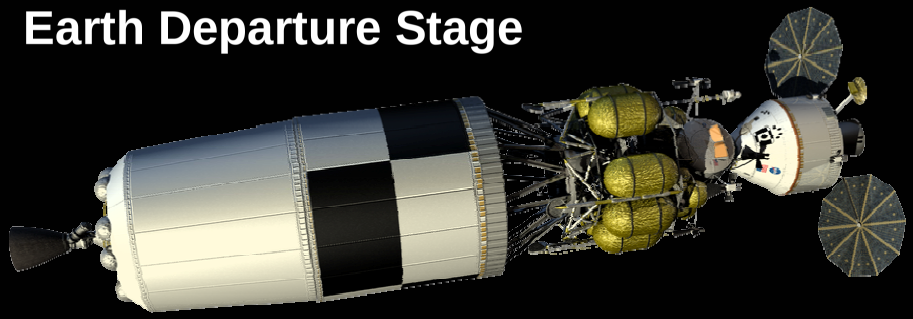
Orion-CEV Project Overview To the NASA Sports and Exploration "Kick-Off" Meeting

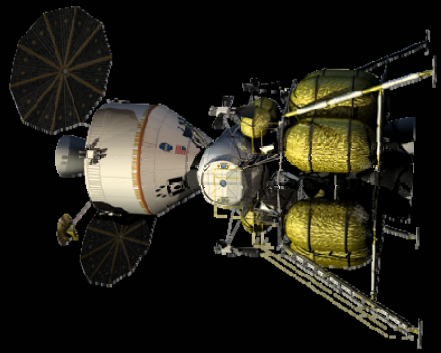
Paul Marshall
Orion-CEV Asst. Project Manager

May 30, 2007

Components of Program Constellation

Earth Departure Stage

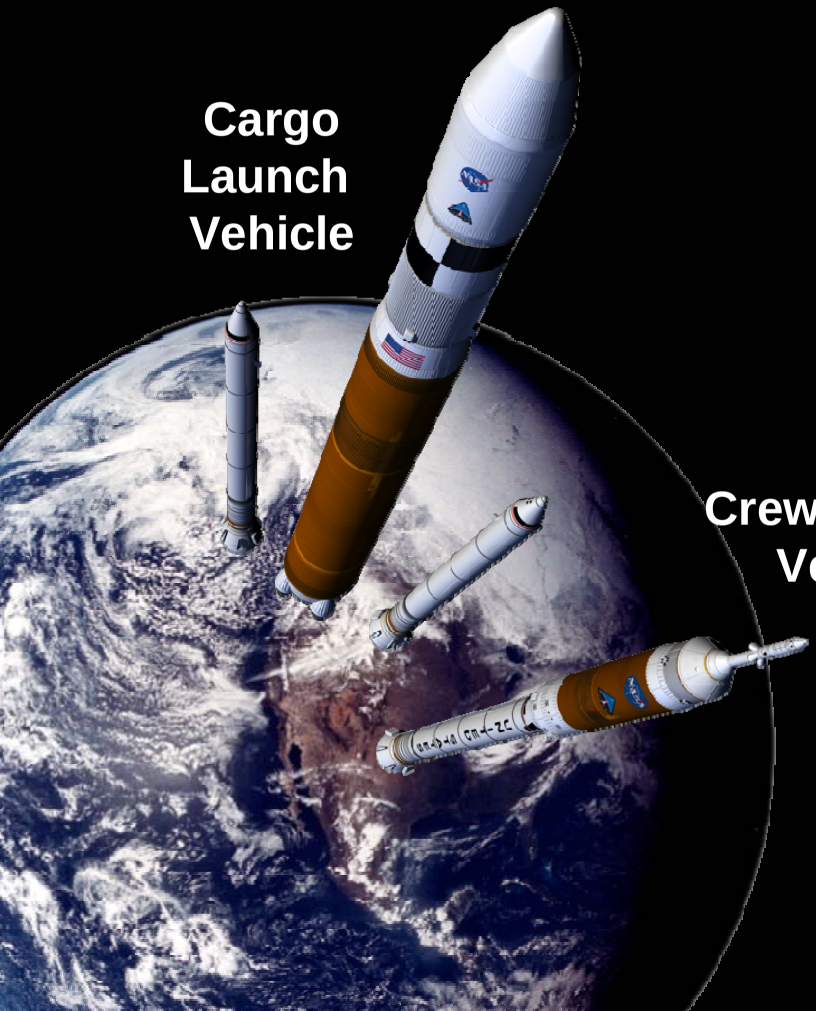




Orion - Crew Exploration Vehicle

Cargo Launch Vehicle

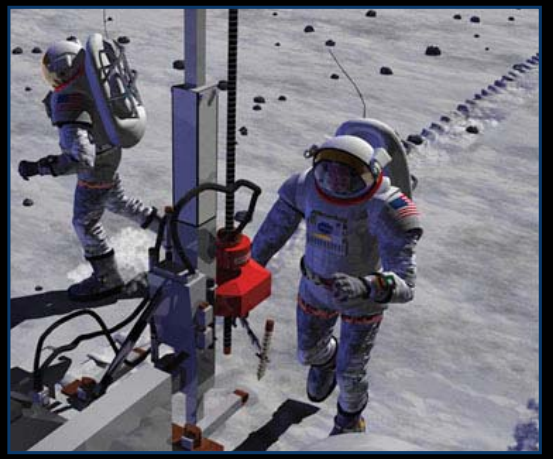
Crew Launch Vehicle



Lunar Lander

The Moon – the First Step to Mars and Beyond….

- **Gaining significant experience in operating away from Earth's environment**
  - Space will no longer be a destination visited briefly and tentatively
  - "Living off the land"
  - Human support systems
- **Developing technologies needed for opening the space frontier**
  - Crew and cargo launch vehicles (125 metric ton class)
  - Earth ascent/entry system – Crew Exploration Vehicle
- **Conduct fundamental science**
  - Astronomy, physics, astrobiology, historical geology, exobiology



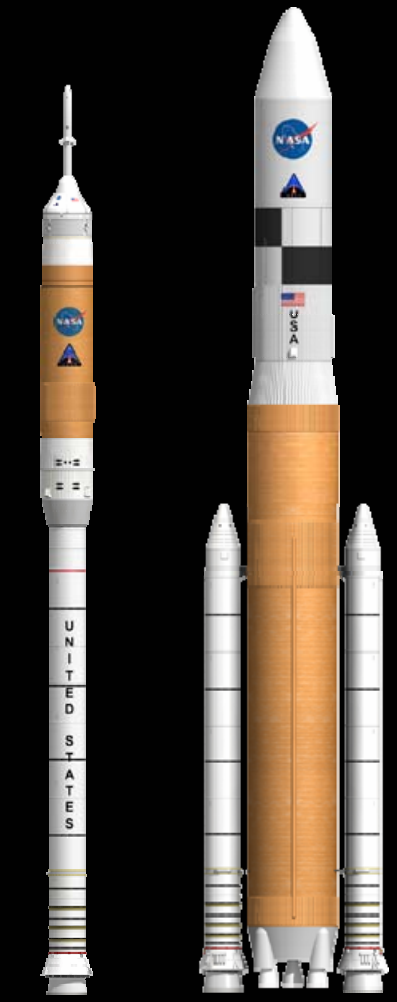
We are Continuing our Historical Legacy As Explorers

How We Plan to Return to the Moon

Project Ares

- **The safest, most reliable and most affordable means of meeting crew requirements is a system derived from Space Shuttle components**
  - Capitalizes on human rated systems and existing facilities
  - The most straightforward growth path to later exploration launch needs

- **130 metric ton lift capacity required to minimize on-orbit assembly and complexity – increasing mission success**
  - A clean-sheet-of-paper design is too expensive and risky
  - The current Shuttle system lifts 100 metric tons to orbit on every launch – but 80 metric tons is the Orbiter

