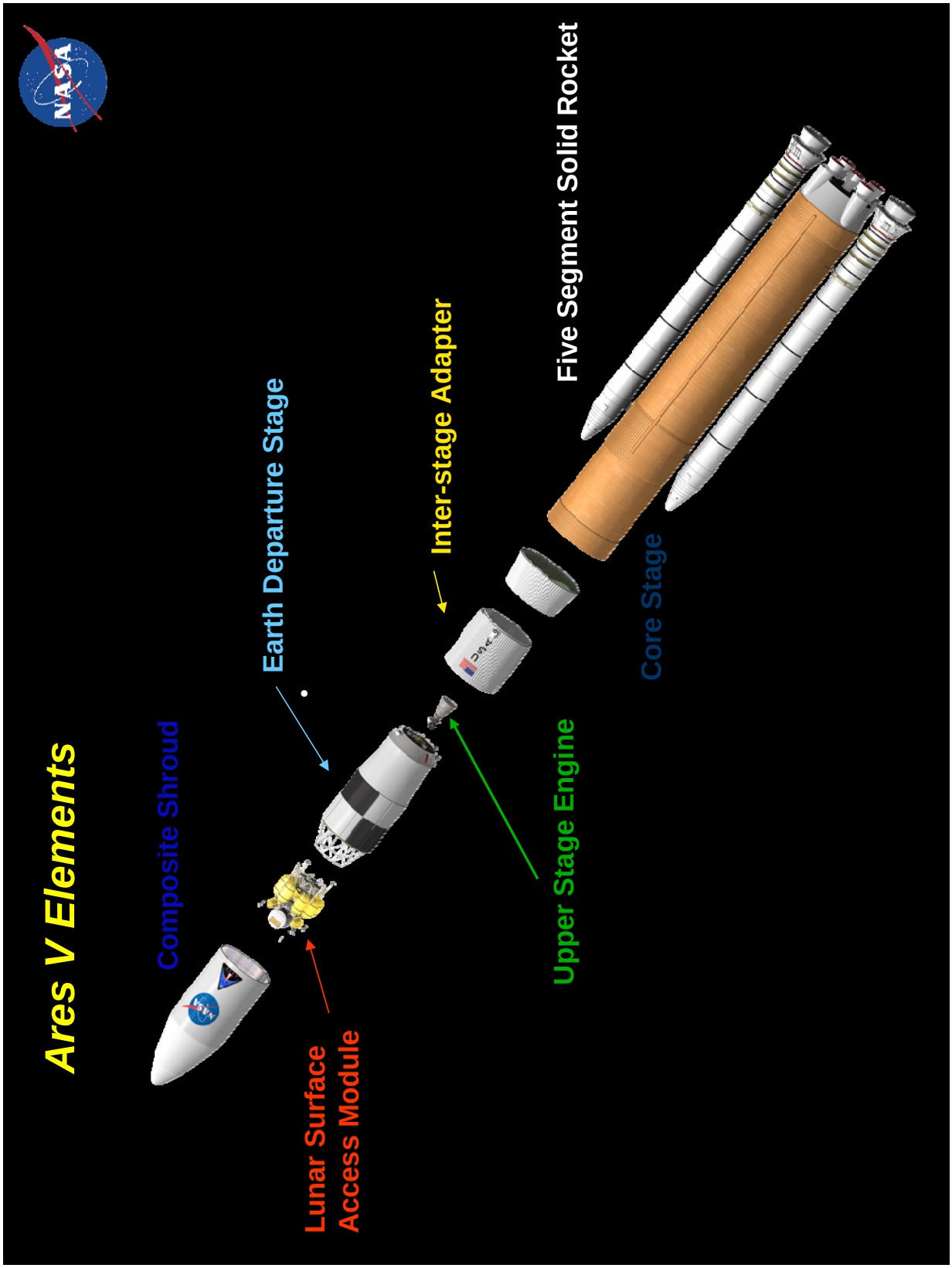
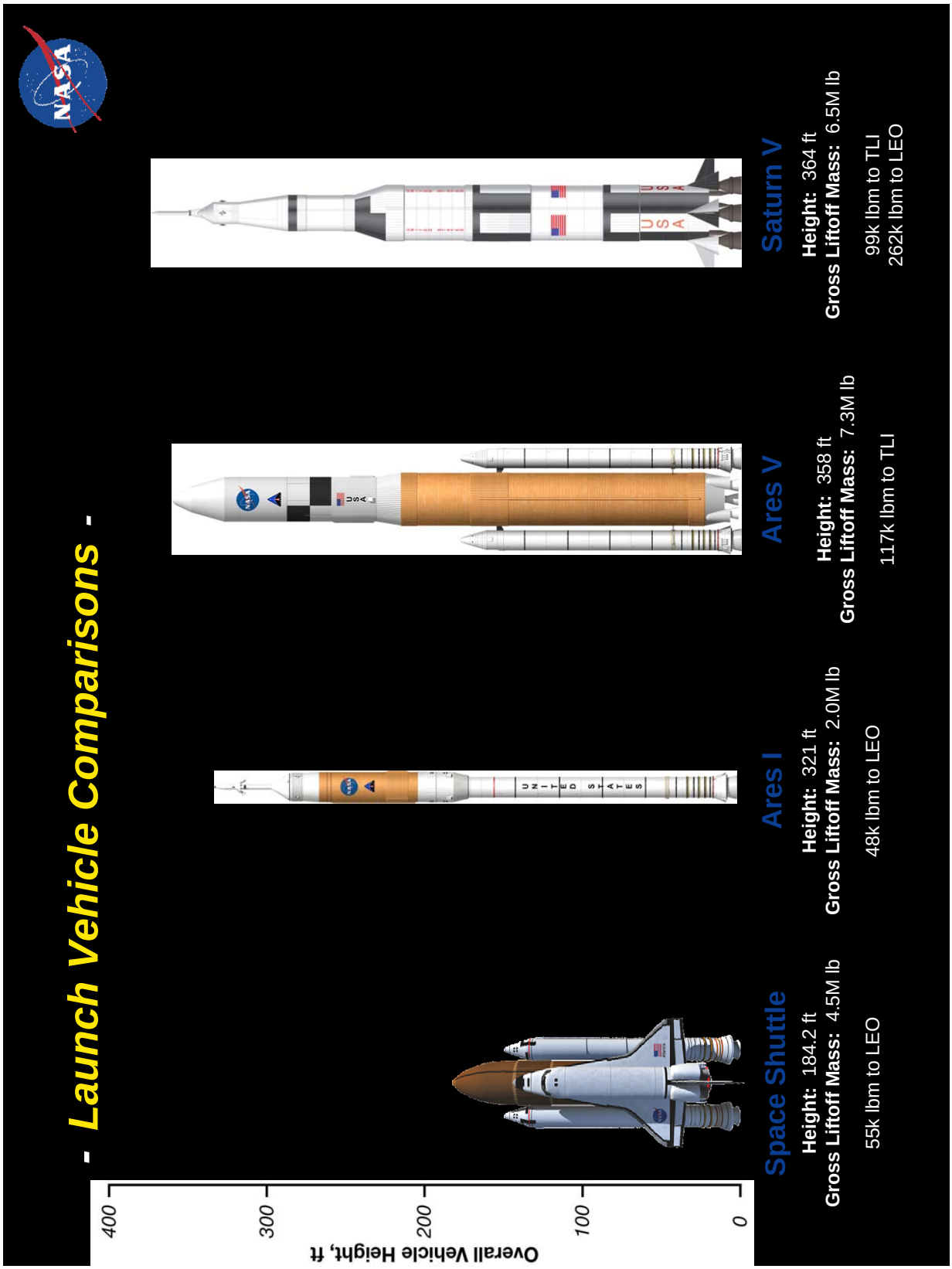
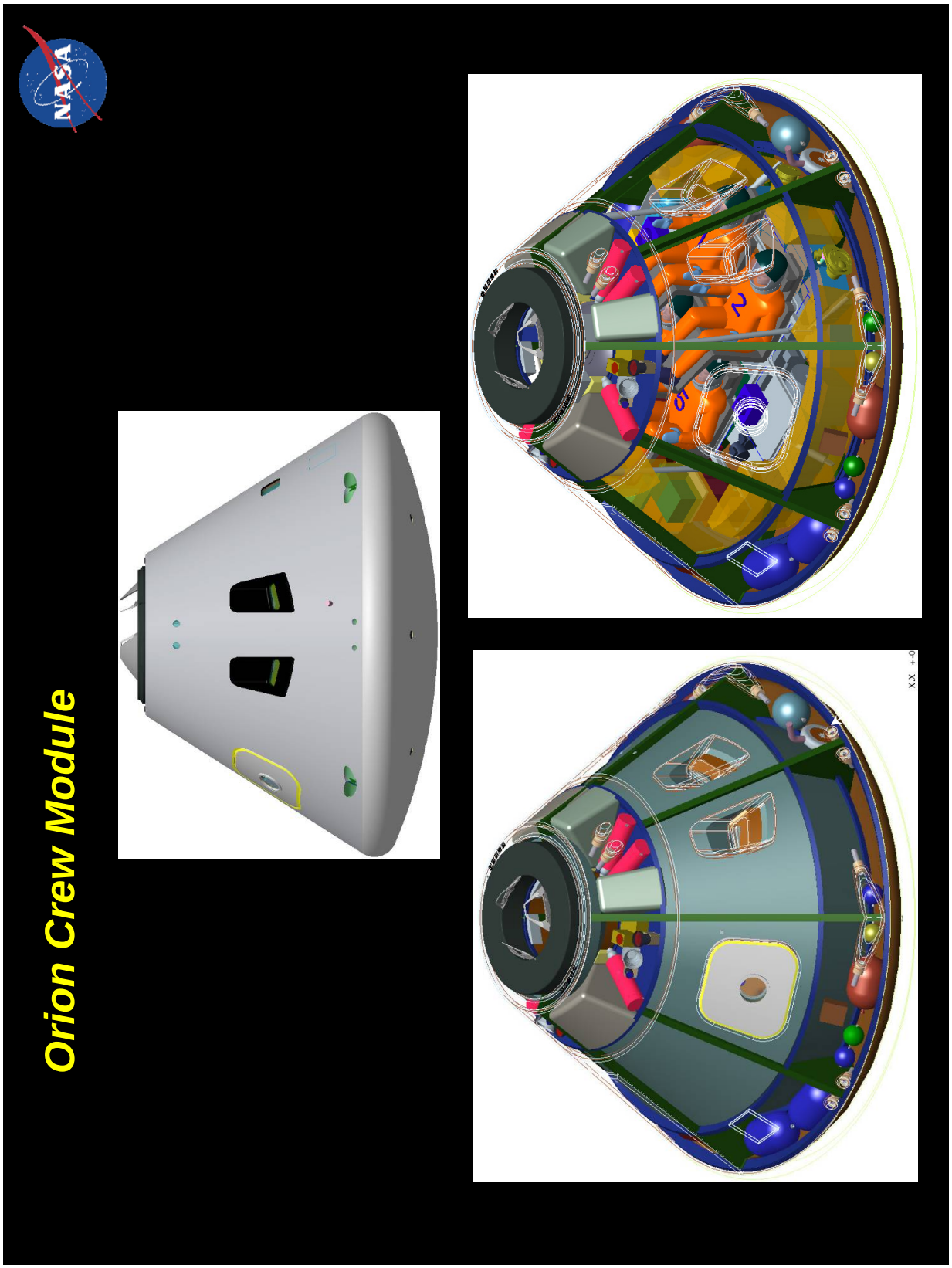
Lunar Outpost Buildup
Initial CEV Capability
1st Human CEV Flight
7th Human Lunar Landing
Mars Expedition Design
Lunar Robotic Missions
Science Robotic Missions
Commercial Crew/Cargo for ISS
Space Shuttle Ops
CEV Development
Crew Launch Development
CEV Production and Operations
Lunar Lander Development
Lunar Heavy Launch Development
Earth Departure Stage Development
Surface Systems Development
Early Design Activity


