



# Commercial Spaceflight Status Briefing

NAC Exploration Committee Meeting

April 26, 2011

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# Accomplishments / Milestones

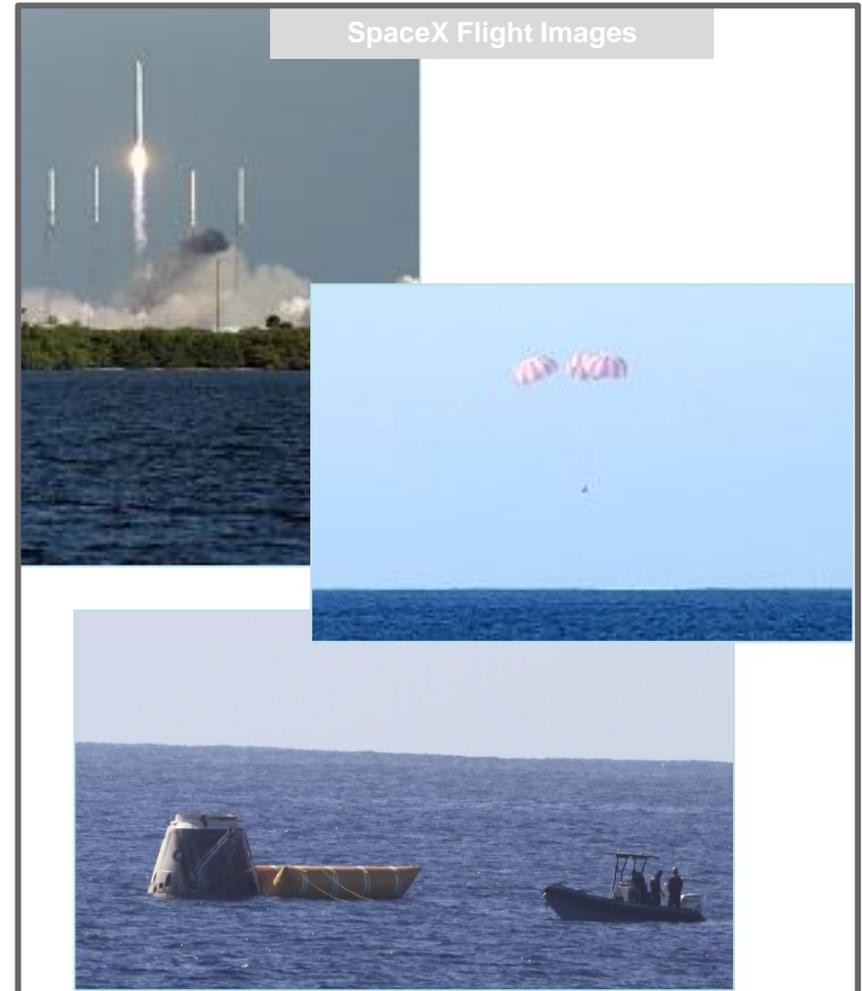


- COTS Cargo
  - 1<sup>st</sup> and 2<sup>nd</sup> quarter augmentation milestones negotiated, signed, and completed by Orbital and SpaceX. 3<sup>rd</sup> and 4<sup>th</sup> quarter milestones in work
  - March 22: Ribbon cutting for Wallops Horizontal Integration Facility
  - March 29: SpaceX Demo 2 and 3 combination briefing to NASA HQ
- CCDev 1 Projects
  - All CCDev 1 Space Act Agreements complete
- CCDev 2 Projects
  - April 18: Awarded four (4) new Space Act Agreements
- Commercial Crew Program
  - March 22: Space Suit Requirement Technical Interchange Meeting
  - April 5: Commercial Crew Program Office officially established at KSC
  - Commercial Crew Program Office will manage the CCDev 2 Projects

# COTS Cargo Accomplishments



AJ-26 Engine Test Firing



SpaceX Flight Images

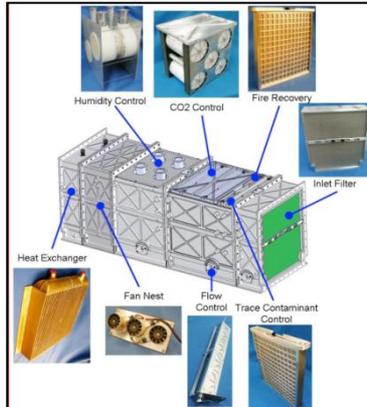


Launch Pad Construction

# CCDev 1 Accomplishments



**Boeing Air Bag Test Article**



**Manufacturing of key components of the Engineering Development Unit**



**SNC Motor Firing**



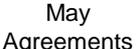
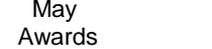
**ULA Emergency Detection System Prototype and Test Bed**



