Ensuring the Safety of Human Space Flight

House Committee on Science and Technology
Subcommittee on Space and Aeronautics
December 2, 2009

Chair: Gabrielle Giffords (D-AZ) (opening statement)
Ranking Member: Pete Olson (R-TX) (opening statement)

Witnesses:

- Bryan D. O'Connor, Chief of Safety and Mission Assurance, NASA (opening statement)
- Jeff Hanley, Program Manager, Constellation Program, Exploration Systems Mission Directorate, NASA (opening statement)
- John Marshall, Council member, Aerospace Safety Advisory Panel, NASA (opening statement)
- Bretton Alexander, President, Commercial Spaceflight Federation (opening statement)
- Joseph Fragola, Vice President, Valador, Inc. (opening statement)
- Lt. Gen. Thomas P. Stafford, USAF (ret.) (opening statement)

Background

The safety of human space flight systems built and operated by commercial companies compared to systems built and operated by NASA has become a focal point for discussion since the Augustine committee released its report on the future of the U.S. human space flight program. In that report, the Augustine committee was optimistic about turning responsibility for taking astronauts to and from the International Space Station (ISS) in low Earth orbit (LEO) over to the commercial sector by 2016 – a concept called "commercial crew" – allowing NASA to focus on destinations beyond LEO. NASA is currently building a new launch vehicle, Ares 1, primarily to serve the ISS transport role. Several commercial companies have developed or are developing launch vehicles that can take cargo to LEO, and are interested in developing a capability to take crews as well. Some question whether a commercial system would be as safe as NASA's, at least in the near term. Witnesses from NASA and its Aerospace Safety Advisory Committee, the commercial space sector, and others discussed the safety aspects of government and commercial launch vehicles for human space flight missions. For more information, see the charter and webcast for the hearing.

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Nuggets

"I am under no illusions that human space flight can ever be made risk-free."
Chairwoman Giffords

"I do not believe the Columbia Accident Investigation Board Report is a historical artifact, but a guiding document."
Ranking Member Olson

"There is no cookie cutter approach to safety in space nor is it a 'given'."
Mr. Marshall

"I do know that it will take longer [to human-rate commercial crew vehicles] if we don't start now."
Mr. Alexander

Hearing Highlights

This hearing before the House Committee on Science and Technology's Subcommittee on Space and Aeronautics focused on the issue of safety in human space flight systems. The hearing considered both NASA's Constellation Program architecture – the Ares I launch vehicle and its Orion spacecraft – and potential commercial crew services to and from the International Space Station.

Referring to the findings of the Augustine Committee report, Chairwoman Giffords said in her opening statement that the issues addressed at the hearing would allow for "reasoned judgments about the wisdom of investing significant taxpayer dollars in would-be commercial providers or of altering Congress's commitment to the existing Constellation program." Ranking Member Olson alluded to the inherent risks associated with implementing change, such as changing from NASA's Constellation program to a commercial alternative. While emphasizing that he was not advocating that "the status quo dictate the way our government runs," he cautioned that associated challenges and risks not be overlooked. In his opening statement the Ranking Member of the full Committee, Representative Ralph Hall (R-TX), said that "the safety of our crews simply has to be at the heart of everything NASA does in space."

Mr. Bryan O'Connor, NASA's Chief of Safety and Mission Assurance and a former astronaut, described the policies that NASA has instituted to ensure that safety is and will continue to be the agency's top priority, which include integrating safety early on in the development process of new human space flight systems. Expanding on this topic, Mr. Jeff Hanley, Program Manager of NASA's Constellation Program, described the early stages of that program as "a risk-informed design process" and said that one of the objectives has been to increase astronaut safety 10-fold compared to the Space Shuttle. The goal has been "designing a system inherently safe…and then add backup to eliminate residual risk."

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One example is addressing the lack of a launch abort system for the crew, which according to Mr. Fragola, Valador Inc.'s Vice President, is one of the principal problems of the Space Shuttle. While the solid rocket motors are firing during launch, there is no safe escape mode for the crew, as demonstrated in the 1986 *Challenger* tragedy. The Constellation system incorporates a launch abort system to carry the crew safely away from the launch vehicle in an emergency.

