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U.S. HOUSE OF REPRESENTATIVES

STATEMENT OF

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AEROJET ROCKETDYNE

BEFORE THE

HOUSE COMMITTEE ON ARMED SERVICES,

SUBCOMMITTEE ON STRATEGIC FORCES

ON

ASSURING NATIONAL SECURITY SPACE: INVESTING IN AMERICAN INDUSTRY TO END RELIANCE ON RUSSIAN ROCKET ENGINES

JUNE 26, 2015

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Statement of Ms. Julie Van Kleeck before the
House Armed Services Committee, Subcommittee on Strategic Forces
June 26, 2015

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

Good morning Chairman Rogers, Ranking Member Cooper and members of the Subcommittee. It is a privilege to be here today to discuss this important national security issue. It is well past time to eliminate the use of non-allied propulsion systems for U.S. National Security Space launches. On behalf of Aerojet Rocketdyne, and its 5,000 employees nationwide, I want to thank the Congress, and especially this Committee, for recognizing the problem, and taking action. Simply stated – we have a Russian engine problem on the Atlas V rocket. The Atlas V is arguably the Nation's best and most versatile launch vehicle but the problem is that Atlas depends upon the Russian-made RD-180 booster engine. Aerojet Rocketdyne believes that the fastest, least risky and lowest cost way to remedy this problem is to develop an advanced American rocket booster engine to replace the Russian RD-180 on the existing Atlas V. With a focused competitive acquisition based on a robust public-private partnership, we firmly believe that this can be accomplished by 2019.

We thank the Committee for its leadership in authorizing funding, for fiscal years 2015 and 2016 for the Air Force to competitively develop such an engine by 2019. Aerojet Rocketdyne welcomes the opportunity to compete for that effort. Our company has the experience and capabilities to develop a state of the art, advanced technology kerosene-fueled booster engine that can be certified by 2019 and replace the RD-180, as well as serve other large booster propulsion users and future markets. To keep this engine on track for 2019, Aerojet Rocketdyne

is currently self-funding development of such an engine – an engine we call "AR1." Unfortunately, over six months have passed since FY 2015 funds were appropriated for the engine development program that this Committee mandated. It appears that this engine development program may be subsumed into a lengthy new launch vehicle development cycle and a subsequent launch service acquisition.

Aerojet Rocketdyne

Aerojet Rocketdyne is a supplier of rocket, missile and satellite propulsion – solid, liquid and ion. We do not make launch vehicles; we design, develop and produce the engines and motors that power them into and through space. Aerojet Rocketdyne has been in the space propulsion business since the beginning of the Space Age. For more than 60 years, we have been on the leading edge of developing and producing advanced rocket propulsion. Aerojet Rocketdyne's first stage booster engines, upper stage engines, maneuvering thrusters and solid rocket motors have launched every American that travelled to the Moon, propelled all Space Shuttle missions, landed probes on Mars, placed national security payloads into proper orbits and provided propulsion for America's missile defense and strategic deterrent systems. Overall, Aerojet Rocketdyne has successfully powered more than 2,000 launch vehicles into space.

A Shrinking Industrial Base and an Advanced Hydrocarbon Engine Technology Gap

Since the end of the Cold War the U.S. rocket propulsion industrial base has shrunk significantly and a troubling technology gap has widened. While the U.S. leads the world in liquid oxygen – liquid hydrogen rocket engines and large solid rocket motor propulsion, the country is woefully behind in the area of liquid oxygen – hydrocarbon rocket engines. Russia is the world leader in

hydrocarbon engines and a Russian produced engine, the RD-180 powers America's most versatile U.S. launch vehicle, the Atlas V. The Russian RD-180 uses an advanced staged combustion cycle that provides significant launch vehicle performance benefit; thus it is not surprising that it was selected during the EELV competition to power the Atlas. There were no equivalent engines in the U.S. inventory at that time and, sadly, that situation still exists today. Russian engines now have been imported for more than 15 years, thereby sustaining the Russian industrial base, while critically impacting the U.S. industrial base and sending hundreds of millions of dollars offshore. In addition, media reports indicate that the Chinese will debut this technology next month on a Long March launch vehicle.

Current American hydrocarbon launch vehicle engines are lower performing from virtually all aspects as compared to the Russian and Chinese staged combustion hydrocarbon engine standard. Aerojet Rocketdyne is the only U.S. company with experience developing, producing and operating a staged combustion advanced technology engine - the Space Shuttle Main Engine (RS25). This is a reusable hydrogen-based staged combustion engine that powered the Space Shuttle for 30 years and that will soon power the Space Launch System. But there are no domestically developed staged combustion hydrocarbon-fueled engines available in the United States today.

