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UNITED STATES SENATE

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SUBCOMMITTEE ON AVIATION AND SPACE
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UNITED STATES SENATE

SUBJECT: Emerging Space Environment and Operational and Policy Challenges

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INTRODUCTION

Chairman Cruz, Ranking Member Sinema and distinguished Members of the Committee, I'm honored to appear before you today in my capacity as Vice Commander of Air Force Space Command (AFSPC). It is a distinct privilege to represent our commander, General Jay Raymond, and the 26,200 men and women of AFSPC who develop, field, and operate the space capabilities that underpin the joint force, our Allies and partners and the Nation. In recent years we have made tremendous progress along with our National Security Space (NSS) partners in the on-going effort to address the reality that strategic competitors have made space a warfighting domain. Among these initiatives are the President's issuance of four Space Policy Directives (SPD), direction to establish a space-focused combatant command – U.S. Space Command, and the Department of Defense (DoD) proposal for a sixth branch of the armed forces – the U.S. Space Force. We expect the coming year will be equally full of progress across these and other NSS endeavors.

EMERGING SPACE ENVIRONMENT

Today, great power competition with China and Russia continues to be the primary challenge to U.S. and global security. Both of these nations seek to challenge peace, stability and U.S. leadership in all domains: land, sea, air, space and cyberspace. In the space domain in particular, these competitors seek to deny the United States and its Allies freedom of action, while developing their own capabilities to project power and enhance their military strength.

Fortunately, this comes at a time when our National Security Strategy, National Defense Strategy, national leaders, and Air Force plans, programs and operations are in unprecedented alignment. The National Security Strategy dictates that we treat space as a priority domain and vital interest, maintaining unfettered access and freedom to operate in space for civil, military and economic benefit. The National Defense Strategy establishes five priority missions: (1) defend the homeland, (2) provide a safe, secure, and effective nuclear deterrent, (3) defeat a powerful conventional enemy, (4) deter opportunistic aggression, and (5) disrupt violent extremists. Space capabilities play a critical role in each one of the missions, supporting U.S. forces and our allies and partners around the globe. Our primary objective remains to deter conflict from extending to space; the best way to do this is to be prepared to fight and win in space should deterrence fail. Military, civil, and commercial space cooperation is critical to

AFSPC efforts to organize, train and equip space forces that will deter adversary action in space, and if necessary, fight and win in the space domain. My testimony focuses on current and future areas of cooperation among military, commercial and civil space sectors.

CURRENT MILITARY-CIVIL-COMMERCIAL SPACE COOPERATION

AFSPC recognizes that it is impossible to accomplish our mission alone; we are committed to identifying new partners and solidifying existing relationships as a core activity across many mission areas.

Assured Access to Space

For the first time in 20 years, the Air Force is postured to meet national security launch needs through competition among multiple launch providers. The National Security Space Launch (NSSL) program, formerly known as the Evolved Expendable Launch Vehicle program, provides assured access to space for our most important national security satellites. As the stewards of this capability for the Department of Defense and the National Reconnaissance Office, we have achieved unprecedented mission success by delivering 76 NSS launches to orbit since 2002 without a launch failure. During this period, the National Aeronautics and Space Administration (NASA) has also used this space launch capability to support numerous science, exploration and other civil missions. While our priority remains ensuring the Nation can launch all NSS payloads, our strategy to utilize launch services from certified domestic launch providers supports their viability in the globally competitive launch sector and helps to ensure this fundamental element of space power is also available for civil, commercial, scientific and exploratory purposes.

The Air Force has moved into the next phase of the NSSL program. In October the Space and Missile Systems Center (SMC) entered into development contracts with Blue Origin, Northrop Grumman and United Launch Alliance called Launch Service Agreements. These public-private partnerships leverage commercial launch investment and seek to end our use of the Russian RD-180 engine ahead of the 2022 deadline. Earlier this month, SMC released the Request for Proposal for Phase 2 launch procurement contracts, which will use full and open competition to procure launch services for launches starting in 2022. The Launch Service Agreements are not prerequisites to winning NSSL Phase 2 launch contracts. They are the best

way to ensure commercially viable launch systems are available and ready to meet our stressing NSS launch requirements at that time.

Last year Congress recognized the potential for cost savings associated with launch vehicle reusability, and the inherent competitiveness this feature can provide. With launch service providers demonstrating success at a rapid pace, reusable launch systems may offer higher reliability, increased responsiveness and greater flexibility in support of NSS missions. The Air Force is actively evaluating the risks, benefits, and potential costs savings from reusable launch vehicles for future missions. Evidence of this can be seen in SMC and SpaceX's recent contract modification allowing the reuse of the Falcon Heavy side core boosters for the Air Force's Space Test Program-2 mission. This mission further demonstrates our commitment to balance risk with increased responsiveness and flexibility.

