House Armed Services Committee (HASC)
Strategic Forces Subcommittee Hearing

"Assuring National Security Space:
Investing in American industry to end reliance on Russian rocket engines"

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Chairman Rogers, Ranking Member Cooper, and members of the subcommittee, thank you for the opportunity to speak before you today.

Assured access to space is a national priority and a challenge that we must meet domestically. Blue Origin is working tirelessly to deliver *the* American engine to maintain U.S. leadership in space and efficiently deliver critical national security capabilities to the men and women who rely on them for mission success. Our partnership with ULA is fully funded and offers the fastest path to a domestic alternative to the Russian RD-180, without requiring taxpayer dollars.

Established by Jeff Bezos, founder and CEO of Amazon.com, Blue Origin is focused on developing a world-class engine that will end reliance on Russia and lower the cost of the EELV program. For more than a decade we have steadily advanced our capabilities, flying five different vehicles and developing multiple liquid rocket engines all with private funding.

The U.S. industrial base now includes a number of commercial companies, like Blue Origin, that have developed significant liquid propulsion capabilities with private investment. We're spending our own money, rather than taxpayer's funds, and we are taking a "clean sheet" approach to development. We have invested in modern manufacturing equipment and processes to maximize production efficiency. We aren't burdened by unused capacity that so often gets billed back to the Government in the form of high overhead rates. As a result, we are able to out-compete the Russians, building modern, American engines on flexible production lines to serve multiple launch vehicles.

Blue is commercial and agile – a focused team with the resources to move quickly. We are vertically integrated, limiting reliance on outside suppliers and test facilities. Our development of the BE-3 hydrogen engine demonstrates the significant propulsion capability we have assembled. We have involved experts from the NASA Marshall Space Flight Center in our design cycles and risk-mitigation efforts, and we use the same processes and government-developed tools as traditional engine developers. Members of our team have held key roles on all recent liquid rocket engine development programs, including SSME, Integrated Powerhead Demonstrator (IPD), J-2X, RS-68, RS-83, RS-84, and Merlin.

Blue began developing our own engines because we couldn't find what we needed at an affordable price. Our requirements include high performance, deep throttling, restartable and reusable engines at low cost. Over the past 10 years, we have developed four different rocket engines and, in April of this year, our BE-3 engine performed flawlessly powering the maiden flight of our New Shepard space vehicle. The BE-3 is the first new American hydrogen engine to fly to space in more than a decade, after completing an extensive development program of more than 450 tests for more than 30,000 seconds of ground test time.

United Launch Alliance, America's premier launch services company, recognized the merits of our approach when they selected our BE-4 engine for their Vulcan rocket. The BE-4 improves performance at a lower cost and is already more than 3 years into development. Most importantly, it is on schedule to be qualified for flight in 2017 and ready to support the first Vulcan flight in 2019, two years ahead of any alternatives. Over 70 years of propulsion history has shown that engine development takes time. ULA and its parent companies did a great deal of due diligence before choosing the BE-4 engine. They concluded that not only could we develop the BE-4, but that we could do so on schedule and at a price that makes them more competitive over the long term. The fact that we have been in development of the BE-4 for more than three years and are on schedule gives us and ULA confidence in our ability to meet the Vulcan development timeline. Being available two years earlier means two years less reliance on the Russians.

As with any engine, an ox-rich staged combustion cycle presents significant technical challenges. For the BE-4, Blue has made conscious design choices on chamber pressure, injector design, and performance to increase margin and reduce the need for exotic materials. We also have an extensive testing program underway, testing the powerpack and injector components at our West Texas facilities, with more than 60 staged combustion tests and multiple powerpack hotfire tests conducted to date. Full engine testing is on schedule to begin by the end of next year. All of this testing is conducted on our own dedicated test stands. Having our own facilities affords us the unique advantage of testing at an accelerated pace, up to four times more throughput than in a typical government facility. In addition to dedicated test facilities, we have mitigated common schedule risks through vertical integration and multiple supply sources. We have also completed design and awarded contracts for all long-lead hardware, including critical castings, and awarded contracts for critical manufacturing equipment. The BE-4 is *the* fastest path to a domestic alternative to the Russian RD-180.

The availability of the RD-180 was the enabler for the Atlas V launch vehicle. Given its demonstrated high performance and low cost, there is no such thing as a "drop-in replacement" for the RD-180. Vehicles are designed around engines, and any new engine requires redesign and re-certification of the whole vehicle. There is no easy switch, even if the right U.S. kerosene engine actually existed today. Even if you could simply swap engines, it would result in lower performance without significant re-work to get back to current levels of performance. The BE-4 engine is the enabler for the Vulcan launch vehicle, providing increased performance over Atlas V at a lower cost.

Blue Origin supports a thoughtful and deliberate transition from the Russian RD-180, to the next generation of American launch vehicles. This means allowing ULA to acquire the engines they need to maintain Atlas V launches until transitioning to the Vulcan rocket. A gap in launches between Atlas and Vulcan undermines assured access to space and endangers national security. Blue supports the HASC FY16 NDAA language, which would allow ULA to purchase and use the RD-180s it has contracted to buy. Congress should avoid creating a new monopoly by forcing retirement of the Atlas V before the Vulcan vehicle is ready, which would be counter to the strategy of bringing competition to national security launch.

Blue is well capitalized and significant private investment has been made in the facilities, equipment, and personnel necessary to develop the BE-4. The engine is fully funded primarily by Blue with support from ULA. Most importantly, the BE-4 does not require government funding to be successful.

Overfunding engine development while leaving a gap in funding for full vehicle integration will create a deficiency in U.S. space launch capabilities. Instead of duplicating privately funded engine development efforts, the U.S. government should focus its resources on developing the next generation of launch vehicles to meet the broad spectrum of national security space launch requirements. No new engine can simply be “dropped in” to an existing launch vehicle. Launch vehicles have to be designed around their engines, and launch providers are best able to decide what engine they need.

Thank you, and I look forward to your questions.