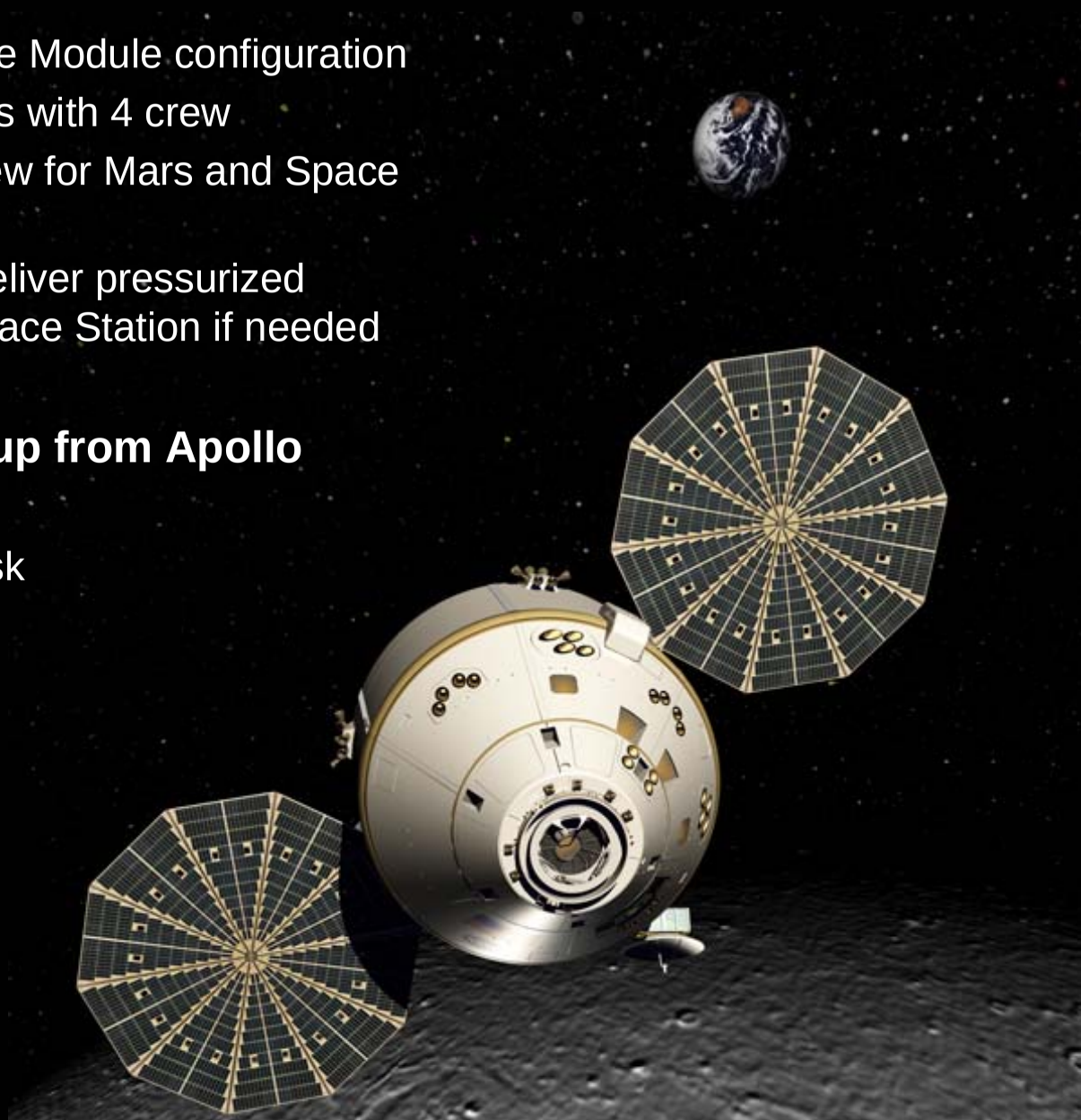


Ares I ***Ares V***

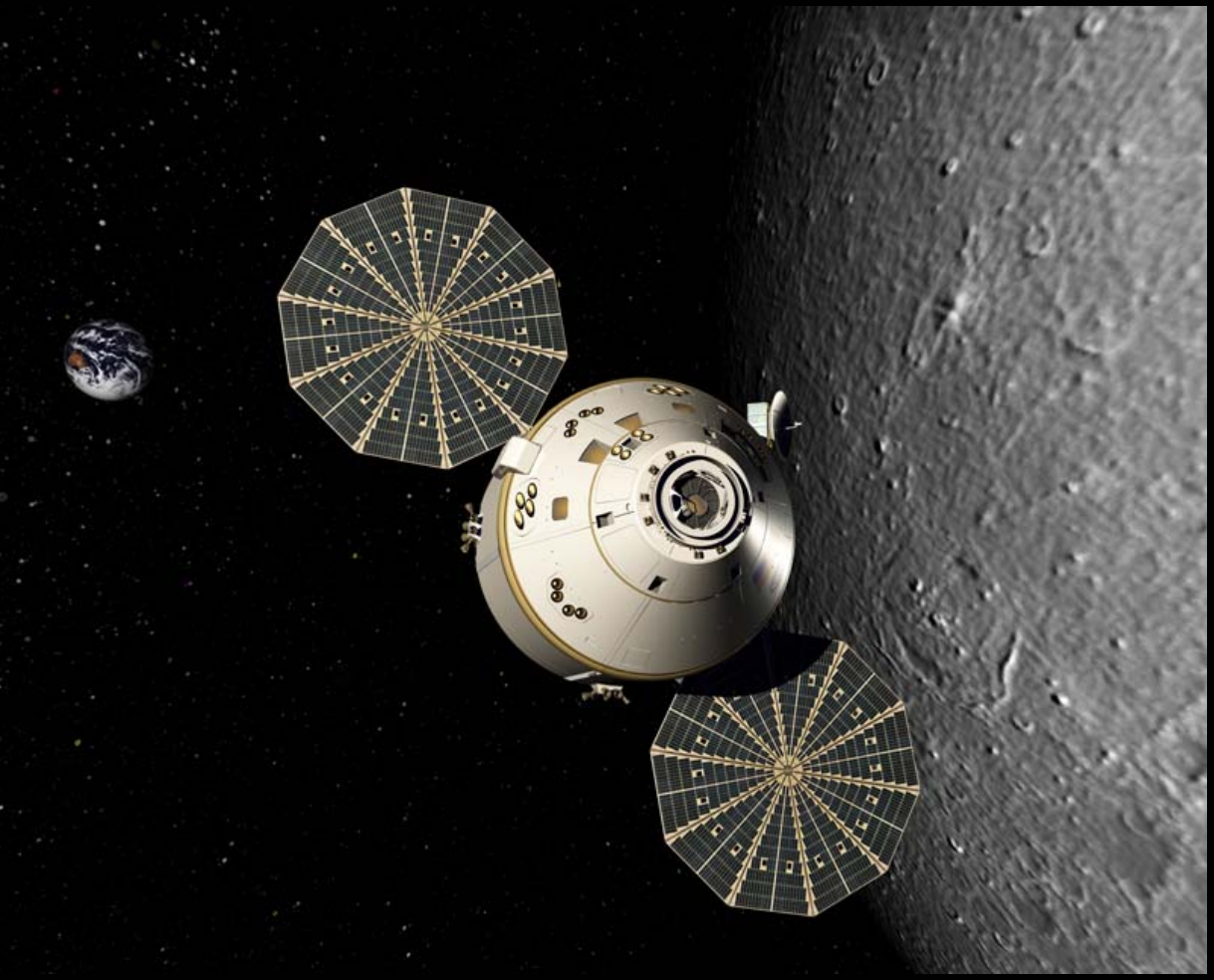
Orion - Crew Exploration Vehicle

- **A blunt body capsule is the safest, most affordable and fastest approach**
  - Separate Crew Module and Service Module configuration
  - Vehicle designed for lunar missions with 4 crew
    - Can accommodate up to 6 crew for Mars and Space Station missions
  - System also has the potential to deliver pressurized and unpressurized cargo to the Space Station if needed

- **5 meter diameter capsule scaled up from Apollo**
  - Significant increase in volume
  - Reduced development time and risk
  - Reduced reentry loads (skip entry)
  - Likely increased landing stability



Orion Lunar Mission



- **Orion and Lunar Lander boosted to lunar orbit**
  - Up to 4 crew onboard
- **Lander descends to lunar surface**
- **Orion is uninhabited during lunar surface operations**
- **Lander upper stage returns to Orion in lunar orbit**
- **Orion returns crew to Earth**

Lunar Mission Video ▶

Lunar Mission

Orion Earth Orbital Mission

- Capable of supporting ISS missions
- Transport up to 6 crew members on Orion for crew rotation
- 210 day stay time
- Emergency lifeboat for entire ISS crew
- Deliver pressurized cargo for ISS resupply

