PREPARED STATEMENT OF CHARLIE PRECOURT

Mr. Chairman, Members of the Committee:

Thank you for inviting me to discuss NASA's commercial crew program and, more specifically, ATK's Liberty Launch System. Allow me to begin with a detailed introduction to the Liberty Launch System, background about our international partner and our progress to date, followed by some challenges I believe Liberty and others in the commercial crew industry are facing.

ATK and EADS-Astrium developed the Liberty Launch System as part of a new commercial space transportation business in response to NASA's CCDev-2 competition. The launch vehicle focuses first and foremost on achieving the maximum possible safety levels for our astronauts. Liberty also focuses on the sustainment of the International Space Station by delivering the safest and most cost-effective transportation capability as quickly as possible following the retirement of the Space Shuttle. Liberty achieves these important goals by leveraging flight proven, human-rated launch elements developed by both NASA and ESA, in their respective Shuttle, Constellation and Ariane programs. Liberty also delivers on the U.S. policy goals of increased use of commercial systems and increased international collaboration, while leveraging the prior investments of both the United States and Europe.

Liberty is a simple, inherently safe, two-stage launch vehicle. Its first stage is the five-segment solid rocket booster derived from the Space Shuttle and Constellation programs. The upper stage is the core liquid engine stage used in ESA's Ariane 5 program. Having both stages based on existing, flying systems dramatically lowers the remaining development costs as there are only minimal changes necessary to integrate the stages to form Liberty. Both stages were designed from inception to NASA's human-rating requirements (Shuttle, Ares I and the Hermes Space Plane that was originally envisioned for launch of ESA's astronauts). This heritage enables unmatched crew safety. Liberty has a payload capacity of 44,500 pounds, which is enough to carry any of the currently proposed crew vehicles, with margin, to low Earth orbit. The launch vehicle will use existing facilities at NASA's Kennedy Space Center for processing and launch, including the Vehicle Assembly Building, mobile launch platform and launch pad, as well as the services of an expert NASA and contractor workforce across the country to perform design, testing, integration and launch operations.

The first stage's five-segment solid rocket booster enables Liberty to leverage the successes realized and data collected from close to 300 booster flights and tests. The five-segment booster takes advantage of new advances in materials and propellant design that provide even higher safety and performance than the original shuttle version. The five segment solid rocket has been successfully ground tested three times, and a flight test in a Liberty-like configuration (Ares I-X) has successfully demonstrated the operational concept and performance margins. These milestones have brought the first stage to a CDR-equivalent level of maturity. The booster has also recently been slated for use on the initial test flights of NASA's Space Launch System, which enables considerable synergy and cost-savings between the two programs.

Liberty's second stage has achieved 46 successful consecutive launches since 2003 as the core of the Ariane 5. As with the first stage, there is valuable synergy and cost savings with this propulsion element, as the Ariane 5 is ESA's prime vehicle for launching cargo resupply to the ISS via the Automated Transfer Vehicle (ATV). Astrium's track record of reliability is such that commercial payloads flown on the Ariane 5 are rewarded with the lowest insurance rates in the launch industry. The flight-proven liquid core stage includes the Vulcain-2 engine, a simple gas-generator engine that is inherently very safe and reliable and was designed to meet Human Rating Requirements – adding further simplicity, robustness and safety to the Liberty Launch System.

Both of Liberty's propulsion stages are at or beyond a CDR-equivalent level of maturity; however, since the two have not yet flown together, the *integrated* Liberty system is currently approaching a PDR-equivalent level of maturity. The development necessary to deliver the Liberty for commercial crew requires meeting two major milestones. These are the validation of design modifications that provide structural attachment of the two stages, and modifications enabling in-flight start of the upper stage (in the Ariane 5 configuration the Vulcain engine is ground-ignited). Current analysis shows these design milestones, with appropriate funding, can be completed and result in a full CDR-equivalent launch vehicle in less than one year.

