



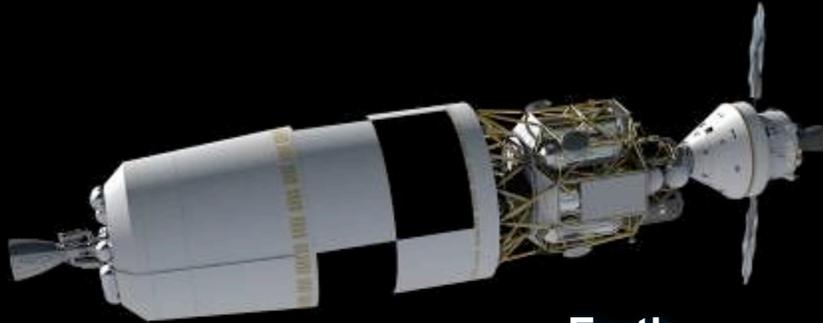
Project Orion Progress and Challenges



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Constellation Program Components



**Earth
Departure
Stage**



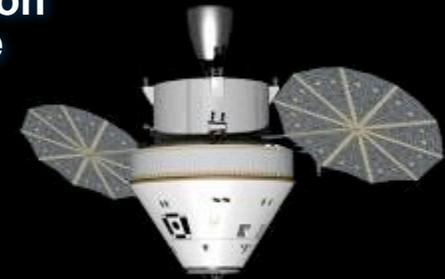
**Orion - Crew
Exploration
Vehicle**



**Ares V -
Heavy Lift
Launch
Vehicle**



**Ares I -
Crew
Launch
Vehicle**



**Altair-
Lunar
Lander**





Orion-CEV Expanded View

Crew Module

crew and cargo transport

Spacecraft Adapter

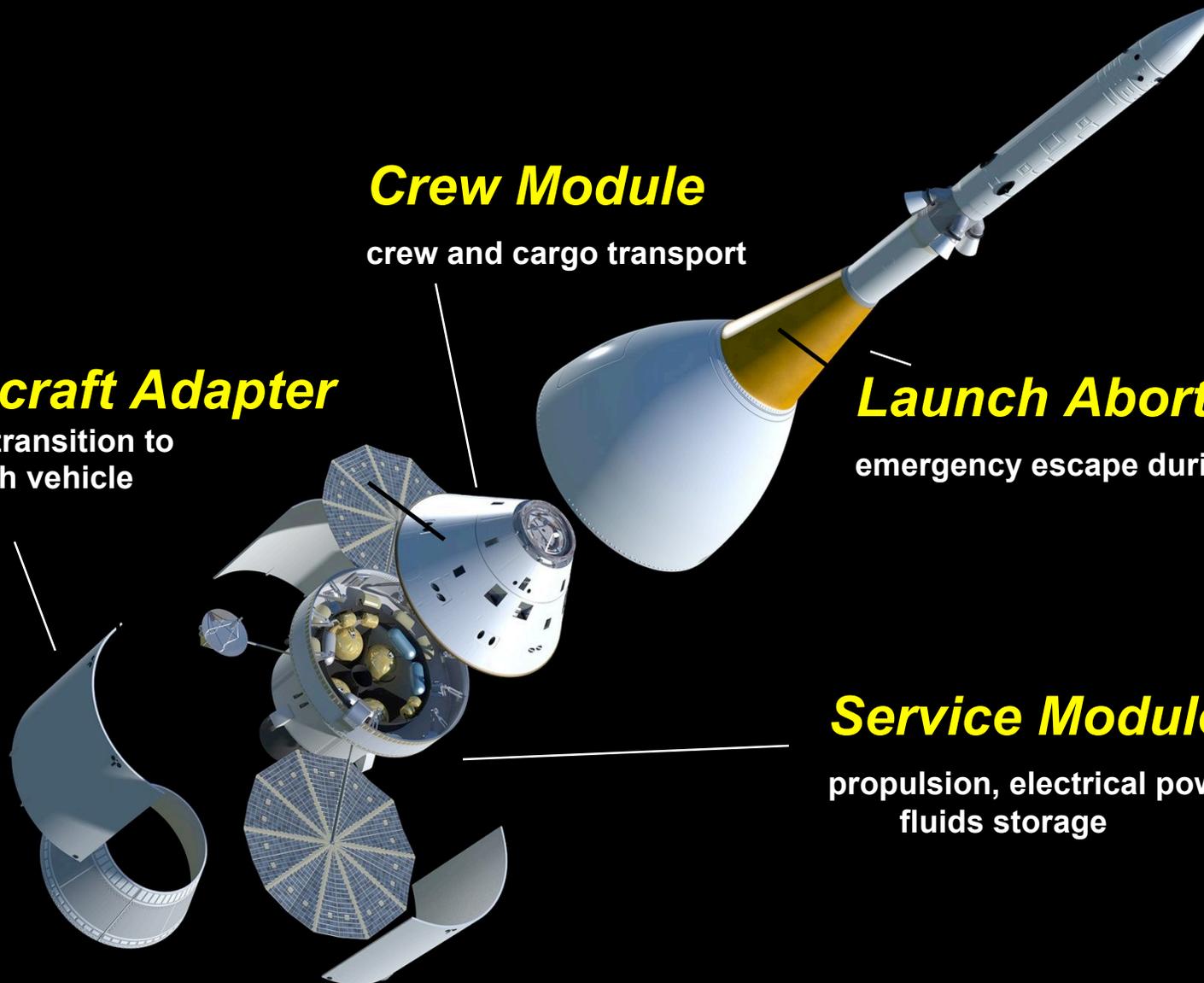
structural transition to
Ares launch vehicle