ISS Docking Video ►

International Space Station Mission

NASA's Exploration Roadmap

1st Human
Orion Flight

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

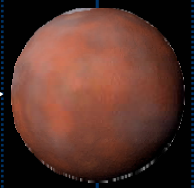
Initial Orion Capability

Lunar Outpost Buildup

Lunar Robotic Missions

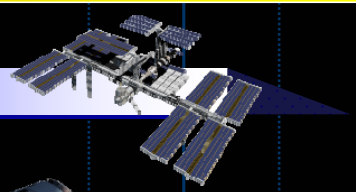
7th Human
Lunar
Landing

Science Robotic Missions



Mars Expedition Design

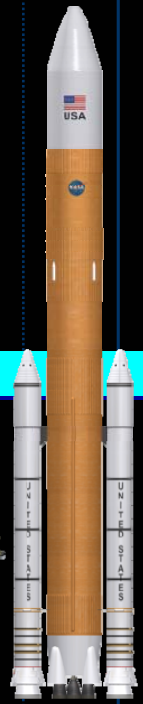
Commercial Crew/Cargo for ISS



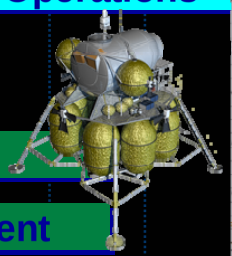
Space Shuttle Ops

Orion Development

Ares Development



Orion Production and Operations



Early Design Activity

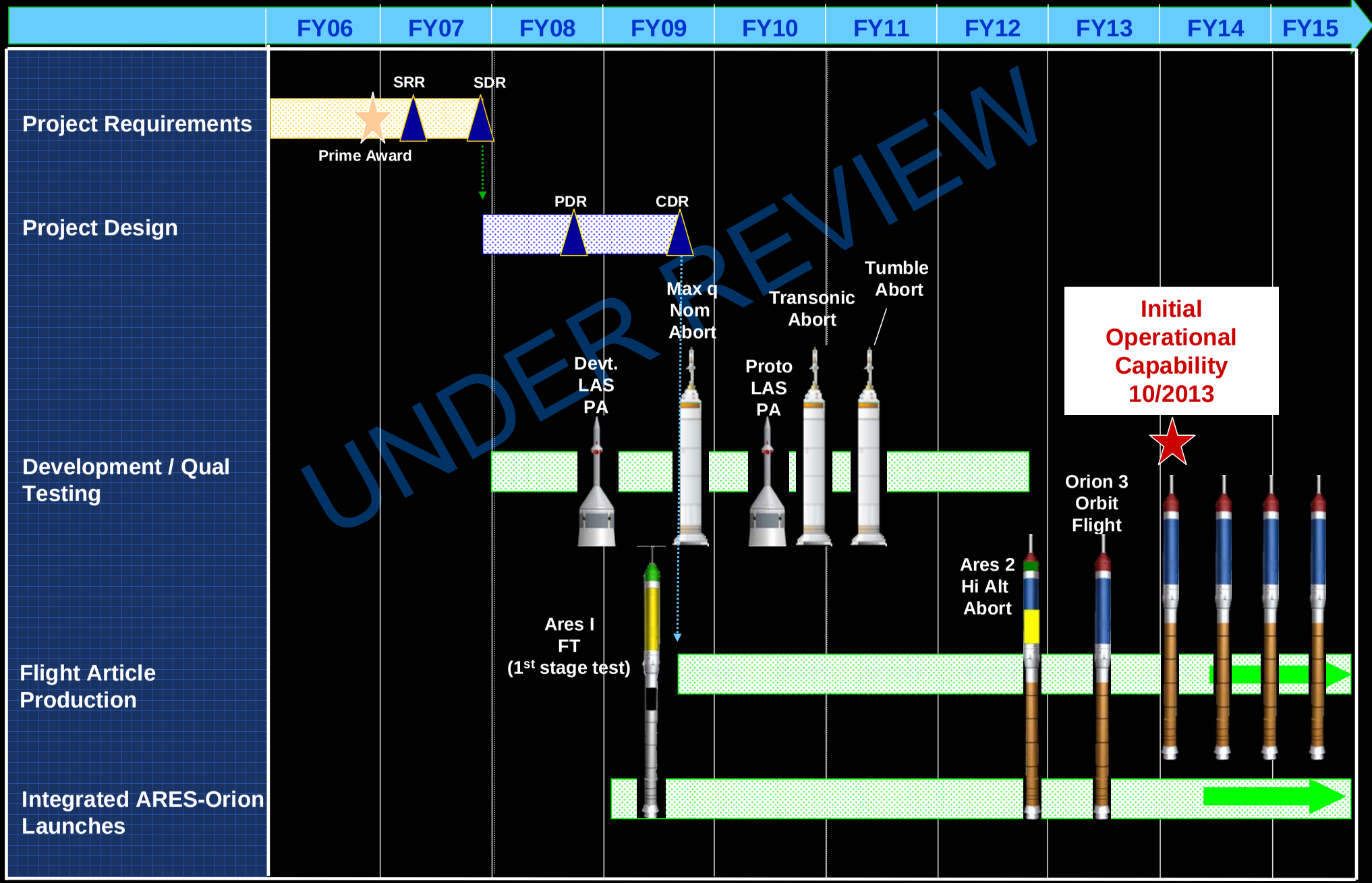
Lunar Lander Development

Lunar Heavy Launch Development

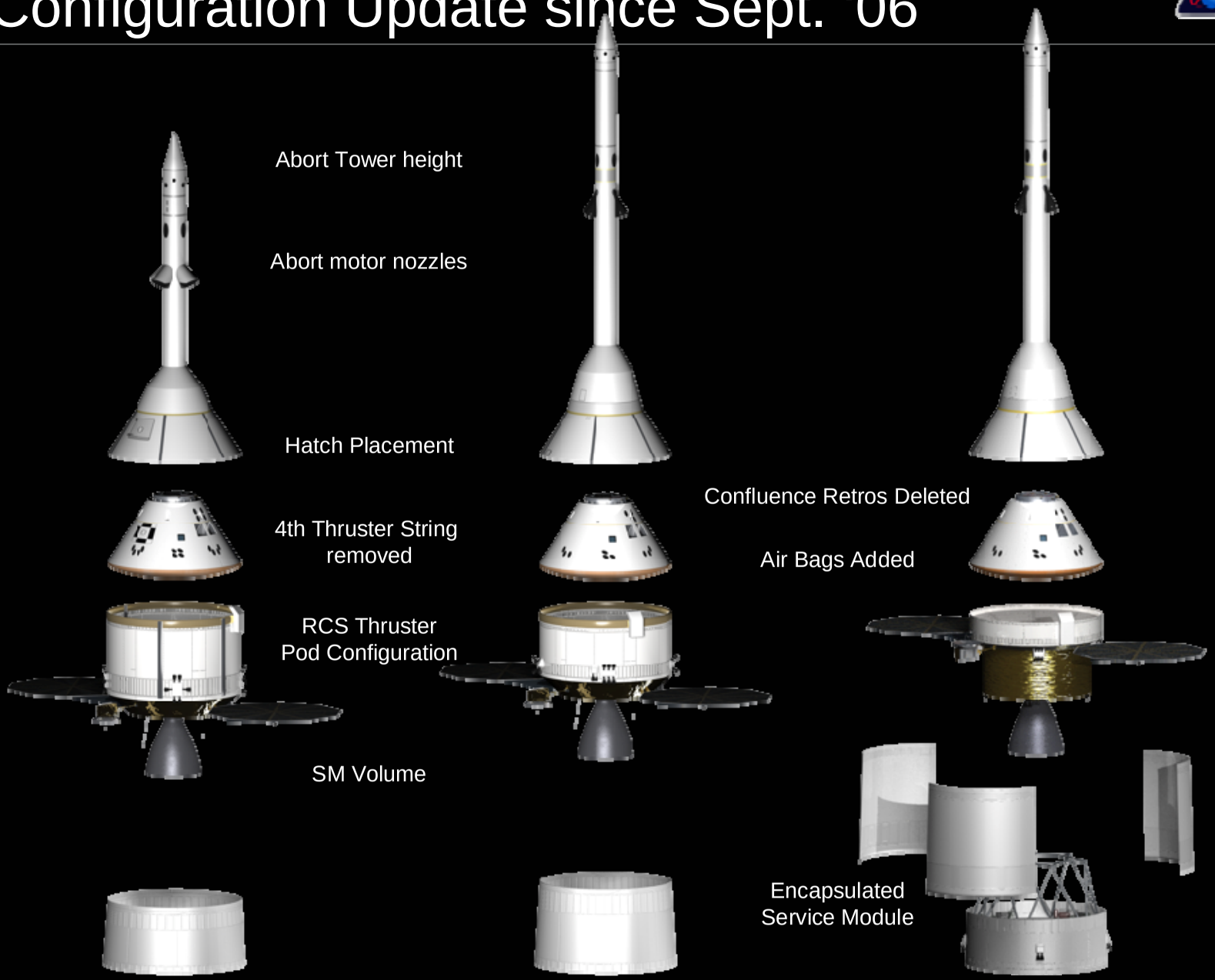
Earth Departure Stage Development

Surface Systems Development

Orion/Ares Flight Schedule Overview

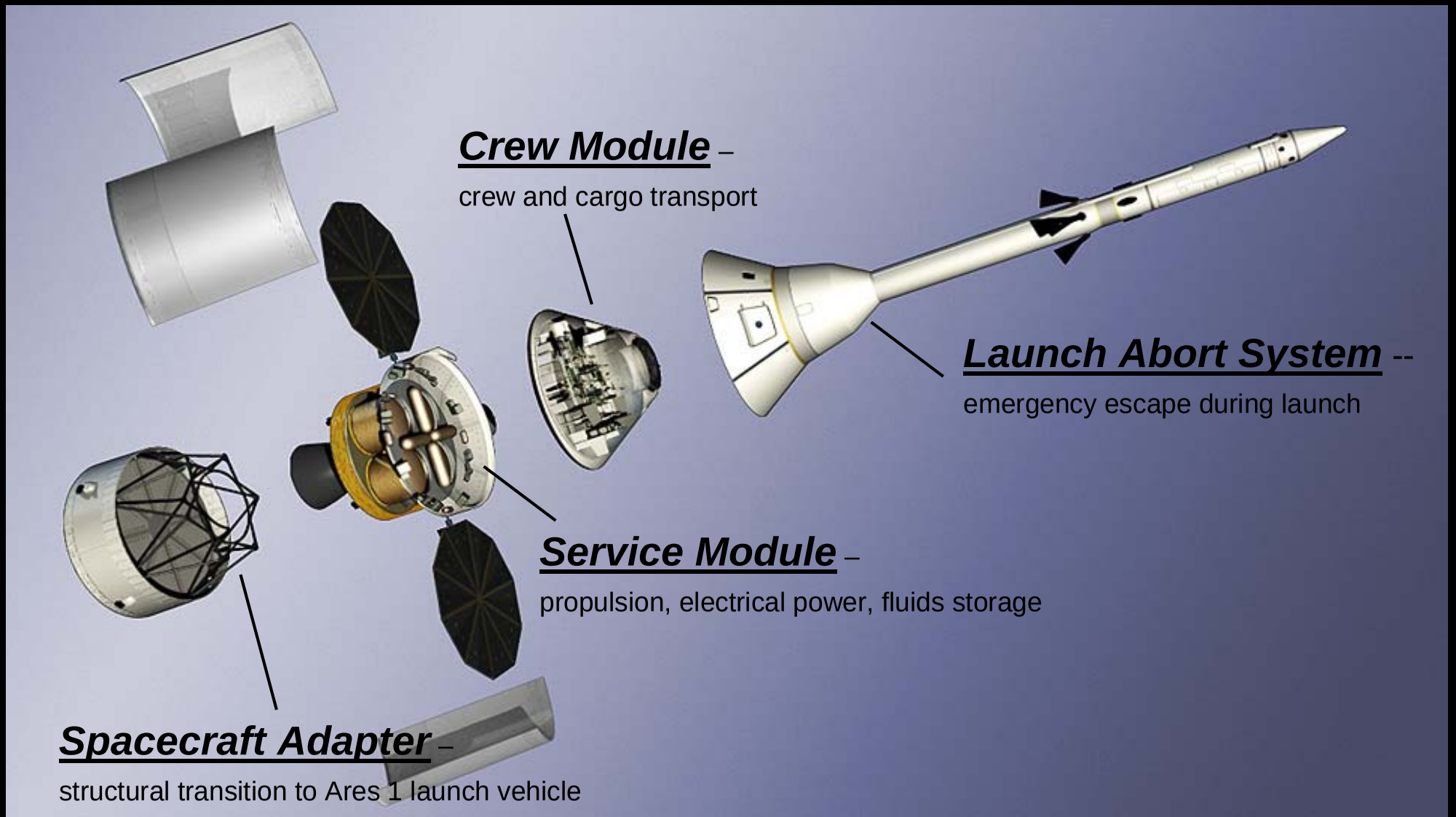


Orion Configuration Update since Sept. ‘06



Orion 606 Stack Configuration

Orion 606 Stack Configuration (expanded view)



