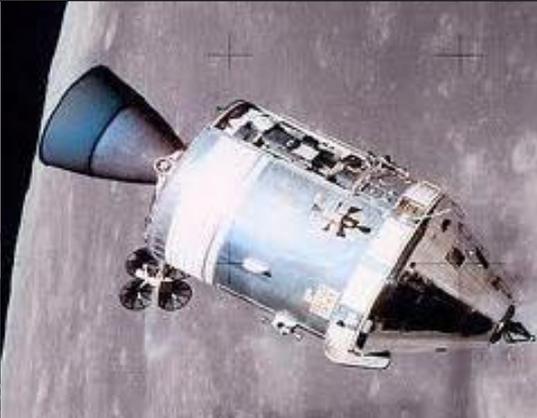




# Boeing Commercial Crew Transportation System

Chris Ferguson  
Boeing  
February 6, 2013

# Boeing Brings History of Human Space Flight & Commercial Airplanes Together



# Commercial Crew Transportation System (CCTS)

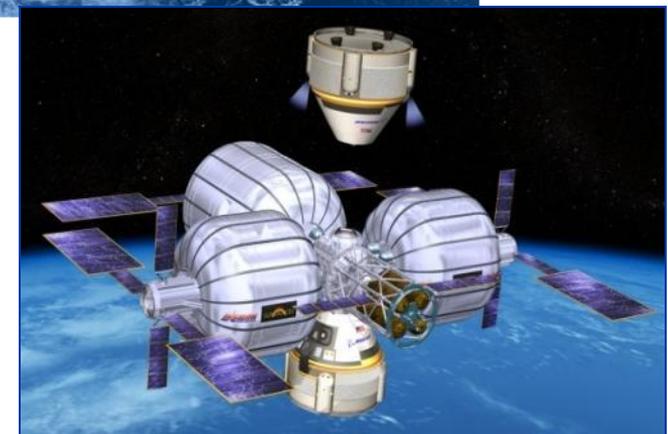


- **Complete transportation system**
  - **Crew/Launch Vehicle**
  - **Ground/Mission Operations**
- **High TRL systems and proven components**
  - **Safe and reliable**
  - **Low development risk / cost**
- **Compatible with a variety of launch vehicles**
  - **Atlas V for initial flight tests and verification**
- **Operational in 2016**

