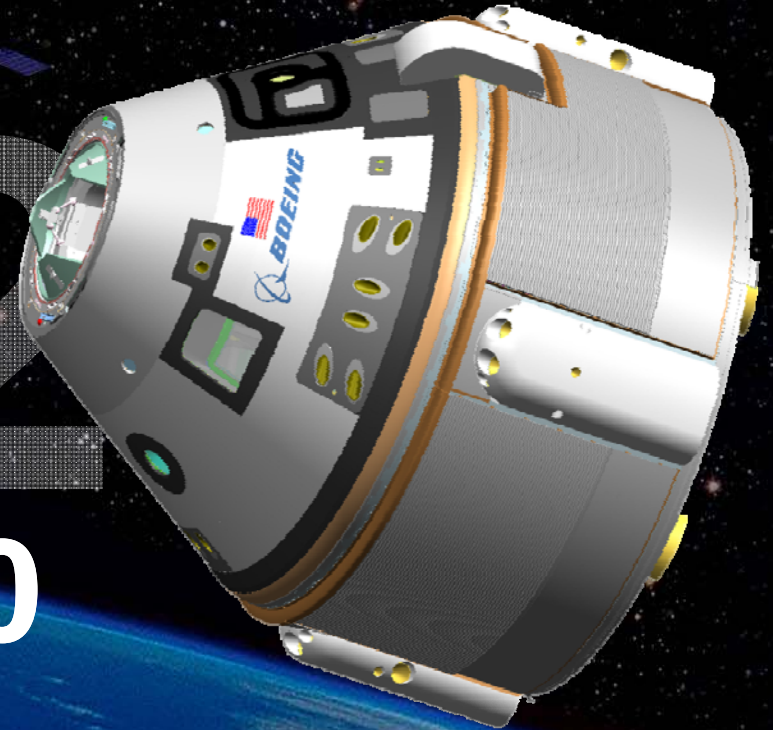
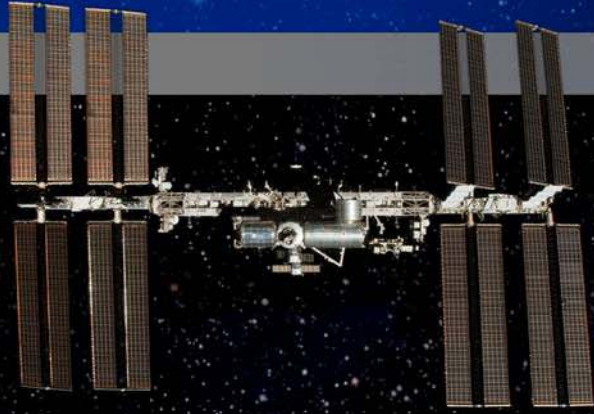




NASA Commercial Crew
Development 2 (CCDev2)



Boeing CST-100

Commercial Crew Transportation System

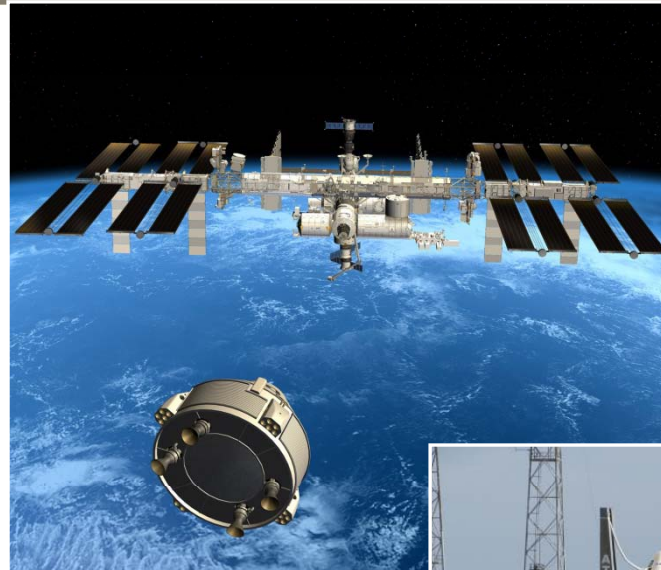
Mike Burghardt
Director - Commercial
Crew Spacecraft
Development

