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Before the Subcommittee on Aviation
House Committee on Transportation & Infrastructure

Wednesday, December 2, 2009

Thank you, Mr. Chairman, for the opportunity to testify before this Committee on the state of the U.S. commercial space transportation industry. I am speaking today not only as CEO of XCOR Aerospace, an entrepreneurial developer of rocket propulsion and reusable launch vehicles, but also as Vice Chairman of the Commercial Spaceflight Federation, an association of 20 businesses and organizations working to make commercial human spaceflight a safe, dependable reality. CSF's mission is to promote the development of commercial human spaceflight, pursue ever higher levels of safety, and share best practices and expertise throughout the industry.

The Current CSLAA Regime is Working Well

It was nearly five years ago that the Congress demonstrated bipartisan leadership by enacting the Commercial Space Launch Amendments Act (CSLAA) of 2004. Since then, Congress' foresight has been validated in several ways.

First and foremost, the regulatory regime made possible by the CSLAA has allowed for the privately-funded development of several different competing suborbital reusable launch vehicles to address scientific research and education markets as well as private individuals seeking a spaceflight experience. Beyond suborbital flights, the CSLAA regime has also enabled significant investments in commercial spacecraft capable of carrying humans to and from low Earth orbit using proven expendable launch vehicles.

Clarity of regulatory jurisdiction and approach has given confidence to investors, entrepreneurs, and customers alike, and the U.S. is seen as a world leader because we have created a supportive regulatory climate.

The Office of the Associate Administrator for Commercial Space Transportation has done an excellent job of implementing the letter and spirit of the statute, both in new regulations and through transformation of its internal staff to focus on these new kinds of vehicles. Of particular value has been the office's placement of technical staff out in the field, where they can more closely observe development and test activities of industry.

At the same time, industry has taken a deliberate, step-by-step, safety-conscious approach to developing new vehicles, rather than rushing into service since Congress acted in 2004. Companies have conducted research and development, including low-altitude flight tests. Thanks to the CSLAA, we are not attempting to learn things via computer analysis that can only be learned by building and flying real hardware; but neither are we putting our own employees or customers, let alone the uninvolved public, at casual risk.

This is 2009, not 1909, and the public and therefore Congress will not endure the devil-may-care attitude of early aviators. Fortunately we are more advanced in terms of engineering as well as safety expectations, but still no one can predict what will be the safest designs, technologies, or operating approaches for routine, safe commercial spaceflight. To learn them we must fly, including large numbers of test flights and, when ready, flying, for revenue.

Every single operator, and I feel confident speaking for all of my friendly competitors, knows that we all bear the burdens of our collective safety performance. On the one hand, we are all attempting to do things never done before, and we know that mishaps will occur and, sadly, lives may be lost. But we also know that our goal is to learn quickly from tiny mistakes so that we can avoid larger ones, while at the same time revolutionizing America's access to space, with all of its attendant benefits to our fellow citizens and our economy.

I believe that our judicious progress over five years, as witnessed by both GAO and Aerospace Corporation independent reviews, as well as the growing signs of confidence that policymakers are showing in this industry's capabilities, is a sign that no major change in legislation or regulation is necessary at this time, or is likely to be in the near future. As an industry we are still pecking our way out of our shell. It will be years before we will know what might be useful improvements or refinements to our regulatory regime, let alone to legislation.

Safety and Promotion are Aligned

Of course, I appreciate that there is some discussion as to how an agency like the FAA can be asked both to regulate and promote the commercial human spaceflight industry, when it no longer has a mandate to promote the aviation industry?

First of all, spaceflight is not air travel. We are not a mature, 100+ year old industry. That said, aviation benefitted from several decades, starting with the passage of the Air Commerce Act in 1926, of a single federal agency that both regulated and promoted the industry.

Second, the FAA already regulates us stringently to protect the uninvolved public, because after all the public at large are not choosing to take the risks of human spaceflight. Beyond this, it is actually FAA's promotional authority that gives them the power to regulate demonstrably unsafe practices or providers, or to encourage the adoption of best practices.

It was only twenty five years ago that Congress enacted the original Commercial Space Launch Act, and granted the Department of Transportation the power to be a one-stop shop for licensing of launch activities. Indeed, the purpose of Congress granting this licensing authority was clearly not limited to protecting the public but also included promoting the industry, since before that time companies had to ask some 40 different agencies for permission to conduct a single launch. Today, the FAA's mandate to promote, within the limits of maintaining overall public safety, allows the agency to lower the barriers to conducting R&D and flight tests, resulting in greater safety sooner.

