National Aeronautics and Space Administration

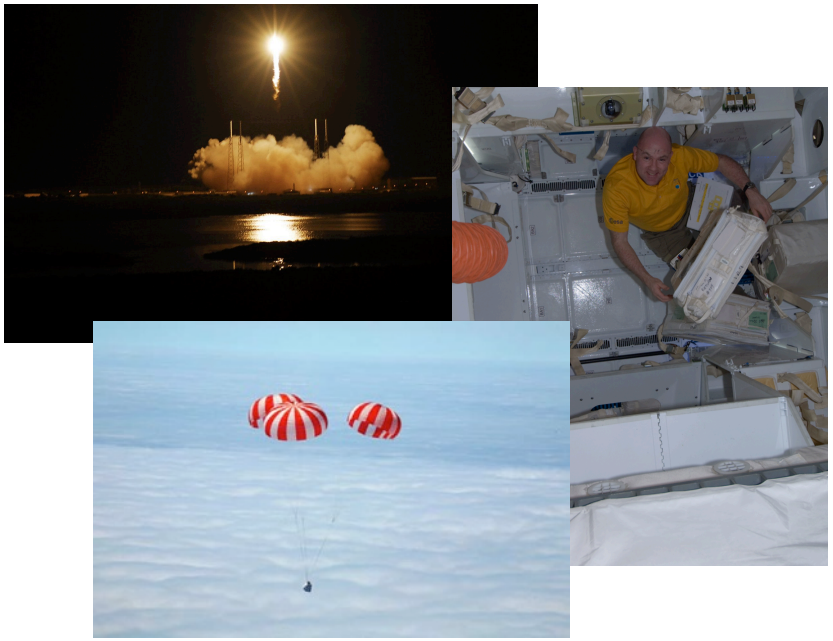
Commercial Certification Process and Accomplishments

November 15, 2012
NAC Meeting

Commercial Cargo Status

- SpaceX
  - After 72 months, 40 milestones, and a $396M investment from NASA, SpaceX developed and brought into operations:
    - A new U.S. intermediate class commercial launch vehicle (Falcon 9),
    - A spacecraft (Dragon), and
    - A launch pad (LC-40)

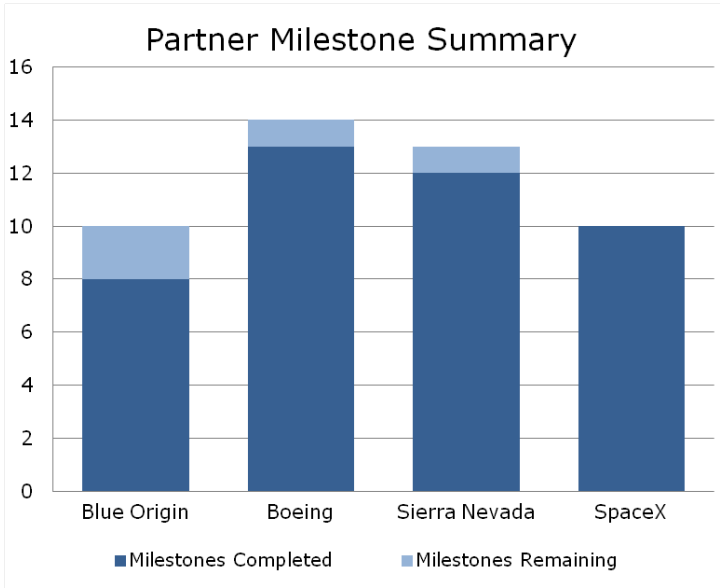
    capable of safely transporting cargo to the ISS and returning cargo to the Earth.



- Orbital Sciences Corporation
  - Orbital Sciences has completed 25 of 29 milestones and received $276M out of $288.
  - The maiden test flight of the Antares is tentatively scheduled for December 2012. The ISS Demonstration Mission will potentially occur 3 months after the maiden flight.