August 2011

Commercial Crew Transportation System (CCTS)

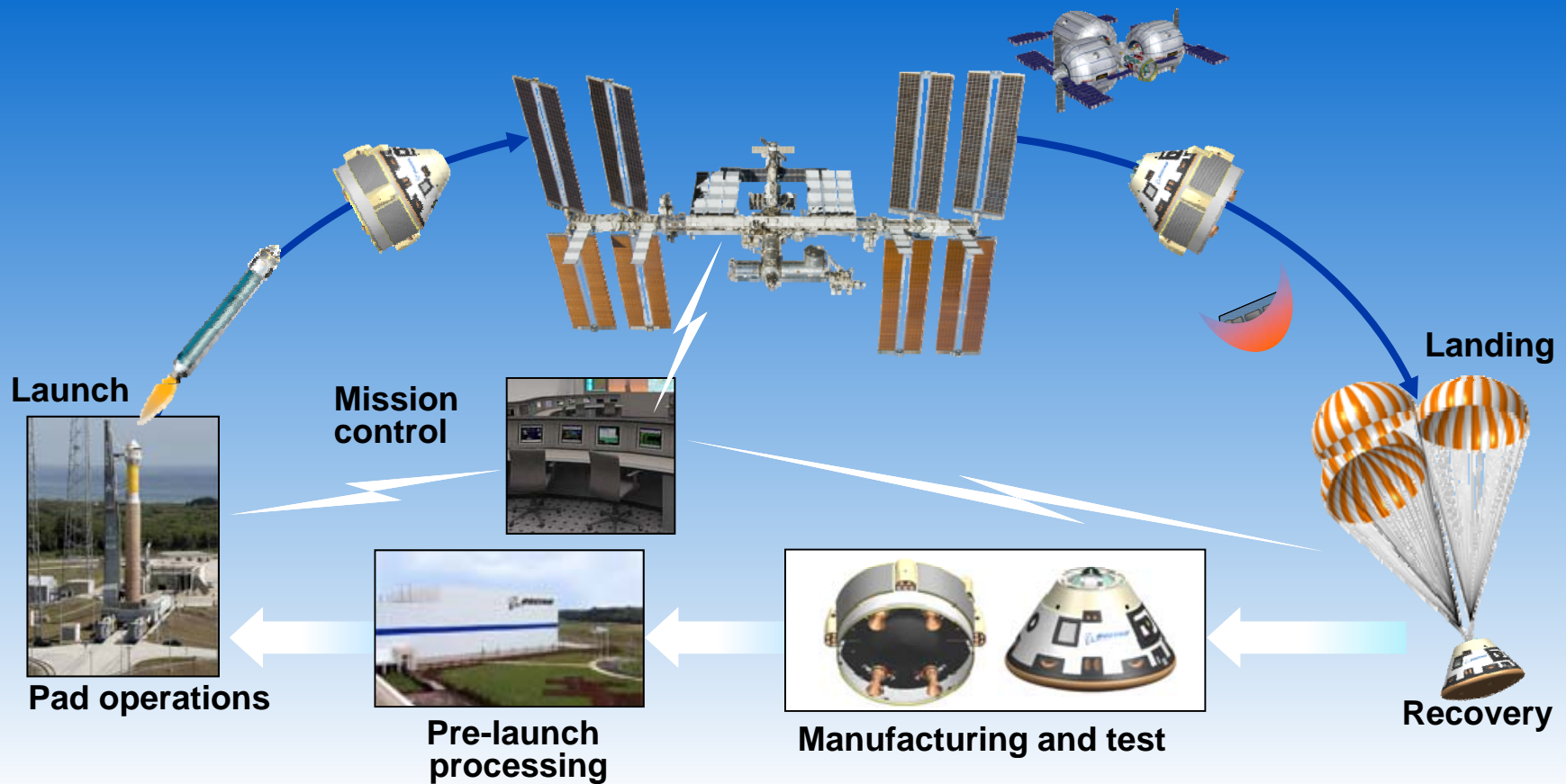
Space Exploration | NASA Commercial Crew Development 2 (CCDev2)

