

National Aeronautics and Space Administration



Commercial Crew and Cargo Program

13th Annual FAA Commercial Space Transportation Conference

Arlington, VA

February 11, 2010

Alan Lindenmoyer

Program Manager
Commercial Crew & Cargo Program
Exploration Systems Mission Directorate
Johnson Space Center

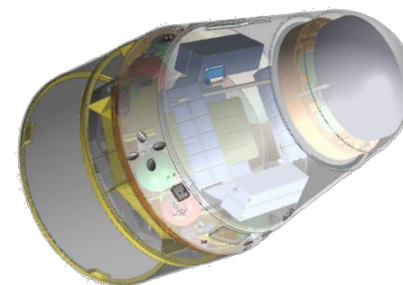
COMMERCIAL CREW & CARGO

SpaceX COTS System

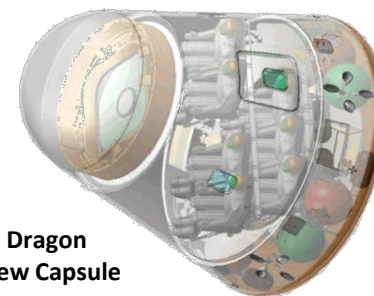


Description and Features:

- Falcon 9 Medium Class Launch Vehicle
- Dragon Crew/Cargo Spacecraft
- Recoverable launch vehicle and spacecraft
- Cape Canaveral LC-40 Launch Site
- ISS Flight Demonstrations: 2010
- NASA Investment (Cargo): \$278 M



Dragon
Cargo Capsule



Dragon
Crew Capsule

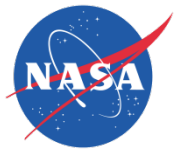
Falcon 9
Rocket



SpaceX Launch Site at Cape SLC 40



Orbital COTS System



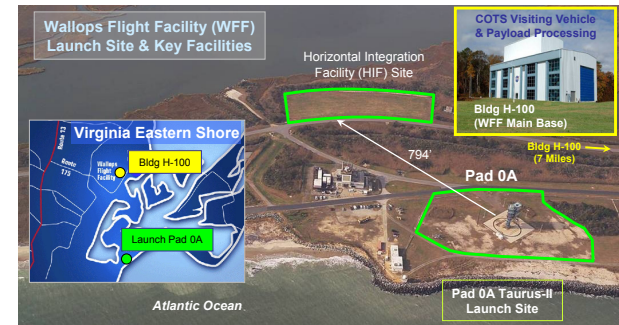
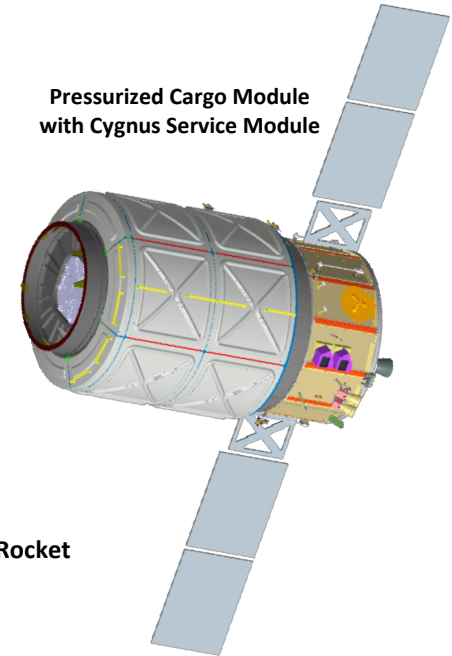
Description & Features:

- Taurus II Launch Vehicle – derivative of Taurus I with Aerojet AJ-26 engines (2) & Castor 30 2nd stage
- Cygnus Service Module used for all missions – derived from STAR™ & Dawn spacecrafts
- Pressurized Cargo Module (PCM): Heritage - ISS MPLM
- Wallops Flight Facility Launch Site
- ISS Flight Demonstration: March 2011
- NASA Investment (Cargo): \$170 M