Aerojet Rocketdyne, investing its own resources, and in collaboration with the Air Force Research Laboratory, NASA, and academia, has advanced the American understanding of this critical technology over the last 20 years to a point where development and production of a globally competitive U.S. staged combustion hydrocarbon engine can occur rapidly. It is now

time for the United States to aggressively pursue development, production and deployment of this technology in the U.S. launch vehicle inventory to end dependence on Russian engines and return the U.S. to leadership in globally competitive hydrocarbon engines. Aerojet Rocketdyne believes its AR1 engine can provide the United States with an advanced technology, staged combustion, hydrocarbon-fueled engine that will eliminate America's reliance on Russian engines for national security launch and close this technology gap by 2019.

Fix Atlas V's Russian Engine Problem - Quickly, Economically and with the Least Risk

Focused, sustained funding today can result in the development and certification of a U.S. rocket engine replacement for Atlas V by 2019. Rapid insertion of a replacement staged combustion kerosene-fueled engine, such as the AR1, is the lowest risk, fastest and lowest cost path to ending reliance on the Russian RD-180.

Our team is proud of AR1. It is an all U.S. designed, advanced technology, kerosene-fueled staged combustion booster engine providing over 500,000 pounds of thrust. A set of two AR1 engines coupled together form the replacement main propulsion system for the existing Atlas V – providing over one million pounds of thrust. Integration of the main propulsion system onto the existing Atlas V requires minimal changes to the launch vehicle. Using a near drop in engine replacement allows the Atlas launch vehicle to utilize the existing launch infrastructure, operations and facilities already in use for National Security Space missions today.

AR1 is not a copy of the Russian RD-180. It is being developed to match the mechanical and fluid interfaces required to integrate with the Atlas V booster and will be produced with the latest

materials, advanced manufacturing techniques and the ingenuity of experienced American engineers and aerospace workers. AR1 will be superior to the RD-180 and will leapfrog the Russian technology. AR1 will be available to any U.S. large booster propulsion user and is configurable to any respective launch vehicle.

AR1 Can Be Ready by 2019

Mr. Chairman, our company can, with a focused public-private partnership, develop and certify AR1 by 2019. Aerojet Rocketdyne is able to say this with a confidence based on more than 60 years of proven experience developing and producing launch vehicle propulsion. There are a number of reasons for our confidence, including:

- Aerojet Rocketdyne has active, state of the art, liquid rocket engine production facilities that are currently delivering production engines for upcoming National Security and NASA space launches. These are engines that were first designed, developed and tested by Aerojet Rocketdyne.
- Aerojet Rocketdyne is the only domestic company that has ever designed, developed, produced, and flown rocket engines with thrusts greater than 150,000 pounds.
- Aerojet Rocketdyne has developed large liquid launch engines on similar timelines. The RS-68, the first stage booster engine on the Delta IV launch vehicle, was developed and produced on a five year schedule. It is a 700,000 pound thrust engine.
- Aerojet Rocketdyne is utilizing advanced metallurgy and additive manufacturing three dimensional printing to accelerate AR1 development and reduce cost.

- Aerojet Rocketdyne has the most advanced rocket engine development tools and processes in the industry and a proven track record of using them to continually reduce the development cycle time and bring product to market on a reliable schedule.
- Aerojet Rocketdyne fully understands the test infrastructure required to develop and certify an engine of this thrust and complexity and is actively readying these test stands to support the 2019 date.

Mr. Chairman, the biggest risk to AR1 development is continuing delay in a focused Air Force engine development program. As stated, Aerojet Rocketdyne is currently using its own funds to keep AR1 on a timeline for certification in 2019. We are ready to move forward as quickly as possible with a public-private partnership that can have AR1 available in 2019 to power an all-American Atlas V. The benefits of this public-private partnership will flow well beyond Atlas V, since the AR1 rocket engine will be a national asset available to all U.S. launch providers – current and future.

Closing

Mr. Chairman, I want to thank you again for holding this important hearing and for your and the Committee's leadership on this critical issue that is fundamental to our Nation's assured access to space for national security missions. Simply stated, America has a Russian engine problem on Atlas V, our premier launch vehicle for national security launch. With a focused U.S. staged combustion hydrocarbon engine development effort, America can rapidly eliminate its use of Russian engines on the Atlas V. A new U.S. engine, the AR1, can power an all-American Atlas V, move the United States back into a leadership position with a globally competitive

hydrocarbon engine – and in doing so reinvigorate the U.S. rocket propulsion industrial base and foster a new generation of entrepreneurial American launch.