- **Design objectives dictate simple systems and proven components**
 - Safe and reliable
 - Low development risk
 - Low recurring cost
- **Compatible with a variety of launch vehicles**
 - Have down selected to Atlas V for initial flight tests and verification
- **Operational in 2015**
- **Complete transportation system**
 - Spacecraft
 - Launch Vehicle
 - Ground Operations
 - Mission Operations
 - Recovery



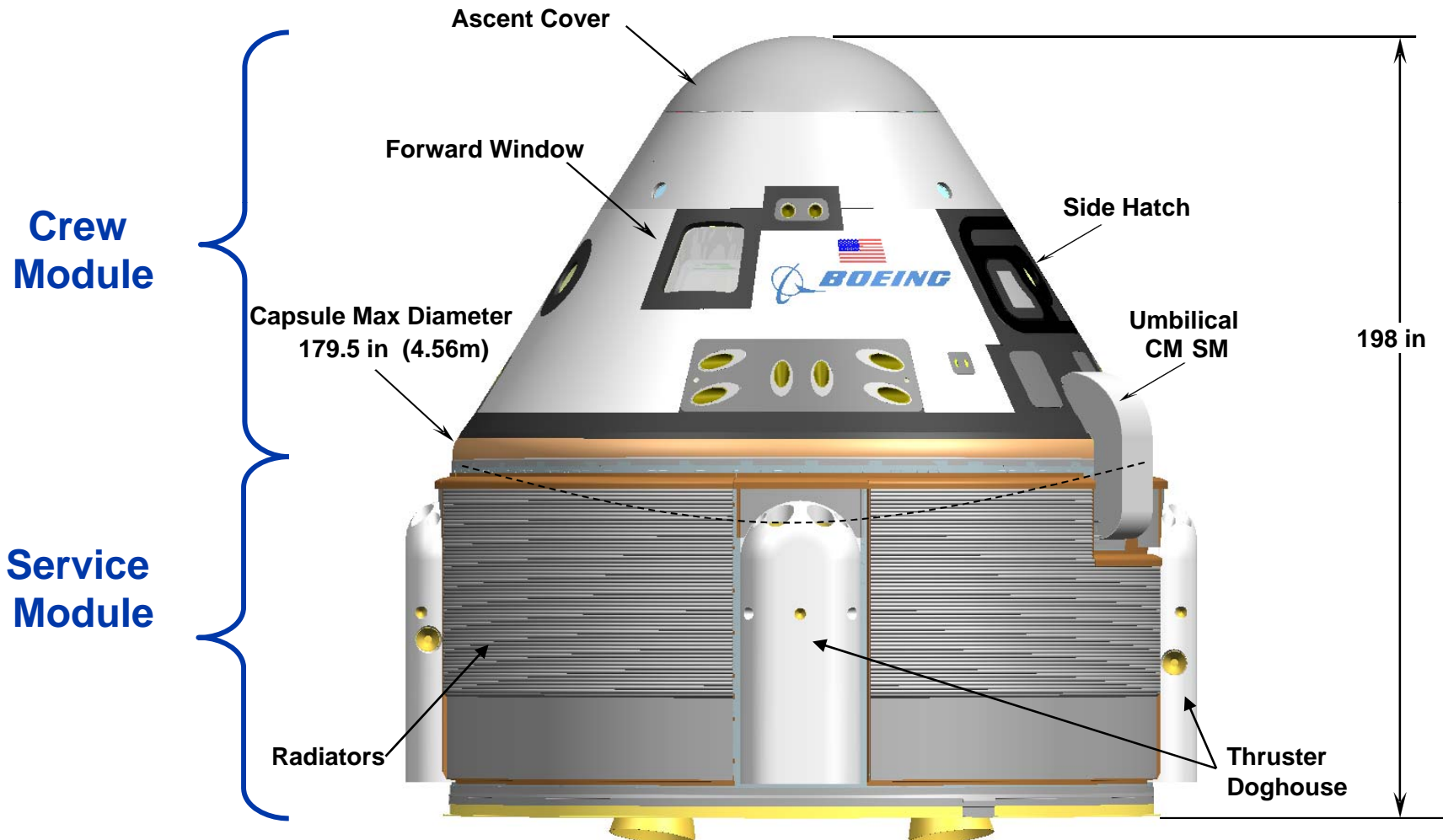
Operations Concept Supports Crew Transportation Requirements

