

George Whitesides

President and CEO, Virgin Galactic

The Emerging Commercial Suborbital Reusable Launch Vehicle Market

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Subcommittee on Space and Aeronautics
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Chairman Palazzo, Ranking Member Costello, and members of the Subcommittee, I am honored to be here today on behalf of Virgin Galactic. I have been asked to address the emergence of a strong domestic industry for commercially built reusable launch vehicles, with particular focus on the industry's relationship with the Federal Aviation Administration (FAA) and on the potential impact regulatory uncertainties have on our business and others like ours.

I will begin by providing a brief overview of the company I represent here today and of the markets we serve. I will then discuss our relationship to date with the FAA, and how that relationship might be impacted by recently passed legislation. I will conclude with some thoughts on what regulatory uncertainties still remain, how those uncertainties are impacting our business today, and how they might impact us in the future.

Virgin Galactic was founded in 2004, directly as a result of the historic success of SpaceShipOne, the first privately built spaceship to successfully carry human beings into space and bring them back. As that vehicle rocketed into space, it not only earned the famous \$10 million Ansari X PRIZE and a spot in the Smithsonian's National Air and Space Museum, it also served as proof that private entities are capable of building and operating spaceships that can carry humans to space both affordably and safely. That vehicle was also in many ways the impetus behind Congress passing the "Commercial Space Launch Act Amendment of 2004," which was signed into law only a few months after SpaceShipOne claimed the X PRIZE. Among many other accomplishments, that bill directed the US Secretary of Transportation to "encourage, facilitate, and promote the continuous improvement of the safety of launch vehicles designed to carry humans ... [and] to encourage the development of a commercial space flight industry." One way in which Congress charged the Department of Transportation to meet these dual goals was by limiting certain new regulations within eight years after the bill passed. This was done specifically because, as the bill reads, "the regulatory standards governing human space flight must evolve as the industry matures so that regulations neither stifle technology development nor expose crew or space flight participants to avoidable risks."

These two milestone events of 2004—the successful flights of the world's first privately built manned spacecraft and Congress's protection of this critical freedom to learn and grow—helped convince entrepreneurs like our founder, Richard Branson, that commercial human spaceflight was a worthy field for investment, and that the United States of America was the only country on the planet in which this

industry could begin. In that spirit, Virgin Galactic was born as the world's first commercial spaceline. Our first step was to hire Scaled Composites—the legendary California-based company that designed and built SpaceShipOne, in addition to numerous vehicles for private, corporate, and US military customers—to build a larger, more customer-friendly version of SpaceShipOne and its mothership. These new designs would come to be known SpaceShipTwo and WhiteKnightTwo.

Since that time, our investors have pumped hundreds of millions of dollars of private funds into this business and into the American economy. Our prime contractor, Scaled Composites, has fully constructed our first space vehicles, and is currently testing them as we prepare for commercial service. Virgin Galactic and Scaled Composites—and now Scaled's parent company, Northrop Grumman—have created a new joint venture called The Spaceship Company (TSC), of which I am also President and CEO. TSC is a manufacturing organization designed to build not just a single spaceship, but a fleet of SpaceShipTwos and WhiteKnightTwos. Overall, this project has directly or indirectly employed more than one thousand people in the United States since its inception, with the majority of those people holding high skill, high wage positions.

As we prepare to enter routine commercial service, demand has been extremely encouraging. Virgin Galactic has accepted \$70 million in paid deposits on spaceflights, with \$107 million in commitments. The financials are important, but so is a different measurement: we have accepted deposits from more than 535 people. This is more than the number of astronauts who have ever been put in space by NASA, Russia, and China combined. We anticipate flying that many people within our first year or two of commercial service.

Virgin Galactic's current and future revenue is almost entirely derived from private individuals and organizations. Our future astronauts have already paid us between \$20,000 and \$200,000 (the full ticket price) for their future tickets to space. They come from a wide range of backgrounds and nationalities, but are united in their desire to have the unique experience of floating in weightlessness and looking down on planet Earth from above. These future astronauts are aware that they are pioneers of a new era of exploration, and are excited to play a critical role in maturing this industry as early adopters.