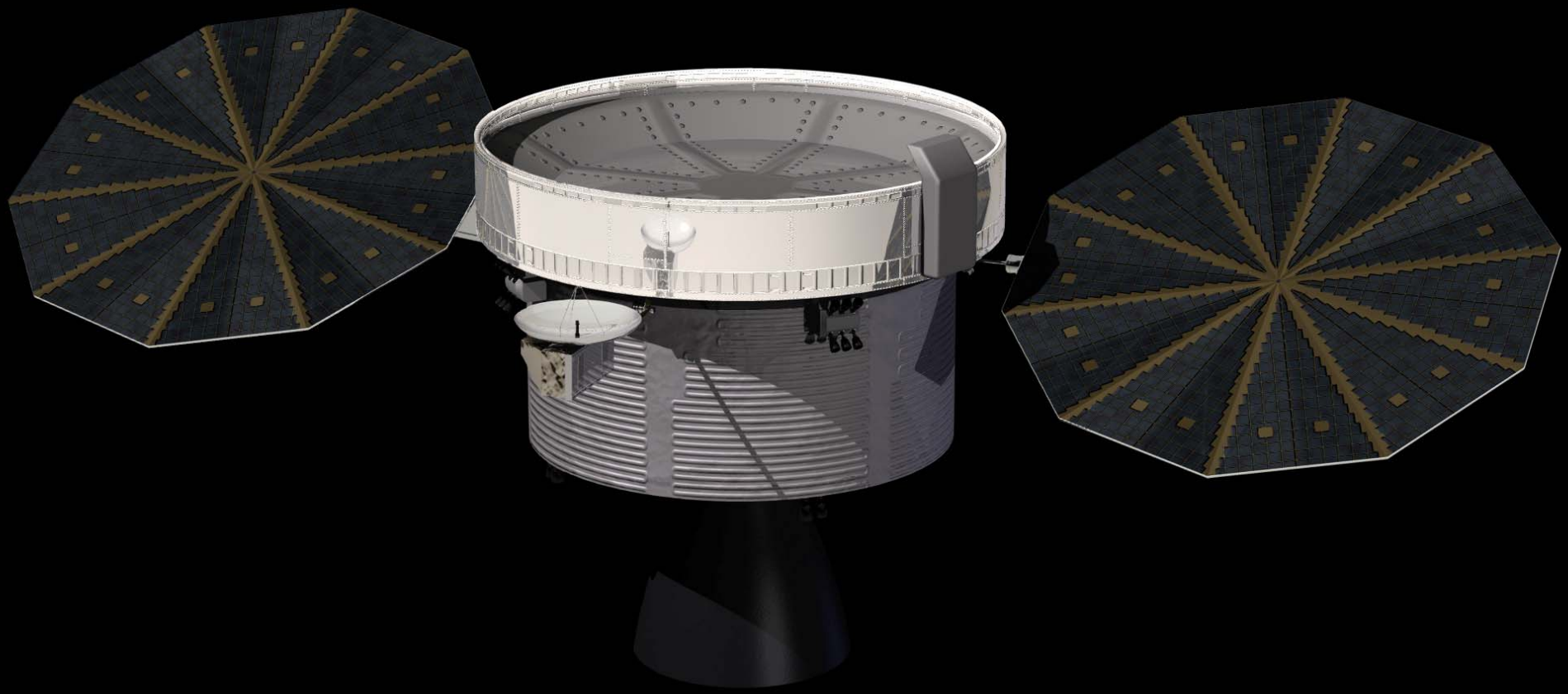
Crew Module –
crew and cargo transport

Launch Abort System --
emergency escape during launch

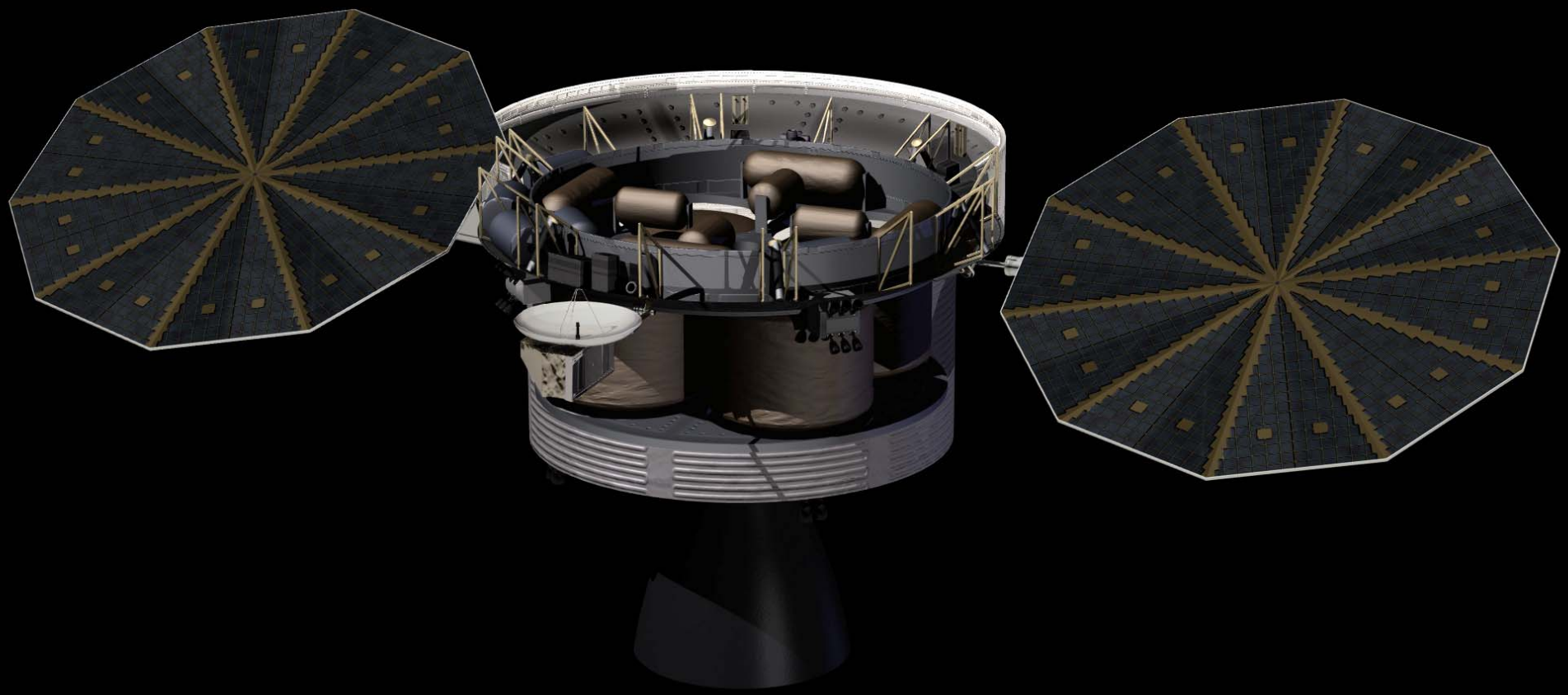
Service Module –
propulsion, electrical power, fluids storage

