National Aeronautics and Space Administration

Commercial Crew Program Status to the NAC

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We are getting started…

Boeing: CST-100

SpaceX: Dragon

Boeing: CST-100 Interface Test

SpaceX: 39A RP1 System

Boeing: C3PF Logistics Systems

SpaceX: Common Booster Transport to Qualification

Boeing: Water Landing and Rotation Test

Agenda

- **Commercial Crew Program (CCP) Space Act Agreement Status**

- **Commercial Crew transportation Capability (CCtCap) Status**
  - Contract Scope and Content
  - Boeing Accomplishments and Upcoming Milestones
  - SpaceX Accomplishments and Upcoming Milestones
  - SpaceX Upcoming Milestones

- **CCP Budget Overview**

- **CCP Independent Review Status**

SAA Updates

- **Blue Origin (CCDev2)**
  - CCDev2 SAA with Blue Origin was extended to April 2016 and added three unfunded milestones:
    - Flight Demonstration of BE-3 Engine – September 2015
    - Flight Demo of Subscale Propellant Tank Assembly – September 2015
    - Pusher Escape In-Flight Escape Demonstration Data Review – March 2016

- **SNC (CCiCap)**
  - Extended SNC's CCiCap period of performance to March 2016
    - The final funded CCiCap milestone, Engineering Test Article Flight Testing #2, was rescheduled to December 2015
    - As part of the extension an unfunded milestone was added, Design Analysis Cycle-6 Closeout Review – November 2015

SAA Updates

- **SpaceX (CCiCap)**
  - Completed Milestones
    - Operations Critical Design Review – September 2014
    - Crew Vehicle Technical Interchange Meetings – October 2014
    - Interim Progress Crew Vehicle Delta Critical Design Review – Dec. 2014
  - Extended SpaceX's CCiCap period of performance to December 2015
  - The final CCiCap milestones were rescheduled
    - Pad Abort Test – April 2015
    - In-Flight Abort Test – September 2015
    - Dragon Primary Structure Qualification - Hatch Open Test – November 2015
    - Delta Crew Vehicle Critical Design Review – November 2015

Commercial Crew transportation Capability

- **CCtCap Contract Objectives**
  - Complete development and certification of crew transportation systems that meet NASA's safety and performance requirements.
  - Provide for crew rotation capability for 4 NASA or NASA-sponsored crewmembers
  - Provide emergency crew return capability for these crewmembers at any time while the commercial spacecraft is docked to the ISS
  - Transport a limited amount of pressurized cargo to the ISS
  - Return pressurized cargo from the ISS
  - Provide for a crew safe haven capability when the spacecraft is docked to the ISS

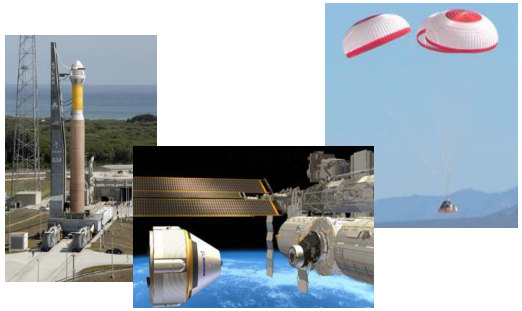
Contract Scope and Structure

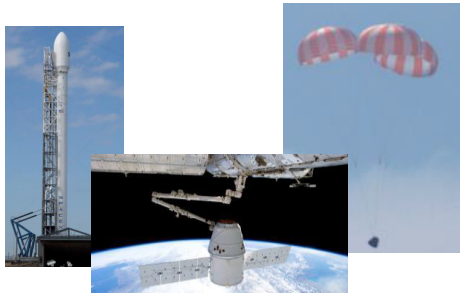
- **CCtCap contracts are Firm Fixed Price with Indefinite Delivery Indefinite Quantity (IDIQ) components**
  - CLIN 001 – Certification
    - Government mandatory milestones
    - Company-proposed performance-based financing milestones
    - All milestones are firm fixed price
  - CLIN 002 – Post Certification Missions (PCMs)
    - IDIQ task order will be issued for each PCM executed
    - Minimum guaranteed order of 2 PCMs per contract award
    - Maximum order of 6 PCMs per contract award
    - PCM prices vary and were established as firm fixed price at contract award
  - CLIN 003 – Special Studies
    - IDIQ task orders for additional special studies, including tests or analyses, at NASA's discretion
    - Does not include work necessary to meet the requirements under CLINs 001 and 002
    - Company labor rates were established at contract award