In 2019, the SMC-led DoD Space Test Program partnered with the Defense Innovation Unit to pursue first use of small, "venture-class" launch services through the Rapid/Agile Launch Initiative (RALI). Under this partnership, the Air Force procured five launches from venture-class launch service providers using Other Transaction Authorities. RALI demonstrates rapid procurement and the responsiveness of commercial launch, dedicated launch for small payloads to militarily-relevant orbits, and increased operational tempo over legacy launch services. RALI leverages an expanding commercial launch market to increase DoD's access to space.

AFSPC places a high priority on streamlining space launch operations and identifying opportunities to improve our speed, innovation, resiliency, and efficiency to satisfy national security needs, and increase safety. This includes the architecture transformation of both launch ranges that started in 2019 and will continue through 2023. Changes in flight and ground systems will put us on a path to support a 2025 implementation of the Autonomous Flight Safety System for all commercial space launches. This enables us to increase the pace of launch and reduce sustainment of costly infrastructure, while maintaining public safety.

We are also working closely with the Federal Aviation Administration (FAA) as they implement streamlined commercial launch licensing approvals. The Air Force and FAA have a long history of cooperation in space launch and use common standards to ensure the safety of the public and critical launch infrastructure against the hazards of launch operations. AFSPC installation commanders also work closely with the FAA and launch provider to synchronize all

activity on the installation to ensure the commercial and military missions are optimized in support of national objectives.

We have learned many lessons in recent years as our partnerships with the FAA, NASA, and industry have matured. Finally, we are pleased with the success of industry operating from Air Force-managed space launch ranges and will continue to refine our processes and requirements in pursuit of assured access to space.

Space-based Environmental Monitoring

Every military mission begins with a weather briefing; terrestrial weather, space weather, or both. The data required to generate forecasts for our forces is largely dependent on complex models, and approximately 95 percent of the data that feeds these models comes from space-based sensors or ground-based observatories looking into space. Defense Meteorological Satellite Program (DMSP) satellites have been collecting weather data for U.S. military operations for more than five decades and provide assured, reliable, global terrestrial and space weather data to support DoD operations. A 1994 Presidential directive realigned day-to-day operations of DMSP to the Department of Commerce's (DoC) National Oceanic and Atmospheric Administration (NOAA), and today the DMSP constellation is operated by mission partners consisting of the NOAA Office of Satellite and Product Operations and a detachment of Air Force Space Command's 50th Operations Group, both located in Suitland, Maryland. The 50th Operations Group detachment has Satellite Control Authority and delegates day-to-day operations to the NOAA. A backup operations center, operated by the Air Force Reserve's 6th Space Operations Squadron, is located at Schriever Air Force Base, Colorado.

The Air Force's Responsive Environmental Assessment Commercially Hosted (REACH) program is a space weather and space situational awareness project demonstrating the viability and effectiveness of a commercially hosted, disaggregated architecture. REACH payload sensors provide an unprecedented amount of space weather measurements for more rapid satellite anomaly attribution. Working in partnership with Iridium, Johns Hopkins, Harris Corporation and others, the program fielded 32 REACH hosted payloads on-orbit in under 24 months at a total cost of \$18 million, a 92 percent cost savings from the original cost estimate for the program. The successful launch of these payloads and the critical data they provide made the REACH team a finalist for the prestigious 2018 Collier Trophy recognizing achievement in

aeronautics and astronautics, and are an example of SMC innovation in developing partnerships with industry to rapidly field new capabilities while reducing cost and schedule.

Satellite Communications

To comply with the 2018 National Defense Authorization Act, responsibilities for DoD procurement of commercial satellite communications (COMSATCOM) services transferred from the Defense Information Systems Agency to AFSPC on December 11, 2018. Since that date, AFSPC has been bringing together government and industry partners to chart a way forward to both enhance satellite communications (SATCOM) provisioning and our ability to provide SATCOM in a contested environment. DoD and commercial industry have a long track record of collaboration, partnership, and mission success in this area. That being said, we are not content to rest on the laurels of that partnership with all our commercial industry partners have to offer. To that end, we currently have multiple ongoing and planned initiatives to improve and expand upon current COMSATCOM use cases.

