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NASA's Commercial Crew Development Program

Statement of

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Mr. Chairman and Members of the Committee:

Thank you for inviting me to discuss the progress made – and challenges remaining – with NASA's efforts to develop privately owned, commercially operated crew launch capabilities.

With the final Space Shuttle flight in July 2011, the Agency turned its attention to the manned space program called for in the NASA Authorization Act of 2010 while continuing to encourage development of commercially operated U.S. space transportation systems. When these commercial capabilities are matured and available to the Government and other customers, NASA intends to use them to replace its reliance on the Russian Soyuz for transporting astronauts to the International Space Station (ISS).

The emergence of commercial companies seeking to provide access to the ISS and low Earth orbit presents NASA with both opportunities and challenges. In April 2011, NASA announced a second round of funded Space Act Agreements with four companies totaling $269.3 million as part of the Agency's Commercial Crew Development (CCDev) effort. NASA has since reported that these four companies – Blue Origin, Boeing, Sierra Nevada Corporation (Sierra Nevada), and Space Exploration Technologies Corporation (SpaceX) – have successfully met all initial milestones set for them. Furthermore, NASA has amended its agreements with Boeing and Sierra Nevada to include optional milestones for specific tests intended to accelerate development efforts. If met, these new milestones bring the potential value of the companies' agreements to $112.9 million and $105.6 million, respectively.

Additionally, in July 2011 NASA and United Launch Alliance (ULA) entered into an unfunded Space Act Agreement to share personnel, infrastructure, and information to accelerate the potential use of ULA's Atlas V launch vehicle as part of a commercial crew transportation system. Similarly, last month NASA and Alliant Techsystems (ATK) entered into an unfunded Space Act Agreement to collaborate on the development of ATK's commercial launch system known as Liberty. Under the agreement, ATK and NASA will review and discuss Liberty system requirements, safety and certification plans, computational models of rocket stage performance, and avionics architecture designs.

These Space Act Agreements illustrate the progress NASA has made to date with its CCDev initiative. However, significant challenges remain as NASA attempts to cultivate privately owned, commercially operated crew launch capabilities and foster a commercial space industry that could meet the Agency's low Earth orbit crew transportation needs. Although the Agency has over 50 years of experience with contractor-built, Government-owned space vehicles, NASA has never procured transportation for its astronauts aboard a commercially developed vehicle. Of primary concern in this new paradigm is how NASA will work with its commercial partners to ensure that commercially developed vehicles meet NASA's safety and human-rating requirements, which seek to ensure that spaceflight systems accommodate human needs, control hazards, manage safety risks and, to the maximum extent possible, provide the capability to recover the crew safely from hazardous situations. How NASA responds to this challenge will to a large degree determine whether the nascent commercial space transportation industry evolves into a viable commercial enterprise that meets NASA's crew transportation needs.

To examine NASA's progress as it transitions from its traditional role of contracting for and owning human spaceflight vehicles into the role of purchasing crew transportation services from industry, the Office of Inspector General (OIG) earlier this summer reported on the Agency's efforts to modify its existing safety and human-rating requirements to make them applicable to commercially developed vehicles. We also evaluated the overarching challenges associated with possible approaches NASA may use to certify and acquire commercial crew transportation services.

Our report, issued on June 30, 2011, concluded that NASA has made sustained progress toward its goal of obtaining commercial transportation services to low Earth orbit.[1] At the same time, we identified a series of challenges NASA faces as it expands its Commercial Crew Transportation program:

- modifying NASA's existing safety and human-rating requirements for commercially developed systems;
- managing its acquisition strategy for commercial crew transportation services;
- implementing the appropriate insight/oversight model for commercial partner vehicle development;
- relying on an emerging industry and uncertain market conditions to achieve cost savings; and
- managing the relationship between commercial partners, the Federal Aviation Administration (FAA), and NASA.

I summarize each of these challenges in turn.

Modifying NASA's Existing Safety and Human-Rating Requirements for Commercially Developed Systems. In December 2010 NASA issued a consolidated set of health and medical, engineering, and safety and mission assurance requirements that commercial partners will have to meet to obtain certification to transport astronauts ("Commercial Crew Transportation System Certification Requirements for NASA Low Earth Orbit Missions"). These Requirements describe NASA's certification philosophy; the content and timing of the certification packages commercial companies will be required to deliver to NASA; and NASA's expectations for system safety, human control of the vehicle, and crew survival. In addition, the Requirements reference a set of 93 other documents, each containing additional requirements the companies must consider in order to obtain certification. NASA has categorized the underlying 93 documents into three types: Type 1 – mandatory, must be implemented as written; Type 2 – alternatives allowed with NASA approval; and Type 3 – suggested best practices. Each of the 93 documents reference other documents that set forth additional requirements. According to one estimate, NASA's Certification documents contain more than 4,000 requirements.

[1] "NASA's Challenges Certifying and Acquiring Commercial Crew Transportation Services," NASA Office of Inspector General (June 20, 2011) accessible at http://oig nasa.gov/audits/reports/FY11/IG-11-022.pdf.