Flight Test Programs

- **These crew transportation systems are very complex and the development and test activity planned over the next three years will be extremely challenging. Most likely, many things will not go exactly like we and our partners expect.**
- **Below shows the proposed flight test programs of the partners. The acceptability of these tests in terms of meeting NASA's safety and performance requirements will be determined by NASA.**

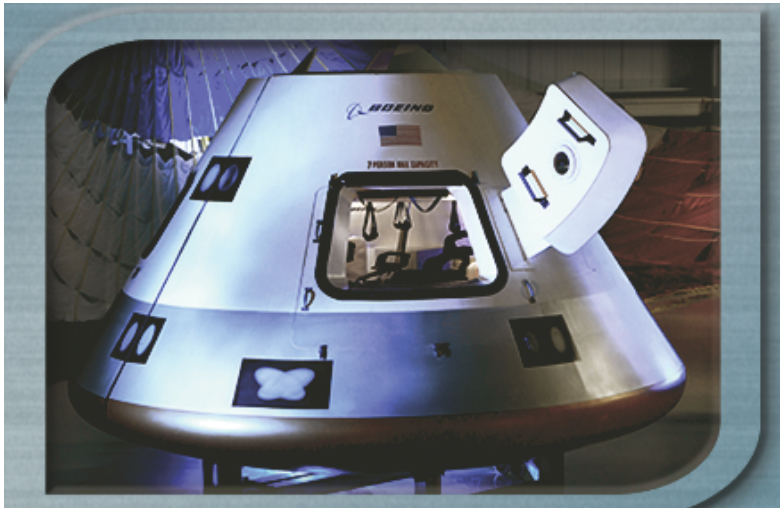
- **Boeing**
  - Pad Abort Test – 2017
  - Uncrewed Orbital Flight Test to ISS – 2017
  - Crewed Flight Test to ISS – 2017
- **SpaceX**
  - Pad Abort Test (CCiCap) – 4/2015
  - In-flight Abort Test (CCiCap) – 9/2015
  - ISS Flight w/o Crew – 2016
  - Flight to ISS with Crew – 2017





