

Hearing of the Senate Space, Science, and Competitiveness Subcommittee

“Reopening the American Frontier: Exploring How the Outer Space Treaty Will Impact American Commerce and Settlement in Space”

Tuesday, May 23, 2017 – 2:30 pm – Russell Senate Office Building

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Thank you Chairman Cruz, Ranking Member Markey, distinguished members of the Subcommittee, as well as the Subcommittee’s dedicated and hardworking staff, for this opportunity to discuss the *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*, commonly referred to as the Outer Space Treaty (“OST” or the “Treaty”). My name is Mike Gold and I am Vice President of Washington Operations and Business Development for Space Systems Loral (“SSL”).

SSL is America’s most prolific commercial communications satellite manufacturer. Over eighty satellites built by SSL are currently in orbit providing services to the entire populated surface of the Earth. Billions of people depend upon satellites manufactured by SSL every day. Moreover, SSL is a trailblazer in space-based robotics, supporting a variety of innovative projects with both the National Aeronautics and Space Administration (“NASA”) and the Defense Advanced Research Projects Agency (“DARPA”). SSL is also a global leader in space-based propulsion, leveraging highly reliable and robust systems such as the 1300 bus, a proven workhorse, while advancing the state of the art with new solar electric propulsion technologies. Earth observation and other types of satellites are generating an ever-increasing volume of data that can be leveraged for national security, commerce, and science. SSL and its affiliated companies have decades of experience extracting useful information from data through advanced image and signal processing as well as change detection. SSL provides customers with complete end-to-end services from satellite manufacturing to data analysis.

SSL employs thousands of engineers, scientists, and technicians across the country, and has been a leader in ‘commercial space’ over many decades. For SSL, and the American commercial space industry as a whole, to continue to survive and thrive, a regulatory environment that is conducive to innovation as well as private sector operations and growth is vital. The OST, which forms the foundation of global space law, addresses a wide variety of issues and activities. However, the most relevant portion of the Treaty, which requires immediate action from policymakers, relates to Article VI.

I. “Continuing Supervision” Under Article VI of the Outer Space Treaty

Article VI of the Outer Space Treaty states in relevant part:

“The activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require *authorization and continuing supervision* by the appropriate State Party to the Treaty.” (*emphasis added*)

Authorization and continuing supervision for established commercial space activities, such as telecommunications or remote sensing, are currently conducted by, respectively, the Federal Communications Commission (“FCC”) and the National Oceanic and Atmospheric Administration (“NOAA”). However, there is no established process for the United States Government (“USG”) to authorize or supervise new, innovative commercial space activities.

There has never been a more exciting time to be in the commercial space world. Private sector space stations, space tourism, asteroid mining, and commercial lunar rovers are all transitioning from science fiction to reality. American entrepreneurs are leading the way into this new frontier, and we are still at the very beginning of what is certain to be an era of great change and progress. Like every other space activity, the satellite industry could be transformed by new technologies and concepts. Specifically, the introduction of robotic satellite servicing in low Earth orbit (“LEO”), as well as in geosynchronous orbit (“GEO”), may substantially alter the industry’s existing paradigm.

A. The Importance of Satellite Servicing

SSL is currently supporting two innovative satellite servicing activities, NASA’s Restore-L and DARPA’s Robotic Servicing of Geosynchronous Satellites (“RSGS”). The Restore-L mission is focused on a robotic spacecraft refueling Landsat-7 (a NASA remote sensing satellite). SSL satellites are built to last and their operational lifetimes are nearly always limited due to a lack of fuel. Via Restore-L, NASA and SSL will demonstrate the ability to overcome this challenge by delivering fuel to satellites, substantially extending their lifetimes.

DARPA’s RSGS program will focus on repairing satellites as well as adding and replacing satellite components. Fixing a satellite that has failed to deploy properly would save American taxpayers hundreds of millions of dollars. Moreover, the ability to add and/or replace various components will substantially bolster satellite capabilities, ensuring that regardless of when a satellite is launched, it can still take advantage of new technologies. This ability to add components could also be used to attach payloads that will enable a satellite to protect itself from tampering or attacks.

