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Statement of
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before the

Subcommittee on Space
Committee on Science, Space and Technology
U. S. House of Representatives

Mr. Chairman and Members of the Committee, thank you for the opportunity to appear before you today to discuss NASA's Commercial Crew Program (CCP). Over the past several years, NASA has made significant progress implementing its plan to develop the first ever commercially available American crew transportation system to low Earth orbit, with a goal of returning human spaceflight launches to U.S. soil by 2017 and ending our sole reliance on Russia. The recently awarded Commercial Crew Transportation Capabilities (CCtCap) contracts are the final phase of this development effort. U.S. crew transportation will allow the International Space Station (ISS) to increase the crew complement from six to seven enabling a substantial increase (~100 percent) in the amount of International Space Station (ISS) research that can be conducted, all the while reducing the costs the agency currently pays for transportation services.

Background

NASA's CCP is designed 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 the ISS and low-Earth orbit. Throughout the process, both NASA and industry have invested time, money and other resources in the development of these commercial systems.

Through the CCP, NASA provides technical and financial support to industry partners during development of their crew transportation systems, and certifies them to carry NASA astronauts to and from ISS. Interaction between NASA and its commercial partners through each phase of the program has been excellent and will enable these new commercial systems to meet NASA's safety requirements.

Once complete, the crew transportation systems will support four NASA or NASA-sponsored crew on each flight, and provide emergency crew return, transport/return of pressurized ISS cargo, and crew safe haven while docked to ISS. The benefits of competition in implementing the CCP are numerous, as reinforced in statements by the

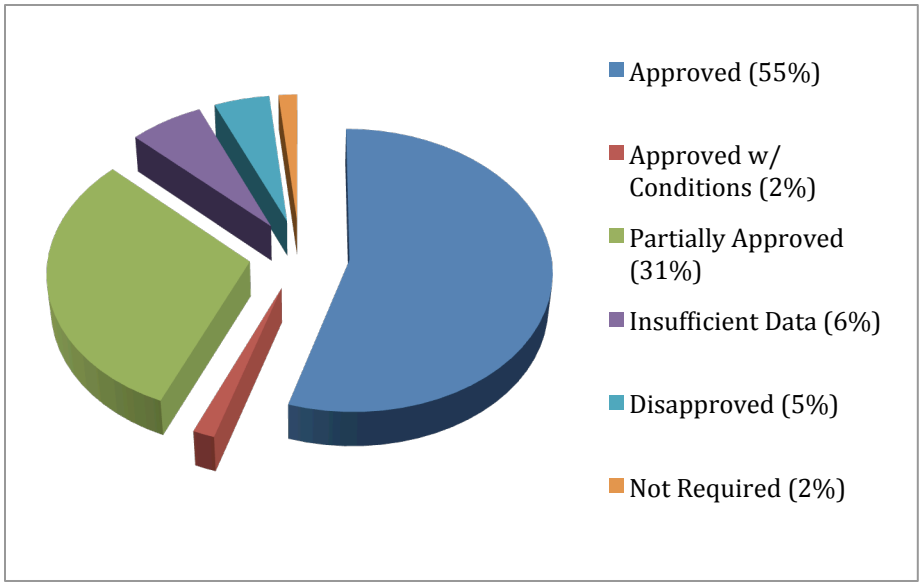
Government Accountability Office, Aerospace Safety Advisory Panel, and NASA Inspector General. Commercial Crew represents a significant endeavor in U.S. human spaceflight, with the goal of ending our sole reliance on foreign crew transportation to ISS, and certification of safe, reliable, and cost-effective U.S. commercial crew transportation systems. In addition, the approach NASA is taking with the CCP is helping to stimulate the growth of a new space transportation industry available to all potential customers, strengthening America's space industrial base and providing a catalyst for future business ventures to capitalize on affordable, globally competitive, U.S. space access.

Certification Products Contracts (CPC)