The AFSPC Commercial Satellite Communications Office (CSCO) facilitates the acquisition and delivery of operationally responsive, customer-focused, cost-effective COMSATCOM services and capabilities for Combatant Commands, Services and agencies throughout the DoD, as well as for federal agencies and foreign partners. The CSCO has two business units, the COMSATCOM Solutions Branch and the Enhanced Mobile Satellite Services (EMSS) Program. In Fiscal Year 2019, the CSCO has an annual working capital budget of approximately \$800 million.

The COMSATCOM Solutions Branch manages approximately 100 contracts annually with commercial providers, providing approximately 9 GHz of bandwidth across all commercial bands and 2.5 Gbps of throughput, with a lifecycle value exceeding \$5 billion. Supported missions include intelligence, surveillance, and reconnaissance; command and control; logistics; research and development; special operations; and training.

The EMSS Program Office provides global mobile satellite communications via the commercial Iridium low-Earth orbit (LEO) satellite constellation. For a fixed annual rate, customers receive unlimited voice and data on L-band devices, including satellite phones, push-to-talk radios, and small form-factor sensors and trackers. EMSS capabilities are meeting critical narrowband satellite communications requirements for current operations, including tactical, warfighter and disadvantaged user requirements. Currently over 100,000 devices are

provisioned to the DoD's wholly-owned and operated EMSS Gateway, where all communications are securely processed and ingested into other networks.

The Commercial Integration Cell (CIC), established in 2014 at the Combined Space Operations Center, has proved beneficial to both industry and government. The CIC improves our understanding of the capabilities and limitations of the various commercial COMSATCOM and space situational awareness (SSA) systems that the DoD procures to satisfy warfighter needs, which improves industry's knowledge and employment of their systems in response. More recently, the command held two COMSATCOM industry day engagements. These events allowed the government to glean a better understanding of how to better leverage and incorporate existing and planned COMSATCOM capabilities into our SATCOM Enterprise Vision and Strategy while providing industry the opportunity to gain a better understanding of how the command intends to capitalize on the value the COMSATCOM industry is building.

Innovation and rapid technology advancement are occurring throughout the space industry, especially in "New Space" companies with agile development and deployment processes. The Air Force is looking to partner with commercial industry, the civil space sector, and others to leverage these activities and increase agility, reduce cost, improve technology and decrease program development cycles. SMC's Space Enterprise Consortium aims to leverage this activity, minimizing barriers to entry for small businesses and non-traditional vendors and identify teaming opportunities to promote research and prototyping with the Government. At present, AFSPC is using this tool to identify and field a SATCOM Enterprise Management and Control capability to manage and control a hybrid DoD SATCOM Enterprise consisting of purpose-built DoD satellites and commercial SATCOM services.

Finally, the Air Force COMSATCOM Office is pursuing a research, development, test, and engineering initiative to look at the use case for commercial COMSATCOM services in the Arctic, as well as commissioning a study to identify new government to industry business models for acquiring and employing COMSATCOM capability that will reduce the currently over 100 disparate contracts for commercial SATCOM while simultaneously expanding the overall capability and capacity available to our users.

Space Situational Awareness

In June 2018 the President signed SPD-3, which is intended to ensure that the United States remains the leader in providing a safe and secure operating environment as space traffic

increases. This policy establishes foundational principles, lays out goals, provides guidance, and establishes clear roles and responsibilities. In accordance with this policy, DoD will transition the non-military aspects of space situational awareness and space safety monitoring and responsibilities to the Department of Commerce.

For the last year AFSPC has collaborated closely with the DoC on many fronts. In partnership with U.S. Strategic Command, there has been an active dialogue to differentiate roles and responsibilities to meet SPD-3 objectives. Next month the first DoC liaison will arrive at the 18th Space Control Squadron located at Vandenberg Air Force Base, California. This will mark the start of operational-level engagement between the DoD and DoC related to the transfer of SSA domain knowledge to the DoC in support of their efforts to comply with SPD-3.

SSA data sharing has been an area of great interaction and opportunity. In May 2018, an unclassified data environment was created to aggregate SSA data and to make that information easily accessible to developers, operators and allies alike. Called the Unified Data Library (UDL), this unclassified capability was built by the Air Force Research Laboratory. Since its delivery last summer, the UDL capability has grown exponentially and demonstrated its ability to be a marketplace that aggregates commercial, Allied, Intelligence Community, and academic data sets in a way that supports any data consumer at the correct classification level. Today, 16 commercial data providers and multiple non-traditional data providers like the University of Arizona are feeding the UDL. We also have government data available from the Naval Research Laboratory, the 18th Space Control Squadron, and others at the unclassified level. The DoC is currently evaluating the unclassified version of UDL to facilitate its broader Space Traffic Management objectives, and expects a final decision on their desired way ahead this summer.