RSGS and Restore-L are complimentary activities, each focused on unique technological proficiencies, although both systems will be capable of conducting such operations as satellite inspection and refueling. However, RSGS and Restore-L will operate in two very different environments. Restore-L will be placed in a LEO Polar orbit where it will circle the Earth approximately fourteen times per day. Restore-L will use Tracking and Data Relay Satellite Systems (“TDRSS”) for communications and will serve as a testbed for advancing critical space-

based robotics and automation to support future human spaceflight and robotic exploration missions. RSGS will operate in GEO, where it will orbit the Earth only once per day and will utilize ground-based communications systems. The primary objective of RSGS is to enhance the security and resiliency of military satellites while evolving the state of the art in defense-related robotics.

Per DARPA's support of RSGS, mastering satellite servicing is critical to national security. Earlier this month, Daniel Coats, Director of National Intelligence ("DNI"), made the following statements for the record to the Senate Select Committee on Intelligence.

"We assess that Russia and China perceive a need to offset any US military advantage derived from military, civil, or commercial space systems and are increasingly considering attacks against satellite systems as part of their future warfare doctrine. Both will continue to pursue a full range of anti-satellite (ASAT) weapons as a means to reduce US military effectiveness. In late 2015, China established a new service—the PLA Strategic Support Force—probably to improve oversight and command of Beijing's growing military interests in space and cyberspace. Some new Russian and Chinese ASAT weapons, including destructive systems, will probably complete development in the next several years. Russian military strategists likely view counterspace weapons as an integral part of broader aerospace defense rearmament and are very likely pursuing a diverse suite of capabilities to affect satellites in all orbital regimes. Russian lawmakers have promoted military pursuit of ASAT missiles to strike low-Earth orbiting satellites, and Russia is testing such a weapon for eventual deployment. A Russian official also acknowledged development of an aircraft-launched missile capable of destroying satellites in low-Earth orbit. Ten years after China intercepted one of its own satellites in low-Earth orbit, its ground-launched ASAT missiles might be nearing operational service within the PLA. Both countries are advancing directed energy weapons technologies for the purpose of fielding ASAT systems that could blind or damage sensitive space-based optical sensors. Russia is developing an airborne laser weapon for use against US satellites. Russia and China continue to conduct sophisticated on-orbit satellite activities, such as rendezvous and proximity operations, at least some of which are likely intended to test dual-use technologies with inherent counterspace functionality. For instance, space robotic technology research for satellite servicing and debris-removal might be used to damage satellites. Such missions will pose a particular challenge in the future, complicating the US ability to characterize the space environment, decipher intent of space activity, and provide advance threat warning."

As described by the DNI, potential adversaries are actively developing weapons to attack satellites in "all orbital regimes" while perfecting their own space-based robotics, rendezvous, and proximity capabilities. The U.S. cannot leave its critical orbital assets vulnerable to attack and the U.S. Government should be sponsoring additional follow-on programs to RSGS and Restore-L. Numerous missions will be needed to successfully develop and implement holistic satellite servicing proficiencies, ensuring that vital national security and economic assets in both LEO and GEO are properly protected.

Moreover, while satellite servicing capabilities are vital, they are only the first step on the road to even more exciting technological developments, such as the deployment of persistent platforms. Currently, roughly eighty percent of an average GEO telecommunications satellite is comprised of propulsion, power generation, radiators, redundant parts, and other subsystems that keep the satellite flying and healthy. Only twenty percent of the mass of most satellites conduct the revenue generating activity.