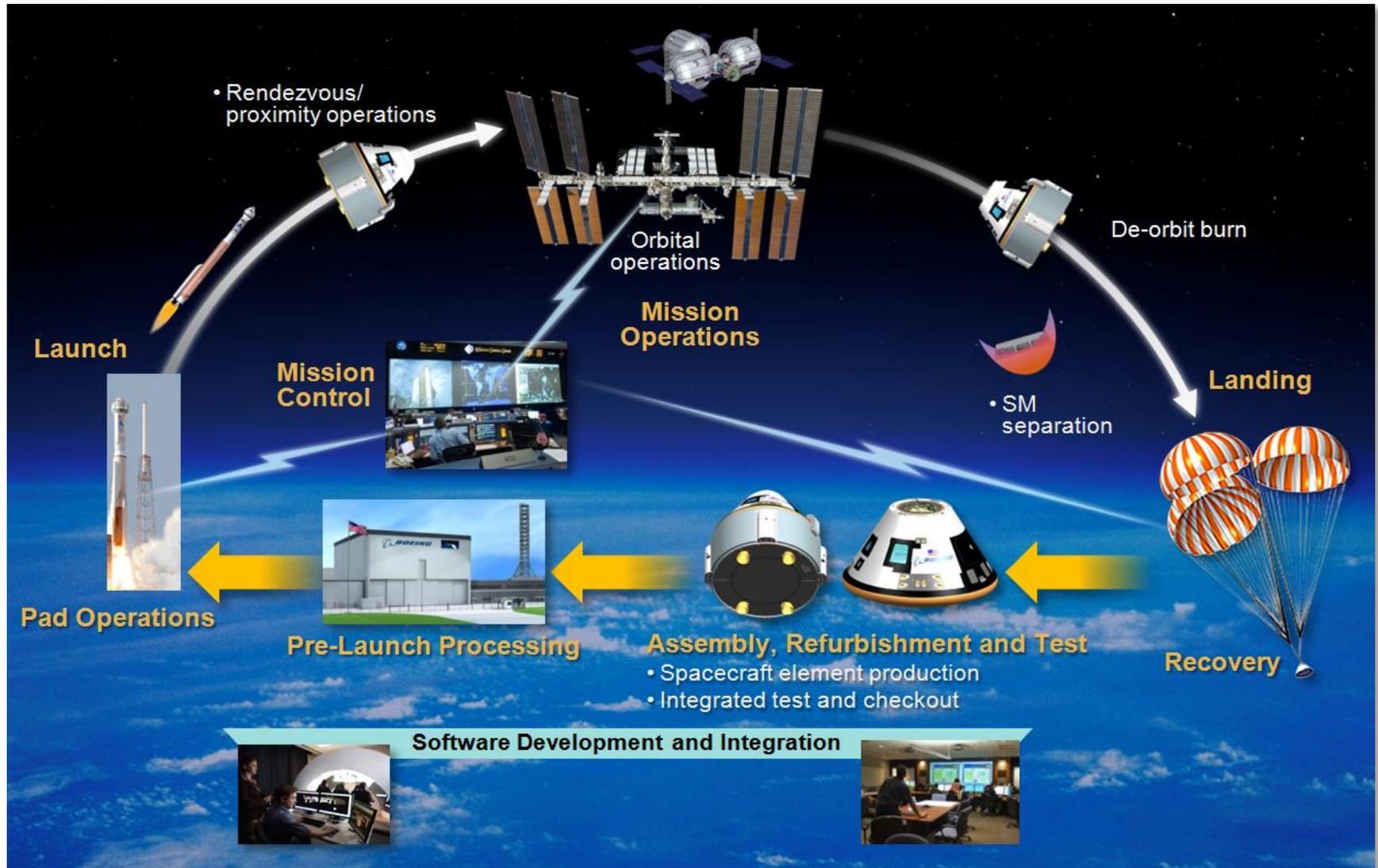


**Boeing CST-100  
Partners & Subs**

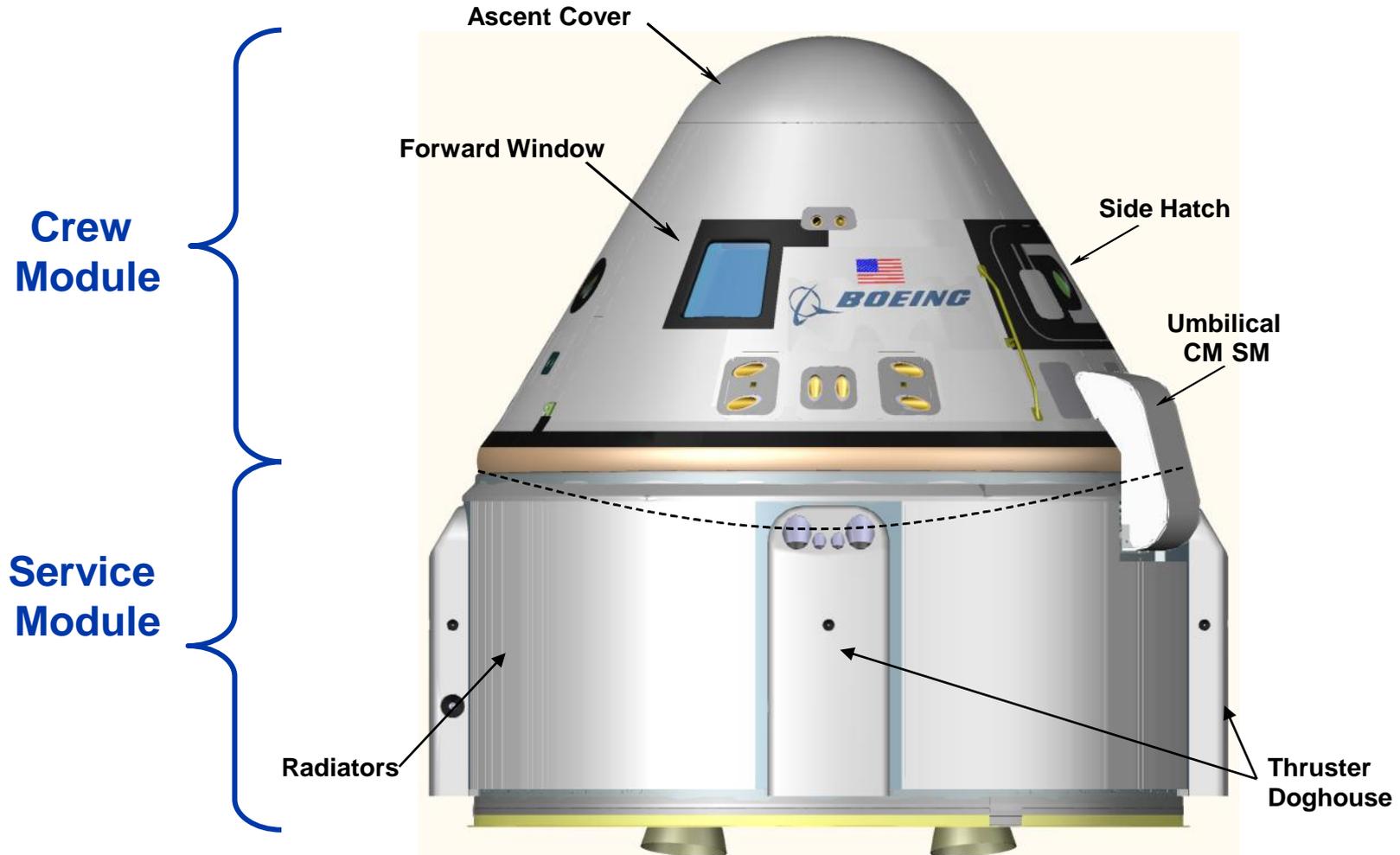
**Bigelow Aerospace  
PWR  
General Dynamics  
Airborne Systems  
Spincraft**



# Concept of Operations



# Spacecraft Segment (CST-100)



# Launch Abort System



- Abort capability from the launch pad through orbit insertion. Protects for:
  - Complete or partial loss of ascent propulsion
  - Loss of attitude/trajectory control
  - Time-critical system failures

