

National Aeronautics and Space Administration



Exploration Enterprise Workshop:

FY 2011 Commercial Crew Point of Departure Plans

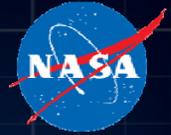
Moody Gardens Conference Center/Hotel

Galveston, TX

May 25, 2010

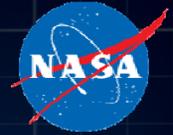


Disclaimer



- This chart set was presented by the Commercial Crew (CC) study team on May 25, 2010 at the NASA Exploration Enterprise Workshop held in Galveston, TX. The purpose of this workshop was to present NASA's initial plans for the potential programs announced in the FY2011 Budget Request to industry, academia, and other NASA colleagues. Engaging outside organizations allows NASA to make informed decisions as program objectives and expectations are established.
- The Commercial Crew presentation begins with a description of the future state of commercial human spaceflight. The charts contain information about the objectives of NASA's proposed Commercial Crew Program and the approach that NASA will take to achieve those objectives. How NASA will provide insight/oversight into the development and operation of commercial crew carriers is discussed in some detail, along with the process for human spaceflight certification for commercial systems. The presentation outlines how and where the program requirements for the International Space Station will be captured and lists several potential ones. The presentation concludes with a notional timeline of commercial crew activity through 2015.
- **DISCLAIMER:** The following charts represent at "point of departure" which will continue to be refined throughout the summer and the coming years. They capture the results of planning activities as of the May 25, 2010 date, but are in no way meant to represent final plans. In fact, not all proposed missions and investments fit the in budget at this time. They provide a starting point for engagement with outside organizations (international, industry, academia, and other Government Agencies). Any specific launch dates and missions are likely to change to reflect the addition of Orion Emergency Rescue Vehicle, updated priorities, and new information from NASA's space partners.

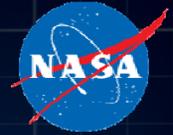
Commercial Crew Outline



- The Future State
- Objectives and Approach
- Framework
- Key Attributes of Strategy
- Human Spaceflight Certification
- International Space Station (ISS) Requirements
- Preliminary Insight/Oversight Approach
- Concept of Operations
- Notional Timeline
- Summary

All information contained in this briefing is for planning purposes only. NASA reserves the right to make any changes to these plans in the future.

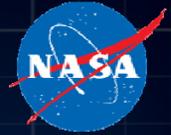
The Future State



- The vision of commercial human spaceflight to Low Earth Orbit (LEO) is a robust, vibrant, profit-making commercial enterprise with many providers and a wide range of private and public users.
- A successful human space transportation system will: strengthen the ISS Program, allow NASA to focus on beyond LEO exploration, potentially reduce the cost of human access to space, and significantly contribute to the national economy.
- NASA's commercial crew initiative will be the next, major step in making this vision a reality.



Objectives and Approach



- The primary 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 LEO and the International Space Station (ISS). Once the capability is matured and expected to be available to the Government and other customers, NASA could purchase commercial services to meet its ISS crew transportation needs.
- Preliminary Approach
 - Competition through pre-negotiated, milestone-based agreements that support the development, testing, and demonstration of multiple systems.
 - Support a range of higher and lower programmatic risk systems.
 - Require an end-to-end transportation solution, but will encourage the development of a range of launch vehicle and spacecraft combinations.
 - Some amount of industry investment capital will be included as part of any agreement.
 - Clearly and promptly state NASA's safety requirements and ensure that they are met.
 - Lead to the competitive selection of one or more commercial service providers through firm fixed price contract(s).

Framework



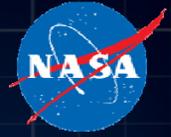
- The framework should be designed to achieve both program goals:
 - Safe transport of U.S. and U.S.-designated astronauts to and from ISS.
 - Support the development of non-NASA markets for commercial human transportation services to and from LEO.
- Given this, the framework should:
 - Accommodate a diversity of people (e.g., astronauts, international partner personnel, scientists, spaceflight participants) for a variety of reasons (e.g., science, research, station operations, tourism), including NASA personnel as crew or participants.
 - Support multiple commercial systems.
 - Incorporate requirements and a concept of operations that are as high-level as possible, providing commercial providers with maximum flexibility to propose a variety of safe and cost effective system solutions.
 - Rely on NASA human spaceflight certification for ISS crew transportation missions. This will not cover the certification of other NASA missions or non-NASA missions.
 - Eventual state will be FAA licensing with NASA human spaceflight certification and technical mission assurance oversight.