We need to reverse this paradigm and reduce the amount of infrastructure that each satellite requires. The persistent platform concept accomplishes this by deploying a truss in space, similar to what was done with the International Space Station. However, instead of accommodating astronauts and habitats, this truss would contain power generation, thermal controls, propulsion systems, and connection points for a dozen or more ‘plug and play’ payloads. Robotic servicing systems developed via programs such as Restore-L and RSGS would deliver the payloads (that would support a wide variety of activities including communications, remote sensing, and space situational awareness) to the persistent platform for attachment. The payloads would share the platform’s propulsion, power, and other capabilities, removing the cost and need to construct, launch, and support these systems and subsystems for each individual payload. Additionally, when a payload becomes obsolete or fails, the robotic servicing craft will switch out the old payload with a new one, providing the ability to refresh technology in a way that is impossible today. This persistent platform architecture will dramatically lower the cost of orbital operations while enhancing capabilities. Space Systems Loral is currently investing millions of its own dollars to further develop this next-generation strategy, which will play an important role in transforming not only commercial space operations, but national security and scientific missions as well.

B. The Challenge of Regulatory Uncertainty

For satellite servicing, persistent platform, or any other technological advances to take place, funding is required. Investors that will finance such projects crave predictability, transparency, and efficiency. When a positive regulatory environment is aligned with technological growth, innovation flourishes. However, as described previously, there is no established USG process for providing authorization and continuing supervision of non-traditional space activities such as satellite servicing. This situation has already caused confusion and could ultimately lead to programmatic delays and forum shopping. Currently, the FAA Office of Commercial Space Transportation (“FAA AST” or “AST”) serves as the de facto federal entity that companies have gone to for their innovative commercial activities. Bigelow Aerospace and, most recently, Moon Express, have leveraged the FAA AST’s payload review process to obtain reassurance that their proposed lunar operations would not conflict with USG interests or activities. Due to the lack of an established process, both companies combined their payload review applications with voluntary disclosures to relevant federal agencies and departments such as NASA, and the Departments of Defense and State, to support and expedite the interagency process. Although I believe that both Bigelow Aerospace and Moon Express were ultimately satisfied with the end result, officials at the FAA AST as well as the Departments of Defense and State, have repeatedly voiced concerns that the current ad hoc process is untenable and may result in negative payload reviews if Congress does not provide additional direction to clarify jurisdiction and establish relevant procedures.

Entrepreneurs pursuing daring new concepts have helped to revitalize the American aerospace sector and will carry this nation into the future. However, innovative commercial space activities require funding. Internal and external investors, as well as insurers, need to know what, if any, regulatory risks a particular project will face before financing an initiative. Therefore, the lack of a defined process for non-traditional space activities is anathema to investors and insurers alike. Non-traditional commercial space operations inherently involve many risks. Businesses and investors that are already embracing trailblazing activities should not be asked to also bear the added burden of regulatory uncertainty. The U.S.'s regulatory environment should encourage growth and investment, whereas the current lack of an established process creates yet another challenge for entrepreneurs to overcome. For example, the existing lack of defined deadlines, explicit areas for review, and transparency requirements all empower the bureaucracy while leaving companies with little to no recourse to gain the certainty they need to obtain funding and execute their business plans. Congress should take action with alacrity to address this challenge and remove a potentially problematic barrier to entry.

C. Enhanced Payload Reviews

As noted previously, the FAA AST already has the authority to conduct payload reviews. Despite the lack of an established process, the AST has successfully executed these reviews for non-traditional commercial space activities. The AST has a great deal of experience conducting interagency reviews in an effective and expeditious manner, and while no process is perfect, my professional experiences working with the AST has been overwhelmingly positive. Instead of creating new bureaucracies and needlessly spending additional taxpayer dollars, Congress should support a concept that was initially proposed by Congressman Jim Bridenstine, to simply expand the existing payload review process to include non-traditional space activities. This 'enhanced' payload review process represents the most expeditious, cost effective, and least disruptive strategy to address America's Article VI obligations. Congress could direct the AST to augment payload reviews in this manner, while also establishing a presumption of approval, deadlines, and other forms of protection to support an efficient process. Again, the AST is essentially doing this work already and has demonstrated the ability to successfully execute a non-traditional interagency payload review.