**Bantam Engine**



**Launch Abort Engine Test Firing**

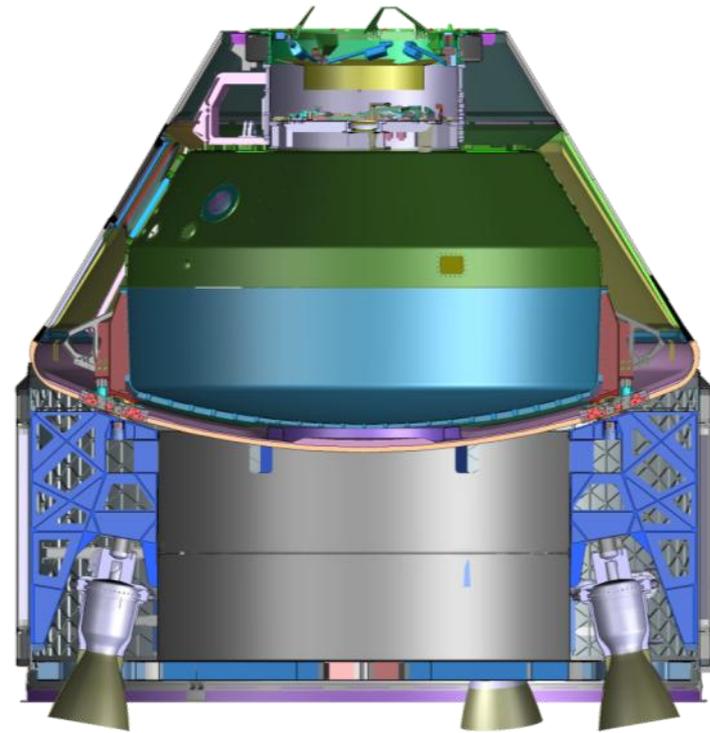


**OMAC RCS Engine Test Firing**

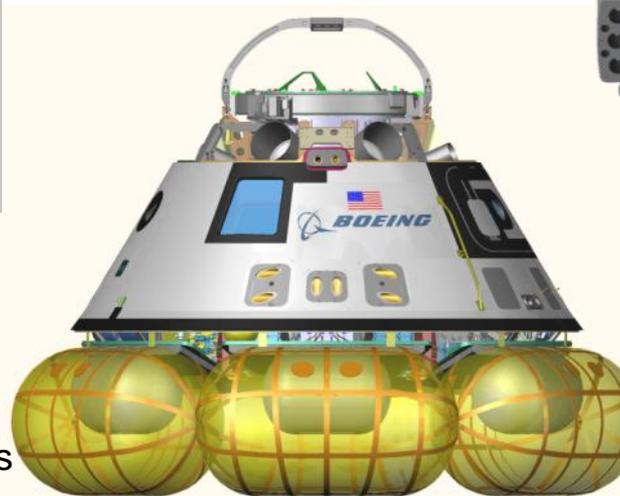
# CST-100 Key Design Features



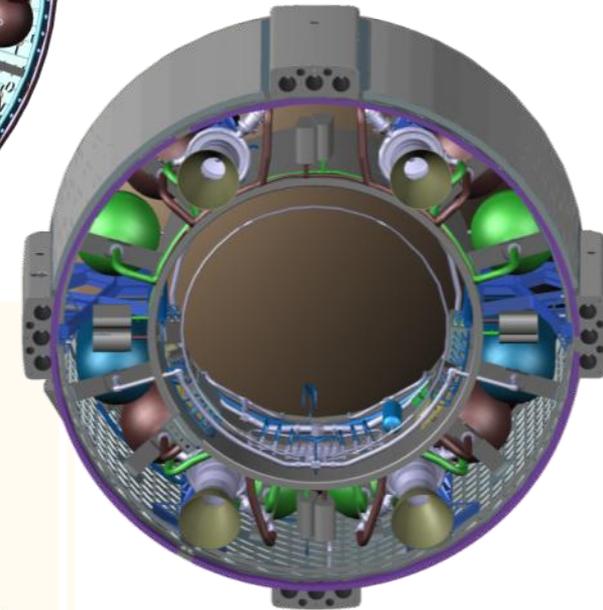
Crew of Seven or  
Combination of Crew and Cargo



Reusable Crew Module (CM)  
Expendable Service Module (SM)