Safety and Business Success are Aligned

At the present time, questions of safety are foremost in the minds of potential customers, both participants and payload developers. To achieve a viable industry we must innovate in safety; we must achieve a superior record to that of the past. Innovation requires change; and to achieve superior safety we must try new safety technologies and practices. The reality is that some changes will be improvements over past practice and some will not; but without the freedom to try, we cannot improve.

This need to find a better, safer way to operate is what motivates the industry; and the best way for the FAA to promote the industry is to aid us in identifying best practices and encouraging their swift adoption. The experimental permit regime is a good start on that. I cannot state strongly enough that at the present time the industry faces irresistible economic pressures to strive for the safest possible operation that is economically achievable. The mandate to promote the growth of the industry is therefore a mandate to foster continuous safety improvement.

In the view of my colleagues and myself, there is simply no conflict today between regulation and promotion. Furthermore, there will not be any conflict in the future until industry has a demonstrated safety record in which multiple operators have shown themselves safe enough that customers no longer "shop for safety," but come to expect it as a given. We are certainly not at that point today, and may not be for many years hence.

Space and Air Traffic Management

Space vehicles transition through the National Air Space at the beginning and end of their journey. Historically, however, space launches were so infrequent that a paradigm of clearing all air traffic away from the launch of large expendable rockets, typically from one of the national ranges, seemed to make sense. That will not work for fully reusable commercial suborbital vehicles this industry is developing.

Fortunately, the FAA has been planning for this new era. The goal for future development of the airspace has been to have space flight become just one of many uses of shared airspace. It appears that ADS-B technology plus GPS is sufficient to provide the tracking capabilities our industry will need for transition through the NAS.

Even today, however, all the various launch site operators have procedures in place or in development to manage the integration of space and air traffic. Each spaceport has different issues depending on the nature of their proposed space operations and the local features of the air traffic and air space.

For example, in Mojave, the spaceport operator has worked out procedures by which the local civilian and military air traffic authorities will be notified of our launches in a manner analogous to filing a flight plan. We will make use of the existing transition corridors used for high altitude military aircraft descending in to the National Air Space. XCOR has already tested elements of this system with our rocket-powered experimental aircraft. We have worked out procedures by which, when we request permission to take off from the control tower, the tower notifies the military traffic control authorities so that they are not surprised by the fast-climbing vehicle appearing on their radar screens. Also, they have the opportunity to inform our tower of any conflicting traffic should such ever occur.

The FAA's Office of the Associate Administrator for Commercial Space Transportation is aware of these procedures and, through their new field office in the Mojave area, will now have opportunities to watch them first hand and draw lessons from them for application elsewhere.

Management of, and jurisdiction over, traffic in orbit, sometimes called space traffic control, is a very complex issue. Orbital space is inherently a global domain and the physics of the environment make it inherently very different from air traffic control. Orbiting objects have very little ability to maneuver. Today, the tracking is primarily done by the U.S. Air Force, but the collision avoidance prediction technique, the method of communicating collision hazards to satellite operators, and the reaction by satellite operators, proved inadequate on February 11, 2009, when an Iridium satellite and Cosmos 2251 collided.

Since then, procedures have been somewhat improved. Unfortunately, the bulk of objects in space are not active satellites but derelict hazards to navigation. Yet there is no equivalent to maritime salvage law to encourage removal of such hazards, and such removal is technically difficult. This is an area where policy development at the national and international level is needed, and there are many stakeholders. Developing an appropriate multinational regime for space traffic awareness, control, and debris clearance is an effort worth starting; but which agency or agencies of the U.S. government will play which roles in an eventual system is far from clear.

Other challenges: Export Control

Another reason not to separate promotion from regulation is the abundance of issues relating to commercial space transportation where we need the FAA to be a strong advocate in the interagency process on behalf of industry's needs.

First and foremost remains the "broken record" of America's aerospace industry: reforming ITAR (International Traffic in Arms Regulations) and MTCR (Missile Technology

Control Regime). These are not just an issue for the U.S. commercial satellite industry, which export control practices have nearly destroyed, but for my industry as well.

