Statement of
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before the

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

August 1, 2012

Chairman Palazzo, Ranking Member Costello, and Members of the Committee, thank you for the opportunity to testify this morning on behalf of Blue Origin. We appreciate the Committee's long-standing support of the development of space.

About Blue Origin

Blue Origin was founded in 2000 with the sole purpose of developing technologies and vehicles to enable human access to space at dramatically lower cost and increased reliability. The ultimate goal is to enable more people to fly in space to be able to do more things, whether for science, exploration, or simply making space travel a more *personal* and accessible endeavor, sometimes referred to as tourism.

Blue Origin was founded by Jeff Bezos, the founder of Amazon.com, and has a design, development and manufacturing facility in Kent, Washington, a suburb of Seattle, and a launch and test site in west Texas.

To increase the number of people that can fly into space, we believe we need to dramatically improve safety while also lowering the cost. To do so, we are developing reusable launch vehicles that take off vertically and return to the launch area to conduct a powered vertical landing.

We believe in incremental development, beginning with suborbital vehicles before moving on to orbital systems. In 2006 and 2007, we flew a subscale demonstrator which demonstrated vertical takeoff and landing of a multi-engine vehicle. Last year, we flew a larger experimental vehicle which was developed to demonstrate the full suborbital mission profile. We continue on our development of the *New Shepard* suborbital system, which will take three or more astronauts to 100 kilometers altitude where they will experience several minutes of microgravity, be able to see the darkness of space, and view the curvature of the Earth.

During a *New Shepard* flight, our Crew Capsule will separate from the Propulsion Module for flight through apogee and descent, landing by parachute, while the Propulsion Module returns for a powered vertical landing. The Crew Capsule is equipped with a pusher escape system, which can be activated at any time to accelerate the capsule away from the booster in event of an emergency.

Key elements of our suborbital *New Shepard* system – a reusable vertical takeoff, vertical landing rocket, and a separable Crew Capsule with a pusher escape system – are also key elements of our orbital

architecture, which is being designed to enable human access to low Earth orbit and the International Space Station.

Suborbital Markets

Blue Origin is focused on enabling human access to space. We believe that people are the game-changing element for spaceflight. We can't tell you all the activities that people will do in space, but we are certain they will find many useful human endeavors as the cost comes down and safety improves.

One human spaceflight market that is directly relevant to NASA is astronaut training. Suborbital vehicles will offer the ability for astronauts to train in many aspects of the spaceflight environment, including the high G's of launch, the weightlessness of microgravity, and landing and recovery procedures. NASA routinely flies astronauts on dozens of parabolic flights for training and we believe suborbital flights will be able to provide an integrated, realistic experience that will contribute significantly to astronaut training.

Research and science is a valuable secondary market. In addition to tourism, these vehicles open the gates for realizing a vast array of scientific and technical goals, from high altitude observations of the sun and the universe around us to the effects of microgravity in materials, fluids, and biology.

Suborbital flights are nothing new; sounding rockets have been flying for decades. What is changing today is that we are poised to offer the research community flexible, repeated access to space on dramatically accelerated timelines for a fraction of the cost.

The reusable launch vehicles, or "RLVs", Blue Origin is developing offer new and enhanced capabilities, and with it we expect new researchers and other users.

- These vehicles are designed for much lower 'g' loads than a sounding rocket, as the *New Shepard* vehicle's primary mission is human space flight. As a result, the *New Shepard* vehicle can accomodate much more delicate experiments than could be undertaken on a sounding rocket.
- We plan for flights at more frequent intervals, allowing researchers to collect repeated data, and thereby study trends and changes over time.
- We expect the size and reusability of the *New Shepard* vehicle will allow much lower costs than sounding rockets, widening the number and type of researcher who can consider space research.
- Research can be tended by an on-board human technician. Previously, researchers had to create an entirely autonomous experiment, and if the slightest thing went wrong it could amount to a complete loss of the experiment. Tended experiments free researchers from being required to automate everything, and allow for quick trouble shooting while the experiment is in progress.
- Finally, New Shepard will fly to altitudes that are not well serviced by sounding rockets. Scientists sometimes joke about the area in the atmosphere that they call the "Ignorosphere", often ignored not because of its importance but simply because of the difficulty collecting data

from it. The *New Shepard* RLV will facilitate more frequent study of this region of the atmosphere.

As a result, we are entering a new era in space research. Research tools once limited to a few investigators will be within reach of a wide array of federal agencies, industry R&D programs, and even college and high school students. The RLV will also add a few new tools to the tool chest, by providing capabilities that simply are not currently available.