John Marshall, a member of NASA's Aerospace Safety Advisory Panel, emphasized that NASA's role in the process of determining if commercial companies are capable of providing safe transport for crews should be in establishing "how safe is safe enough" for the rating of commercial crew transports and in exercising oversight. He concluded that NASA is behind the curve in assuming this responsibility and expects that safety "may be the highest challenge in commercialization" of human space launch activities.

A general sentiment during the hearing was that the Constellation program deserves more credit than it is getting for its demonstrated progress. Mr. Fragola discussed the findings of an independent assessment that found that the Ares vehicles were between two and three times safer than alternative vehicles and that "its inherent reliability" could be credited to "its first stage [and] also to the nature of the solid rocket booster." Lt. Gen. (Ret.)Thomas P. Stafford, a renowned Apollo-era astronaut who co-chairs a U.S.-Russian committee that oversees safety issues associated with the International Space Station program, opined that "we need to save this program; we need to go forward with this program."

Mr. Bretton Alexander, President of the Commercial Spaceflight Federation, represented the commercial space flight industry. Although much attention has been focused on new entrant SpaceX, Mr. Alexander's testimony focused more on the existing Delta IV and Atlas V launch vehicles built by Boeing and Lockheed Martin, respectively, and co-marketed by the United Launch Alliance. Mr. Alexander and Members of the subcommittee, including Chairwoman Giffords who supports the Constellation program and Representative Rohrabacher who champions commercial space activities, all offered conciliatory statements that government and commercial crew services to LEO were complementary and not competitive.

With the prospect of a lengthy gap between retirement of the Space Shuttle in 2010 and the availability of any new U.S. human-rated system, another focus of the hearing was whether the Augustine committee's assessment that a commercial crew capability might be available by 2016 was realistic. Panel members offered different views. General Stafford was of the opinion that "it would be a very tough goal" while Mr. Alexander concluded that "the timetable laid out is realistic." He asserted that existing transportation systems like the Delta IV would not need extensive modifications to meet safety standards associated with launching crews. Other panel members disagreed, saying that the Delta IV would indeed require modifications, such as a new second stage, if it were to launch the Orion spacecraft. Mr. Alexander agreed that a new second stage would be needed to launch Orion, but said that a smaller and less complex human spacecraft could be developed just for LEO missions that could be launched with the current version of Delta IV.

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Mr. Fragola focused on the difference between the design philosophies of Delta IV and Atlas V, which launch satellites and robotic spacecraft, and a system designed to launch human crews. Although the Delta IV and Atlas V have demonstrated high launch reliability, if there is a failure during launch, the fate of the payload is not a concern. The payload will be lost or placed into an incorrect orbit. In the case of launching crews, however, the fate of the payload is of paramount concern. Thus, he argued, launch abort systems need to be designed as an integral part of the launch system from the beginning.

Representative Parker Griffith (D-AL) asked if there is evidence that NASA and Congress can rely on commercial providers for the safety of its astronauts. Mr. Alexander explained that these capabilities will be repeatedly tested with cargo first, "those will fly many times before people [do]," to get to that threshold of demonstrated reliability. Additionally, he said that a "rigorous training program for any commercial service," born out of agreements between NASA and the commercial providers, would ensure that NASA has the confidence not only in the system but also in the people involved with it. Perhaps some lessons can be gleaned from the long standing relationship between NASA and its Russian counterpart who, despite having different systems and standards, have worked together to transport U.S. astronauts aboard the Russian Soyuz. On this point, Mr. O'Connor explained that it took about three years "to get to the comfort level" and to achieve the level of trust that has enabled the U.S. to rely on Russia's Soyuz transport system. General Stafford highlighted that since 1971, the Soyuz has had 100% reliability. Mr. O'Connor agreed, saying that NASA relies on Russia's demonstrated reliability, skilled workforce, and the close relationship between U.S. and Russian engineers.

The hearing ended with Chairwoman Giffords' restating her support of the Constellation Program. She said that the information provided at the hearing led her to conclude that there is "no justification for a change of direction…on safety grounds." She reiterated, however, that commercial and governmental systems should be thought of as complementary approaches to fulfill the needs of the human spaceflight program.

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