Commercial Crew Development (CCDev2)

- Objective: Mature the design and development of elements of U.S. crew transportation systems, such as launch vehicles and spacecraft.
- Four companies selected in April 2011:
  - Blue Origin awarded $22M
  - Boeing awarded $113M
  - Sierra Nevada Corporation awarded $106M
  - SpaceX awarded $75M




Boeing Parachute Test


Blue Origin Composite Crew Module


Sierra Nevada Dream Chaser Test

SpaceX Crew Cabin Test

Commercial Crew Integrated Capability (CCiCAP)

- CCiCap Goals:
  - Advance multiple integrated crew transportation systems
  - Commercial Provider investment
  - Affordable development costs leading to cost-effective access to LEO
  - Develop a CTS capability to LEO that supports a commercial market

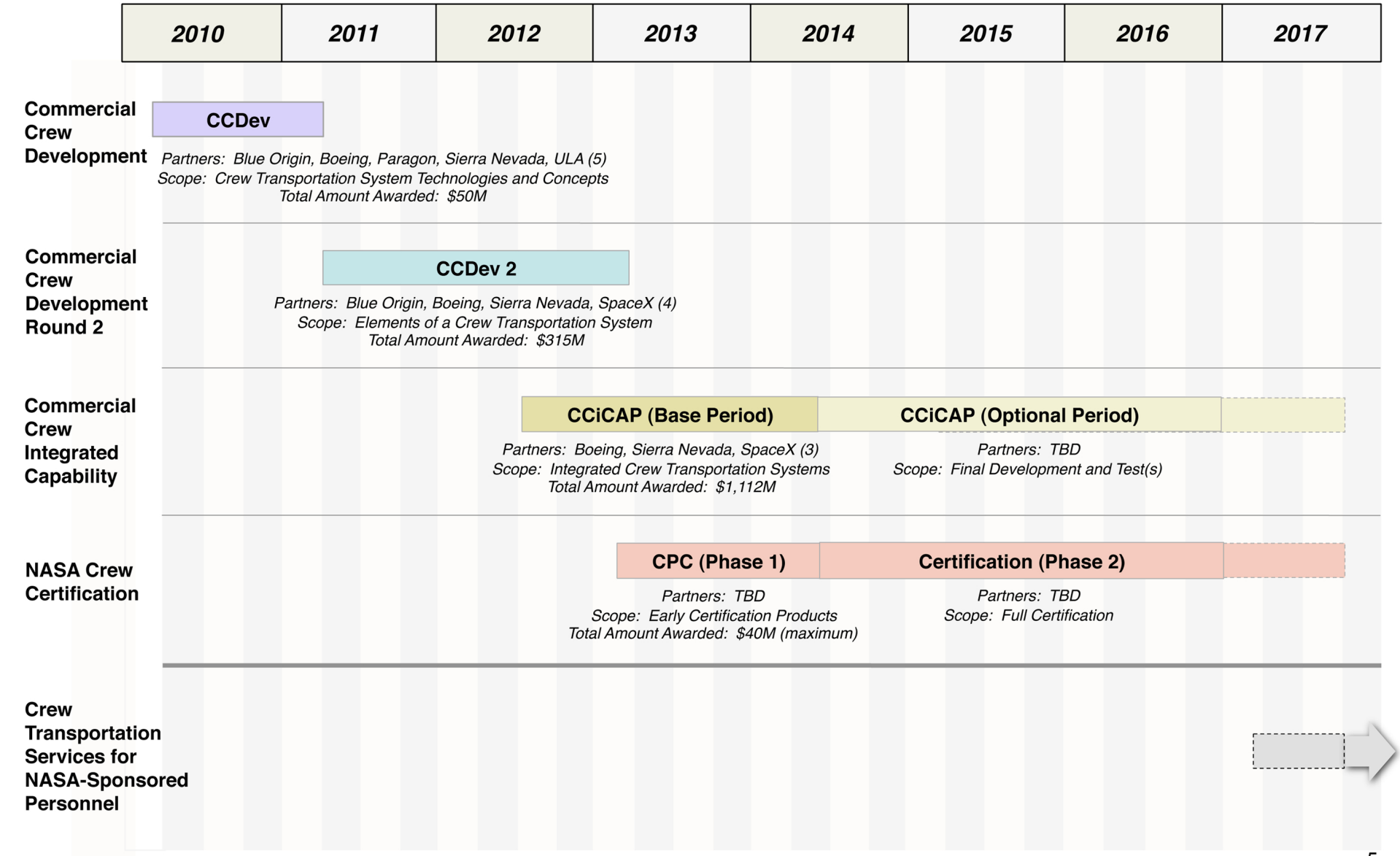
- Base Period: 21 months, August 2012 – May 2014, culminating in a level of maturing approximately equivalent to a Critical Design Review (CDR).