We have already begun preparations to fly three research experiments on our early test launches, allowing researchers from Colorado, Indiana, Florida, Missouri, Louisiana and Germany to study fluid dynamics and astrophysics.

Suborbital activities also have significant promise for science, technology, engineering and mathematics (STEM) education for our nation's youth. With routine flights, the ability for schools to tuck small untended experiments and payloads along for the ride is within reach. One can even envision standard payload kits schools can buy for spaceflight clubs much the way school robotics teams buy standard robot kits and compete against each other.

It's "hands on" and it's about science, technology, engineering and math. But it's the 'magic' of spaceflight that is the draw for kids. Some of you may remember the Shuttle's "Getaway Special" and "Hitchhiker" programs that flew dozens of student experiments in the 1980's and 1990's. Imagine now if we could open up these doors to hundreds of classrooms around the country, as well as extracurricular groups. That would be a powerful catalyst for STEM engagement.

Other markets for suborbital spaceflight are likely to be developed that we cannot yet imagine. Who would have thought 10 years ago that there would be over 500,000 apps for something called a smart phone? The barrier to entry to develop an app is minimal, requiring nothing more than one person with coding skills. No need to spend billions on developing a cellular network or the iPhone platform. Similarly, scientists, school kids, and others can develop "apps" for suborbital spaceflight at little-to-no up-front cost compared to traditional spaceflight. The sky is truly the limit.

Regulatory Interactions

Commercial spaceflight is in its infancy and there is no "one size fits all" approach to regulation at this time. Each company is developing a different system, some of which are radically different from each other and traditional space systems. Blue has a vertical takeoff, vertical landing vehicle with a capsule that returns under parachute. Others have vehicles with wings and wheels that drop from an airplane or takeoff horizontally from a runway. What is appropriate for one type of vehicle may not be appropriate for others. In the development of regulations, industry and the FAA need to have a dialogue on the validity of differing regulatory approaches on the differing technical approaches. Without this, we will be left with an approach that could do considerable harm to the emergence of this new industry.

The 2004 Commercial Space Launch Amendments Act (CSLAA) established a learning period in which commercial space flights could take place based on the informed consent of those flying, with the goal of eight years of flight experience before even considering a more top-down regulatory regime. We thank the House of Representatives for the passage last year of an extension of this learning period to last a full eight years from the date of the first paying passenger flight, as per the original intent of the CSLAA. While the final bill extended this period only until October 2015, we appreciate the Congress's recognition that the learning period serves a valuable purpose. We will work with the Congress to extend the learning period to at least eight years or longer from the date of the first paying passenger flight, as per the original intent of the CSLAA.

The best path forward, however, would be to continue the current path, in which individual passenger astronauts are allowed to make their own decisions on how best to manage their own safety in the inherent challenges of spaceflight. We believe that the informed-consent approach to passenger safety should be extended indefinitely, at least until spaceflight is sufficiently routine that it merits the commitment of regulatory resources and we can be confident that the top-down regulatory approach will prove safer than allowing informed individuals to make their own decisions. The current uncertainty surrounding how and when the FAA will regulate the safety of spaceflight participants is the greatest regulatory uncertainty affecting the development of this industry.

At the present, there are two primary ways in which we as a spaceflight developer interact with the Federal Aviation Administration (FAA) on the development of regulations: The first is through the formal process of promulgating regulations. The second is through our individual applications for experimental permits and licenses and FAA oversight of flight activity. We have found that, on the whole, both work well. In the permitting and licensing process, FAA closely scrutinizes applications and simultaneously has shown itself receptive to input on how to best protect public safety and foster a commercial space industry. As the industry matures and the number of flights increases, real world data is being gathered that can be used to refine the FAA's methodologies to be more realistic while continuing to protect the public.

We look forward to the FAA's planned experiment of monthly telecons with people interested in the space launch regulatory process, to create a more-informed dialogue on the role of regulation in this human endeavor. We hope that this will be an opportunity for dialogue between the FAA and industry that precedes the formal Notice of Proposed Rulemaking (NPRM) process, allowing for open and frank discussions about technical designs and safety.

Conclusion

Suborbital spaceflight offers great promise and opportunity for the nation's economy, scientific research, and STEM education. As private commercial developers, we are not looking just to government, but are investing private funds to enable this bright future. NASA and other government agencies should capitalize on this private investment and take full advantage of these new capabilities.

Blue Origin is working to develop a new market for human spaceflight. Like any new market, no one really knows the size and breadth of this new marketplace. We are confident that new human access to space will be self-expanding, and look forward to serving this new market.

Thank you for the opportunity to be here today and I look forward to your questions.

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