Taurus II Rocket

Pressurized Cargo Module with Cygnus Service Module



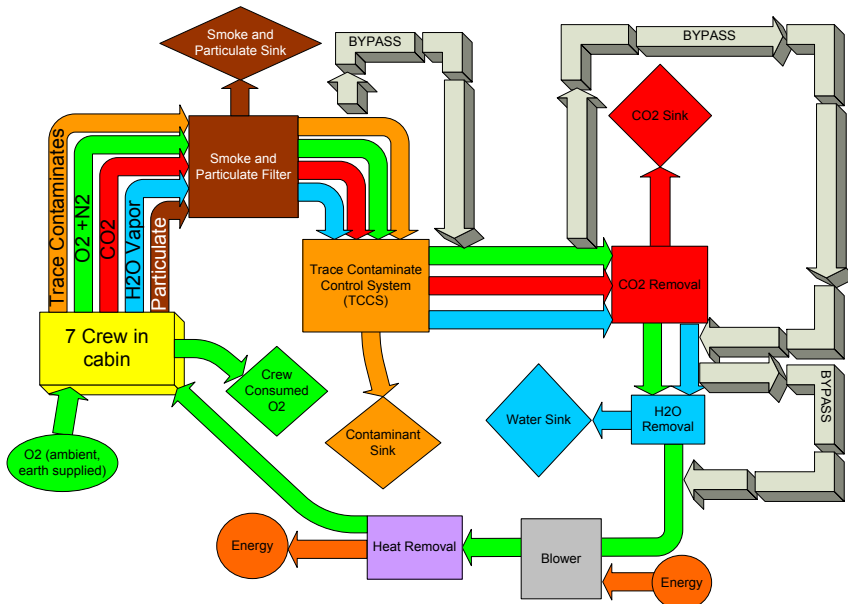
MARS/Wallops Launch Site

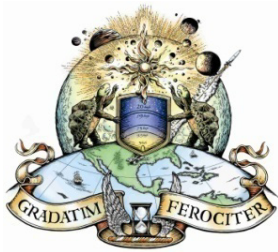
ECLSS Human Rating Facility



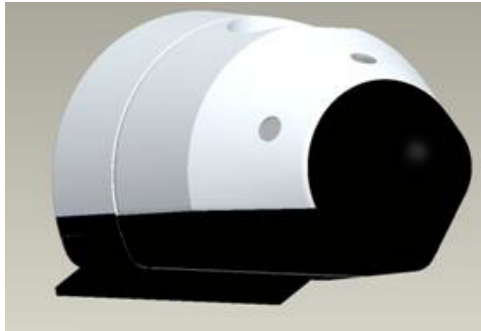
Paragon CCDev Project

- **Developing Commercial Crew Transport-Air Revitalization System (CCT-ARS)**
 - Carbon dioxide control and removal
 - Humidity control and removal
 - Trace contaminant control
 - Post-fire atmospheric recovery
 - Airborne particulate filtration
 - Cabin air circulation
 - Cabin air cooling
- **Matures concept**
 - Requirements development with input from potential vehicle providers
 - Design through System PDR level
 - Manufacture an Engineering Development Unit and test in their EHF
- **NASA investment \$1.44M**



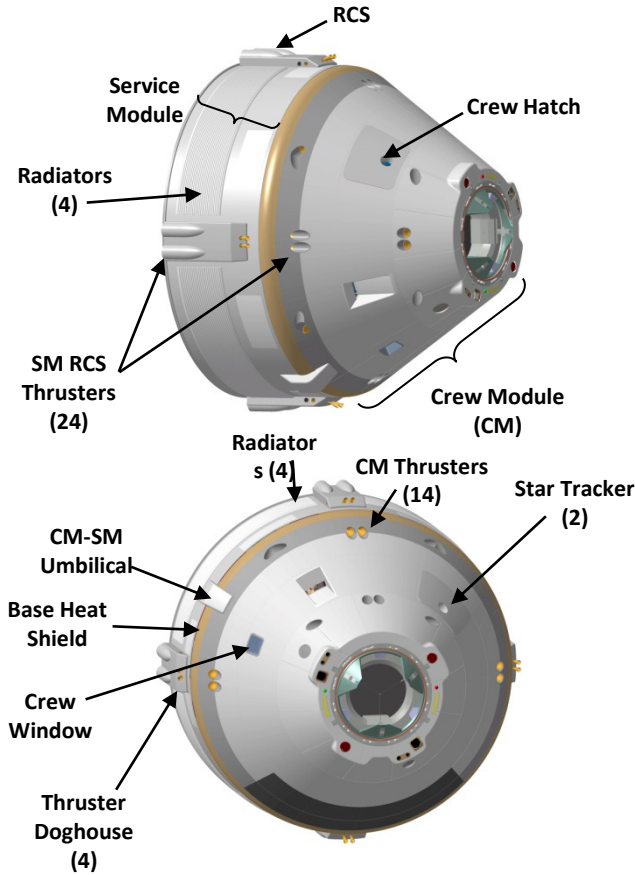


Blue Origin CCDev Project



- **System concept is bi-conic space vehicle launched on Atlas V 402**
- **Matures Pusher Escape System**
 - Conduct TVC ground testing
- **Matures Composite Pressure Vessel**
 - Manufacture structural test article of a suborbital capsule as a subscale demonstrator for the orbital Space Vehicle
 - Over-pressurize the test article to failure
 - Repair the test article and conduct a drop test
- **NASA investment \$3.7M**