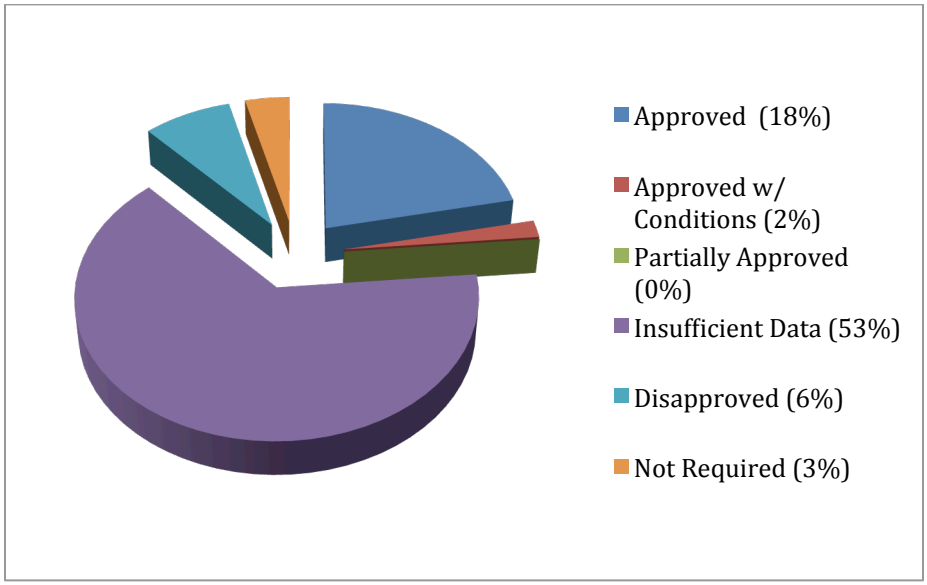
The first phase of the development effort was a series of competitively awarded Space Act Agreements, followed by Certification Products Contracts (CPC) competitively awarded to SpaceX, Boeing, and Sierra Nevada Corporation. The scope of the CPC contracts included submittal and technical disposition of specific, early development certification products. The CPC effort allowed potential providers to better understand and align with NASA human spaceflight requirements and gave NASA early insight into vehicle designs and approaches.

The companies submitted requests for alternate standards and variances to meeting NASA human spaceflight requirements. NASA's disposition of these requests is shown below.

Alternate Standard Dispositions under CPC



Variance Dispositions Under CPC



NASA's dispositions, with explanatory rationale, were provided to the companies. This feedback enabled our partners to make technical changes to better align their designs with NASA's requirements. The CPC phase also enabled NASA to examine the technical specifications and approaches that the companies were proposing to meet NASA's requirements. Understanding and agreeing on technical requirements is critical to developing a safe design. This phase shows tremendous progress in setting and understanding requirements. Overall, this phase of the contract was critical to allowing the contractors to understand the human rating requirements and NASA's understanding of how the contractors' approaches intend to meet those requirements. The number of variances from this phase with insufficient data shows the areas of concentration needed in the design phase.

Commercial Crew Transportation Capability (CCtCap) Contracts

CCP entered the development and certification phase with the award of Commercial Crew Transportation Capabilities contracts to SpaceX and Boeing. CCtCap will enable NASA to reach our goal of once again launching astronauts to the ISS from American soil.

In September 2014, after a highly competitive procurement and thorough evaluation process, NASA selected two providers, SpaceX and Boeing for the final development phase of the Commercial Crew Program, CCtCap. In selecting these companies, NASA evaluated the proposals for mission suitability, past performance, and price. NASA concluded that the proposals submitted by SpaceX and Boeing represented the best value

to the government. There was no ranking of awardees. NASA's rationale for these selections is described in detail in the *Source Selection Statement for Commercial Crew Transportation Capability Contract,* which can be found at http://www.nasa.gov/sites/default/files/files/CCtCap-Source-Selection-Statement-508.pdf.

The total potential contract value including certification, the maximum value for six post certification missions per company, and special studies is $2.6 billion for SpaceX and $4.2 billion for Boeing.[1]

These FAR-based contracts are designed to complete the NASA certification for human space transportation systems capable of carrying people to the ISS. Once certification is complete, NASA plans to use these systems to ferry astronauts to the ISS and return them safely to Earth. The contract scope of both contracts is the same, but because Boeing and SpaceX are using very different hardware, including launch vehicles, and are using different development, operational and management approaches, they have different prices for their respective integrated crew transportation systems.

The contracts include at least one crewed flight test per company with at least one NASA astronaut aboard to verify the fully integrated rocket and spacecraft system can launch, maneuver in orbit, and dock to the ISS, and to validate that all its systems perform as expected. Both companies proposed one uncrewed test flight to ISS prior to the crewed test flight. Once each company's test program has been completed successfully and its system achieves NASA certification, each contractor will conduct at least two, and as many as six, crewed missions to the ISS. These spacecraft also will serve as a lifeboat for astronauts aboard the ISS. If all 12 post certification missions are flown, these contracts can support the ISS crew transportation needs into 2023. NASA also anticipates having a Russian crew member on each U.S. commercial crew transportation flight and one astronaut will continue to fly on Soyuz. This is being done to insure that a U.S. and Russian crew member will remain on ISS in any contingency return of a vehicle. This will be accomplished on a no exchange of funds basis.

