Commercial Spaceflight Status Briefing

June 16, 2011
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NASA HQ
Major Accomplishments / Milestones

• COTS Cargo
  – All COTS augmentation milestones negotiated and signed. Several milestones have already been completed.
  – 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 (CCP)
  – April 5: Commercial Crew Program Office officially established at KSC.
  – Commercial Crew Program Office will manage the CCDev 2 Projects.
  – May 24-25: Industry Workshop held in Florida to discuss CCP requirements.
COTS Cargo Accomplishments

AJ-26 Engine Test Firing

SpaceX Flight Images

Launch Pad Construction
## Commercial Crew Structure and Timelines

<table>
<thead>
<tr>
<th>Title</th>
<th>Purpose</th>
<th>CY 2010</th>
<th>CY 2011</th>
<th>CY 2012</th>
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<tbody>
<tr>
<td><strong>CCDev</strong></td>
<td>Develop and demonstrate technologies that enable commercial human spaceflight capabilities.</td>
<td>February Awards</td>
<td>April Agreements Complete</td>
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<td><strong>CCDev Round 2</strong></td>
<td>Mature the design and development of elements of the system, such as launch vehicles and spacecraft.</td>
<td>October Announcement for Proposals</td>
<td>April Awards</td>
<td>Agreements Complete</td>
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<tr>
<td><strong>Commercial Crew Program</strong></td>
<td>Mature the design for the integrated end-to-end commercial crew systems.</td>
<td>June Advanced Planning Team Established</td>
<td>Request for Proposals</td>
<td>Awards</td>
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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**
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

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.

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 $1 billion from NASA.
- Proposals included spacecrafts, launch vehicles, sub-systems, and trade-studies
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.
CCDev 2 Partners and Suppliers
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.


CCDev 2 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.

CCDev 2 Content: Mature CST-100 design through Preliminary Design Review & perform development tests.

CCDev 2 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 CCDev 2 Project

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

CCDev 2 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
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. The longest-lead and most safety-critical system is the Launch Abort System (LAS).

CCDev 2 Content: Mature the flight-proven Falcon 9 / Dragon transportation system focusing on developing an integrated, side-mounted LAS.

CCDev 2 Milestones (partial):
• 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
The objective of the proposed commercial crew initiative is to facilitate the development of a U.S. commercial crew space transportation capability with the goal of achieving safe, reliable, and cost effective access to and from low-Earth Orbit and the International Space Station (ISS).

 Acquisition strategy will feature competitive agreements, pay-for-performance milestones, and a fixed government investment.

 Competition among multiple partners is a fundamental aspect of the strategy: incentivizes performance, supports cost-effectiveness, and eliminates NASA dependence on a single provider.

 The 2010 NASA Authorization Act established commercial crew as the primary means for ISS crew transportation.
1) Federal budgets, including NASA’s, are extremely constrained
   - COTS and CCDev have shown that we can change the cost equation
   - We hope to fund multiple partners for less than $6B
2) Well understood technology
   - Human spaceflight is hard, but no breakthroughs are needed
   - We have been launching people into orbit for over 45 years
3) Strong and mature industrial base
   - Global commercial space industry revenues have doubled from $80B
e  $160B during the last five years
4) Strong potential for customers other than the U.S. government
   - Non-U.S. astronauts, space tourism, research and development
5) Decision to extend the International Space Station to at least 2020
   - For the first time in history, we have a long-term, sustainable market
     for commercial human space transportation services
Benefits of a Successful Commercial Crew Program

• After the Shuttle is retired later this year, only Russia and China will have the capability of getting people into Earth orbit.

• As the primary means for the U.S. to launch crew to low-Earth orbit, the Commercial Crew Program will:
  – End the gap in U.S. human access to space
  – Give us assured access to the International Space Station
  – Strengthen America’s leadership in space
  – Allow NASA to focus on exploration, enabling us to go further, faster
  – Contribute to the national economy

• By pushing the boundaries of private enterprise and commerce into low-Earth orbit, we will have planted the first truly sustainable flagpole in our expansion into space.

NASA is fully committed to making Commercial Crew safe and successful