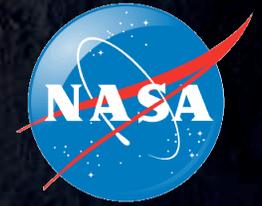
Launch Abort System

emergency escape during launch

Service Module

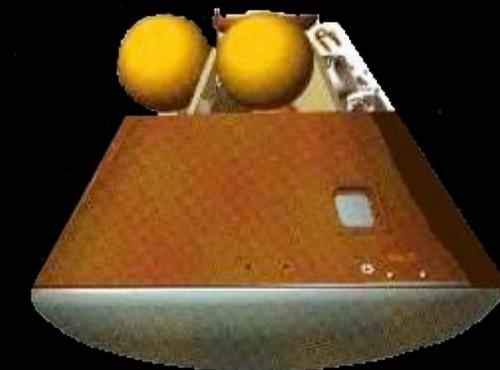
propulsion, electrical power,
fluids storage





Orion Design and Operational Heritage

- **5 meter diameter capsule – Apollo shape**
 - Significant increase in volume from Apollo (3.9 meter)
 - Proven safe technique to withstand extreme heating loads
 - Able to leverage Apollo performance data
 - Reduced development time and risk
- **Larger Crew Accommodations**
 - Lunar missions: 4 crew
 - Space Station missions: 6 crew
- **Expanded Mission Capabilities**
 - Long Duration (6 months)
 - State-of-the-Art Materials, Systems



← 3.9 M →



← 5.0 M →



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 limited pressurized cargo for ISS resupply