Boeing Concept

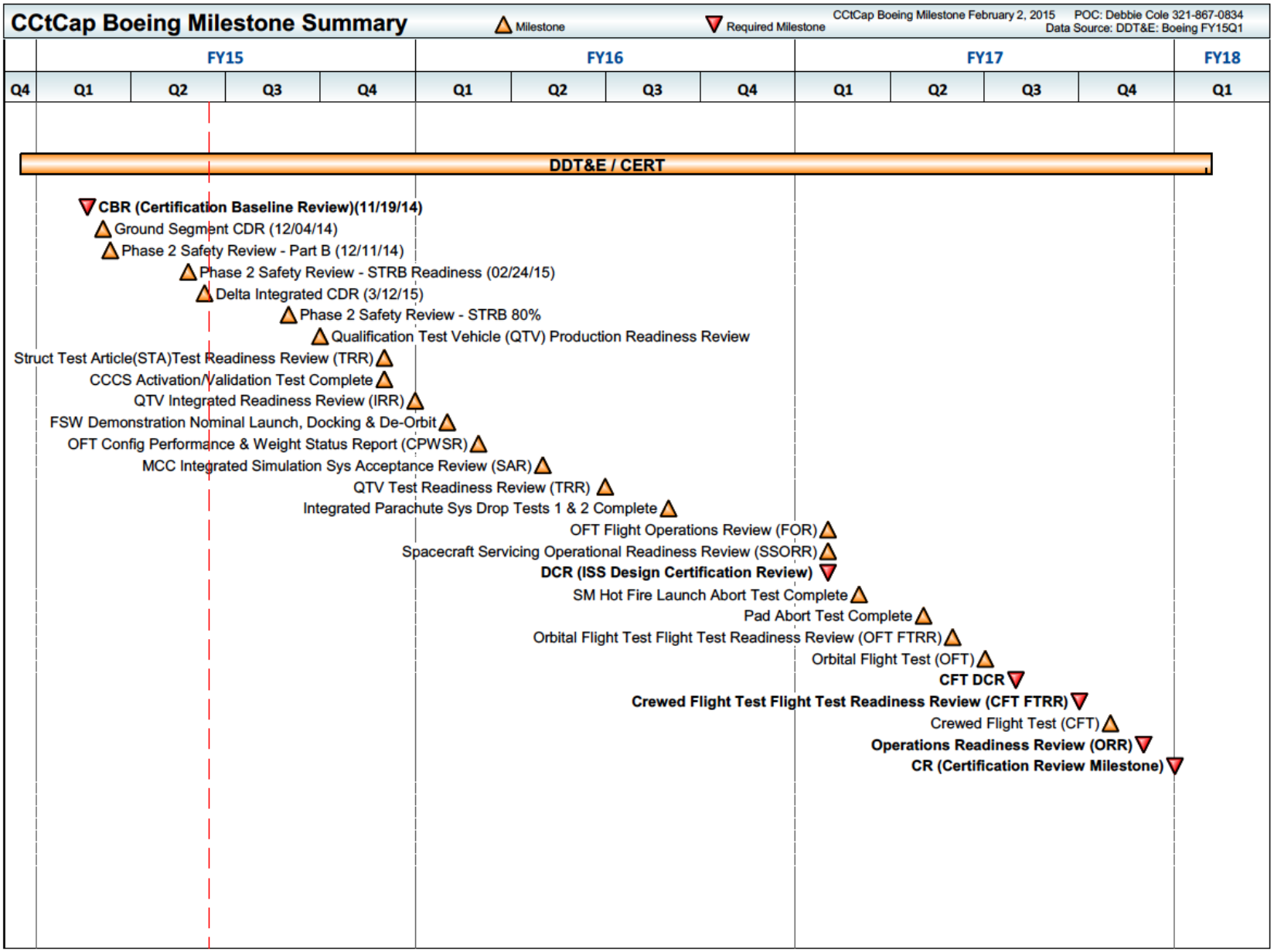
- Boeing offered its CST-100 crew transportation system featuring a capsule spacecraft, launched using United Launch Alliance's Atlas 5 launch vehicle, and landed using parachute and airbag systems for hard-surface landings, or contingency water landings.
- Boeing plans to launch from SLC-41 (current Atlas 5 launch pad) at the Cape Canaveral Air Force Station.



Boeing CCtCap Accomplishments To Date

- **Completed first four milestones**
  - Certification Baseline Review (CBR)
  - Ground Segment Critical Design Review (GS CDR)
  - Phase II Safety Review Part B Integration System (a)
  - Phase II Safety Review Part B Integration System (b)
- **Initiated CCtCap Verification Analysis Cycle (VAC-1)**
- **Kicked off multiple sub-contract work**
  - ULA
  - 27 spacecraft subsystem suppliers
- **Delta Integrated CDR milestone held in March**
- **Multiple TIMs held with NASA to provide insight**
  - Batteries TIM
  - Certification Plan TIM
  - Environmental Test TIM
  - End to End System Validation TIM
  - Integrated System Verification Testing TIM
  - Integrated Master Schedule TIM
  - Parachute TIM
  - Avionics and Software TIM