However, NASA has not finalized the processes Agency officials will use to verify that commercial partners have met these requirements and certify that a commercial partner's vehicle can safely transport NASA personnel. In May 2011 the Agency released for industry comment six draft documents (the 1100-series) that supplement the Certification Requirements relating to missions to the ISS. These documents provide additional information to commercial partners regarding roles and responsibilities, technical management processes supporting certification, crew transportation system and ISS services requirements, and the application of technical and operations standards.

Since issuance of our report, NASA has received industry's feedback, reviewed and updated the 1100-series documents, and is working to validate the requirements for development of commercial services to deliver crew to the Space Station. Updates to these requirements will continue through the formal NASA document change process with final approval and release planned for early November 2011.

Despite the absence of finalized requirements from NASA, the private sector is already developing systems and vehicles to meet NASA's crew transportation needs. During the comment phase, companies have suggested that NASA (1) modify existing requirements to the greatest extent possible and ensure they are achievable so that industry fully understands what is expected; (2) coordinate with the FAA – which has regulatory oversight of U.S. companies providing commercial space transportation services – to ensure NASA requirements and FAA regulations are compatible; and (3) allow for flexibility so that changes in vehicle or system design are attainable within reasonable costs. For its part, NASA said that it has reduced its compliance documents to those truly necessary to meet Government requirements. Additionally, the Agency has stated that it will allow commercial partners to propose alternative standards, where applicable.

Every requirement NASA imposes on commercial vehicles has a cost associated with it in time, money, or decreased innovation. Conversely, incurring these costs is often necessary to appropriately manage risk, particularly when the issue is human crew as opposed to cargo. Consequently, many of the requirements NASA will impose on its commercial partners are the same as those the Agency applies to its own spaceflight programs. NASA must determine if, when, and how it will oversee commercial partners' development efforts in order to ensure they meet Agency requirements and maximize safety and reliability without burdening commercial partners with unnecessary demands that lead to higher development and operations costs.

Managing the Acquisition Strategy for Commercial Crew Transportation Services. When we issued our report in late June, NASA was still developing its acquisition strategy and had not settled on the specific mechanisms it planned to use for procuring commercial crew transportation services. Therefore, our report discussed the financial and programmatic challenges of several possible strategies, including those that rely on funded Space Act Agreements; competitive procurements, in particular fixed-price contracts; or a combination of both.

With respect to funded Space Act Agreements, we reported that their use limits Government control compared to traditional procurement contracts based on the Federal Acquisition Regulations (FAR). As one potential customer of the private sector market, NASA expects

CCDev Space Act Agreements to result in commercial capabilities that consider the Agency's Certification Requirements. However, under such agreements the Agency cannot dictate specific system concepts or elements or mandate compliance with its requirements. Rather, commercial partners are free to determine the system requirements and concepts they believe will best serve their target markets. Because crew transportation for NASA is the most viable segment of the human spaceflight market in the short term, it is in the companies' best interests to ensure compliance with NASA requirements if they hope to obtain NASA's business. Nevertheless, the lack of mandatory compliance with NASA's requirements would have presented some risk that differences between partner designs and Agency requirements could occur. In addition, according to Agency policy, NASA may only enter into funded Space Act Agreements when its objective cannot be accomplished through a contract, grant, or cooperative agreement. Moreover, under the law a procurement contract is required if NASA is the sole beneficiary of the expected deliverables.

Similarly, we reported that the use of fixed-price contracts for crew transportation services also presented challenges. Traditionally, cost-reimbursement rather than fixed-price contracts have been used on projects in which costs and risks are not clearly defined. While fixed-price contracts lock in the Government's initial investment, proceeding in this manner may not eliminate cost risks. Some of NASA's potential commercial crew partners are building spacecraft for the first time and design and development are under way without fully defined and finalized requirements. In this type of environment, there is a risk that during the period of contract performance NASA's requirements may change so significantly that contractors could successfully argue that the Agency is changing the contract's scope, in which case NASA could be required to pay the contractor to make necessary modifications.

In September 2011, NASA released an outline of its acquisition strategy to achieve a certified crew transportation capability from private industry no later than the end of fiscal year 2016. The draft request for proposal calls for a firm fixed-price Commercial Crew Integrated Design Contract in the first phase to be awarded to one or more companies that will result in a complete end-to-end design compliant with NASA Crew Transportation System requirements, including spacecraft, launch vehicle, launch services, ground and mission operations, and recovery. The contract value could be up to $1.61 billion from July 2012 through April 2014. In the second phase, NASA will issue a separate, formal solicitation for follow-on contracts for development, test, evaluation, and certification activities with optional ISS service flights.