The enhanced payload review process would provide an elegant and effective means of addressing Article VI's requirement for authorization and continuing supervision of non-traditional space activities. By providing a governmental review and approving a payload, the 'authorization' component of Article VI is clearly met. The 'continuing supervision' obligation could similarly be addressed in a relatively simple fashion by including a proviso in a payload review approval letter requiring that if the proposed non-traditional space activity substantially changes from what was described in the payload review application, an update must be provided to the AST. This simple, benign clause, would be sufficient to address Article VI's continuing supervision requirement, and I believe that the relevant attorneys and policy leadership at the Department of State would agree with this contention.

An enhanced payload review approval is especially helpful to entrepreneurs since, via the interagency process, the approval carries with it the support of both the Department of Defense and the Department of State. While NASA, the Department of Commerce, the FCC, and other

agencies are also part of the payload review process, it is particularly important to have a mechanism for the Departments of Defense and State to be able to provide feedback. Companies need to know that their proposed activities will not interfere with Defense and/or Intelligence Community operations. Similarly, it is vital that a review process include an avenue for the Department of State to provide input relative to international treaty obligations. Ensuring that neither the Departments of Defense or State will object to a commercial space activity taking place is vital for entrepreneurs to obtain the regulatory certainty that they need to raise funds and execute innovative programs.

Again, regulatory certainty is vital, and even if the U.S. were not a signatory to the OST, entrepreneurs would still need the enhanced payload review process to ensure that their operations could proceed without fear of objection from Defense, State, or other USG departments or entities. Moreover, the Enhanced Payload Review process provides a mechanism to de-conflict domestic private sector activities, ensuring that non-traditional commercial space operations can occur without fear of interfering with each other.

The Enhanced Payload Review process also provides the private sector with protection against a more pernicious interpretation of the OST's 'continuing supervision' requirement. In the realm of export control, USG supervision was often implemented in a counterproductive and even irrational manner. The Enhanced Payload Review process would establish a commonsense means of meeting U.S. obligations under Article VI, while also providing the private sector with the regulatory certainty that it needs regardless of any treaty obligations.

II. Problematic and Unclear Aspects of the Outer Space Treaty

A. Article XII

Article XII of the OST states that:

“All stations, installations, equipment and space vehicles on the Moon and other celestial bodies shall be open to representatives of other States Parties to the Treaty on a basis of reciprocity. Such representatives shall give reasonable advance notice of a projected visit, in order that appropriate consultations may be held and that maximum precautions may be taken to assure safety and to avoid interference with normal operations in the facility to be visited.”

It is likely that when the OST was drafted fifty years ago, private sector space stations, lunar facilities, and commercial transportation vehicles were not contemplated or even imagined. However, what was once science fiction is now becoming reality, and Article XII's requirement that foreign representatives be allowed to visit such facilities or spacecraft represents an unreasonable and possibly illegal demand for the USG to make upon the private sector. As a matter of fact, if a private sector company complies with Article XII, such actions could violate domestic export control laws depending upon the nationality of the visiting foreign representative. Although the U.S. has and should continue to support the peaceful development of space and encourage international cooperation and comity, due to the development of non-

governmental spacecraft and the potential for future private sector orbital and/or lunar facilities, the requirements of Article XII warrants attention.

B. Unclear Aspects of the OST

There are several aspects of the OST that remain vague and/or are open to interpretation. For example, Article I of the Outer Space Treaty states in relevant part that:

“The exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.”

Although nothing in the OST prohibits commercial activities, language such as this has been raised by some nations to justify calls for the mandatory sharing of any economic benefits gained by private sector entities via outer space operations. Conversely, the U.S. and many other nations would interpret this clause to support free access (which is referenced later in Article I) to all countries for the exploration and use of outer space.

Additionally, Article II of the OST states that:

“Outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.”

Some nations have interpreted this language to prevent the extraction and utilization of space resources by the private sector, or to create a global system of benefits distribution per the language cited previously in Article I. The U.S., and many other countries, do not share this interpretation of Article II and, per the Commercial Space Launch Competitiveness Act, contend that the utilization of extraterrestrial resources by the private sector does not conflict with Article II or any other aspect of the OST. During the most recent meeting of the United Nations Committee on the Peaceful Uses of Outer Space (“COPUOS”) Legal Subcommittee, the issue of asteroid mining and Article II were discussed at great length. Again, Article II does not prohibit or even limit asteroid mining or similar activities on other celestial bodies, but this debate and issue also warrants continued attention.