- Optional Milestones Period: Following the Base Period through orbital crewed flight demonstration.

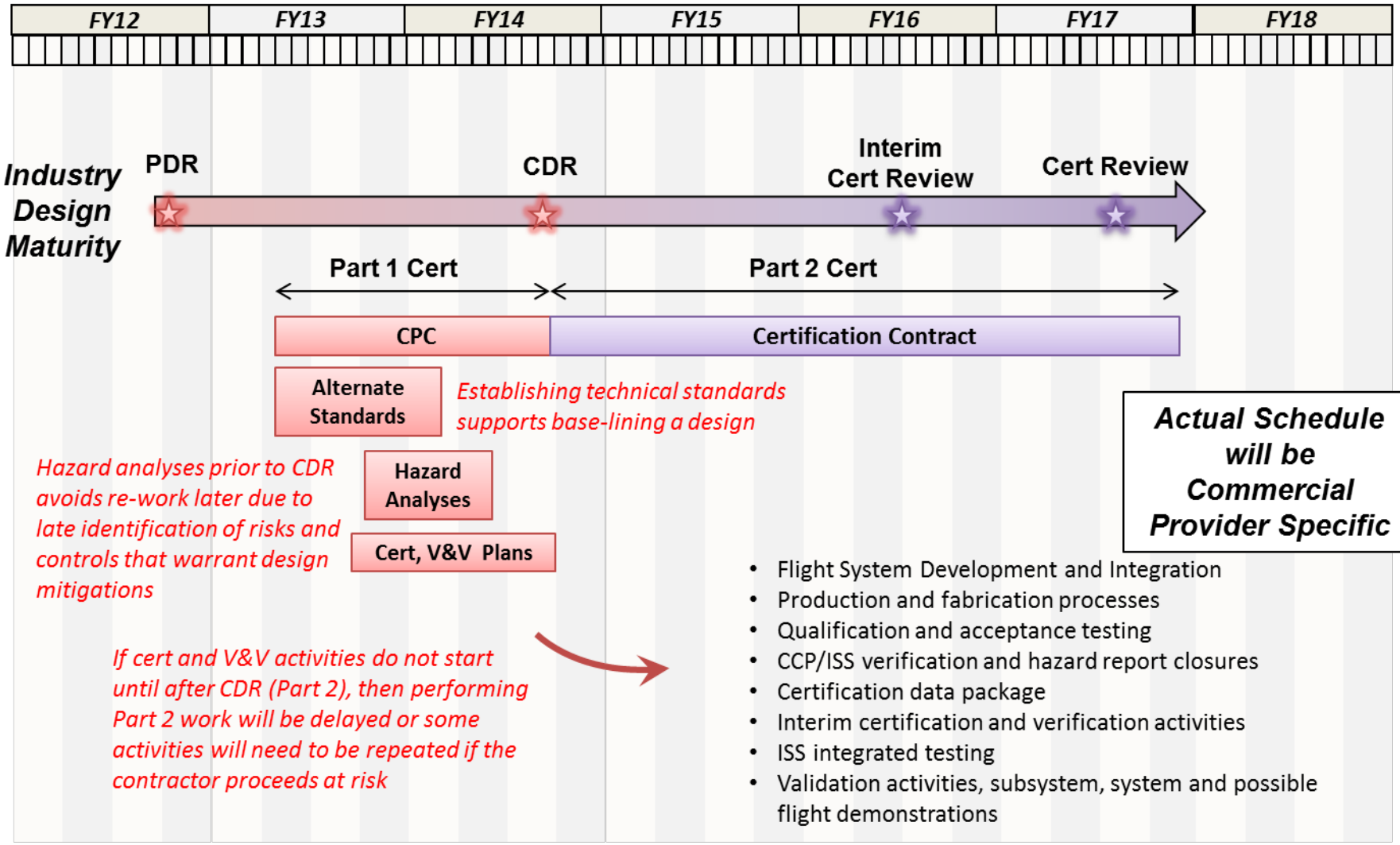
- Awards made to three companies in August 2012:
  - Sierra Nevada Corporation – $212.5 million
  - SpaceX – $440 million
  - Boeing – $460 million