We have made significant progress on the Liberty program over the past year and a half, culminating in an unfunded Space Act Agreement (SAA) with NASA's Commercial Crew Program Office in September, 2011. Analysis has determined that Liberty's capacity of 44,500 pounds of payload to low Earth orbit enables highly-competitive launch pricing. A full-vehicle

Systems Requirement Review and Systems Design Review were completed in early 2011. The team is currently working towards Preliminary Design Review, which is scheduled for early 2012.

Liberty's approach to meeting the goal of maximum achievable crew safety leverages numerous lessons from past programs. A major lesson articulated by the Columbia Accident Investigation Board was to lower the complexity of the launch vehicle to reduce the number of possible failure points. Liberty draws its high safety from a simple design with an absolute minimum number of "moving parts," which provides the lowest potential loss of crew. The resulting design is more than 10 times safer than shuttle and even safer than the Ares I vehicle projections, due to the use of established stages (Valador Study, April 2011). The use of the solid rocket first stage also provides a trajectory that enables survivable aborts throughout ascent to orbit, alleviating the black-out zones that are prevalent with full liquid launch vehicles. Liberty offers the safest, most reliable access to space of any of the launch vehicles currently proposed. The vehicle is also capable of carrying cargo or satellites and has payload capability comparable to that of the Delta IV heavy launch vehicle. The DoD has inquired about using the Liberty System as a new entrant into the EELV launch system and following their technical review, considered both first and second stages to be at a critical design review level of maturity – which ultimately allows Liberty to achieve operational flights at the earliest possible time.

A critical consideration for ATK was finding the right partner to speed development of a commercial crew capability. Leveraging existing systems not only minimizes cost to field a capability, but also results in achieving that capability soonest. The Ariane 5 core stage was the only one to meet all the desired attributes, which led to a natural partnership with EADS Astrium to create Liberty. Astrium brings demonstrated reliability, flight-proven mature hardware, and commercial know-how, all of which contribute to the reliability and faster development time of Liberty. With a European partner for the upper stage, the program also advances the *United States' 2010 National Space Policy*, which called for greater international partnerships for space exploration and takes advantage of the existing strong human space flight partnership between the United States and Europe.

An additional strength of the partnership is Astrium's long-term history and commitment to human space flight. Astrium is the prime contractor for ESA's Ariane 5 and the ATV cargo vehicle for the ISS. ESA is a historically very strong partner of NASA in the area of human

space flight. European astronauts have flown in NASA's Shuttle program under cooperative agreements since 1983, when the first non-American to fly on the Shuttle was German astronaut Ulf Merbold. Since then, Europeans have been part of 25 Shuttle missions, including nine Shuttle missions to the International Space Station. One ESA astronaut has also served as commander of an ISS crew that was comprised of Americans, Russians and Europeans. The Europeans have a significant investment in the International Space Station – nearly $10B, and place high priority on sustaining this commitment and ultimately achieving a strong scientific return from the ISS. ESA has contributed four of the ten modules that comprise the ISS—more than any other international partner, as well as supplying the ATV. In short, the Europeans have been close partners with the US for the entire history of both Shuttle and ISS. ATK's partnership with Astrium takes advantage of a partner highly motivated to the same objectives of high safety and robust ISS sustainment. The Liberty engineering team's completion of the System Requirements Review and System Design Review validates the Ariane 5 core stage mission suitability and enables Liberty to leverage ESA's prior investment of nearly $4 billion in Ariane's development. As Liberty represents Europe's greatest means of assurance of access to its own investment in the ISS, there is a high level of commitment to the success of the effort.

The Liberty program will sustain and create aerospace jobs in the U.S. In our arrangement with Astrium, Liberty's upper stage will be built using the existing manufacturing base. Once produced, it will be shipped to the Kennedy Space Center, where it will employ the services of hundreds of America's most highly-skilled aerospace workers and NASA's infrastructure to assemble and launch. Liberty has already created jobs in Utah, Florida, Ohio, Texas and Alabama, and additional jobs will be created across the country as our Liberty teams work with other NASA centers and suppliers.