Land Landing on Airbags



Liquid Propellant  
Launch Abort System

# Atlas V: TDRS – K Launch



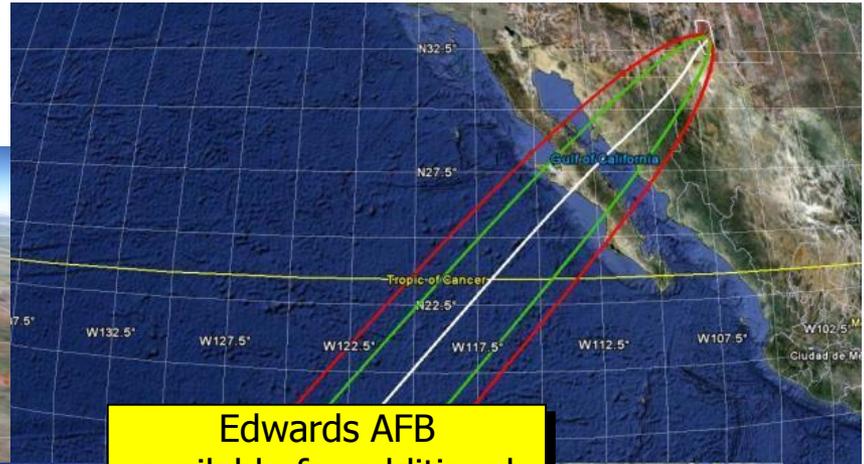
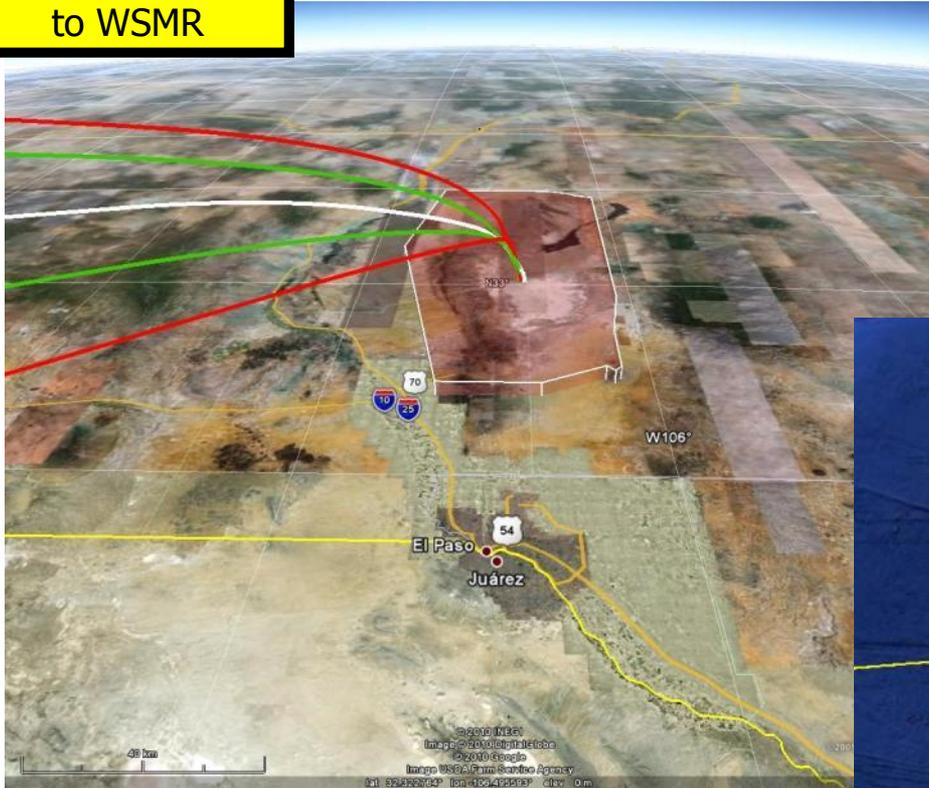
- 617<sup>th</sup> launch for Atlas program since 1957
- 206<sup>th</sup> mission for the Centaur upper stage
- 35<sup>th</sup> launch of an Atlas V since 2002
- 27<sup>th</sup> Atlas V under United Launch Alliance
- 8<sup>th</sup> NASA launch on Atlas V
- 4<sup>th</sup> TDRS launched on an Atlas vehicle
- 1<sup>st</sup> Atlas V launch for TDRS