Components of Program Constellation
Earth Departure Stage
Orion - Crew Exploration Vehicle
Lunar Lander
Ares V - Heavy Lift Launch Vehicle
Ares I -Crew Launch Vehicle

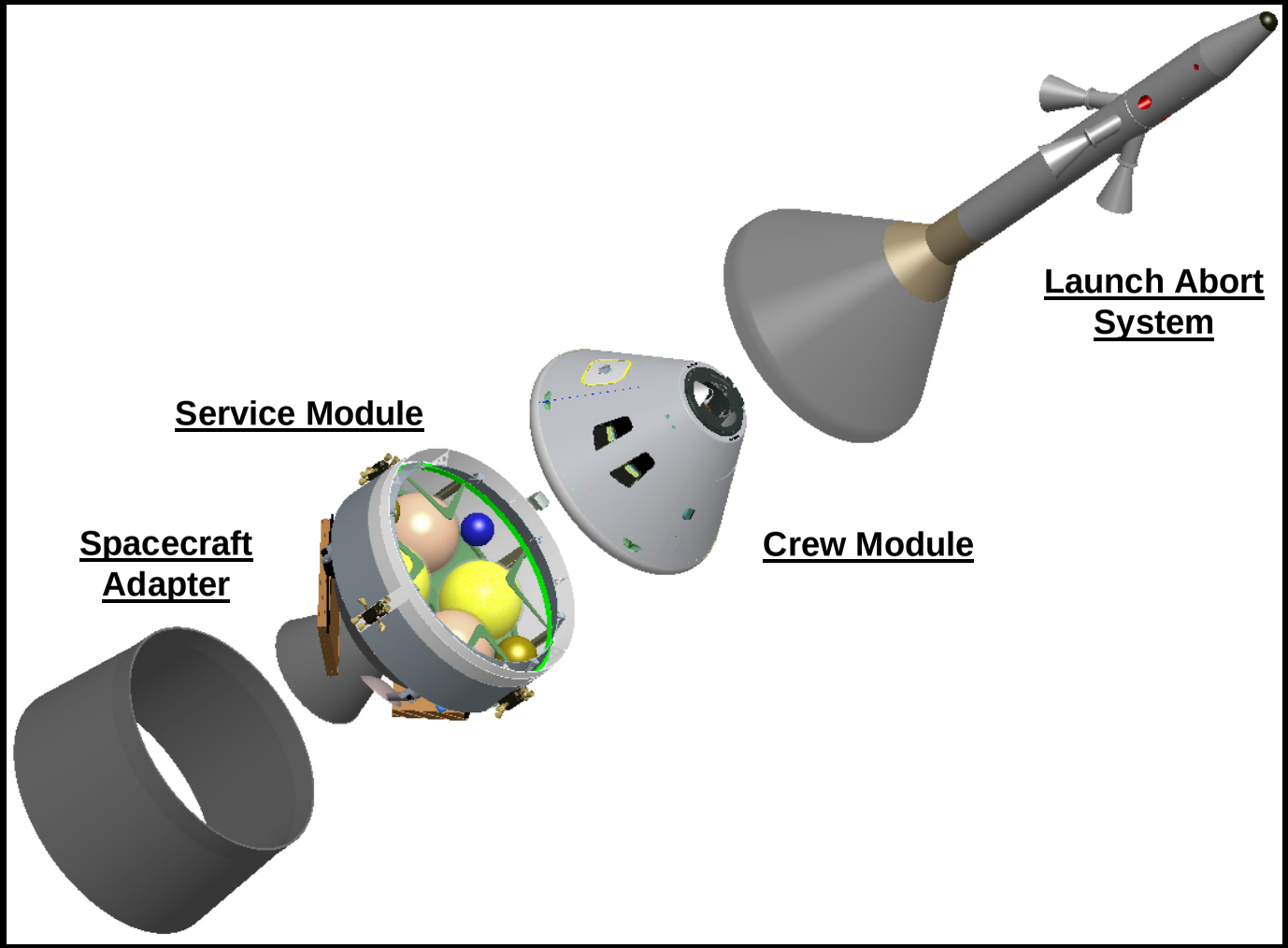

Ares I Elements
Crew Exploration Vehicle
(Project Orion)
Upper Stage
First Stage
Upper Stage Engine


Ares V Elements
Composite Shroud
Lunar Surface
Access Module
Earth Departure Stage
Inter-stage Adapter
Upper Stage Engine
Core Stage
Five Segment Solid Rocket


