National Aeronautics and Space Administration

Commercial Spaceflight Status Briefing

NAC Exploration Committee Meeting

April 26, 2011

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Accomplishments / Milestones

- COTS Cargo
  - 1st and 2nd quarter augmentation milestones negotiated, signed, and completed by Orbital and SpaceX. 3rd and 4th 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

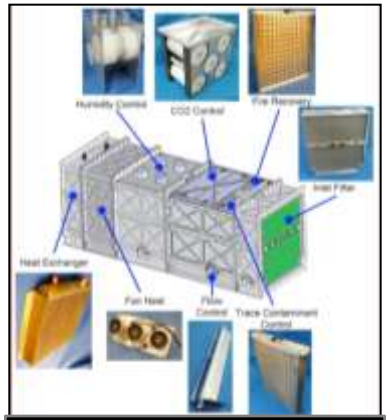
AJ 26 Engine Test Firing

Launch Pad Construction

SpaceX Flight Images

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
CCDev	Develop and demonstrate technologies that enable commercial human spaceflight capabilities.	February Awards	April Agreements Complete	
CCDev Round 2	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
CCDev Round 3	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

Boeing CCDev2 Project

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

SNC CCDev2 Project

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

NASA investment: $80M

SNC has assembled a world-class team

SpaceX CCDev2 Project

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