Space Exploration | NASA Commercial Crew Development 2 (CCDev2)



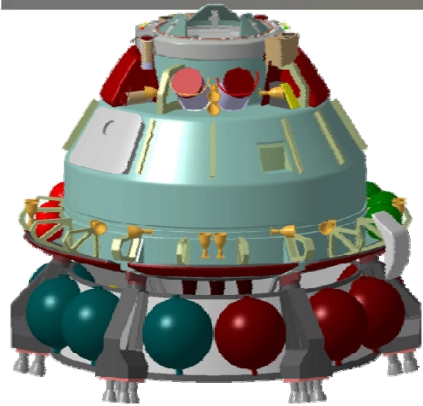
CST-100 Configuration

Space Exploration | NASA Commercial Crew Development 2 (CCDev2)



CCV Evolution

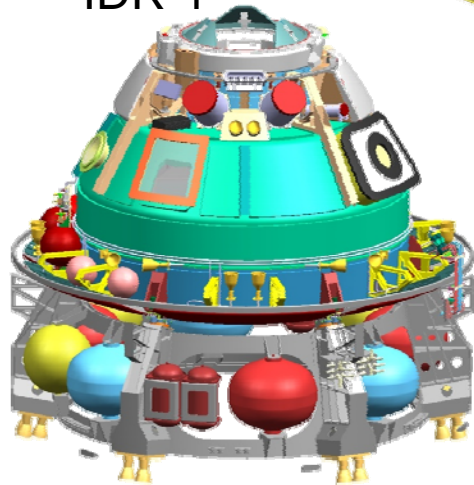
Space Exploration | NASA Commercial Crew Development 2 (CCDev2)