- Launch Vehicle Comparisons -
Overall Vehicle Height, ft
400
300
200
100
0
Space Shuttle
Height: 184.2 ft
Gross Liftoff Mass: 4.5M lb
55k lbm to LEO
Ares I
Height: 321 ft
Gross Liftoff Mass: 2.0M lb
48k lbm to LEO
Ares V
Height: 358 ft
Gross Liftoff Mass: 7.3M lb
117k lbm to TLI
Saturn V
Height: 364 ft
Gross Liftoff Mass: 6.5M lb
99k lbm to TLI
262k lbm to LEO

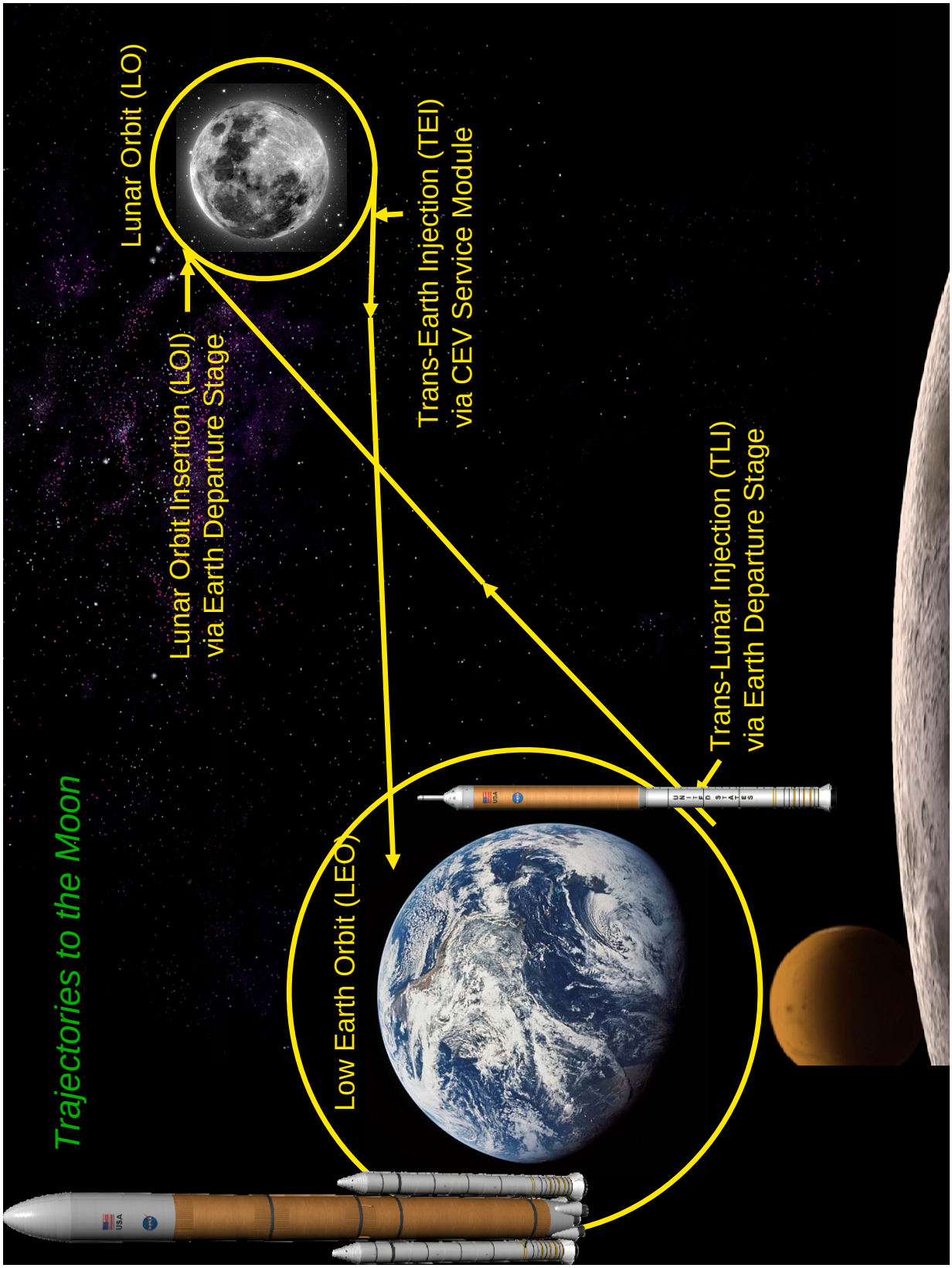

Orion Crew Module

NASA Baseline Configuration



Orion will travel to the Space Station

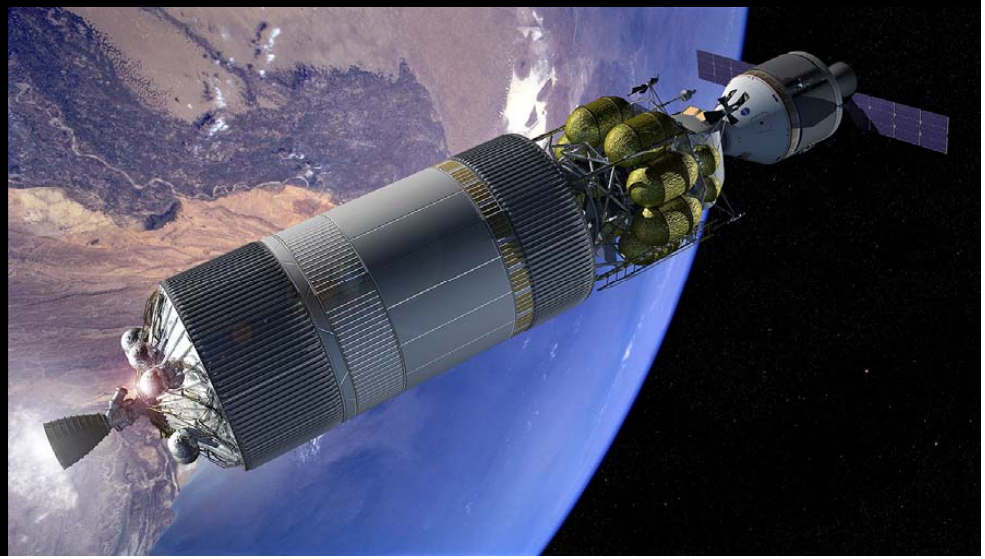
- **Transport up to 6 crew members on Orion for crew rotation**