Boeing CCtCap Development Milestones



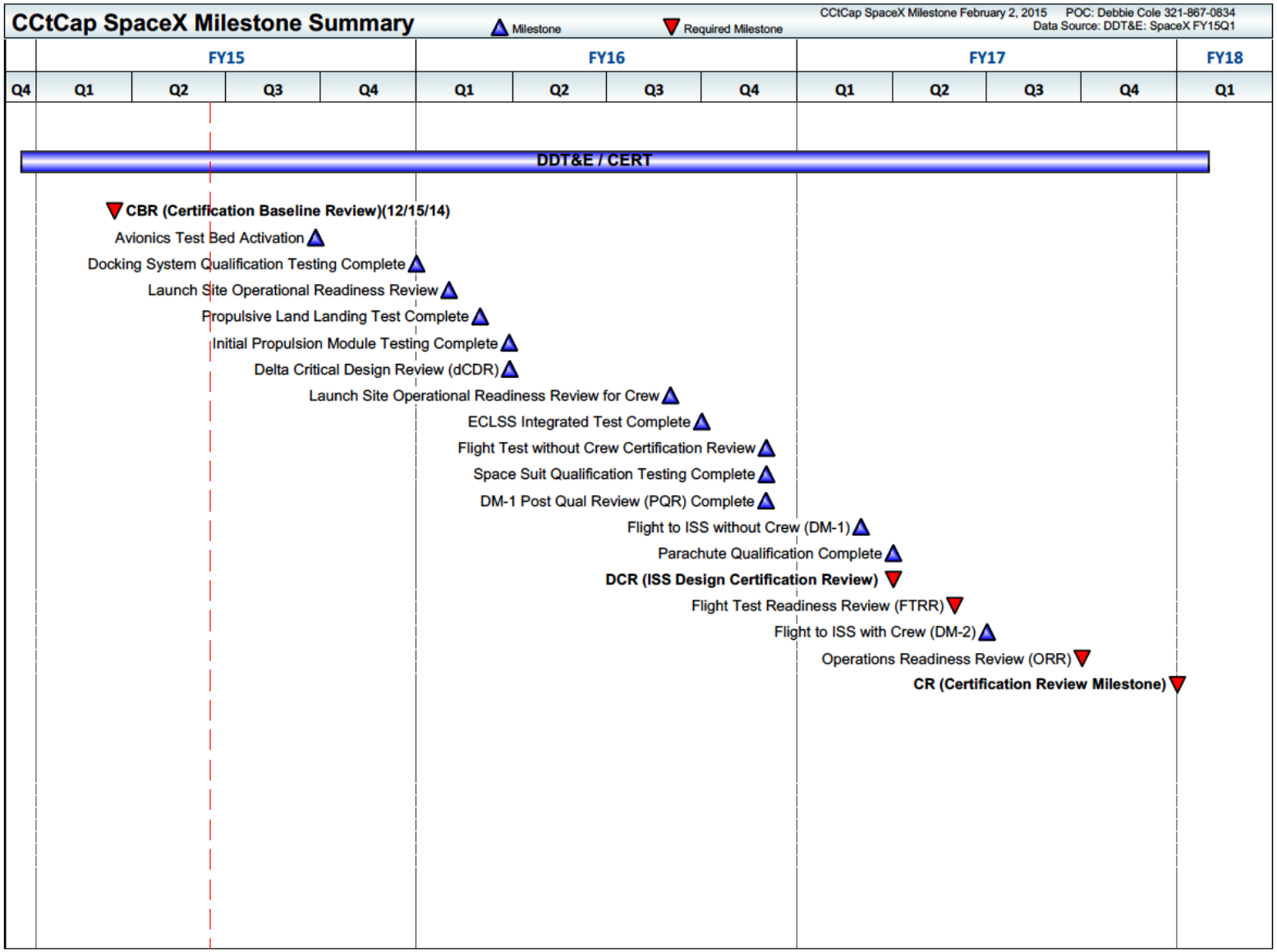
SpaceX Concept

- SpaceX offered its Crew Dragon crew transportation system featuring a capsule spacecraft, launched using SpaceX's Falcon 9 launch vehicle, and water landings with a planned future upgrade to soft land landing using propulsive systems.
- SpaceX plans to launch from LC-39A (former Space Shuttle launch pad) at the Kennedy Space Center in Florida.