The SpaceX Crew Dragon and Boeing CST-100 will carry four crew members on each mission, which will enable the crew complement on the ISS to increase from six to seven crew members. As a result, the total crew research time on the orbiting laboratory can expand from 40 hours each week to 80 hours, enabling critical science investigations that increase our understanding of what it takes to live and work in space while also benefiting life on Earth.

[1] After the awards were made, Sierra Nevada Corporation (SNC) filed a protest with the Government Accountability Office (GAO) on September 26, 2014. During this period, the case was under protective order and NASA was unable to publically release the rationale for the selection of the contracts as well as other details of the contracts. The GAO denied SNC's protest on January 5, 2015.

Safety

Safety is an inherent aspect of NASA's strategy to develop a U.S. Commercial Crew space transportation capability. The first phase, the Certification Products Contracts is complete. During that phase, our industry partners made significant progress in honing their designs to meet our certification requirements, with explicit feedback from NASA on conformance.

The overarching objective of the second phase, the recently-awarded CCtCap contracts, is to ensure that NASA's human safety and certification requirements are met. The contracts include a robust insight clause, which will enable NASA to fully evaluate the company's designs to determine whether NASA's safety requirements are satisfactorily met. Defined milestones in the contracts enable NASA to incrementally assess the safety and performance of the systems through the certification process. In addition, the contracts include a comprehensive test program, including at least one crewed flight test to the ISS. The contract also includes a contract line item to add contractor-led studies, as needed, to provide extra analysis and possibly test in critical areas. The budget also includes funding for and fully involves NASA's technical authorities in the development process. This ensures that the entire NASA team is focused on this activity.

Simply put, crew safety is prioritized in the Commercial Crew Program. It is NASA's consistent and publicly stated position that any crew transportation systems selected and certified must meet the same rigorous safety standards as all human spaceflight programs in NASA.

CCtCap Milestones

NASA measures partner progress against fixed-price milestones, based on performance of agreed upon entrance and success criteria. Although the content varies by partner, milestones are designed to demonstrate progress toward completing crew transportation system development such as risk reduction testing, design reviews, hardware development, and flight tests. The CCtCap Request for Proposals (RFP) listed five mandatory milestones for the development phase and five mandatory milestones associated with the post certification missions to ISS. The contractors added milestones beyond these minimum mandatory milestones. Boeing has 23 total milestones for the development phase and SpaceX has 18 milestones for this phase. The government pays for milestones only after completion. Criteria for successful completion of the milestones is negotiated prior to the milestone. NASA and the companies can mutually agree on changes to milestones, such as splitting contract milestones into smaller tasks with no price change. The total price for the sum of the smaller tasks will not exceed the total value of the original milestone. Payment for the milestone or smaller task will not be made until the agreed to criteria is met.

NASA and our industry partners are currently in the process of re-baselining the CCtCap schedule of milestones. It is likely that there will be a relatively large number of changes because the original contract milestones were established over a year ago when the

companies submitted their CCtCap proposals. These changes will not be indicative of poor contractor performance, but rather the significant maturity and advancement that has occurred on the partner designs since the proposals were submitted. In addition, these changes should not affect the total CCtCap contract costs or the FY 16 CCP budget request.

The goal outlined in the RFP is to complete certification in 2017. NASA and our partners are committed to that goal and have a plan to meet it, but we will not sacrifice safety of crew for that goal.

Recent Progress

NASA's industry partners have made good progress under CCtCap.

Boeing completed the Certification Baseline Review in November 2014, which baselined a plan for achieving the certification of a commercial system to transport crew and cargo to/from the ISS. Also during November 2014, Boeing completed the Ground Segment Critical Design Review, which performed a review of crew and mission operations systems and ground systems for spacecraft assembly, integration, and test. In December 2014, Boeing completed the Phase II Safety Review Part B Integration System milestone.

Upcoming Boeing milestones include: an internal commercial crew transportation system Program Readiness Review, another Phase II Safety Review, and a Delta Integrated Critical Design Review.

SpaceX completed its Certification Baseline Review, which baselined the company's plan for achieving the certification of a commercial system to transport crew and cargo to/from the ISS.

Upcoming milestones include: a Pad abort test (performed under the CCiCap Space Act Agreement), an Avionics Test Best Activation milestone, and an In-Flight Abort Test (also under CCiCap).

It should be noted that 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 as we and our partners plan. This is true of any spaceflight development activity.