Details for all three companies and their concepts are available in back-up

Commercial Crew Program Roadmap



NASA Certification Strategy



Phase 1 – Certification Products Contracts (CPC)

- Matures key certification products to enable industry readiness and level of maturity required for NASA enter into Phase 2 certification contracts

- Allows technical interchanges between NASA and partners on certification requirements
  1. Alternate Standards
  2. Hazard Analyses/Reports
  3. Verification & Validation Plan
  4. Certification Plan

- Enables NASA and the partners to meet certification requirement objectives before the partners complete integrated system design

- Mechanism for ISS integration activities for commercial crew systems

Phase 1 – CPC (cont.)

- Type of competition
  - Full and open competition with the expectation of multiple awards
- Contract type
  - Firm fixed-price
- Maximum contract value per award
  - $10M

Activity	Date
RFP Release Date	Complete
Pre-Proposal Conference Date	Complete
Proposal Due Date	October 12, 2012
Estimated Start Date	February 2013
Estimated Complete Date	May 30, 2014

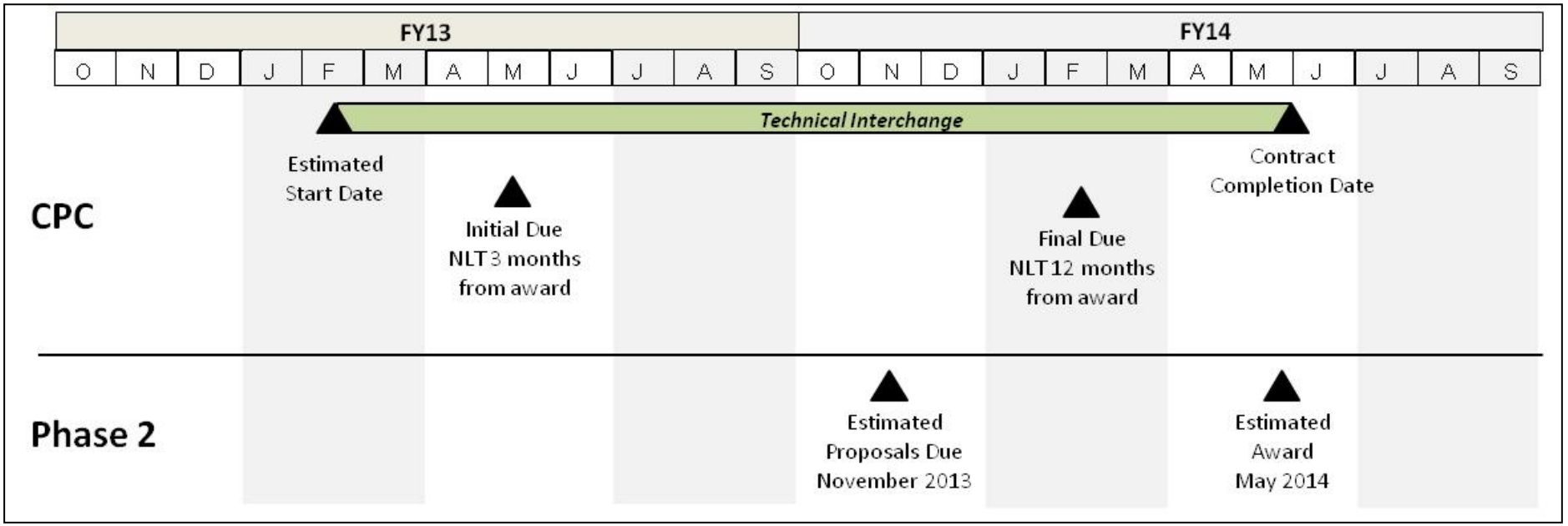
Decision-Making Process for CPC

- CCP has formed a Tiger Team to address decision-making process during execution of CPC for:
  - Approving alternate standards, hazard reports, verifications, and deviations/waivers/exceptions
  - Ensuring decision velocity and certainty
  - Reducing Program risk posture
- Process to be completed before CPC awarded
- Decision-making process will:
  - Streamline decision-making within the Program for making technical compliance decisions