SpaceX CCtCap Accomplishments

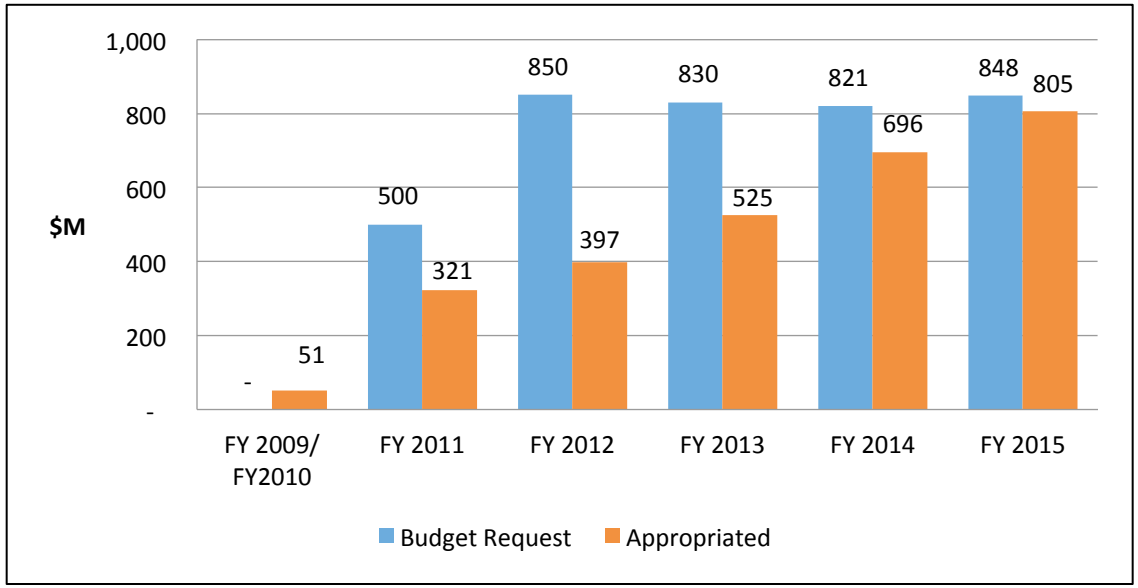
- Completed first CCtCap milestone – Certification Baseline Review
- Established communication between management & technical counterparts and a strong partnership base
- Engineer-to-engineer contact is in full swing, with daily contact and numerous, value-added tag-ups and TIMs already complete or planned
- SpaceX customer insight and delivery tools are up and working
- Delivered Integrated Master Schedule (IMS) and held Schedule TIM

SpaceX CCtCap Development Milestones



CCP Budget @ $805M for FY15

- **CCP should be able to cover CCtCap funding commitments for FY 2015 with the $805M appropriations.**
- **Unfunded Future Expenses line item is funded for FY 2015.**
- **FY 2016 funding request of $1.2B is the high water mark for CCP funding and will be critical to enable NASA and our partners to meet the goal of 2017.**



Independent Reviews of CCP Activities

COMPLETED

- **Office of the Inspector General (OIG)**
  - Jan. 10, data request for un-redacted CCtCap contracts
  - Jan. 24, status of implementing recommendations from Nov. 2013 report
- **Government Accountability Office (GAO)**
  - Jan-Feb, data call for GAO Quick Look Book
  - Jan. 29, Entrance Conference, Audit of Commercial Space Launch (focus on FAA/AST)
- **Aerospace Safety Advisory Panel**
  - Jan. telecon describing design risks
  - Feb. briefing providing program status

