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Hearing on Reopening the American Frontier
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Chairman Cruz, Ranking Member Markey, Chairman Thune, Ranking Member Nelson, and members of the Subcommittee, thank you for the opportunity to speak before you today about reopening the American frontier, and Blue Origin's place in this future.

Lewis and Clark's preliminary exploration of the Pacific Coast in 1805 initiated 85 years of exploration and discovery of the American Frontier. Following in their footsteps, settlers spread throughout the Western territories, expanding American opportunity and realizing the region's potential up until the Frontier's "declared" closure in 1890. Much like that 19th century expedition, NASA has been trailblazing the space frontier for nearly 60 years, yet the same expansion of American opportunity seen in the 1800s has not been fully realized in space.

Jeff Bezos founded Blue Origin to bring about a future where millions of people are living and working in space, which would certainly equate to quite a large expansion of the American frontier. As the company's president, it is my job to make this vision a reality for humanity, our customers, and our now more than 1,000 people working tirelessly for Blue Origin across the nation. We believe that the backbone of this vision is to achieve full operational reusability with our launch vehicles which will lower the cost of access to space, at higher flight rates and higher levels of safety and reliability. We will get there through practice, and we've recently made great progress flying our fully reusable *New Shepard* vehicle to space and back five times in less than 12 months. We are now building *New Glenn*, our next-generation reusable rocket which will launch people and payloads to low earth orbit and beyond.

Our near-term goal is to compete in the commercial market - whether suborbital, orbital, or beyond - selling launch services and technologies. We are building the next generation of transportation infrastructure: reliable, affordable, frequent rides to space for everything from suborbital tourism to long-range exploration, from resource mining to microgravity manufacturing.

We recently entered into agreements with our first two commercial satellite launch customers for our *New Glenn* vehicle. We are prepared to partner with NASA for crewed and uncrewed space missions, including a return to the moon within the next four years. We are ready to help end the military's reliance on Russian engines for our national security launches. What makes us most excited about building this infrastructure - this backbone - is the American entrepreneurialism that will undoubtedly flourish in space.

The passage of the Commercial Space Launch Competitiveness Act in 2015 helped lay the groundwork for much of what we plan to do in the coming years, and for that I would like to thank Chairman Cruz, Chairman Thune, Senator Peters, Ranking Member Nelson, Senator Udall, and the other members of this Subcommittee in the previous Congress for your leadership. As you prepare to take the next step, we would like to offer a few suggestions.

AST Focus/Resources

The FAA Office of Commercial Space Transportation, or AST, does a good job of balancing its requirement to protect the uninvolved public with its statutory mandate to promote the commercial spaceflight industry in the United States. AST's budget has remained essentially flat for several years, while the number of launches has continually increased, and is likely to continue growing. We join the rest of the commercial spaceflight industry in urging Congress to increase funding for AST to allow the office to operate as a responsive and effective agency.

That said, we encourage Congress to ensure that AST is prioritizing its existing, and any new resources, on its current statutory mission. As discussions continue on authorities that may be granted to AST in the future, we believe that AST's resources are already insufficient to meet its existing obligations; licensing launches, reentries and spaceports. We recommend that AST not attempt to handle on-orbit authority, space situational awareness, or space traffic management at this time. We do not believe that AST should take on these new authorities now, but we take no position here on whether any of these roles may be appropriate for AST in the future.

Furthermore, Blue Origin strongly supports the continuation of both the current launch indemnification regime and the learning period on human spaceflight regulations. We encourage permanent indemnification as well as ongoing Congressional advocacy and extensions of the learning period. These policies allow the industry to focus on continued maturation of innovative technologies without unnecessary burdens.

Expendable v. Reusable and the Need for Streamlining

One specific example of the need for a single point of access and a streamlined regulatory process is the transition from expendable rockets to reusable rockets. Blue Origin is a leader of this transition, having launched and landed the same rocket five times.

The licensing requirements for reusable rockets differ from those for expendable rockets. In the case of expendable rockets, the Air Force's requirements match AST's requirements almost word for word. This means that a company can create a set of deliverables for the Air Force and essentially provide the same information to AST to satisfy launch license requirements. It is duplicative, but not onerous.

In contrast, the Air Force and AST licensing requirements for reusable rockets are completely different from each other. Blue Origin is seeking an AST reusable launch vehicle license for an orbital class booster operating at a Federal Range. While pursuing our FAA launch license, we simultaneously have an entirely different but equally rigorous set of deliverables for Air Force certification – all for the exact same vehicle. This is duplicative and onerous.

The government is placing a requirement on Blue Origin and other commercial companies that will increase costs, delays, and uncertainty. Instead of encouraging and rewarding companies that are innovating and driving launch costs down, the current process is punishing those companies with red tape, and creating excessive barriers to launch.