Boeing CCDev Project



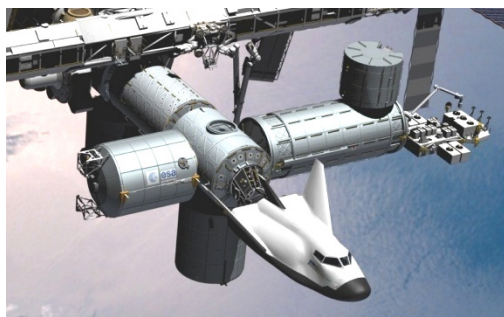
Partners & Subs

Bigelow Aerospace
 Aerojet
 Airborne Systems
 ATK
 Spincraft

- **Commercial Crew Transportation System concept:**
 - Flexible crewed vehicle concept with maximum of seven crew
 - Light-weight design compatible with Atlas, Delta, and Falcon 9
 - Integrated operations & crew training center
- **Matures system architecture and design through SDR and demonstrates key technologies and capabilities via 9 tasks**
 - SDR
 - Abort System Hardware Demonstration
 - Base Heat Shield Fabrication Demonstration
 - Avionics Systems Integration Facility Demonstration
 - CM Pressure Vessel Fabrication Demonstration
 - Landing System Demonstration
 - Life Support Demonstration
 - AR&D Integrated GNC Demonstration
 - Crew Module Mockup Demonstration
- **NASA investment \$18M**



SNC CCDev Project



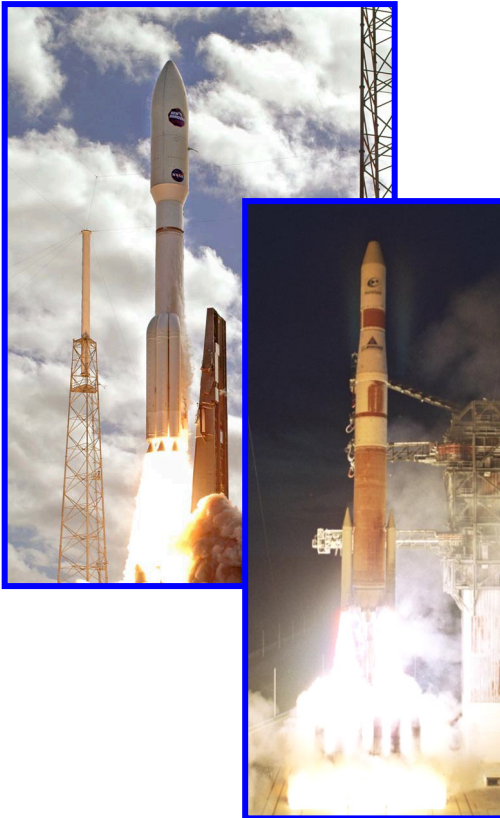
Partners & Subs

Boeing Draper Lab
ULA Aerojet
AdamWorks MDA
University of Colorado
NASA LaRC

- **Commercial Space Transportation System based on NASA HL-20 launched on Atlas V**
 - Requirements definition for Dream Chaser systems design & major subsystems
 - Build & Test Spacecraft Primary Structure
 - Integrated Loads Definition & CFD
 - Main Propulsion Motor Build & Test
 - RCS Thruster Prototype Build & Test
 - Develop Atmospheric and Orbital GN&C architecture
 - Flight Algorithms & Software Assurance Plan
 - TPS Trades
 - Atlas V Integration analysis
 - Wind Tunnel Model Build
- **NASA investment \$20M**



ULA CCDev Project



- **Comprehensive maturation plan for commercial crew launch vehicles includes addition of modular Emergency Detection System (EDS) which can be used with Atlas V, Delta IV, and other LVs**
 - EDS definition
 - Identify LV failure modes and how measured
 - Algorithm development, software coding, validation
 - Crew interface design
 - Prototype EDS testing and demonstration
 - Real-time monitoring demonstration
- **NASA investment \$6.7M**

Partners & Subs

Pratt & Whitney
SAS

A New Era In Spaceflight Is Beginning...



COMMERCIAL
CREW & CARGO