Key Attributes of Strategy



Attribute	Rationale
Performance-based Milestone Payments	Results in low cost-risk to the government.
Fixed Government Investment	Permits NASA to support the development of a risk-balanced portfolio of multiple systems.
Requires Industry Financial Investment	Supplements government funds and provides strong incentive to the industry partners to perform and “stay in the game”. Also, supports the development of commercial services.
Contractor-Retained Intellectual Property	Allows uninhibited commercial sale and application of capabilities.
Only High-Level Objectives Mandated	Enables cost and system-wide performance optimization by the industry partners, and allows creative solutions.
Relief from Requirement for an Approved Accounting System	Relieves industry of the requirement for approved accounting system, enabling companies without such accounting systems to compete, thereby expanding the list of potential suppliers.
Competition	Multiple industry partners provide incentive to perform and does not leave the government dependent on sole provider thereby generally producing lower prices and mitigating the risk of failure of an individual provider.

Preliminary Insight/Oversight Approach

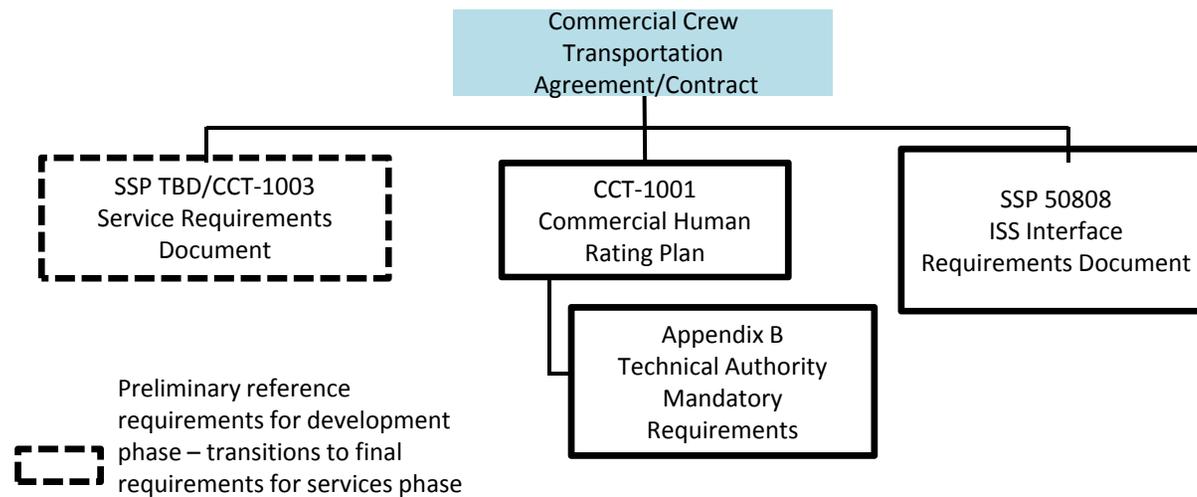


- The insight/oversight approach envisioned will require a change in the way government and industry interact for human spaceflight missions.
 - There will be a stronger reliance on the commercial providers to develop a safe, reliable vehicle.
 - NASA will have in-depth insight of the vehicle design through NASA personnel who are embedded in the contractor's facility.
 - A key facet of certifying the vehicle system will be through the use of requirements and standards. These will be imposed on all the providers and NASA will ensure that these are properly tailored and that the vehicle meets or exceeds the requirements and standards.
 - The scope and amount of government personnel assigned to support insight/oversight for specific commercial providers will vary depending on several factors including system level risk, the strengths and weaknesses of the proposed design, as well as that of the commercial provider's team.
 - The insight approach should be more efficient, more penetrating, provide more insight and can provide a more reliable system than an approach that embraces the review of contract deliverables and requirements accounting.
 - This approach has been highly effective in the past in ensuring reliable high-valued launch vehicle/payloads and robotic spacecraft.