**Blue Origin Composite Crew Pressure Vessel**

# Commercial Crew Structure and Timelines



Title	Purpose	CY 2010	CY 2011	CY 2012
<b>CCDev</b>	Develop and demonstrate technologies that enable commercial human spaceflight capabilities.	 February Awards	 April Agreements Complete	
<b>CCDev Round 2</b>	Mature the design and development of elements of the system, such as launch vehicles and spacecraft.	 October Announcement for Proposals	 April Awards	 May Agreements Complete
<b>CCDev Round 3</b>	Mature the design for the integrated end-to-end commercial crew systems.	 June Advance Planning Team Established	 September Announcement for Proposals	 May Awards

# CCDev 2 Announcement Overview



- The goals of CCDev 2 investments are to:
  - advance orbital commercial crew transportation system (CTS) concepts
  - enable significant progress on maturing the design and development of elements of the system, such as launch vehicles and spacecraft, while ensuring crew and passenger safety,
  - with the overall objective of accelerating the availability of U.S. CTS capabilities.
- New competition open to all U.S. commercial providers.
- Proposals included NASA investment needed and company contribution.
- Awards are for Space Act Agreements, featuring pay-for-performance milestones from April 2011 to May 2012.

# CCDev 2 Evaluation Summary



- The Announcement for Proposals was released on October 25, 2010 and proposals were due on December 13, 2010.
- 22 proposals were received requesting a total of \$1billion from NASA.
  - Proposals included spacecrafts, launch vehicles, sub-systems, and trade-studies
- NASA rigorously followed the Evaluation Plan published in the Announcement for Proposals.
- After an initial evaluation, NASA held due diligence meetings with eight participants whose proposals were most favorably evaluated.

# Selection Process and Results



- Four companies were selected for award:
    - Blue Origin: \$22M
    - Boeing: \$92.3M
    - Sierra Nevada: \$80M
    - SpaceX: \$75M
- Total = \$269.3M
- Within the selected concepts, there is diversity in spacecraft approaches (two capsules, a lifting body, and a biconic shape spacecraft) and in the launch vehicles they propose to use.
  - All proposals showed an understanding of the importance of safety and a commitment to safe spaceflight.
  - NASA believes this portfolio of concepts best meet the goals of CCDev 2 within the available funding. It will significantly mature the design and development of system elements and accelerate the availability of commercial crew transportation system capabilities.



# Blue Origin CCDev2 Project



System Description: Crew transportation system comprised of a reusable biconic Space Vehicle launched first on an Atlas V launch vehicle and then on Blue Origin's own Reusable Booster System.

CCDev2 Content: Mature Space Vehicle design through System Requirements Review, mature the Pusher Escape System, and accelerate engine development for Reusable Booster System.

CCDev2 Milestones (partial):

- Space Vehicle Mission Concept Review
- Space Vehicle System Requirements Review
- Pusher Escape Ground Firing
- Pusher Escape Pad Escape Test
- Reusable Booster System Engine Thrust Chamber Assembly Test

NASA investment: \$22M



System Description: Commercial crew transportation system comprises the reusable CST-100 spacecraft, launch services, and ground systems. CST-100 is compatible with multiple launch vehicles and is reusable for up to ten missions.

CCDev2 Content: Mature CST-100 design through Preliminary Design Review & perform development tests.

CCDev2 Milestones (partial):

- Phase 0 Safety Review
- Launch Abort Engine Fabrication & Hot Fire Test Demo
- Landing Air Bag Drop Demonstration #1
- Phase 1 Wind Tunnel Tests
- Parachute Drop Tests Demonstration
- Launch Vehicle Emergency Detection System/Avionics System Integration Facility Interface Simulation Test
- Preliminary Design Review

NASA investment: \$92.3M

System Description: Dream Chaser is a reusable, piloted lifting body, derived from NASA HL-20 launched on an Atlas V.

CCDev2 Content: Mature Dream Chaser design through a Preliminary Design Review with some subsystems to Critical Design Review, and conduct significant hardware testing.

CCDev 2 Milestones (partial):

- System Requirements Review
- Canted Airfoil Fin Selection
- Cockpit Based Flight Simulator
- Vehicle Avionics Integration Laboratory
- System Definition Review
- Flight Control Integration Laboratory
- Engineering Test Article Structure Delivery
- Separation System Test
- Preliminary Design Review



*SNC has assembled a world-class team*

NASA investment: \$80M



System Description: The crew transportation system is based on the existing Falcon 9 launch vehicle and Dragon spacecraft which have been designed since inception for crew carriage with relatively minimal modification. Both the longest-lead and most safety-critical system is the Launch Abort System.

CCDev2 Content: Mature the flight-proven Falcon 9 / Dragon transportation system focusing on developing an integrated, side-mounted Launch abort System.

CCDev2 Milestones (partial):

- Launch Abort System (LAS) Propulsion Conceptual Design Review
- LAS Propulsion Component Preliminary Design Review
- Crew Accommodation Concept Prototype and In-Situ Trials (2)
- LAS propulsion component initial test cycle
- Concept Baseline Review

NASA investment: \$75M

# Conclusion



- A successful Commercial Crew Program will:
  - Transform human spaceflight for future generations
  - Result in safe, reliable, cost effective crew transportation to LEO and for the ISS
  - Reduce NASA's reliance on foreign systems
  - Free NASA's limited resources for beyond-LEO exploration