While we are pleased that our service has found such a strong reception with private individuals, we also know that our vehicles will be used for more than personal spaceflight. Indeed, our system is proving to be an extremely attractive platform for researchers and educators. Already, we have accepted deposits from several customers in these areas, including universities as well as research institutions, and from NASA itself as future users of SpaceShipTwo. We have signed a Memorandum of Understanding with the National Oceanic and Atmospheric Administration, who have expressed an interest in both SpaceShipTwo and WhiteKnightTwo as research vessels. With a spacious cabin, relatively gentle gravity loads, frequent flights, affordable pricing, and several minutes more high quality microgravity than researchers are accustomed to getting on successful research platforms like drop towers and parabolic flight aircraft—we offer an important tool to help innovators conduct significant science, advance technology, and educate and inspire the next generation. Ultimately, these research and educational flights are an important part of both our bottom line and our corporate citizenship to the world. We commend Congress and NASA for their work in creating programs like NASA's Flight

Opportunities Program, which is playing a critical role in ensuring that experiments are ready to fly as soon as the spaceships themselves are in service.

These different market areas, to say nothing of the real potential offered by further business segments, give us great confidence that our business plan is solid, and that there is great room for growth. We are adding future astronauts at an increasing rate as we clear each technical milestone in the project, and expect a dramatic uptick of sales associated with some of our major upcoming events, such as our first rocket-powered test flight, SpaceShipTwo's first trip into space, and Richard Branson's flight. We have great confidence in our ability to continue bringing new jobs and new revenue to the United States.

Although outside of the scope of this hearing, it is also worth noting that Virgin Galactic has just announced a new small satellite launch vehicle, which we call LauncherOne. As part of that announcement, we identified four future customers for that service, each of which is a privately funded, entrepreneurial American business. In the words of our founder, "LauncherOne is bringing the price of satellite launch into the realm of affordability for innovators everywhere, from start-ups and schools to established companies and national space agencies. It will be a critical new tool for the global research community, enabling us all to learn about our home planet more quickly and affordably."

LauncherOne is still a few years away from its maiden flight, but SpaceShipTwo gets closer to commercial service with each passing day. As we prepare for that historic milestone, staff at both Virgin Galactic and Scaled Composites have been interacting with the FAA, and in particular the Office of Commercial Space Transportation (FAA/AST), for years. Congress has charged FAA/AST to both "ensure protection of the public, property, and the national security and foreign policy interests of the United States during commercial launch or reentry activities, and to encourage, facilitate, and promote U.S. commercial space transportation," and Dr. Nield and his team are living up to both parts of that charge.

Our own safety team includes a number of experts with invaluable experience in safely operating space vehicles gained through time spent with NASA, the Air Force, and other pioneers of the US space industry. This includes our Vice President of Operations, Mike Moses, who served as the Launch Integration Manager for the Space Shuttle until that program's recent retirement, and our Vice President of Safety, Major Jon Turnipseed, formerly of NASA, the US Air Force, and Rockwell International, among other illustrious organizations. Mike, Jon, and many other members of our highly skilled and professional team interact with FAA/AST on a frequent and regular basis, allowing for frank, two-way exchanges of information.

Additionally, our contractors at Scaled Composites have been working with FAA/AST for many years, first in the context of the SpaceShipOne flights, and now in the context of SpaceShipTwo's Experimental Permit, which was recently granted. Beyond those meetings, there is a further set of interactions between FAA/AST and our spaceports—both the Mojave Air and Spaceport, where we are testing our vehicles, and Spaceport America, from which we will begin our commercial operations.

With all of those parallel conversations, there is a significant amount of information travelling back and forth between our project team and the FAA. I would like to note that it has been very useful to have FAA/AST serve as a single point of contact for our permits and licenses. Our system is relatively unique in

combining elements of aviation and space exploration, thanks to our use of the WhiteKnightTwo. Similarly, while we fully anticipate remaining in close contact with the local FAA offices relevant to our centers of operations, it is most beneficial to have those discussions in the context of a broader relationship with FAA/AST.