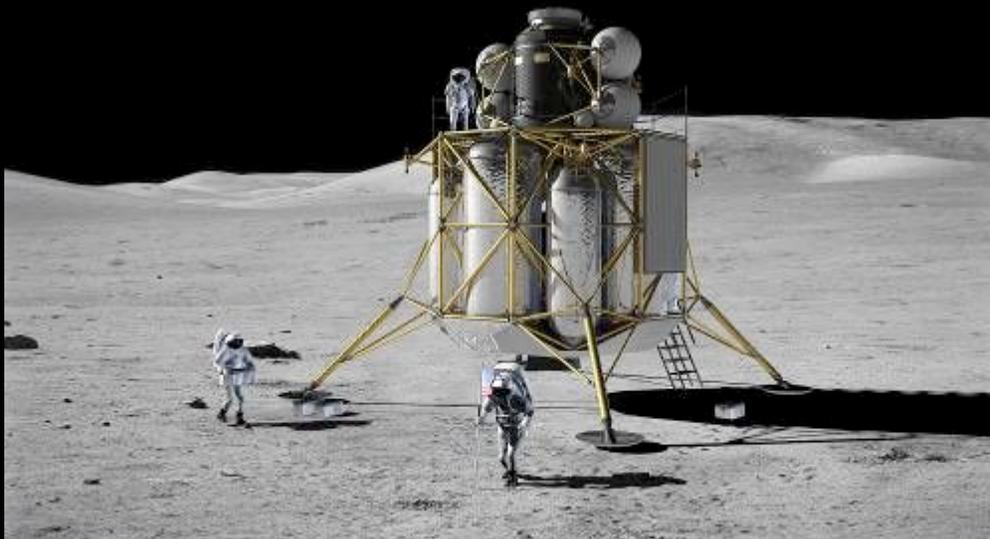




Orion Lunar Mission

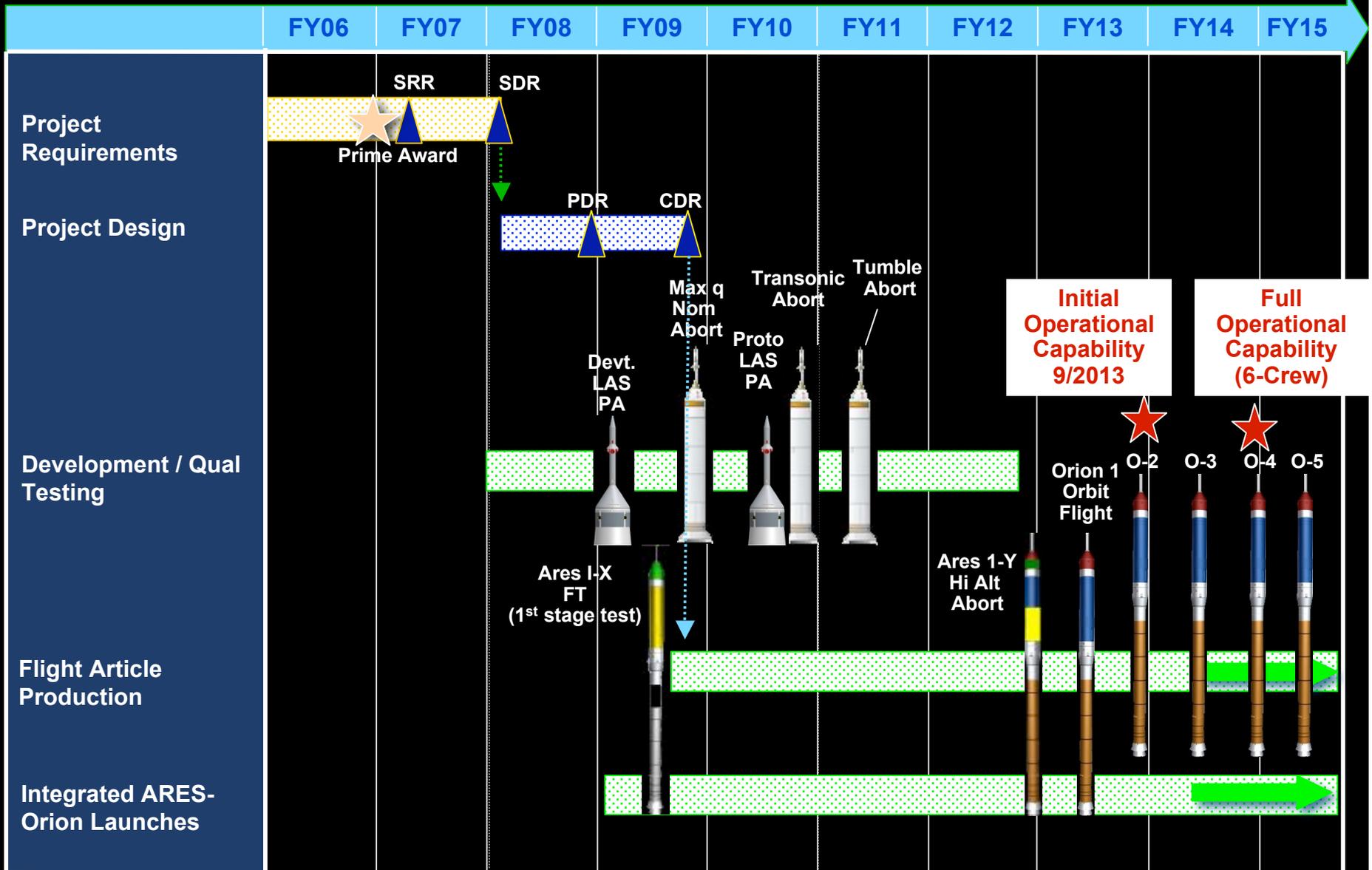


- **Orion and Lunar Lander boosted to lunar orbit**
 - Up to 4 crew onboard
- **Lander descends to lunar surface**
- **Orion is uninhabited during lunar surface operations**
- **Lander upper stage returns to Orion in lunar orbit**
- **Orion returns crew to Earth**





Orion/Ares Flight Schedule Overview



Lunar Sortie Mission

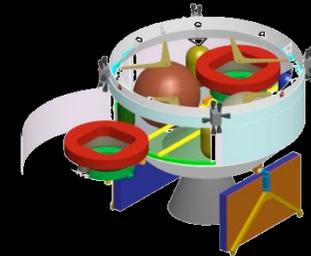


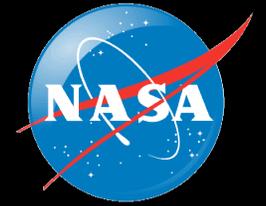
Video



Orion Project Driving Challenges

- Expect to fly Orion for a generation
- Mission adaptability as exploration evolves
- Block upgrades to capability as experience gained
 - First major upgrade for lunar capability
- Invest in safety – *“Liftoff to Landing”*
- Design for low operations cost – Invest in life cycle efficiency and lowest total ownership cost as basis of sustainability
- Leverage experienced workforce and industrial capability





Recent Orion Accomplishments



**Pad Abort Test #1 – Crew Module
Boilerplate Test Article**