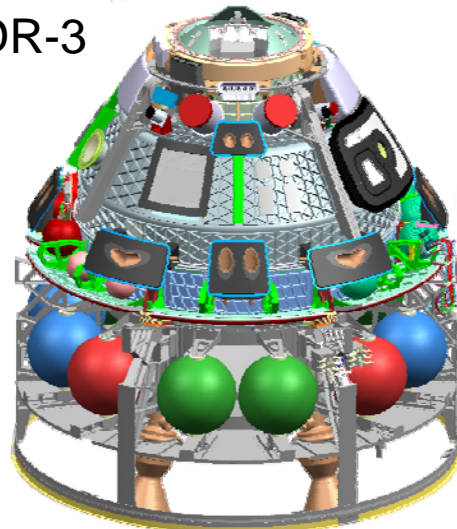
IDR-1



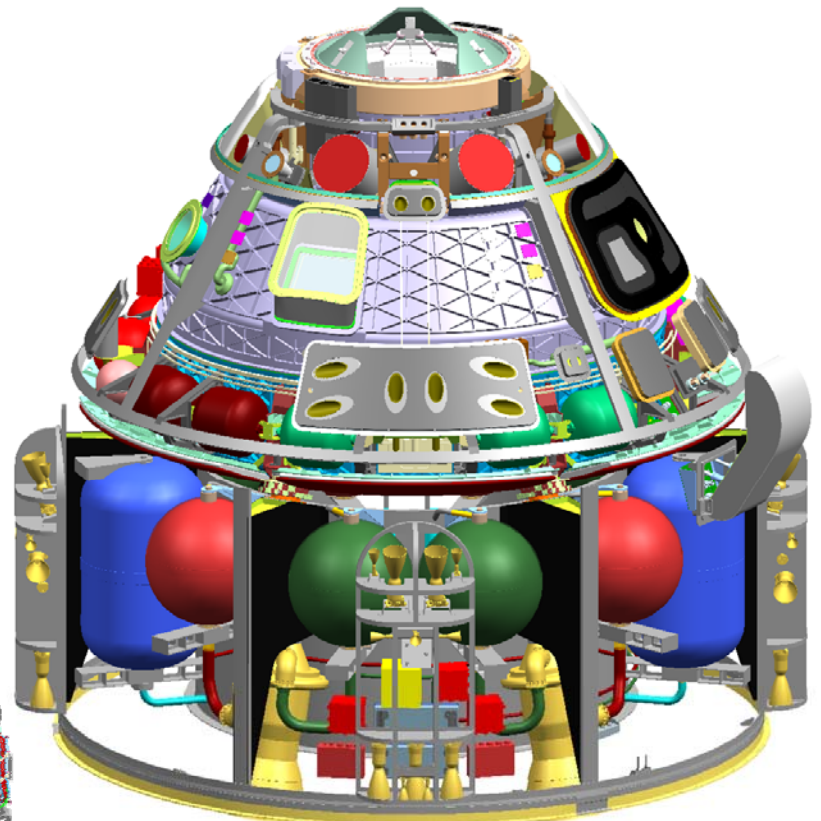
IDR-3



IDR-2



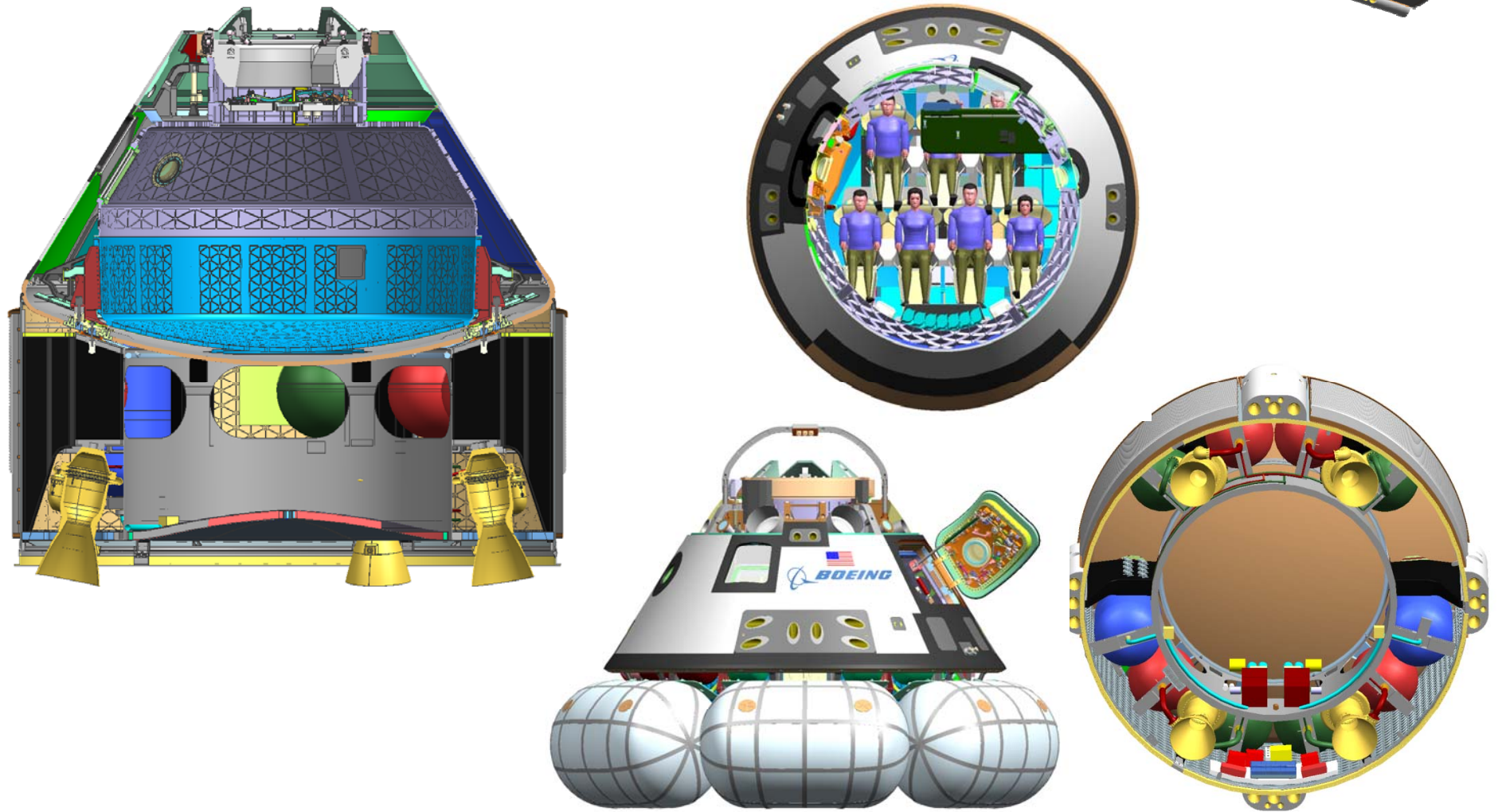
SDR



IDR-4

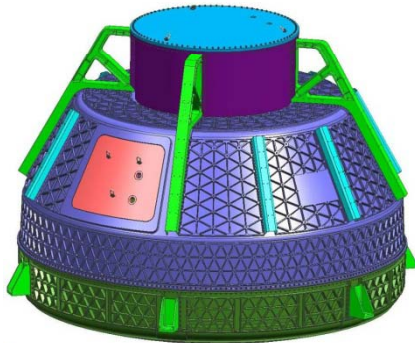
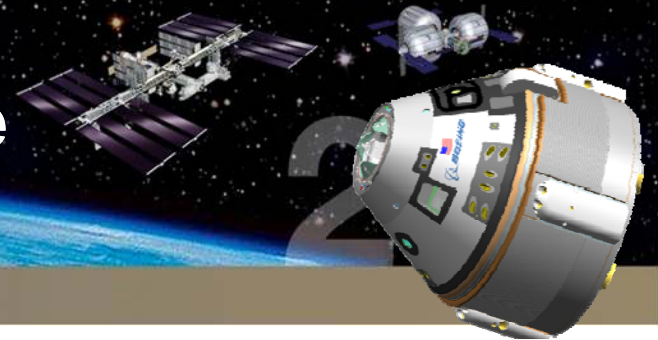
CST-100 Layout

Space Exploration | NASA Commercial Crew Development 2 (CCDev2)



CCDev CM Pressurized Structure Fabrication & Test

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**CM Pressurized Structure
From Concept to Finished Product**