Price Per Seat

It is not possible to do a direct price comparison between Soyuz and Commercial Crew for crew transportation. Soyuz is purchased by the "crew seat" while Commercial Crew flights are purchased on a per mission basis which includes four seats and an additional 100kg of pressurized cargo. However, an equivalent seat price can be calculated for Commercial Crew using the prices established in the CCtCap contracts for the 4-seat configuration and excluding the price for the additional cargo. Using the pricing in the

CCtCap contracts for the 12 Post Certification Missions (6 per company) and assuming all 12 missions are purchased and flown at a rate of two per year, the average seat price is $58 million per seat for Commercial Crew. The currently contracted seat price for Soyuz for 2017 is approximately $76 million per seat. Soyuz seat pricing has been increasing at a rate of approximately 9 percent per year.

It should also be noted that, once both of these systems have been successfully completed, and including all previous commercial crew phases, the United States will have developed two new, independent, human space transportation systems for a cost of less than $5B to the U.S. taxpayer.

Benefits of Competition

American industrialization has long shown the benefits to customers of competitive markets, and NASA is capitalizing on that approach through the Commercial Crew Transportation Capability contracts. The Agency selected two independent systems designed by Boeing and SpaceX which, once certified, will add to the fleet of ships serving the ISS. Multiple awards maximizes meeting the program objectives, provides more options and flexibility for the Agency throughout contract performance, reduces overall risk to the program, and best ensures successfully accomplishing safe, reliable missions to the ISS.

While NASA is confident in the ability of the companies to perform, their designs are still not fully mature. Maintaining the benefits of competition during the rest of the development lifecycle and into initial services is critical to assuring safety by enabling redundant capabilities that will provide assured access to and from the ISS.

According to the Office of Inspector General: "Moving forward with a single company increases the risk that NASA could be left without a viable commercial option to transport crew to the ISS should issues arise that either significantly delay or render inoperable the selected company's systems." It is not in the best interests of NASA to put the Agency into a sole-source situation or to establish a monopoly on crew transportation.

In addition, selecting one company for a CCtCap award would not have accelerated the schedule. In NASA's RFP for CCtCap, the Agency requested proposals from industry for a crew transportation system "as soon as possible" and the companies proposed the optimum funding profile and technical schedule to complete their development as soon as possible.

FY 2016 Budget Request

The FY 2016 budget request for Commercial Crew is $1,243.8 billion, an increase of $395.5 million above the FY 2015 request, and an increase of $438.8 million above the FY 2015 enacted appropriation of $805 million. This increase supports the contracts

awarded to two American companies and keeps us on track toward the goal of returning human spaceflight launches to U.S. soil by the end of 2017. The Commercial Crew Program budget request funds two total post certification missions. The ISS Program will fund all subsequent post certification missions.

The FY 2016 budget request for Commercial Crew is comprised of three components. The first and largest component is the cost of the CCtCap contract milestones. The milestones are contractual requirements that NASA has committed to paying once the companies successfully complete the milestones. The amounts of these contracts were identified when the proposals were selected for the CCtCap awards. The total cost for the development phase and two post certification missions for both contractors is ~$3.9 billion. The second component is NASA program office costs, including civil servant labor, travel, etc. The budget for the program office support across the total activity is ~$266 million. The third component is for Unfunded Future Expenses, risk reduction activities, additional tests, etc. The budget for these tasks is less than 5 percent of the total effort or $198 million.

The $805M appropriated for CCP in FY 2015 should be sufficient to fund the CCtCap contracts for the current fiscal year. If NASA does not receive the full requested funding for CCtCap in FY 2016 and beyond, NASA will have to adjust (delay) milestones for both partners proportionally and extend sole reliance on Russia for crew access to the ISS. The partners may request contract cost adjustments and the certification dates will be delayed.

Conclusion

Human spaceflight is a very difficult endeavor and achieving commercial crew transportation will continue to be a challenge. However, NASA's successful developmental approach over the last several years has led to this final phase where we are ready to take the next step to enable U.S. commercial industry to fly crews to space, and once again launch our astronauts from America. Support for Commercial Crew at this time is critical for NASA to develop a safe, competitive, domestic program which will enable us to end our sole reliance upon the foreign governments for crew transportation by 2017 and to allow NASA to focus its exploration resources on expanding our human presence into destinations beyond low-Earth orbit. The Commercial Crew Program along with the Space Launch System and *Orion* program and daily operations on the International Space Station together make for a robust human spaceflight program for the nation – and are all critical components of our journey to Mars. NASA's human spaceflight team is ready for these challenges. Congressional support is critical.

Mr. Chairman, I would be happy to respond to any questions you or the other Members of the Committee may have.