FUTURE AREAS OF COOPERATION

AFSPC has made significant progress in expanding interagency and commercial cooperation that enhance our position across the national security space portfolio. Based on those recent successes, AFSPC will continue to build our relationships with industry and other government agencies.

Blackjack

Blackjack is a joint Defense Advanced Research Projects Agency- and Air Force-initiated program to define, develop, and demonstrate proliferated low-Earth orbit (PLEO) architectures to

augment, complement or replace existing satellite constellations at lower cost and potentially higher resilience. The Blackjack program will deliver up to 20 satellites to orbit by 2021 and has three main objectives: (1) develop payload and mission-level autonomy software and demonstrate autonomous orbital operations; (2) examine and implement advanced commercial manufacturing techniques and commercial-off-the-shelf parts; and (3) assess the ability of small spacecraft in LEO to support national security space missions. AFSPC, Air Combat Command, and others in the DoD have expressed significant interest in Blackjack and the need for rapid deployment of a more resilient, distributed system. The Blackjack program has recently awarded satellite bus and payload contracts to industry partners.

CASINO

Commercially Augmented Space Inter-Networked Operations (CASINO) is an umbrella program established by SMC to expand on operational concepts prototyped by the Blackjack program. CASINO will operationalize PLEO constellations by improving sensors and concepts of operation and developing prototype payloads for additional mission areas. CASINO is working with a variety of partners to determine requirements, data transport and integration schemes, and cyber security/Information Assurance needs for multiple mission areas. Use of innovative commercial manufacturing and “design for upgrade” techniques will enable rapid production and lower cost, allowing for continuous technology refresh and new technology insertion points not currently available in NSS programs. Using commercial-like production lines and replenishment concepts will drive up to 20 percent constellation re-capitalization each year and allow for technology insertion to outpace evolving and emerging threats. In addition, the CASINO program examines the use of both military unique command and control systems, and is coordinating with commercial PLEO operators on approaches that would enable command and control of military payload and data dissemination through existing commercial processing centers.

Mission Manifest Office

SMC, under the auspices of AFSPC, created the Mission Manifest Office (MMO) to provide rapid, resilient and responsive launch opportunities for small payloads to meet NSS objectives. As the front door for operational launch, the MMO analyzes and identifies DoD, civil, and Intelligence Community launch opportunities to determine potential multi-manifest missions. As a result, the Air Force intends to maximize on-orbit capability and reduce overall launch costs by ensuring excess “throw weight” is used on every NSSL mission. As one of the

SMC 2.0 pacesetters, the MMO will be offering DoD, the intelligence community and civil agencies opportunities to mature their space technologies on the NASA Landsat-9 launch mission in 2020, setting an important precedent for interagency collaboration for years to come.

Space-based Environmental Monitoring

Air Force weather operators have a long history of leveraging U.S. civil and allied Space Based Environmental Monitoring (SBEM) capabilities to support global operations. DMSP has served as the core Air Force SBEM capability for close to sixty years. However, SBEM data from NOAA, the European Consortium for the Exploitation of Meteorological Satellites, and the Japanese Space Agency have been critical in providing meteorological data that DMSP alone cannot fully provide. For the next generation, the Air Force is currently acquiring the Weather System Follow-on–Microwave system to meet two requirements that will not be fulfilled by civil or allied partners: monitoring of ocean surface vector winds and tropical cyclone intensity. The Air Force is also currently developing a unique set of small hosted sensors to be flown in various orbits to sense energetic charged particles. Finally, the Air Force is implementing a comprehensive strategy to meet the two highest priority SBEM sensing needs under the Electro-Optical/Infrared Weather System (EWS) acquisition: cloud characterization and theater weather Imagery. EWS will be comprised of a hybrid architecture of core Air Force sensing capabilities augmented by civil, allied, and likely commercial capabilities. The continued miniaturization of cloud imaging sensors combined with the emergence of “NewSpace” proliferated commercial space architectures provides an opportunity to integrate commercial capabilities into the SBEM family of systems like never before. This hybrid architecture approach will be much more resilient than current and previous SBEM architectures and will be scalable to meet requirements for more timely and actionable weather information.

THE WAY AHEAD

AFSPC has made significant progress in recent years to build and foster close relationships with civilian and commercial space partners to better leverage existing capabilities and to make smarter investments going forward. The command will continue to strive to ensure these relationships solidify over time to maintain a dominant national space enterprise.

I thank the committee for your leadership and support; together we will build a resilient and ready NSS enterprise that will continue to serve as the foundation to our desire to maintain our military advantage and promote American prosperity.