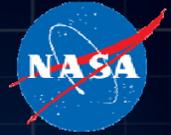
Human Spaceflight Certification



- NASA's Human Spaceflight Certification process for the commercial crew initiative will be outlined in the Commercial Human-Rating Plan (CHRP). A draft of this document was released for industry feedback last Friday, May 21.
- The CHRP outlines NASA's philosophy for human-rating commercial systems and includes tailored requirements from NPR 8705.2B, Human Rating Requirements for Space Systems.
- The CHRP, combined with the ISS Interface Requirements Document (IRD) and the Service Requirements Document (SRD), will enable commercial providers to achieve human spaceflight and visiting vehicle certification for the ISS mission. NASA plans to release drafts of the IRD and SRD for industry feedback later this summer.



ISS Program Requirements

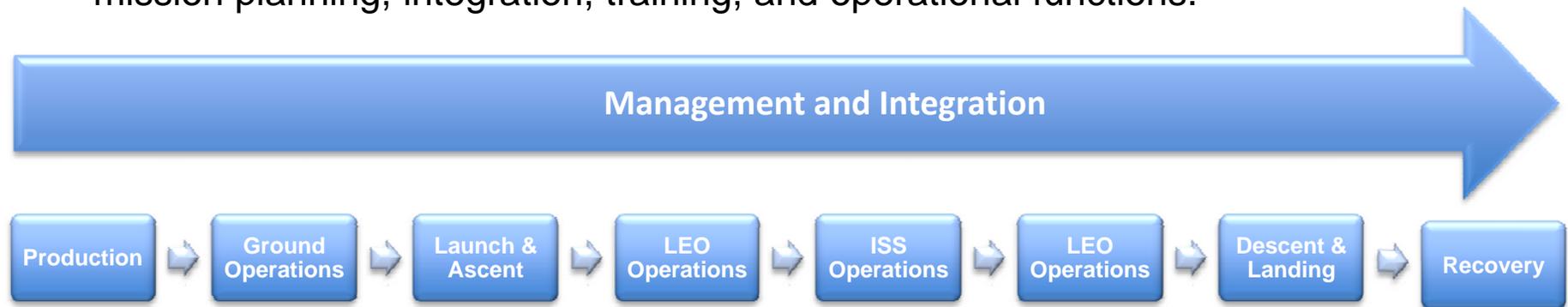


- ISS programmatic needs will be captured in a Service Requirements Document (SRD) which will describe the vehicle performance goals during the development phase and will transition to contract requirements for the services phase.
- The requirements development process was guided by experience with core services provided by Soyuz, lessons learned from prior NASA development programs (such as the Constellation Program, Orbital Space Plane, and X-38), and feedback from industry during the Commercial Orbital Transportation Services (COTS) and Commercial Crew Development (CCDev) activities.
- Key program requirements may include:
 - Safe transit for up to four ISS crewmembers
 - At least two flights per year
 - Targeted availability of 2015
 - Safe abort and crew recovery for all phases of launch and ascent, including pad escape
 - ISS visiting vehicle requirements
 - ISS physical and environmental interface definitions and requirements
 - NASA is currently evaluating the use of commercial vehicles for assured crew return capability