Spacecraft Adapter –
structural transition to Ares 1 launch vehicle

Service Module

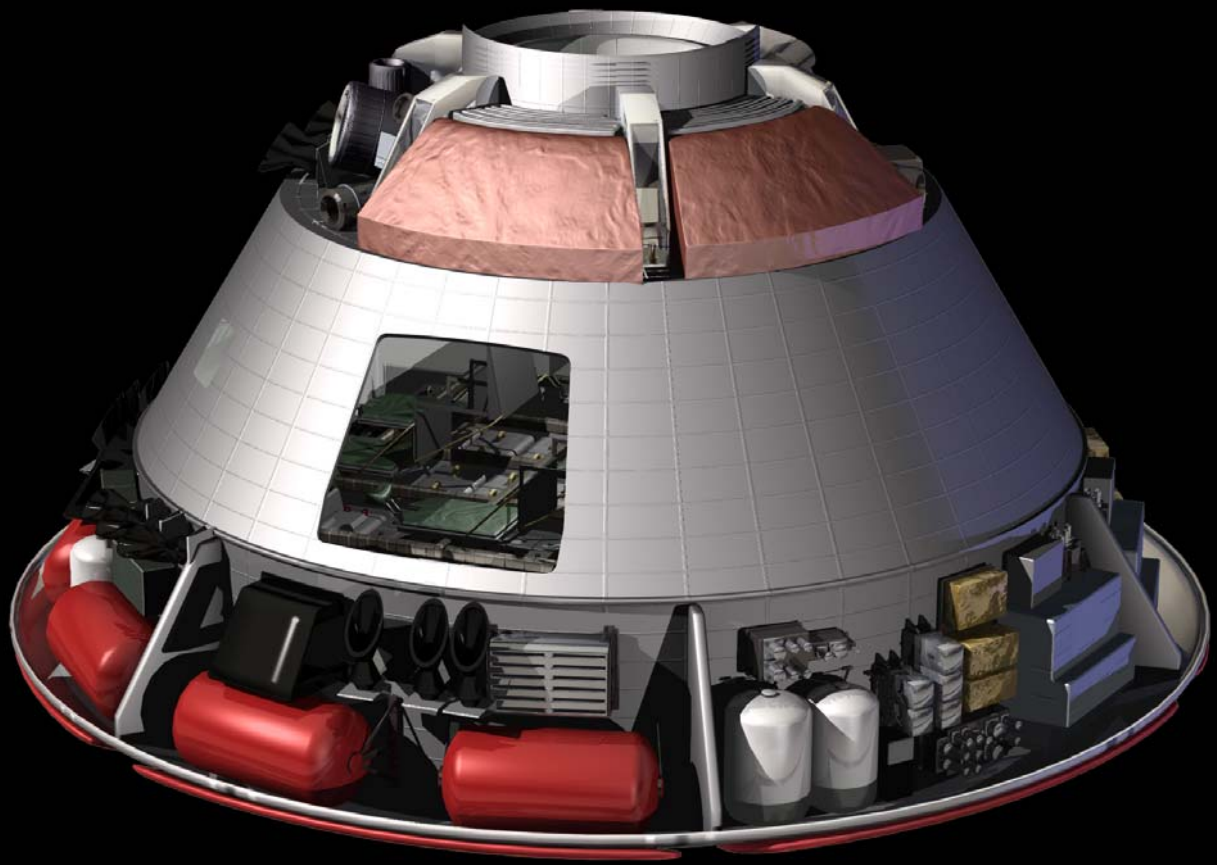


Service Module

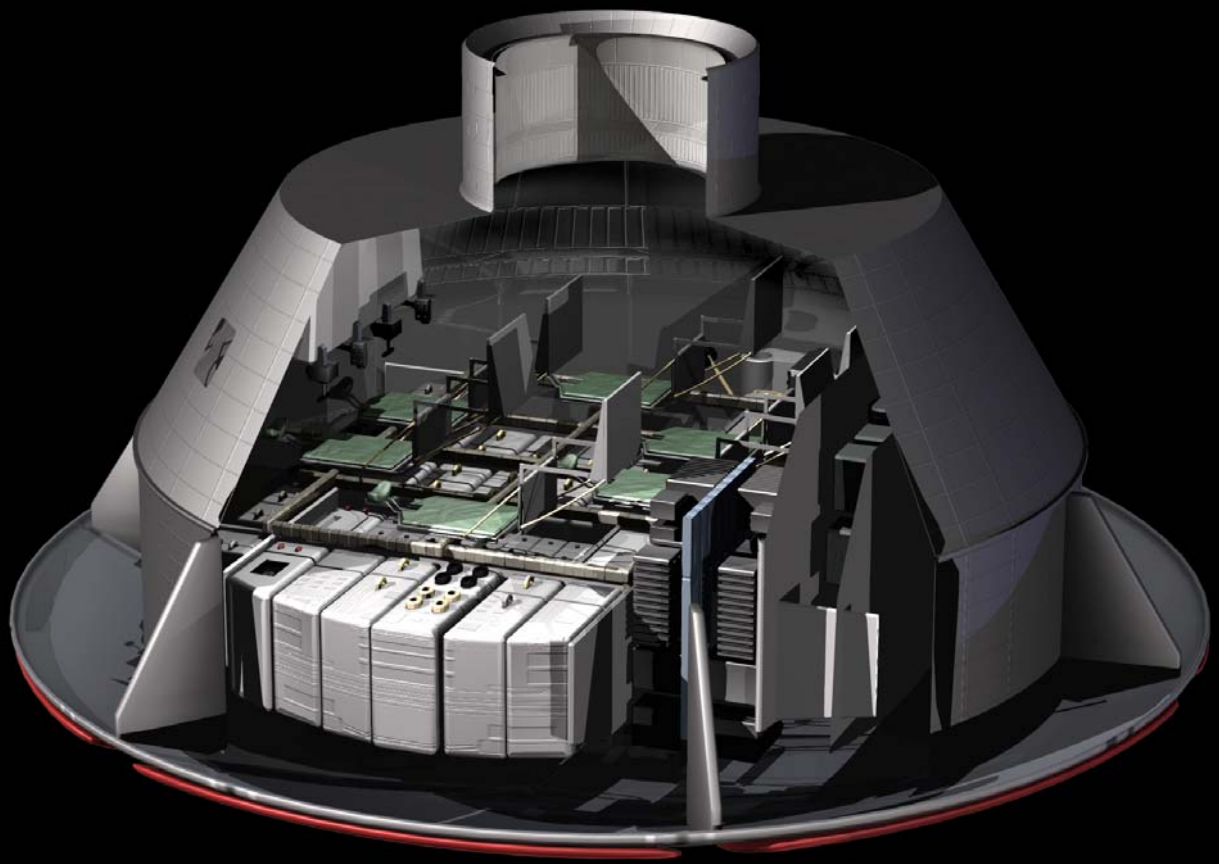


Crew Module

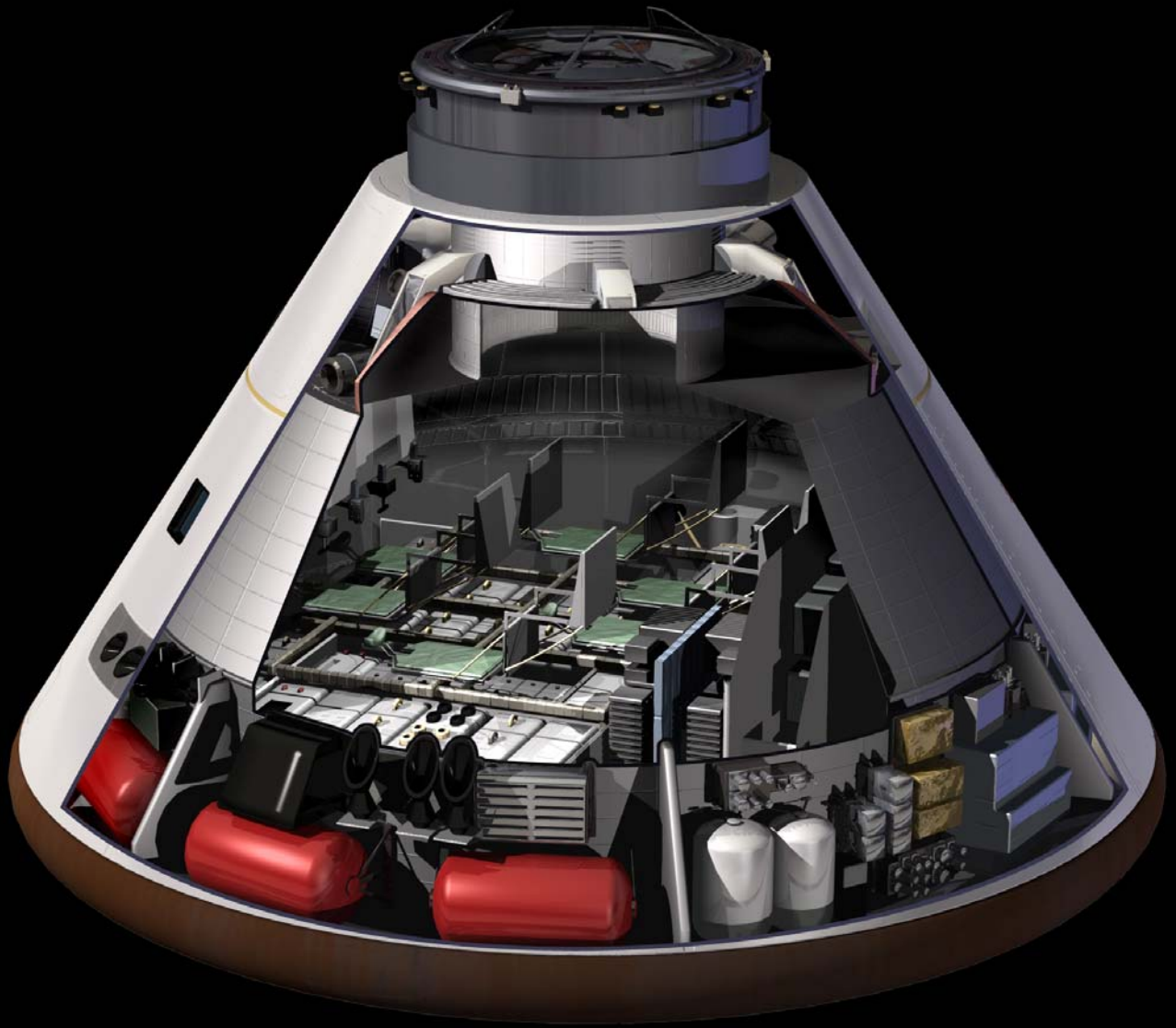
Crew Module



Crew Module



Crew Module



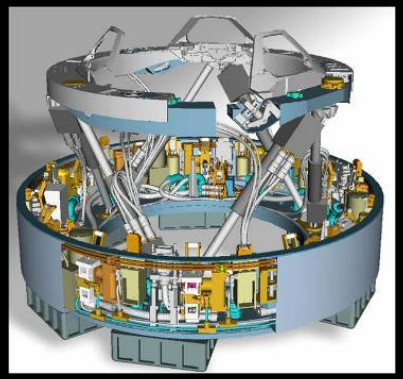