- **210 day stay time**
- **Emergency lifeboat for entire crew**
- **Deliver supplies**


Trajectories to the Moon
Lunar Orbit (LO)
Lunar Orbit Insertion (LOI)
via Earth Departure Stage
Trans-Earth Injection (TEI)
via CEV Service Module
Low Earth Orbit (LEO)
Trans-Lunar Injection (TLI)
via Earth Departure Stage

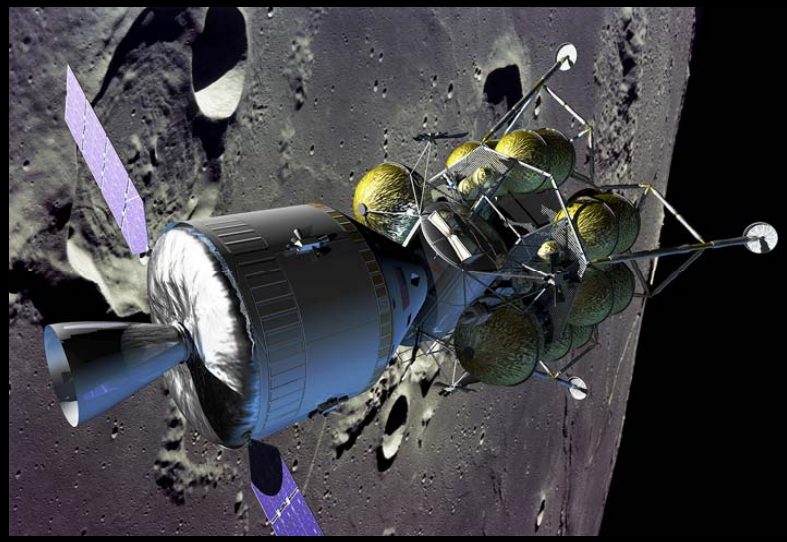
Orion Lunar Mission – Getting There

- **Orion docks with the Earth Departure Stage (EDS) in Earth Orbit**

- **Earth Departure Stage (EDS) travels to Moon with :**
  - **Lunar Surface Access Module (LSAM)**
  - **Orion: up to 4 crew**

