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Strategic Competition with China in Space

For this submission, I have drawn heavily on the "The Center for Strategic and International Studies, Space Threat Assessment 2019" which provides a reasonably comprehensive, unclassified assessment of both the threat and actions being undertaken by our main competitors, with an excellent review of the Chinese capabilities and potential areas of investment. The assessment portrays the clear intent of the Chinese to obtain maximum leverage in the space and cyberspace domains. The assessment's opening pages highlight an excerpt from the 2018 NATIONAL DEFESE STRATEGY, UNITED STATES DEPARTMENT OF DEFENSE; "New threats to commercial and military uses of space are emerging, while increasing connectivity of all aspects of life, business, government and economic infrastructure creates significant vulnerabilities. During conflict, attacks against our critical defense, government, and economic infrastructure must be anticipated."

Air, space and cyberspace have become the strategic high ground for U.S. national, and economic security. Assured presence and passage yield the greatest current and future competitive advantage with both friendly and hostile competitors.

Unique to these domains, in both the physical and non-physical instantiations, are the significant amount of autonomy, robotics, and artificial intelligence necessary to effectively compete. Most activities occur at the speed of light, or extremely high velocities, with decision cycles that exceed the capabilities of the human mind to process.

Commercial and national security interests in the space domain today, are focused from geosynchronous orbits inward toward Earth. Technology is re-opening lunar space, which is rapidly gaining critical commercial and security roles. Both lunar space and the intersection of the lunar and Earth's gravities, provide a gateway to outer space destinations and exploration, and a venue to construct basing and support infrastructure with a far lower gravity well for launch and recovery from as compared to Earth. This area is also a platform with a unique vantage point from which to conduct remote sensing and other operations associated with Earth's orbital fields, e.g. geosynchronous, medium earth orbit, low earth orbits. The national security implications of lunar space will continue to grow in importance as our space exploration and commercial interests grow.

China is demonstrating a focused and long term interest in both the national security and commercial implications of the space domain. China's investments in autonomy, robotics, and artificial intelligence have been, and likely will remain, significant. China's work in quantum communications and other advanced processing constructs set the stage for significant breakout capabilities. While these breakout capabilities have yet to be realized, they merit close scrutiny.

China's investment and exploration of remote proximity operations in space is another venue worthy of close scrutiny. These operations open the opportunity to conduct rendezvous, docking, servicing and other logistical support operations in space. However, these same operations facilitate all forms of space-based weapon employment. Absent a set of international norms and regimes, that are adhered to, and a robust space surveillance capability, these proximity operations can represent a significant threat.

The United States has entered a period of accelerated advancement in space launch and delivery operations, autonomy, robotics and artificial intelligence. Most significant among these is the

introduction of reusability, which is already dramatically reducing cost, while increasing space access to much broader national security and commercial markets, for the U.S., its friends and allies. Current investment in increased payload capacity and faster turnaround time between launches all seem to be well within reach of U.S. commercial and national security customers.

U.S. space investments since the beginning of the century are revitalizing U.S. capabilities and capacity for space operations, in both the commercial and national security venues. Most significant, I believe, and referred to previously, is in the area of reusability, for launch, on orbit, and recovery operations from Earth. This has dramatically increased access, reduced cost, and broadened the opportunity for further competition across all space-based functionality.

Increased capabilities and capacity made possible by advances in autonomy and robotics are also fueling broader operational capabilities. Current R&D efforts with clusters of small satellite architectures are demonstrating increased capacity, resiliency, and survivability. There are no silver bullets; all things can be attacked, disabled, and/or destroyed. The movement toward small satellites and cluster architectures are a significant step in reducing the impact of any hostile action.

Increased capabilities in surveillance of space-based assets will be essential in understanding and correctly characterizing the activities of space-based assets. Newer, dedicated assets are under development to meet this critical function of surveillance and characterization. The cost of a robust capability will be high but must not be underestimated in its value.

Plans for returning to the lunar surface, for basing both on orbit and on the surface, and for expanding the sensing and communications architectures on and around this strategic gateway will be critical in expanding space exploration and defending our home planet space. Understanding the value of this is just now beginning to gain acknowledgement.

The emerging Department of Defense organizational construct for space and the intense focus on how DoD organizes for space are appropriate and necessary. Getting the organizational construct right merits considerable thought and debate. Today, the services are organized around the physical domains – air, land, and sea. The combatant commands are organized geographically and integrate the service domain capabilities for combat in a cross domain integrated strategy. The color of uniforms, unit patches, and headquarters location are irrelevant. We must have space and cyberspace service organizations that are accountable for all train and equip functions. We must have a domain-centric service construct that can be integrated with any and all other domains, via the combatant commands, to conduct combat operations on behalf of the nation.

Artificial intelligence and proximity operations are capabilities essential in any space endeavor, especially security. Proximity operations were touched on earlier. Artificial intelligence is and will be essential in space operations. These two areas require additional policy, resource and testing. At its core, artificial intelligence is best applied in an environment driven by a high degree of robotics, automation and one in which there is a clear strategic imperative for the acquisition of data. Applying artificial intelligence to space-based sensing, processing, storing and disseminating data is a natural fit. Applying artificial intelligence to space operations will require a reference architecture in order to support enterprise level operations for the DOD. In the commercial sector, the efforts of Tesla and

Amazon offer insight into the scale and the distribution of functions necessary to run enterprise level AI. NSA and NRO are the closest government counterparts, principally because of their significant data capture, processing, dissemination and warehousing. We need the right architecture and the right organizational roles and missions construct to successfully field an enterprise-level AI effort for space. Second, and more foundational, AI based lethality is the only realistic way to conduct combat and combat support operations in and through the space and cyberspace domains. How we do this remains a realistic policy void. Use of computational devices to complete fire control chains is not new. How we do it in domains where humans cannot be physically present, and/or cannot comprehend the necessary inputs to functionally complete the fire control loop is going to be challenging for our culture. Policy work and education in this area has to be accelerated, if we are to defend and compete in space and cyberspace.

In order to realize and leverage the potential of space, it is clear that expanding the utility of space beyond the purview of national security will increase resources and research and development efforts. We need policies and incentive structures that favor public/private cooperation. Allowing the full force of our commercial, academic, and government enterprises to participate in the nation's space endeavors will be essential in realizing the potential of space for the nation.