Over the past several years, we and our contractors have seen firsthand that the "learning period" created in 2004 and extended just recently is critical to both the commercial viability of businesses like ours and to the actual safety of the spacecraft themselves. At this point in time, with a wide variety of space vehicle designs being developed by various companies and only a small amount of operational experience, relative to more mature industries such as commercial aviation, it is particularly important that the technical experts be given the freedom to make full use of their unique knowledge of each specific system in order to achieve a very high level of safety. As stated previously, this was the reason that the 2004 bill included a reasonable period of time in which the industry could grow and build a track record, and the recent extension preserves Congress's stated goals while updating the timeline to reflect the current state of the industry.

In 2004, Congress determined that eight years of real flight data was a reasonable amount of time for this learning period, a value which the industry supported then and continues to support now. However, with companies such as ours electing to come to market with more capable and customer-friendly systems that are still under development, (rather than inserting SpaceShipOne directly into commercial operation,) that flight data has not yet been generated. During the recent discussions about this learning period as part of the most recent FAA Authorization bill, the House of Representatives renewed that eight year period. The final bill renewed that learning period for the scope of the FAA Authorization itself, which runs until late 2015. We are pleased and appreciative that Congress took this action, and look forward to working with both bodies of the legislature on this issue in the next Congress.

Businesses like ours have a clear imperative to do all that we can to responsibly manage the risks associated with operating these vehicles. In our case, many of our staff will fly on our spaceship before any member of the paying public; and our founder, Sir Richard Branson, and members of his family will be our first paying customers. Indeed, before I became CEO of Virgin Galactic, my wife and I became some of the company's earliest customers, and we both eagerly await our flights to space. These are just some examples showing why we have the strongest possible incentives for safe operations.

Virgin Galactic and our partners will enthusiastically continue our dialog with FAA/AST over the coming years of the learning period. We are aware of the appropriate channels through which to deliver information about our technology and our concept of operations to the FAA's experts, and do not foresee that the recently enacted extension of the learning period would cause any difficulty in transferring the relevant information.

Moving forward, the regulatory uncertainty that has the biggest potential impact on our business is the concern that the learning period for our suborbital operations might be reduced or circumvented. The lessons of aviation and orbital flight are of great value to us but do not easily map to frequent reusable suborbital flight. While our team is hard at work to ensure that those lessons are being brought to bear

in our own systems wherever appropriate, the regulations that govern a dramatically more mature industry like commercial aviation cannot simply be copied over to govern this brand new enterprise. To do so would eliminate our collective chance to learn, which would have a serious impact on the viability of this business and on the level of safety we can offer. Already, we are faced with the prospect that very shortly after we go into commercial suborbital operations, the rules and regulations may change, potentially disrupting our operations and our business. A stable regulatory environment – which is what we have now, thanks to the recent extension, even if we might wish that the extension had been longer – is the best way for the federal government to accelerate our start of commercial service and to preserve America’s status as a world leader for suborbital spaceflight.

Although it is also likely outside of the scope of this hearing, I would be remiss if I did not mention the other regulatory uncertainty that is most significant for our business: export control. Virgin Galactic, like the rest of the aerospace industry, will benefit greatly from sensible policies and prudent application of those policies. Clearly, much of the original language regarding export of aerospace technologies was written at a time when no one foresaw businesses like ours. The time is approaching when updates to those lists could dramatically impact our business and the USA’s position at the forefront of this new industry. We believe it is possible to modernize export control in a way that both streamlines business and improves national security, and we encourage the Congress to take the actions necessary to accomplish this goal.

In closing, on behalf of my colleagues at Virgin Galactic and at The Spaceship Company, I thank you for the opportunity to appear before you today. As we remember Sally Ride, an American hero and a pioneer who opened the space frontier to women, Virgin Galactic seeks to build on her legacy by opening the space frontier to all. I hope that this analysis of our business, the growth potential for the commercial suborbital launch vehicle industry, and the most critical regulatory issues impacting us and companies like ours has been useful for your deliberations. I look forward to answering any questions you might have.