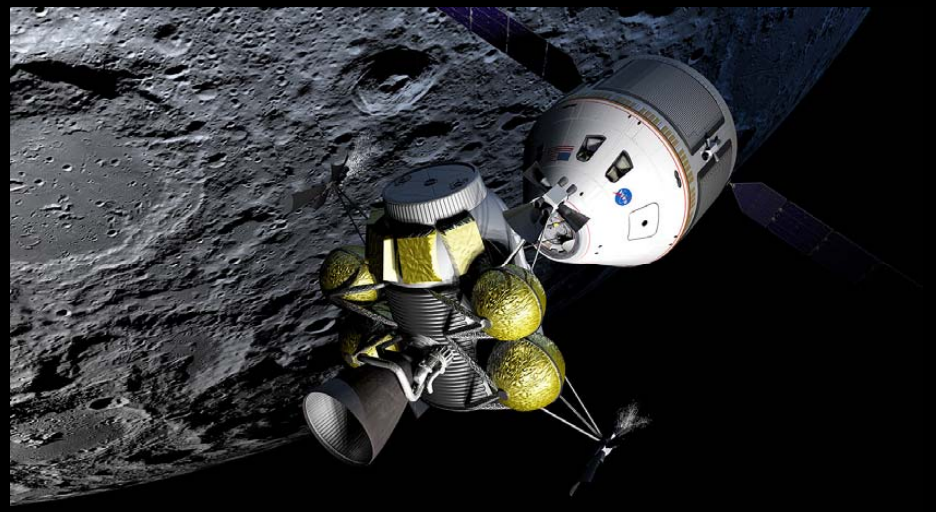


Orion Lunar Mission – Arriving There



- **Orion and Lander travel to Moon**
- **Lander descends to lunar surface for up to 7 days**

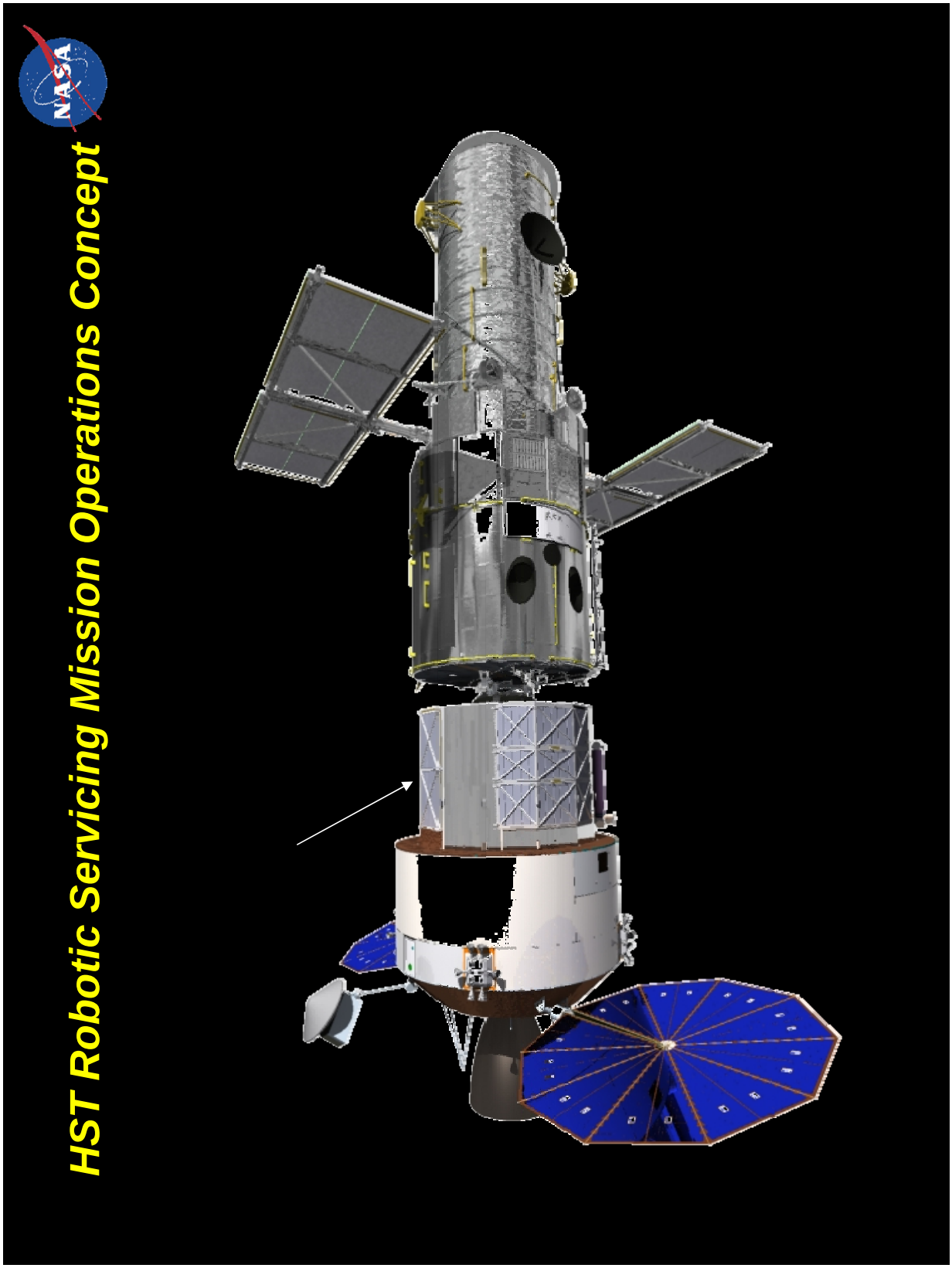
- **Lander upper stage returns to Orion in lunar orbit**