  - Set clear expectations that illustrates who is accountable for the information set and what the contents are to make the actual decision
  - Assure decisions are properly vetted in a timely manner within the Engineering and Safety and Mission Assurance Technical Authorities before they are brought to the CCP Program Boards

Phase 2 – CTS Certification Contract

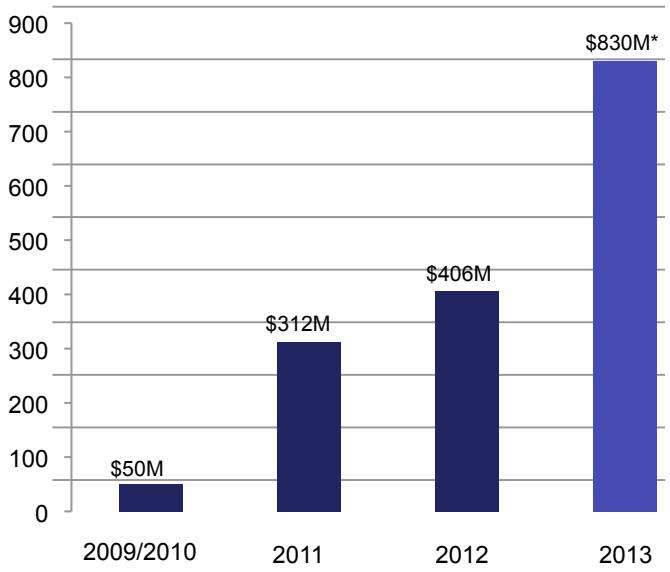
- Phase 2 competition will be based on the results of Phase 1
  - The award criteria for Phase 2 will include successful completion of Phase 1 requirements
  - The demonstration of an integrated design and certification maturity equivalent to successful completion of Phase 1 contract deliverable requirements
- CCP Insight Teams will support verification activities and make recommendations through the System Offices within the Program to accept verifications and certification efforts for the Program
- CCP will approve the verifications and certification activities and recommend to NASA (Agency) to grant Certification
- The Phase 2 with RFP release is anticipated in September 2013

Planned Timing of Phase 1 and Phase 2



Conclusion

- CCDev1 successfully completed; the majority of CCDev2 milestones completed; CCiCAP underway, ISS safety and performance requirements baselined.
- Industry is making significant progress on multiple crew transportation system designs.
- Budget status reflects steady progress.



* FY2013 President's Budget Request

- Together with the capabilities to explore deep space provided by the Space Launch System and the Multi-Purpose Crew Vehicle, NASA has a robust, complementary U.S. human space flight program.