NASA's decision to move away from funded Space Act Agreements and toward FAR-based contracts has drawn criticism from some quarters over fears that this approach may cause significant delays and limit the flexibility of participating companies. In rolling out its new strategy, NASA has described it as a non-traditional contract approach that eliminates certified cost and pricing and Cost Accounting Standards requirements and incorporates tailored requirements, limited deliverables, and focused insight and oversight. Nevertheless, industry representatives have expressed concerns that NASA's plans for a more hands-on FAR-based approach may be prohibitively expensive, create undue administrative burdens, and curtail the innovation and control they have over their system designs. Conversely, NASA believes the risk of commercial partners' inability to meet its human-rating requirements could cause costly and time-consuming redesigns, pose safety concerns, and require NASA to be more involved in the development of any commercial transportation system. Going forward, one of the key

challenges for NASA will be to strike a balance that will enable innovation and flexibility yet provide the appropriate amount of direct Government involvement to ensure the safety of NASA's astronauts.

Establishing the Appropriate Insight/Oversight Model for Commercial Partner Vehicle Development. In selecting the timing and appropriateness of its procurement mechanisms, NASA must balance its role as a supporter of commercial partners with its responsibility to ensure that commercially developed vehicles are safe for NASA astronauts, meet the Agency's needs, and provide for a viable domestic alternative to the Soyuz vehicle. As we reported in June 2011, the Commercial Crew Office is in the process of developing the model for NASA's insight and oversight of commercial companies. According to NASA policy, "insight" means acquiring knowledge and an understanding of contractors' actions by monitoring selected metrics and milestones. Methods of achieving insight include reviewing documents, attending meetings and tests, and conducting compliance evaluations. "Oversight" combines technical insight of contractor activities with approvals that provide the contractor with formally documented authority to proceed or formal acceptance of plans, tests, or other criteria.

With the issuance of the draft request for proposal for the Commercial Crew Integrated Design Contract, NASA has confirmed that it plans to function in an insight role while commercial partners are designing and beginning development of their launch systems. For example, the Agency intends to assign a core Partner Integration Team comprised of NASA employees to follow each contractor as they design and begin to develop their systems, performing insight activities at commercial facilities as needed. Additionally, a board headed by a NASA Commercial Crew Program Manager and co-chaired by an industry representative will approve commercial systems and determine whether they meet NASA requirements.

As each contractor moves forward with development, demonstration, and flight test activities, NASA will still need to maintain insight into the development of each vehicle but may assume more of an oversight role in granting approval or direction to each partner on the path to certification. To our knowledge, NASA has not finalized the oversight model for this phase that will include defining the key milestones commercial partners must successfully meet. Selecting the appropriate level and mechanisms of insight and oversight is critical to provide NASA with sufficient information to assess partners' technical, schedule, and cost risks and certify that commercially developed vehicles are safe for NASA astronauts without unduly affecting the commercial partners' ability to operate in a cost-effective manner.

Relying on an Emerging Industry and Uncertain Market Conditions to Achieve Cost Savings. In the NASA Authorization Act of 2010, Congress stated that commercial companies offer the potential of providing lower cost crew transportation services to support the Space Station. In fact, NASA's acquisition strategy for procuring crew transportation services is premised on competition and a healthy commercial human spaceflight industry that would allow NASA to solicit bids from a number of partners and make informed, competitive procurement decisions that meet individual mission requirements and provide the best value for the taxpayer. However, the commercial human spaceflight industry is in its infancy and the market beyond NASA's own crew transportation needs is uncertain. Many of the risks associated with achieving anticipated cost savings are largely out of NASA's control, particularly in the area of creating non-Government demand for commercial human spaceflight services. The 2010

Authorization Act directs NASA to work with the Federal Aviation Administration's (FAA) Office of Commercial Space Transportation and assess the potential non-Government market for commercially developed crew and cargo transportation systems and capabilities. In April 2011, NASA and the FAA reported that over time the market for commercial crew and cargo services may emerge and provide significantly more customers, more flights, and potentially lower prices to the U.S. Government. The continuing challenge will be to determine at what point the market can sustain a number of commercial partners, allowing NASA to transition to the role of consumer and ultimately realize cost-effective commercial crew transportation.

Managing the Relationship Among Commercial Partners, the FAA, and NASA. The FAA is responsible for regulatory oversight of companies seeking to provide commercial human space transportation. To date, the FAA has issued regulations pertaining to launch and reentry activities that could affect the public safety. However, in December 2012 the FAA is authorized to begin proposing regulations concerning the safety of passengers and crew involved in commercial spaceflight. As previously discussed, NASA plans to impose its own set of requirements, standards, and processes that commercial partners must meet to obtain a certification before transporting Agency personnel. Accordingly, NASA must coordinate with the FAA to avoid an environment of conflicting requirements and multiple sets of standards for commercial companies seeking to transport Government and non-Government passengers to low Earth orbit. Toward that end, the FAA and NASA have expressed a spirit of cooperation, and both groups have agreed that the ultimate goal is FAA licensing of commercially developed vehicles used to transport NASA personnel. Additionally, the agencies are co-locating personnel at NASA Headquarters, FAA field offices, and Johnson and Kennedy Space Centers to optimize Government oversight of commercial partners through compatible requirements, standards, and processes.

While we did not make specific recommendations for corrective action in our June report, we continue to believe NASA must pay particular attention to these challenges as it continues to partner with commercial companies seeking to provide safe, reliable, and cost-effective access to the ISS.

This concludes my prepared statement. I would be pleased to answer any questions.