606 Display Console ▶

GFE Projects ▶

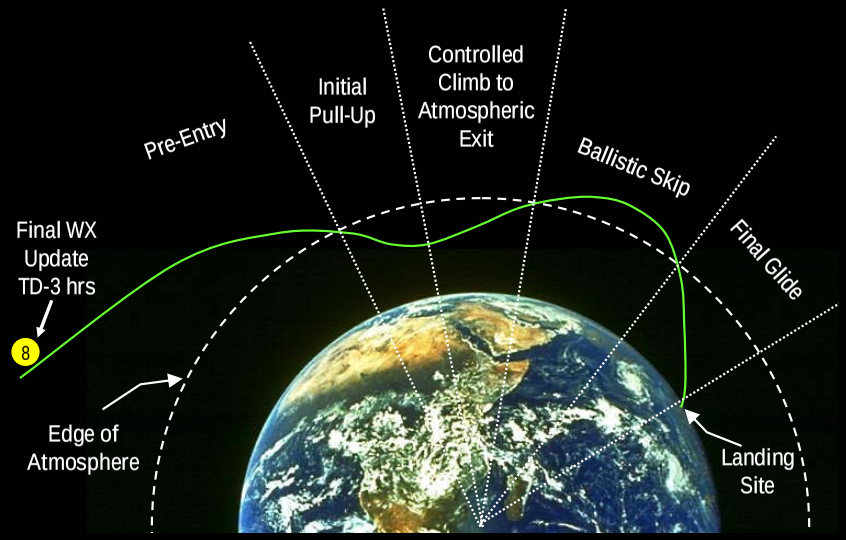
Atlas ▶

Major NASA Technology Applications

Automated Rendezvous & Docking

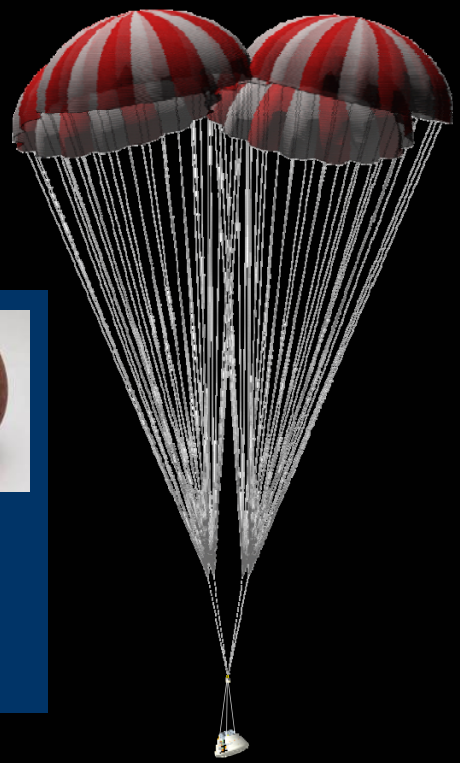


Docking Systems

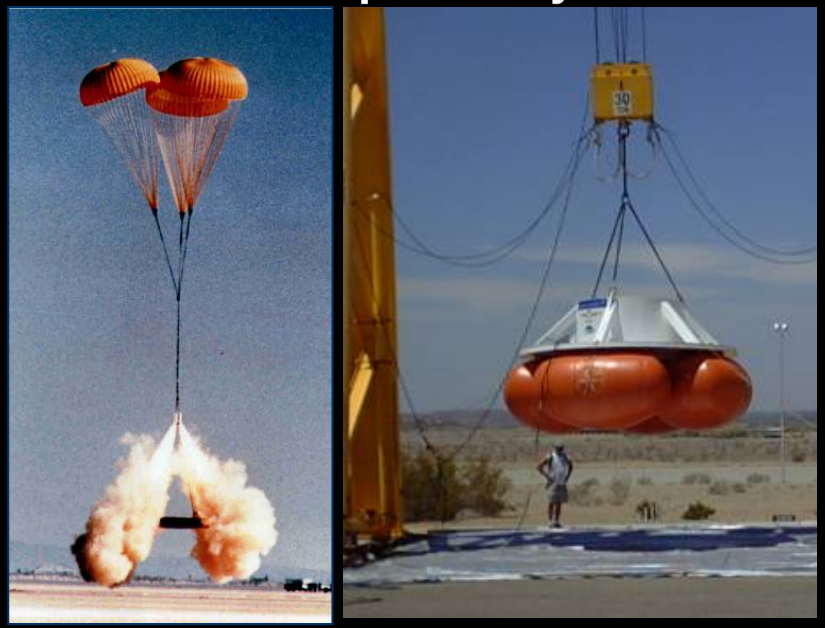


Skip Reentry

TPS “Heat Shield”