# Landing Opportunities



Nominal returns  
to WSMR

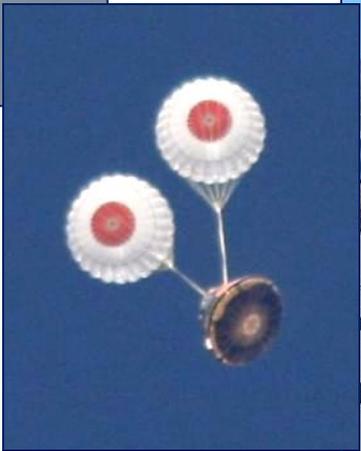
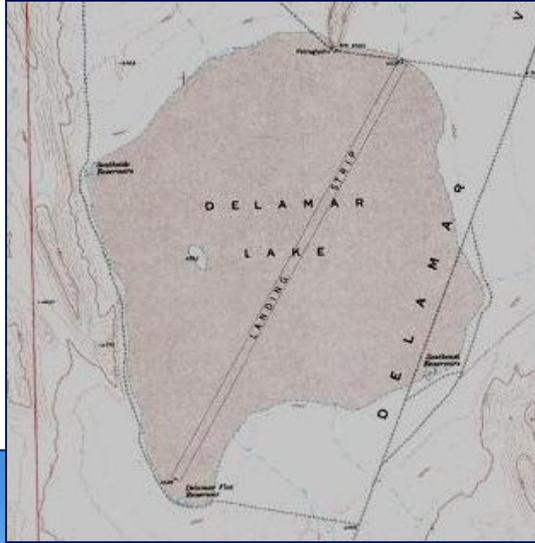
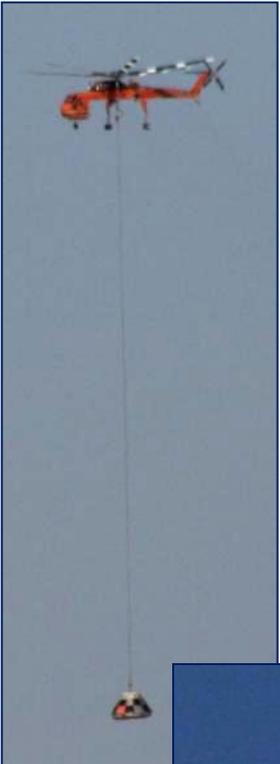


Edwards AFB  
available for additional  
landing opportunities

Emergency  
water landing  
opportunities



# CST-100 CCDev Design Landing Drop Tests



# CM/SM Assembly in KSC OPF-3



***Base Heat Shield Installation***

***Fueling Operations Before Flight***



# CCTS Design Maturation Under CCIcap Thru Jan 2013



- Integrated System Review
- Production Design Review
- Phase 1 Safety Review Board
- CST-100 Interior Layout Evaluation
- Software Engineering Release 2.0
- Landing & Recovery/Ground Comm Design Review

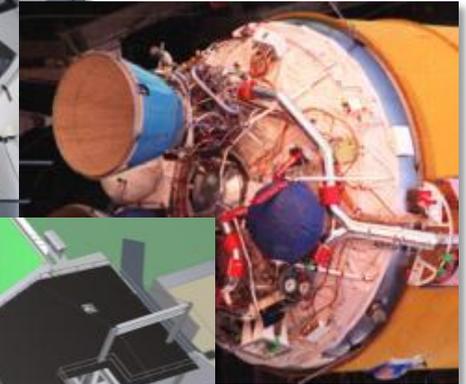


# CCTS Design Maturation Under CCIcap 2013 Milestones



## Boeing's CCTS 2013 Plan:

- CST-100 / Atlas V integration
- Mission Control demonstrations
- Continued re-development of the ULA Dual Engine Centaur
- Launch Vehicle Adapter PDR & CDR
- Continued development of KSC OPF-3



# Boeing Commercial Crew Summary



- **Significant Progress under CCDev and CCiCap**
  - Critical Design Review in Apr, 2014
- **Low Risk Development**
  - Simple systems
  - Proven launch vehicles
  - Commercial approach with NASA involvement
- **Low Operational Costs**
  - Leverages Boeing's commercial aircraft experience
  - Multiple mission capsule

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