Liberty was first proposed at a firm-fixed price for NASA's CCDev-2 solicitation. Had ATK received a funded SAA from NASA, Liberty's first test flight was slated for 2013 with its first crew launch on its third flight in 2015. Although NASA chose to fund only spacecraft providers, we were very pleased that NASA rated Liberty highest of all launch vehicles with high-confidence of success in both business and technical merits—only two of the 18 proposals submitted were rated better. Following the signing of the unfunded SAA in September, NASA assigned individuals based out of Kennedy Space Center and Marshall Space Flight Center to the Liberty team.

Our activities within NASA's unfunded Space Act Agreement further validate our technical approach and business model as sound options for ensuring commercial crew success; however, without partial funding from the government it is extremely challenging to recruit investors and close the business case. NASA's Commercial Orbital Transportation Services program demonstrated that providing "seed" money to stimulate commercial space entrants was effective. With this seed money it becomes the commercial space company's responsibility to execute the program both from a technical and business perspective. After commercially developing the basic space transportation system, it is appropriate for the government to acquire these services through a full and open competition.

Technical issues in development and testing of the Liberty vehicle are less of a challenge than achieving the optimum funding profile to complete development. The infusion of outside capital, although available, awaits customer commitment and endorsement of the value proposition. In the case of Liberty, because much of the development is complete, leveraging flight-proven elements, the amount of necessary government investment is quite modest. In fact, Liberty's CCDev-2 funding request was much lower than the awarded SAAs. As a result, NASA's strategy to emphasize spacecraft development in CCDev-2 has slowed our progress towards Liberty's first flight test.

An additional risk in fielding a commercial crew system is the remaining unknowns in NASA's certification process. NASA has drawn a distinction between human *rating* and human flight *certification*. Although Liberty is designed as a human rated system, NASA has not yet announced its final requirements for the commercial crew certification process. The degree of testing and verification required to achieve certification is still under development at the agency. This could ultimately affect a schedule delay, causing a larger gap in America's access to space and jeopardizing the success of the program. Some parallel funding of the launch vehicles being proposed for crew transportation would be appropriate to mitigate the possibility of surprises in certification. Any delay in the timeline for delivering commercial crew capabilities, given the limited life of the International Space Station, affects the business case for every commercial crew provider.

Liberty considered the commercial crew market potential in establishing our business model. Our assumptions did not depend on a significant initial market for non-US government astronauts. We do believe there are sovereign nations who, although cannot afford their own

space program, could and would fund citizen participants on a commercial system. This market will take considerable time to mature. Liberty, as a launch vehicle, will instead rely on cargo, science payloads and other large satellite opportunities such as with the DoD, in addition to commercial crew for NASA. Launch vehicles having the ability to serve these other markets are less sensitive to the commercial crew market size than are spacecraft uniquely designed to carry crew.

The NASA acquisition strategy of soliciting a full end-to-end service for commercial crew tends to stovepipe the design solutions offered, and does not facilitate interoperability. Interoperability is one of the major enablers for commercial success in the launch vehicle business. That is, a launcher should, through use of common interfaces, be able to fly multiple cargos with low recurring integration expense. Similarly, to enable a robust sustainment of the ISS, interoperability between launchers and spacecraft should be encouraged. Common interfaces will be difficult to achieve with an acquisition strategy that seeks offerings of an end-to-end service. As an alternative, NASA could leverage some acquisition aspects of their existing NASA Launch Services (NLS) program, which has the ability to consider more than one launcher for a given payload. This kind of robustness would largely mitigate the potential risk of abandoning ISS as recently was confronted with the Soyuz failure.

There has been some debate over the contracting mechanism of an SAA versus a Federal Acquisition Regulation (FAR) type contract for future commercial crew activities. However, focusing on a choice between SAA and FAR misses the point, as the objective is to facilitate the most cost-effective government contractor interface. NASA will need the commercially-developed vehicles and services to be certified to the agency's Human Rating requirements, which will require appropriate oversight with the design and development of these vehicles and services. In order to impose these requirements, NASA is naturally driven to a FAR procurement model rather than an "other-transactional-authority" such as an SAA. As a contractor very familiar with FAR-based contracts, we had concerns with how NASA was going to be able to administer that type of contract without over-burdening commercial companies and driving costs higher. However, we believe NASA is achieving the right balance with their approach to the Integrated Design Contract (IDC) phase of the Commercial Crew Program.