I will not choose to belabor the problems of treating all technology pertaining to rocket engines, pressure suits, or any related issue in the most restrictive category of arms control, as if technology available in libraries around the world posed the same security issues as the latest advances in missile defense. Commission after commission has pointed that out. I do not question the usefulness of export controls in principle; but the practice of it is very different from the theory. Current experience shows that the actual effect is to ensure that bright aerospace engineers go to work overseas for our competitors rather than to come to this country and build our industries; to ensure that foreign investors are forced to invest in foreign competitors even when they might prefer to invest in U.S. companies, and generally to squander whatever technological advantage we might have over potential adversaries.

In summary, we need to get vehicles, pressure suits, and other non-sensitive items relating to commercial human spaceflight off the munitions list and instead regulate their export like we do aircraft.

Opportunities for greater partnership with DOD and NASA

While commercial human spaceflight and the vehicles that produce it are still in their early days, we can already see opportunities for the industry to provide services needed by DoD and NASA. The market of serving these needs will stimulate further development of the industry. Four promising areas are: small satellite launch, suborbital research payloads, transport of NASA astronauts to the International Space Station, and launch of propellant to orbit for exploration missions.

U.S. government entities continue to develop smaller and smaller satellites, exploiting advancing electronics technology; but such satellites currently lack a cost-effective dedicated launcher, being launched as secondary payloads. While such launches have served the early experimental phase for these satellites, operational use will require dedicated launch. Furthermore, one driver of such smaller satellites is the need to launch constellations of small satellites quickly, in response to a military need, disaster relief, or because of the unexpected loss of existing satellites – sometimes called "operationally responsive" space launch. That calls for launchers with the same characteristics the industry needs for a profitable business; high flight rate at affordable cost, with short call-up times.

Another growth area for partnership with NASA, as well as other scientific agencies, lies in the burgeoning interest in suborbital research and education missions (REM). Commercial suborbital vehicles will provide low-cost, frequent access to suborbital space for scientific, engineering, and educational payloads. Fly-on-demand, rapid-turnaround, and human-in-the-loop capabilities will enable new types of previously impossible research. By providing lower cost access to the space environment than existing expendable sounding rockets, diverse areas of research from earth science to microgravity physics will benefit, and provide a new avenue for student involvement and hands-on-training with science

experiment hardware. NASA has already recognized the scientific potential of these commercial reusable vehicles through creation of the Commercial Reusable Suborbital Research Program (CRuSR). As NASA Administrator Charles Bolden stated in October, "We are engaged in a new program… that will buy space transportation services from the emerging reusable spaceflight companies to conduct science research, technology development, with a keen focus on education." These new markets will help to diversify and strengthen the commercial spaceflight industry.

Third, NASA's human space flight efforts, as noted in the recent report of the Augustine Committee, in which I participated, has major opportunities to benefit from collaboration with industry. One such area of opportunity is the carriage of crew to Earth orbit in simpler "crew taxi" capsules; such capsules are in development or under serious consideration by a number of private companies ranging from newer entrants to long-established traditional firms. Here is opportunity for both private and government customers to benefit from pooling their demand for such flights. The beginning of commercial human space flight using Russian capsules helped to open people's eyes to what could be done in space. Moving that capability back to U.S. companies would be another important step.

Finally, the carriage of propellant for U.S. exploration missions on private launch capacity could be a transformative opportunity. This allows for much larger missions to be flown for a given size booster; or alternatively, a much smaller booster to be used for a given mission, at substantial savings to the taxpayers. It is difficult to overstate the significance of such a capability to both NASA and the launch industry. The greatest barrier to the introduction of new orbital launch technology has been the limited volume of launch traffic, its unpredictable nature year to year, and the understandable desire of launch customers not to risk high value payloads on new launch technology. Propellant can be launched on any size launcher. It is a low-value payload that we can afford to risk on new technology launch vehicles, and as long as NASA has exploration missions they will need propellant. I can conceive of no other step besides transitioning exploration to a "on orbit refueling" architecture which would have as powerful stimulating effect on the U.S. launch industry, analogous to the effect that the Air Mail had did on U.S. aviation.

The combined promise of these various markets strengthens my belief in a bright future for the commercial space transportation industry, operating within a stable regulatory and policy framework. Thank you for the opportunity to be here today and I look forward to your questions.

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