Parachutes

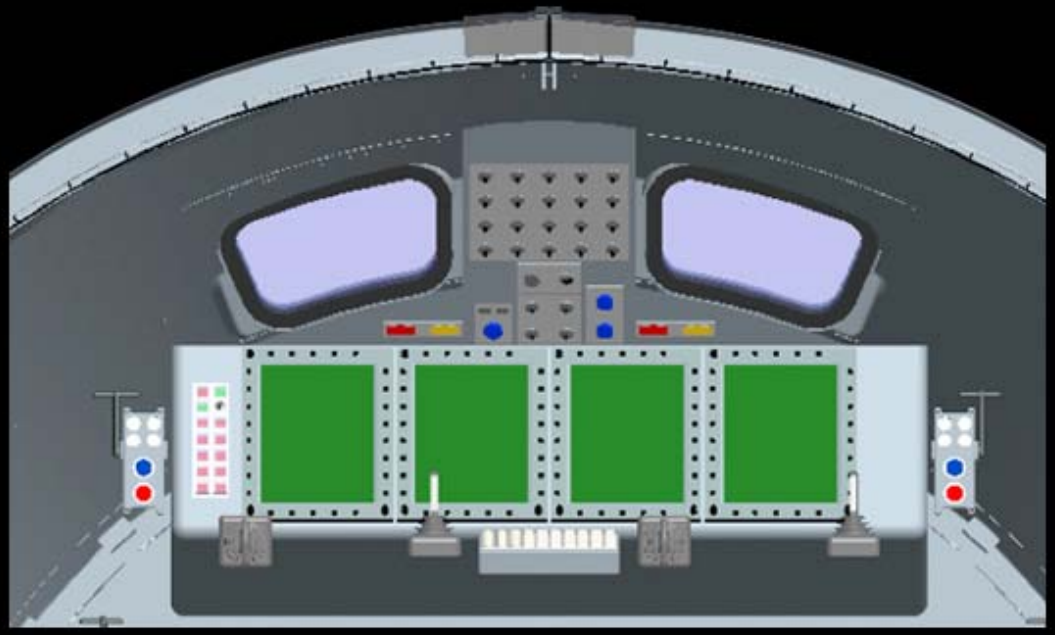


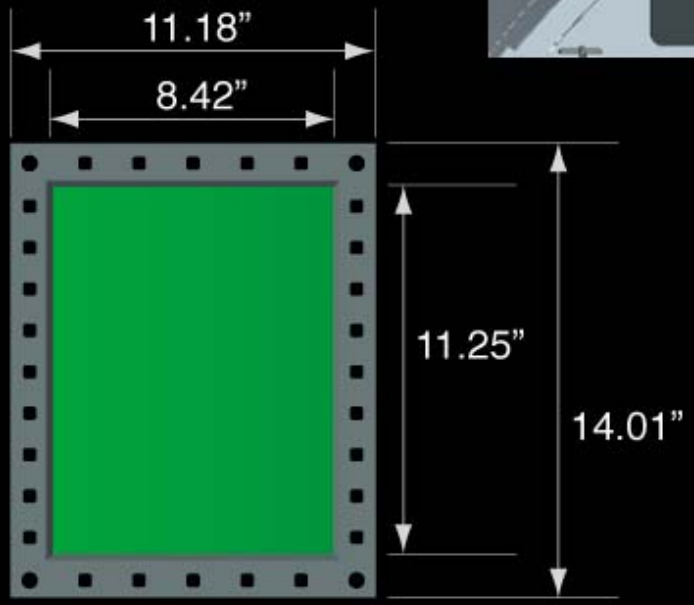
Landing Impact Attenuation

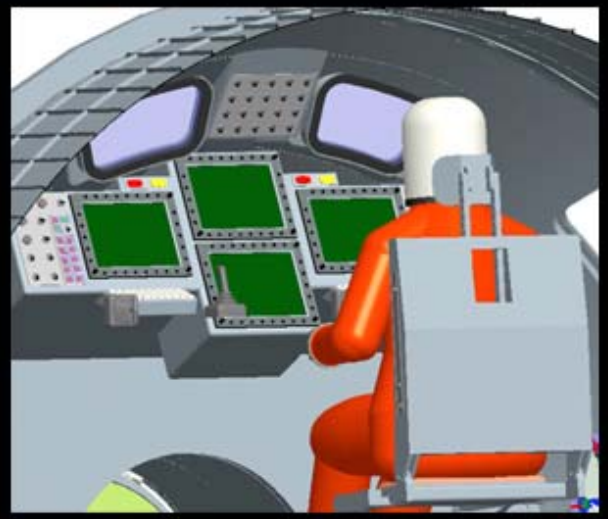
Retrorockets Airbags

606 Display Options

CM606 Display
& Controls Console
Four Screens

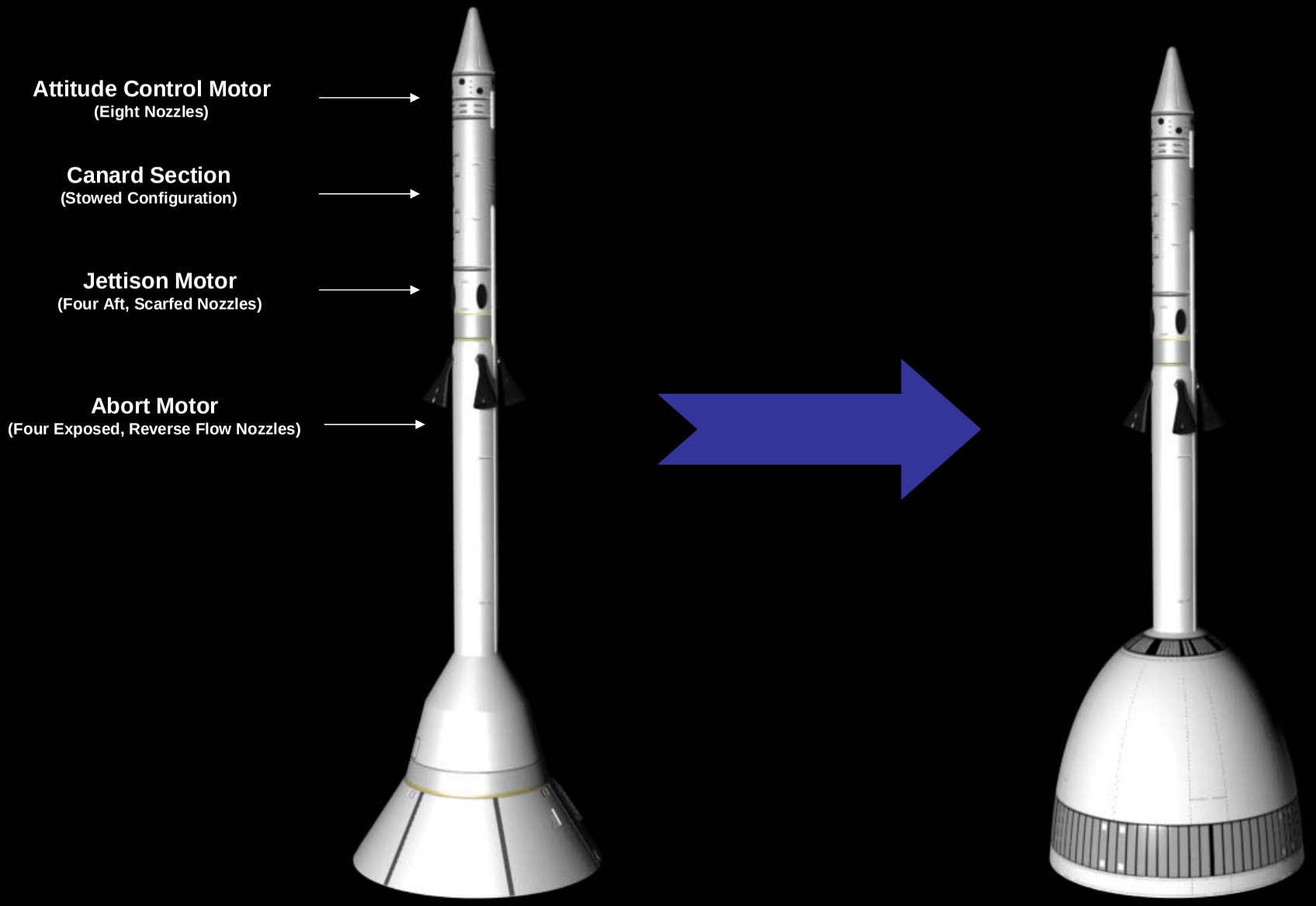






Atlas Docking Adaptor Installation SIM - CM Office