NASA's recent IDC requests for information have demonstrated that the agency has structured the procurement to accommodate commercial aspects of the acquisition while

maintaining appropriate regulatory compliance. NASA has carefully selected specific clauses from the FAR that will enable streamlined development while also providing appropriate protections for both the contractor and tax payer, which are not available through a SAA. NASA structured the acquisition as a competitive Firm Fixed Price procurement to eliminate the burdens associated with providing Certified Cost and Pricing data and complying with government-imposed Cost Accounting Standards. In addition, NASA has structured the approach to Rights in Data to enable potential providers to retain ownership and control of their Intellectual Property while still providing NASA insight. The agency also provides potential providers the opportunity to define the insight/oversight model associated with implementing and complying with NASA's Crew Transportation Plan. The Liberty team believes NASA's transition to this modified FAR-based procurement approach to commercial crew is appropriate. It provides adequate flexibility to enable progress while also performing the most critical functions of FAR contracts—protecting tax dollars, guaranteeing contractor performance, and providing greater assurance of the safety of the commercial crew systems.

An additional risk to the future of the ISS will be the continuing business viability of NASA's commercial partners. Given the significant investment in the ISS, including that of our international partners, NASA should ensure through its contractual arrangements that the ISS mission priority is assured. In addition to contractual means to establish appropriate priorities, the agency should seek to maximize collaboration and synergy between the commercial crew program and its other significant human space flight endeavor, the development of the Space Launch System and Multi-Purpose Crew Vehicle. People, facilities and hardware must be leveraged across both programs to realize the most cost-effective human space flight capabilities for missions in and beyond low Earth orbit. Both programs are critical for sustaining U.S. human spaceflight leadership. It was with this thinking in mind that Liberty was developed. It exploits people, facilities and hardware that facilitate both programs.

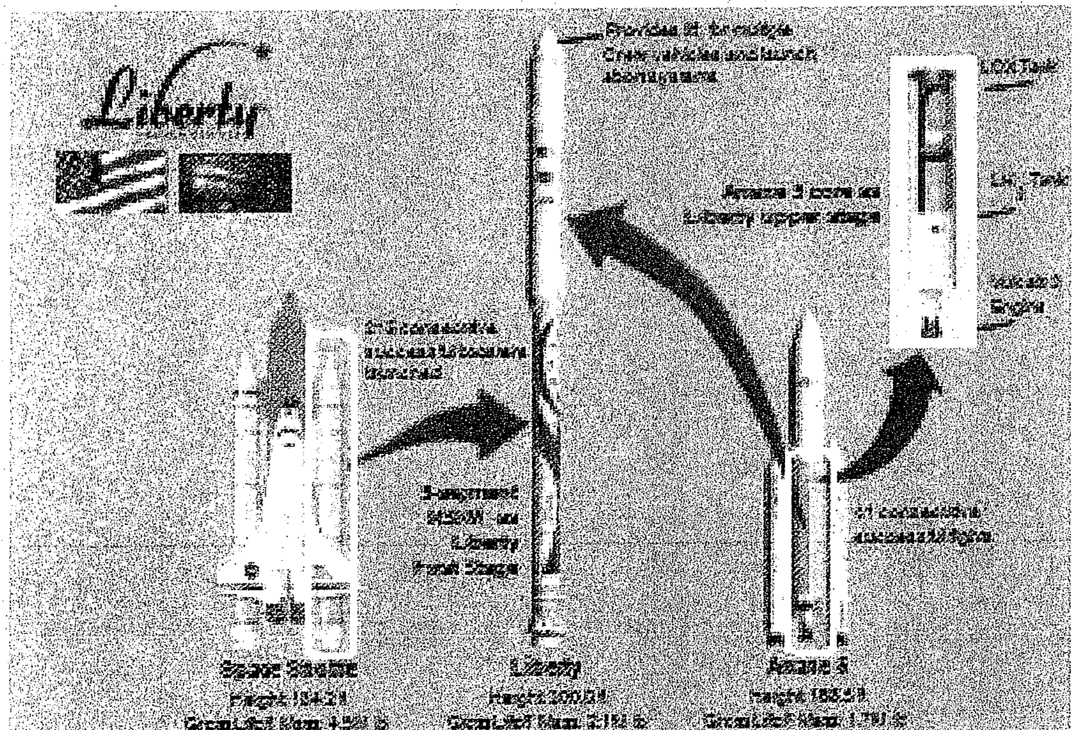
I would like to reemphasize our goal in commercial crew should be to deliver the maximum possible level of crew safety. Our knowledge and technologies today enable an order of magnitude improvement over Shuttle. The August 2011 failure of the Russian Soyuz launcher, attempting to deliver Progress cargo to the ISS, serves to underscore both the difficulty of space flight and the importance of focusing risk mitigation investments on our launch vehicles. By choosing to fund only spacecraft for the CCDev-2 portion of the development