ONGOING

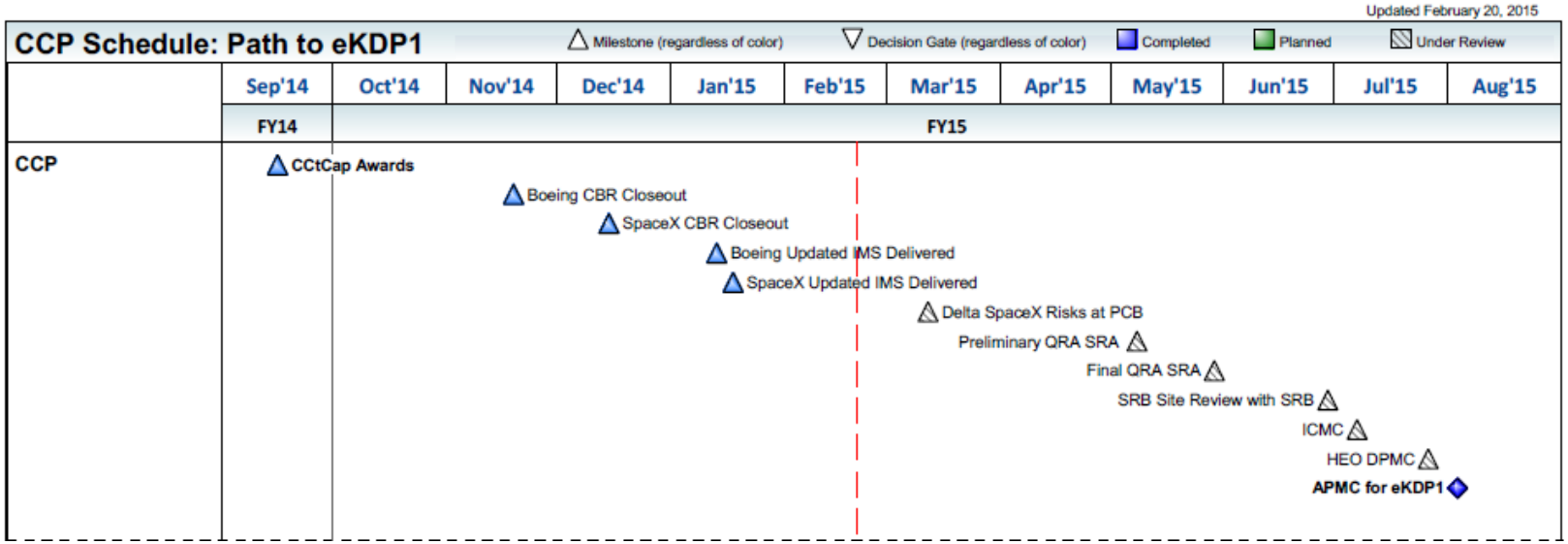
- **Standing Review Board (SRB)**
  - SRB is up and running since Oct. 2014
- **Congressional Reporting**
  - Quarterly reports required by Appropriations Act, 2015

UPCOMING (Planned)

- **Aerospace Safety Advisory Panel**
  - May 12-13 at HQ

Standing Review Board and eKDP I

- **CCP SRB established to accomplish equivalent Key Decision Points (eKDPs), which will be conducted by the NASA AA through the Program Management Council governance structure.**
  - eKDP I – Establishes the Agency Baseline Commitment for CCP which will include a baseline plan, cost through DDT&E, and schedule for certification.
  - SRB Members include: Byron Lichtenberg (Chair), Mike Rudolphi, Gary Kyle, Alan Lindenmoyer, Frank Bauer, David Thelen, Deb Kromis (IPAO), Chris Chromik (IPAO).



Summary

- **The Program remains committed to supporting the remaining SAA (CCDev2/CCiCap) activities with our Partners**

- **The Program is fully engaged with our CCtCap partners who are making progress on their development and certification activities**

- **Through engagement activities the Program is gaining valuable insight into partner designs and potential risk areas**