In his previous role as Commander of US Space Command, General Hyten wrote a memorandum in March of 2016 on "Commander's Intent on Range Support to Commercial Space Launch." The memo highlights the necessity for the Air Force to work with the FAA to eliminate duplicative requirements and approvals in order to support "a more stable, predictable and efficient interaction with commercial space activities." To effectively accomplish this mission, General Hyten recognized the need to "actively seek opportunities to adapt range operations, processes and policy to flexibly accommodate all users."

The leadership of the 45th Space Wing at Patrick Air Force Base in Florida understands the need to transition to a commercial model, and has begun working with Blue Origin and the rest of the industry to adapt processes to facilitate these partnerships. That said, the leadership's vision has not yet been fully adopted at all levels of the Air Force. As a result, the Air Force has not yet realized its full potential to move at the velocity required to support commercial operators. We are hopeful that with continued leadership from the Air Force, FAA, and this Subcommittee, this issue will be fully addressed in the near term.

AST Licensing

Ultimately, we seek streamlined deliverables, irrespective of vehicle type, in alignment with the structure of 14 C.F.R. Part 431, "Launch and Reentry of a Reusable Launch Vehicle". This means we want AST as the single point of contact for any commercial spaceflight company interactions with the government. We would like AST to have sole authority over launches and reentries, without regard to location or type of launch, consistent with the National Space Transportation Policy. When operating our *New Shepard* reusable launch vehicle at our private launch site in West Texas, the licensing process is much more efficient since we deal only with the FAA. At federal ranges, however, licensing the same commercial launches requires duplicative government approvals delaying launch activity and burdening launch providers – this area is primed for increased efficiency in government operations.

Government Overreach

Recently Blue Origin and a number of other companies in the industry received a notification from the U.S. Department of Commerce, Bureau of Industry and Security that they are conducting a "survey and assessment of organizations responsible for the research, design, engineering, development, manufacture, test, and integration of rocket propulsion-related products and services." The survey is intended to assess the health and competitiveness of the rocket propulsion industrial base, and is apparently being shared with 400 propulsion related organizations. The survey contains several hundred extremely detailed questions, and we have some concerns with sharing our proprietary and confidential information. Blue Origin is a private company that is currently not participating in major government contracts, and we are hoping to work with Congress and the Department of Commerce to identify a reasonable path forward to share information.

NASA Public-Private Partnerships

The U.S. government seeks to become more efficient, agile and cost-effective through public-private partnerships. NASA's use of Other Transaction Authority, Space Act Agreements, and other innovative contracting mechanisms has produced incredible results while reducing government spending. The unique risk-and-cost-sharing regimes, such as those seen in the Commercial Crew, Cargo, and NextSTEP Programs, enable true collaboration toward national space priorities.

We believe that the national goal should be to return to the Moon, this time to stay. NASA has identified cislunar space as the strategic high ground, an enabler of grander exploration into our solar system, and a source of critical resources. In March of this year we announced our Blue Moon Lunar Lander Mission, the capability to precisely soft-land large amounts of payload on the lunar surface. Such capability is a necessity for future lunar settlement and exploration. Blue

Origin is willing to significantly invest in this development as part of a public-private partnership with NASA, in the interest of achieving this ambitious national priority.

NASA Enhanced Use Leasing/In-Kind Consideration

NASA's Enhanced Use Leasing (EUL) authority allows NASA Centers to lease underutilized NASA real property to private sector entities, academic institutions, and state and local governments. The authority helps preserve unique assets that NASA may want to use in the future, rather than allowing them to fall into disrepair. EUL authority also allows for a more productive use of the land that NASA must retain as a "buffer zone" around its launch and test sites. Revenues received under EULs cover NASA's full costs in connection with the leases. Any remaining proceeds must be used for maintenance, capital revitalization, and improvement, thereby positioning the Agency to reduce operating costs, incrementally improve facility conditions, and improve mission effectiveness. The NASA Transition Authorization Act of 2017 extended NASA's EUL authority to the end of 2018.

We support extending EUL authority an additional five years, and expanding the agency's authority to accept "in-kind" contributions toward the lease. This will help NASA cultivate public-private partnerships to transform underutilized real property, including launch and test infrastructure remaining from the Apollo and Space Shuttle eras, to serve broader science, exploration, defense, and commercial interests. As an example this authority has been critical in helping NASA's Kennedy Space Center create a multi-user spaceport environment that is drawing commercial launch and satellite enterprises to efficiently use once vacant buffer space while creating a thriving commercial space nexus. Of course, any expansion of the authority should protect against possible abuses, particularly for leases involving in-kind contributions.