CST-100 CCDev Design Maturation – Base Heat Shield

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BHS Ablator Installation



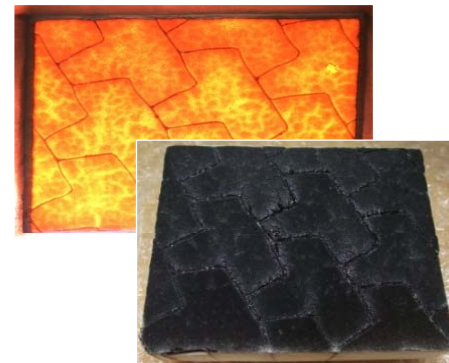
BHS Ablator Machining



**Heat Shield Carrier
Structure Fabrication**



Arc jet test



CST-100 CCDev Design Maturation – Landing Drop Tests

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CM Air Bag Drop Test



Water Landing Up-righting Test



CM Water Drop test

CST-100 CCDev Design Maturation – CM Mock-up

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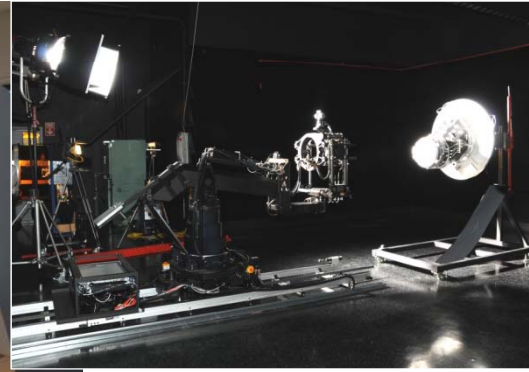


**Crew
Module
Mockup**



CST-100 CCDev Design Maturation – Simulations, Life Support & Abort Engine Hot Fire

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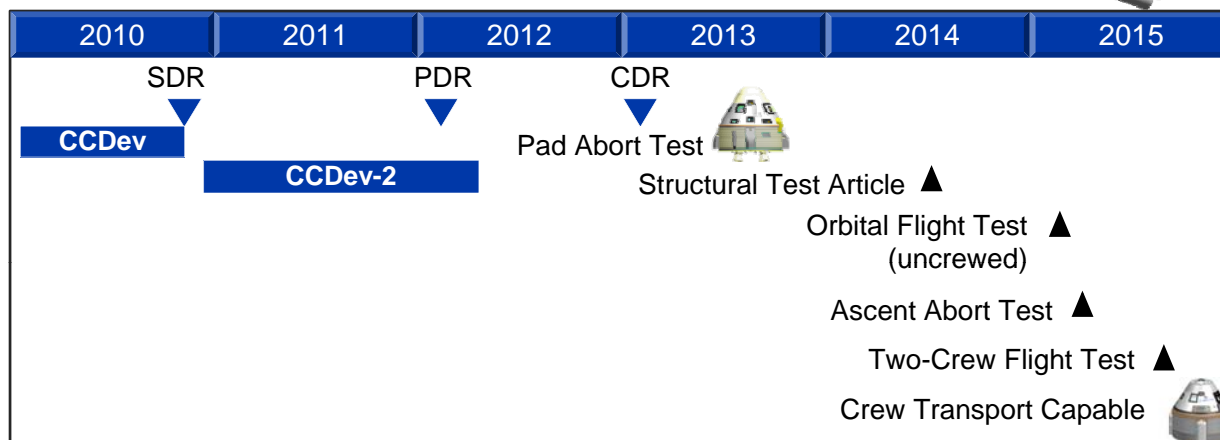


Full Crew Transportation Capability by 2015

Space Exploration | NASA Commercial Crew Development 2 (CCDev2)

■ CST-100 takes advantage of heritage hardware to reduce schedule risk

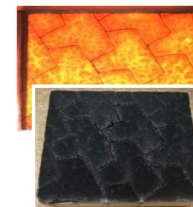
- APAS docking system
- Orbital Express demonstrated AR&D
- Apollo heritage parachute system
- Abort system using existing components
- BLA from other programs
- Delta based spin formed structures
- Airbag landing system from CEV/Orion



Air Bag System



APAS Hardware



Boeing Lightweight Ablator



Weldless structure



Integrated AR&D System



SM Abort Engine



Heritage Parachute System



Simple, passive life support systems

Commercial Crew

Space Exploration | NASA Commercial Crew Development 2 (CCDev2)



- **Significant Progress to date under CCDev & CCDev-2**
 - 40 Milestones completed to plan
 - Preliminary Design Review in Feb. '12
- **Low Risk, Low Cost Development**
 - Simple Systems
 - Existing Technologies
 - Proven Launch Vehicles
 - NASA's Acquisition Approach equates to Fixed Price Development
 - Demonstrated Commercial Development Approach with NASA Involvement
- **Low Operational Costs**
 - Leveraging Boeing's Commercial Aircraft experience
 - Multiple mission capsule

*Reliable, Safe Transportation Soon;
Affordable Access to LEO Enables Exploration Beyond LEO*