CEV Lunar Mission – Coming Home

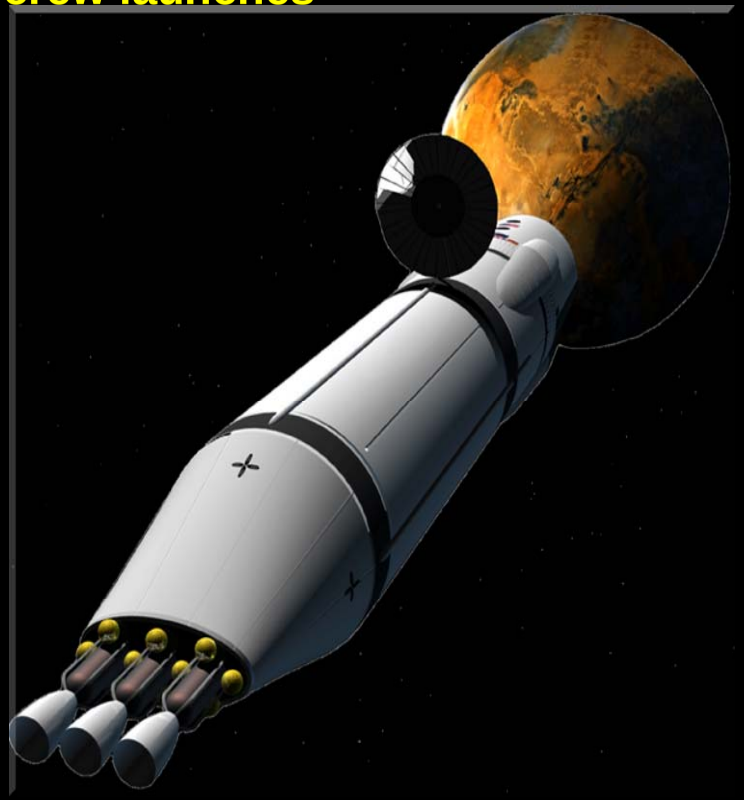
- **Orion provides Earth return trajectory**

- **Command Module capsule reenters atmosphere**
- **Parachute descent**
- **Land in water or on land**


HST Robotic Servicing Mission Operations Concept

How We Will Get to Mars

- 4 to 5 assembly flights to low Earth orbit
- Mars surface outpost before the crew launches
  - Electricity
  - Shelter
  - Supplies
- 180 day transit time to/from Mars
  - 6 crew members
- 500 days on the surface
  - Food, Oxygen and water



Glenn Research Center's Two Campuses

Cleveland (Brook Park and Fairview Park)

- 350 acres
- 1707 civil servants and 1367 contractors

Plum Brook (Sandusky)

- 6400 acres
- 9 civil servants and 87 contractors

Thank you