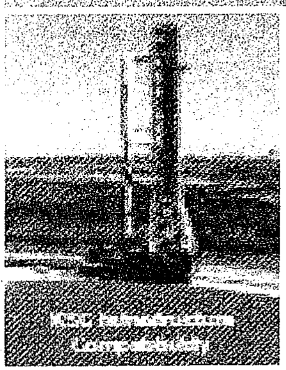
program, NASA has placed a higher obstacle before the launch vehicle providers. From a human rating and flight safety standpoint, the launcher development is significantly more challenging technically than the spacecraft. This is because the preponderance of risks to the crew during launch, which must be mitigated, emanate from the launch vehicle. The U.S. has not certified a human spaceflight launch vehicle other than the space shuttle in three decades. This is not only an issue for our company, but for all of those involved with commercial crew. Whether one is developing a launch vehicle or a capsule, the entire system must be successful for any one element to succeed. Given the nature of the challenge before us, NASA's commercial crew acquisition strategy merits a greater investment in the launcher side of the next generation system than has been made to date. Taking a near term lesson from the failure of the Soyuz rocket, and during this time of dramatic change for this country's human space flight program, we need to be extremely careful as a nation not to fall into the trap of taking shortcuts or overlooking requirements in hopes of shortening development time. As a former astronaut and Chief of the Astronaut Office who personally hand-picked the crew of Columbia, I am confident that striving continuously to achieve the maximum possible levels of crew safety in our human space flight systems will pay the biggest dividends in the long run.

I appreciate the opportunity to introduce our Liberty Launch System to you. The system is available in the near term, with a test flight possible within three years. Liberty offers a great opportunity to foster the next level of cooperation between Europe and the United States, while reinstating and sustaining our access to ISS. I believe our vehicle is a safe, reliable and cost-effective commercial crew launch solution poised to ensure America's Commercial Crew program is safe, robust and enduring.

Two Attach:
One Page Summary
Liberty Pictorial

The Liberty Launch System





[illegible]

- Highly competitive unit cost

The Liberty Vehicle Offers:

- Safest, most reliable launch vehicle
  - Heritage design and experience
  - Existing stages – minimal remaining development
  - Designed for human rating (Shuttle and Hermes programs)
  - Accurate minimum "moving parts"
- International cooperation – advances U.S national space policy
- Commercial approach to acquisition – Lowest cost to government, advances U.S national space policy
- Maximum leverage of existing NASA and ESA investments – multi $B from Shuttle, Ariane 5, and Constellation
- Maximum utilization of existing NASA KSC & MSFC assets and infrastructure
- Strong business case – best value for our space program, low remaining development cost jumpstarts the business
- Synergistic with NASA's Heavy Lift planned investments – both programs benefit by using common infrastructure