New Shepard Suborbital Research & NASA Flight Opportunities

Starting in 2016, Blue Origin began flying research payloads on our *New Shepard* vehicle, allowing university researchers, corporate technology developers, and even K-12 STEM programs to access the space environment at lower cost and with lower barriers than ever before. The results from these studies are changing the way we understand fields as varied as fluid physics, spaceflight medicine, and planetary science.

Examples of payloads flying on *New Shepard* include:

- Purdue University in Indiana, characterizing effective tank geometries for in-space propellant management
- Orbital Medicine, Inc. of Virginia, developing devices for critical spaceflight medical care
- A collaboration between the University of Central Florida, Southwest Research Institute in Colorado, and the University of Braunschweig in Germany to examine rock and particle collisions in low-g environments, such as asteroids and the early solar system
- High school students in Washington State, studying the ways that liquids of different densities behave in microgravity
- NASA centers in both Ohio and Texas, characterizing suborbital flight environments to support the agency's broader research portfolio.

Today, the majority of Blue Origin's payloads are funded by NASA's Flight Opportunities Program within the Space Technology Mission Directorate (STMD). They serve to develop technologies for Earth-based applications, orbital satellite missions, and ISS investigations. This program has been critical in facilitating the use of emerging suborbital commercial vehicles, like

New Shepard, and we support full funding for the Flight Opportunities line item in future NASA appropriations. Additionally, we strongly encourage NASA's efforts to widen this aperture beyond STMD to include the broader agency's science and education objectives.

As we enter the era of frequent private human spaceflight, Blue Origin looks forward to taking both tourists and researchers aboard *New Shepard*. We ask that Congress direct NASA to remove the barriers that exist today for experts seeking to conduct hands-on research aboard suborbital vehicles. Furthermore, we advocate for human-tended suborbital research to be treated in the same manner as other challenging laboratory environments, such as undersea and Antarctic outposts, and not as equivalent to commercial orbital crew.

Ultimately, as the cost and frequency of space access dramatically improves with vehicles like *New Shepard*, spaceflight R&D is growing beyond its cradle at NASA. We are entering an era where every Congressional district and every federal agency should evaluate how it can take advantage of the space environment for discovery-based science, technology breakthroughs, inspiring STEM learners, and catalyzing American business innovation. We hope Congress will join us in this broader view, and will consider how this new era supports not only NASA's objectives, but those of the wider government and the entire nation.

National Security

Air University recently published a report that highlights the necessity for the Department of Defense to take advantage of commercial spaceflight capabilities to increase Air Force resiliency in space and extend the service's reach. Doing so will allow the government to leverage fast, low-cost access to space. While we recognize that it may be many years before the Air Force is prepared to use a flown rocket, Blue Origin has stepped in to assist the Air Force in assuring access to space with our BE-4 rocket engine. A 550,000lbf thrust liquid oxygen, liquefied natural gas engine, the BE-4 is in full-scale testing and is the fastest path and lowest cost option to end American reliance on Russian rocket engines.

Conclusions

Blue Origin was founded to bring about a future where millions of people are living and working in space. With low-cost, safe, and frequent access – achieved through reusable launch technology – an entrepreneurial explosion can begin in space, irreversibly expanding the American Frontier.

Addressing the below recommendations will allow the government and industry to interact more efficiently, develop stronger partnerships towards shared goals, and work toward America's full potential in space.

- *AST Focus/Resources* – Increasing funding for FAA AST and encouraging prioritization of their current mandates will allow the office to continue operating as a responsive and effective agency.
- *AST Licensing* – Designating AST as the single point of contact for commercial space companies will eliminate duplicative approvals and streamline the launch process.
- *Expendable vs. Reusable* – Embracing and readying for the next generation of reusable vehicles will allow the government to fully realize a new era of low-cost launch for its most valuable payloads.

- *Public-Private Partnerships* – Increasing the pursuit of innovative public-private partnerships, like the proposed Blue Moon lunar lander mission, will allow us to collectively achieve ambitious national priorities at the lowest cost.
- *NASA Enhanced Use Leasing (EUL)* – A five-year extension of NASA’s EUL authority and “in-kind consideration” will reinvigorate and preserve underutilized property, often of vast historical national significance.
- *Suborbital Research* – Renewed and ongoing support for suborbital research will not only change the way we understand fields like science and medicine, but will also grant students unprecedented, low-cost access to space.
- *National Security* – The Blue Origin BE-4 American made engine is the fastest path and lowest cost option to end American reliance on Russian rocket engines.

Thank you for the opportunity to testify before you today. I look forward to working with you on an updated Commercial Space Launch Act this Congress.