Concept of Operations

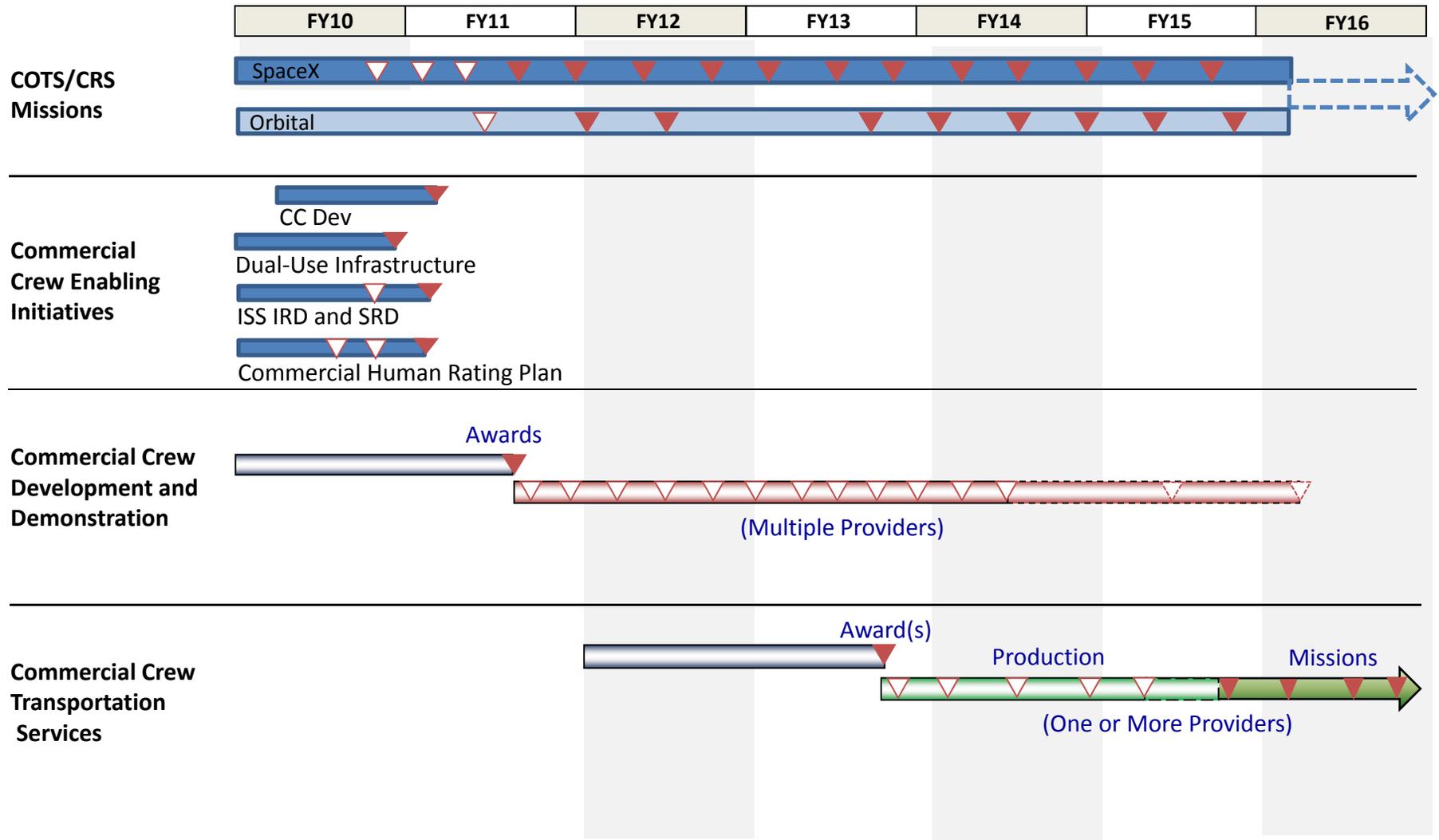


- The conops is intentionally high-level and general, thereby providing commercial providers maximum flexibility to propose innovative and cost effective solutions.
- Commercial providers will generally be responsible for all management, engineering, production, logistics, testing and verification, launch preparations, mission planning, integration, training, and operational functions.

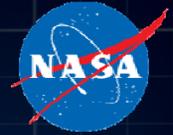


- Commercial providers will generally be responsible for all facilities and infrastructure; however, government resources can be made available to commercial providers, if requested, through reimbursable agreements.
- Commercial providers will be responsible for providing Certification of Flight Readiness (CoFR) for the vehicle and all ground and flight support infrastructure to NASA for acceptance. NASA will conduct a CoFR review for the acquired services.

Notional Timeline



Summary



- The commercial crew initiative is designed to meet the objectives of satisfying NASA's ISS crew transportation needs and enable the growth of a commercial human space flight industry for use by NASA and other customers.
- The commercial crew initiative represents a new way of doing business in human spaceflight, but it is well grounded by:
 - Knowledge gained from prior programs
 - Thorough human spaceflight certification processes
 - Building on the successes of COTS Cargo, Commercial Resupply Services, and CCDEV activities
- If successful, the commercial crew initiative will:
 - Transform human spaceflight for future generations
 - Result in safe, reliable, cost effective crew transportation for the ISS
 - Free NASA's limited resources for beyond LEO capabilities
 - Reduces reliance on foreign systems
 - Lower the cost of access to space, enhance the U.S. industrial base, and act as a catalyst for the development of other space markets.