Back-Up

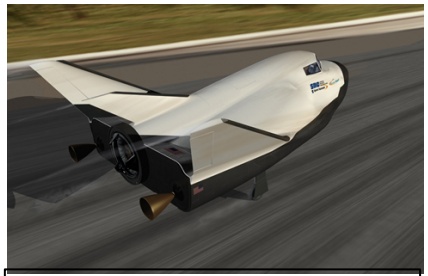
Sierra Nevada Corporation

- **Descriptions & Features**
  - Dream Chaser spacecraft is a reusable, piloted, lifting body, derived from NASA HL-20 concept
    - Carries up to 7 crew members
    - Utilizes non-toxic propellants
    - Primary Launch Site: Cape Canaveral, Florida
    - Primary Landing Site: Shuttle Landing Facility, Florida
    - Abort scenario leverages primary propulsion system with an ability to abort to a runway landing
  - Atlas V vehicle launched from the Space Launch Complex 41 launch pad

- **Base Period**
  - $212.5M total NASA funding for 9 milestones
  - Significant progress toward completion of critical design
  - Two major safety reviews and significant subsystem technology maturation and hardware testing

Artist rendition of Dream Chaser in low-Earth orbit

Artist rendition of Dream Chaser and Atlas V on launch pad

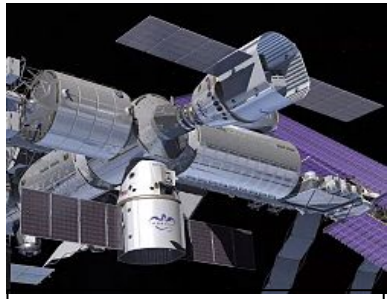


Artist rendition of Dream Chaser landing on a runway

SpaceX

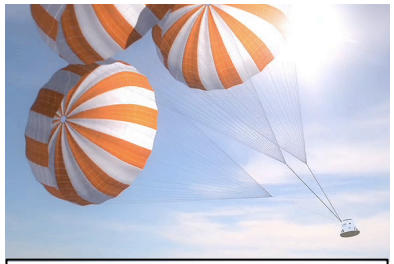
- **Descriptions & Features**
  - Spacecraft uses a crewed version of the SpaceX Dragon capsule
    - Carries up to 7 Crew
    - Primary Launch Site: Cape Canaveral, Florida
    - Primary Landing Site: “On land” landing, specific landing site in work
    - Integrated, side-mounted launch abort system utilizing SuperDraco engines
  - Upgraded Falcon 9 vehicle launched from the Space Launch Complex 40 launch pad
  - Mid calendar year 2015 crewed test flight (dependent on funding and technical progress)

- **Base Period**
  - $440M total NASA funding for 14 milestones
  - Culminates in an integrated critical design review
  - Includes a pad abort test and an in-flight abort test



Artist rendition of Dragon attached to ISS

Picture of Falcon 9 rocket on launch pad in Florida

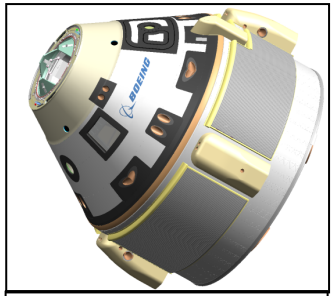


Artist rendition of Dragon re-entering Earth's atmosphere

Boeing

- **Descriptions & Features**
  - CST-100 spacecraft is a reusable capsule design utilizing many proven flight components
    - Carries up to 7 people
    - Primary Launch Site: Cape Canaveral, Florida
    - Primary Landing Site: “On Land” landing, specific landing site in work
    - “Pusher” launch abort system
  - Atlas V launch vehicle using the dual engine Centaur upper stage configuration and launched from the Space Launch Complex 41 launch pad
  - Late calendar year 2016 crewed test flight (dependent on funding and technical progress)

- **Base period**
  - $460M total NASA funding for 19 milestones
  - Culminates in an integrated critical design review
  - Significant propulsion system, avionics, and wind tunnel development and testing



Artist rendition of the CST-100 spacecraft

Artist rendition of CST-100 and Atlas V on the launch pad

Successful parachute drop test accomplished during CCDev2