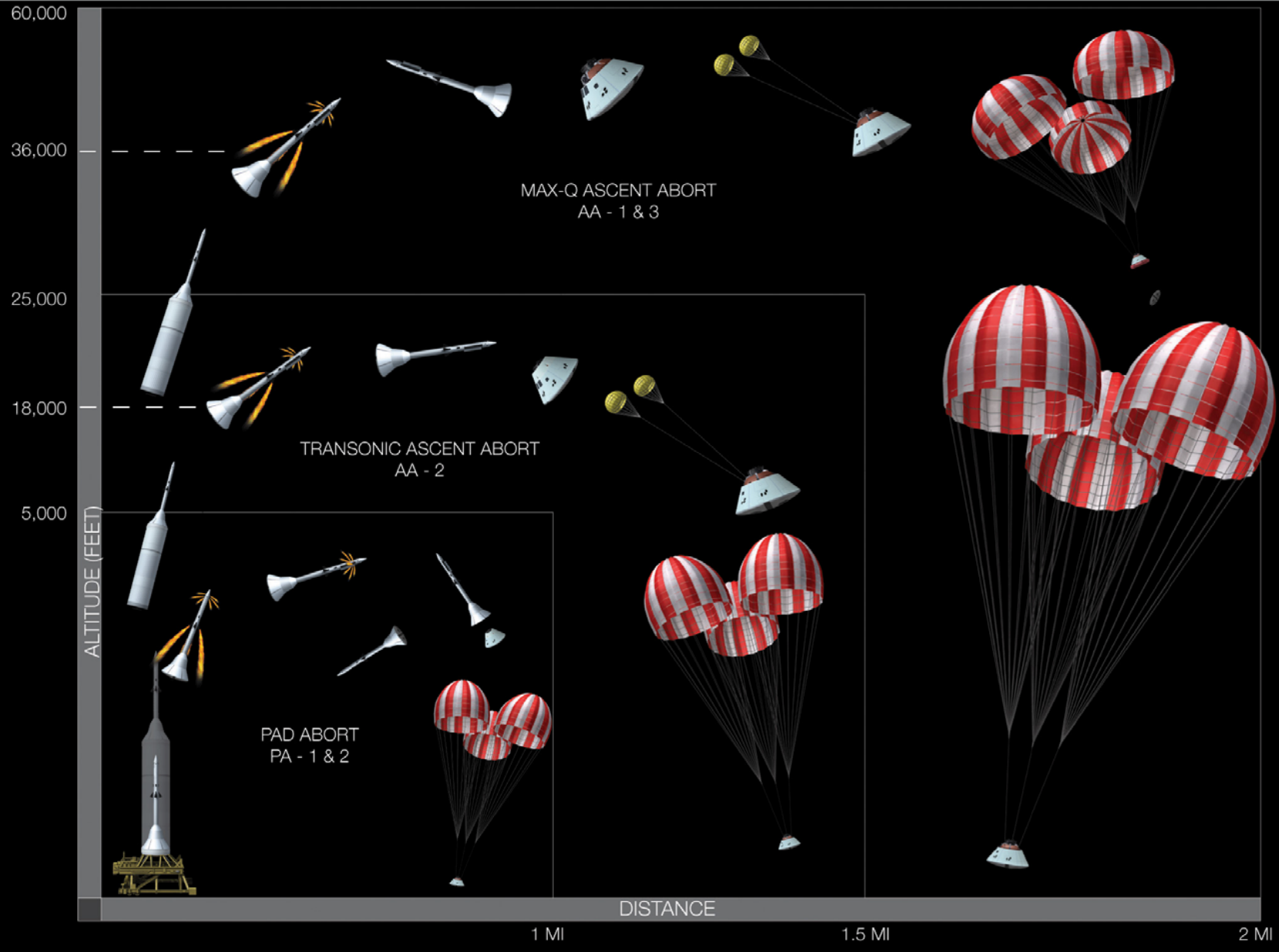
Launch Abort System Evolution



Current
Launch Abort System

Alternate Design
Launch Abort System

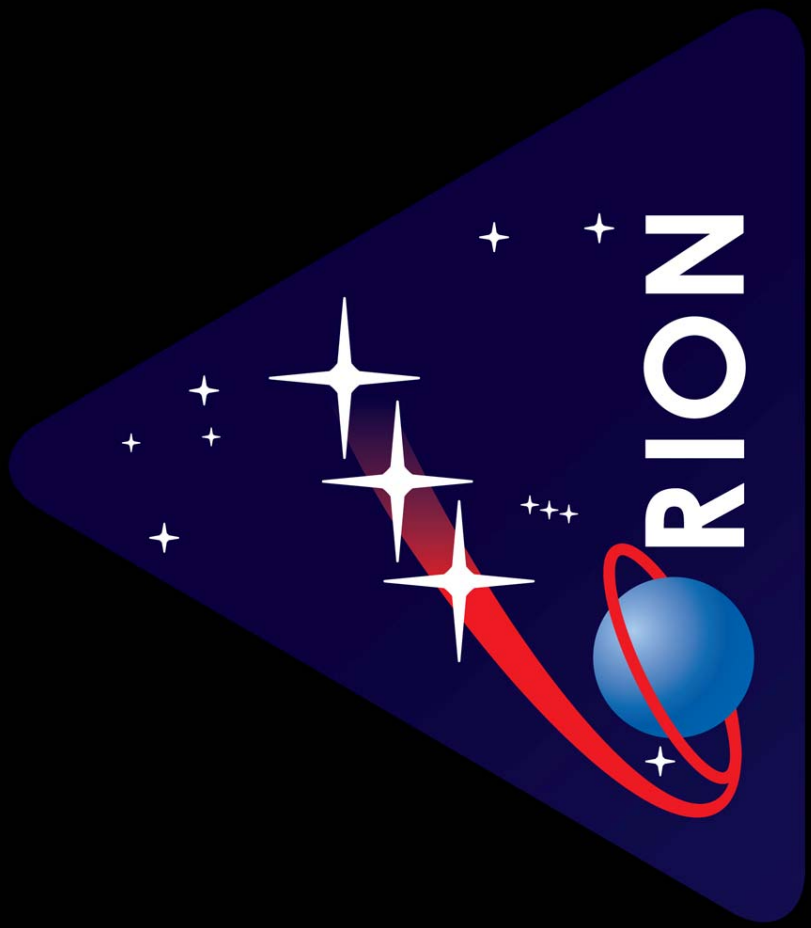
Orion Abort Flight Test Sequence Objectives



Ascent Abort Flight Test #3

◄ back to Orion Abort Scenarios

Spirit of Exploration


RION