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"The Emerging Space Environment: Operational, Technical, and Policy Challenges"

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Thank you Chairman Cruz, Ranking Member Sinema, distinguished members of the subcommittee, and your wonderful staff for inviting me here today. I appreciate the opportunity to talk about the critical operational, technical and policy challenges today in space across the commercial, civil and national security sectors.

There are many opportunities that a growing commercial space community have created across all three sectors. Low-cost launch opportunities and reduction in the size of electronics have created a renaissance in space research and new business models to support civil and government missions. But along with the increasing engagement comes many new challenges as well. We must encourage and nurture the economic and national benefits derived from all of this activity, while protecting national security interests. I believe that the definition of a coherent, thoughtful and effect space traffic management capability is one of the most urgent tasks facing the government in this cause; this requirement underpins the needs across all three sectors.

Currently the Department of Defense (DoD) has statutory authority for conjunction assessment and notification. The Combined Space Operations Center (CSpOC) has access to 29 sensors, 7 of them dedicated full time, with 22 contributing and collateral sensors which are available part-time. These sensors, scattered widely across the globe and providing only poor coverage in the southern hemisphere, are not sufficient for the challenges facing us now. They can be affected by weather, and only take periodic snapshots of the location of objects in space; hours and even days may go by without updates to orbital locations. Furthermore, there are gaps in our capability to track objects, for example, we cannot detect debris less than 10 centimeters in size. These objects present a hazard to navigation for all satellites – civil, commercial, and national security.

Many of the new proposed commercial activities include highly dynamic operations including rendezvous and proximity operations, satellite servicing, and debris removal missions. Consequently any space traffic management will have to not only track and manage the movements of satellites on orbit and but also be able to track the small, but important debris. One way to create a robust space traffic management system is to incorporate a greater number of sensors, potentially from commercial companies and private entities to help provide data that can fill current gaps in our ability to provide persistent custody of all objects in space. Given the proliferation of large satellite constellations and the growth in debris, the ability to provide persistent custody of orbiting objects is urgently needed for both the national security mission and for a future civil space traffic management oversight authority.

While it's exciting to see the new capability that commercial entities can bring to the table, commercial space surveillance data is still a nascent industry. The Air Force and the civil space traffic management oversight authority need to work together immediately to give clarity and direction to how they intend to acquire the necessary data. Only with clear direction can industry position itself to provide the products and services the government needs. There are several immediate and critical issues that the government needs to address. First, the U.S. government needs to establish what data it needs or desires to acquire to serve the domestic community. According to Space Policy Directive-3, the Department of Commerce - as the administration's nominated civil authority - will eventually take over conjunction assessments and notifications currently performed by the Combined Space Operations Center (CSpOC). Important work is still needed to establish the minimum threshold of service that the government should provide to all users, and how much data is necessary to provide that level of service.

Second, a decision has to be made as to how and where that data will reside. If multiple repositories are defined, for example, one for DoD and one for the civilian community, how does the government ensure it is not paying twice for the same information? Another critical question concerns the relationship that DoD will decide to maintain with partner countries and the sharing of critical data as it has done in the past. Will commercial entities resist this sharing as affecting their potential market? As the various government stakeholders struggle with answering these complex questions they can turn to the many lessons learned from both the commercial earth observation data experience as well as commercial weather data.

Finally, let us all recognize that there are implications for the intelligence community as we transition to an open civil system of space situational awareness and space traffic management. A system where open information about satellite position and orbit is available to the general community will present a challenge for conducting national security missions. Unfortunately, the reality of today, however, is that the IC is already facing this challenge. As an increasing number of independent domestic and international sensor operators come on-line, anyone's ability to remain undetected is tenuous. We have worked through such challenges before. The current situation facing national security is analogous to the challenges recently faced when commercial Earth observation capabilities expanded. The solution was to issue licenses to U.S. companies with specific restrictions on selling data about certain sensitive national security locations.

However, then and now, we face the problem that commercial companies from other countries are bound by no such restrictions. As with the Earth observation paradigm shift, we face another with SSA/STM no less intractable, but yet must be resolved. A potential approach could be one that parallels how the national airspace today manages sensitive missions. Currently, the FAA and DoD coordinate every day at both local, regional and national levels with air traffic control to protect information related to the presence of high value assets operating in the national airspace. For example, military flights are not included in the national airspace data provided through the popular "Flight Aware" application. These issues have workable solutions.

Clearly there are critical urgent questions that need to be addressed and guidance provided to the greater community about the approach the U.S. government is going to take. While there is evidence of some activity, it does not appear strategic or coordinated to the outside observer. The Department of Commerce recently issued an RFI on space traffic management and space

situational awareness topic. What is not clear to the greater community is how this effort, along with some others, are coordinated to create an "all of government" integrated approach, including the DoD.

Thus, it is becoming urgent to resolve the impasse existing between the Senate and the House on the subject of who should oversee the civil space situational awareness and space traffic management capability for the U.S. government. Industry does not know who to talk to so they are trying to talk to everyone, which has the potential to muddy the waters with a diversity of business desires rather than a thoughtful strategy. Until this question is resolved the Air Force has no identifiable partner to coordinate with that has statuary authority. And until this decision is finalized, no civilian executive branch office has the resources to address these critical issues.

We are already behind the curve; the commercial need is urgent. Already a myriad of companies, Northrop Grumman Innovation Systems, Chandah Space Technologies, the Japanese company Astroscale, and the Israeli company Effective Space are or soon will be actively seeking regulatory approval for dynamic space activities. Equally important, in absence of U.S. leadership and input on this global problem, other national governments will be making decisions, setting precedents, and defining by default what the global system will comprise. International regulations will be shaped by who leads. We cannot afford not to be part of that dynamic.

Recognizing the significance of this topic, there is substantial activity underway on the topics of SSA/STM ongoing in consortia and non-profit organizations. AIAA published a white paper in October 2017 and formed a working group to address some of the technical issues around data. Their work includes the compilation of a lexicon and an outline of the problem set that needs to be addressed across the landscape of the SSA/STM eco-system. Secure World has also been very active in this area. Industry consensus safety and technical standards are being developed by the Consortium For Execution of Rendezvous and Servicing Operations (CONFERS) and will be invaluable to these regulators. While all of these efforts are admirable and will help reach a solution, without a civil authority, the US is limited in its actions.

I would like to close with two important points. First, we need immediate and urgent all-of-government vision and direction on the definition of the U.S. SSA/STM capability. Next, we need reach out to our international partners to provide input and strong US leadership, leveraging our world-leading technical expertise on this issue globally.

Thank you for the opportunity to discuss this important and exciting topic with you, and I look forward to our discussion.