III. The Benefits of the Outer Space Treaty and the Dangers of Revision

The Outer Space Treaty provides the fundamental underpinnings for international space activities. As described previously, there are aspects of the Treaty that are imperfect and open to interpretation, but despite the passage of fifty years, the OST has generally withstood the test of time. The reason for this can be found in the name of the OST itself. Specifically, The OST is a “Treaty on Principles”. The OST lays out general principles such as the prohibition of weapons of mass destruction, the prevention of one country interfering with another country’s space operations, and nation’s supervising non-governmental activities. The OST is not a proscriptive document and, in a manner that is similar to federalism in the U.S., the Treaty provides each nation with the freedom to meet its obligations in their own way. For example, Article VI does

not dictate how countries should supervise private sector operations, it simply states that supervision should take place, and leaves it to individual countries to adopt laws and regulations that best suit their own unique needs and circumstances. This inherent flexibility and adherence to simple, core principles, is why the OST has survived for fifty years and is as relevant today as it was in 1967.

Again, investors, insurers, and the private sector in general need certainty and predictability. For a half century, the OST has provided a stable framework for global space operations that public and private organizations alike have come to depend upon. The U.S. dropping out of the OST would result in a period of great uncertainty and international confusion, hindering the development and growth of both new and mature commercial space activities.

As described previously, there are certainly aspects of the OST that are in need of clarification. It is important for U.S. policymakers to vigorously engage in the dialogue surrounding Articles I, II, and XII, and I am grateful to the Subcommittee for raising the profile of these issues. However, opening up the OST to revisions would likely only result in more language being inserted into the Treaty that would run counter to U.S. interests. There are 84 nations that belong to the COPUOS, and many of them do not share the U.S.'s desire to bolster commercial space development. Therefore, opening up the OST would create additional uncertainty for public and private space operations while running the risk of new language being inserted into the Treaty that would hinder commercial space development. Alternatively, if the U.S. were to drop out of the OST, it would undermine international obligations that support American interests such as the prohibition on weapons of mass destruction in space.

IV. Addressing Outer Space Treaty Issues Without Revising the Treaty

In lieu of actually changing the language of the OST, the Department of State should meet with industry to identify aspects of the OST that need to be addressed. Subsequently, State, in conjunction with industry, can reach out to like-minded nations, focusing on launching states, to establish a consensus via bilateral and multilateral correspondence and agreements. This strategy would help to clarify and address any shortcomings of the OST, without running the risk of opening the Treaty up to modifications that would further hinder commercial development.

The Department of State should be commended for aggressively reaching out to the private sector. As Chair of the Commercial Space Transportation Advisory Committee (“COMSTAC”, the federal advisory committee to the FAA AST), I have joined the U.S. delegation during COPUOS sessions and have been consistently impressed with the leadership the Department of State has shown in vigorously defending private sector interests. Under the stewardship of Secretary of State Rex Tillerson, who of course has substantial experience in both international relations and exploring the development of new resources, I expect that the Department of State will continue to work closely with the private sector to grow domestic commercial space activities benefiting both the U.S. and the world.

However, additional industry feedback is always helpful, and the Department of State may want to consider establishing a Federal Advisory Committee, similar to the COMSTAC, to

provide the Department with independent input, guidance, and advice. Members of such an Advisory Committee could be nominated by the Director of the Office of Space and Advanced Technology for review and approval by the Secretary. The Department of State already actively consults with numerous companies and trade associations, and creating a Federal Advisory Committee would formalize this process, ensuring a continued strong and productive relationship between the Department and the commercial space sector.

V. American Policy Leadership

When the U.S. leads in space exploration and utilization, the world benefits. Furthermore, U.S. leadership should not be limited to technological advances, but must also include policy development. The U.S. has an opportunity to demonstrate how nations can address their Article VI obligations, establishing a model for other countries to follow, and I therefore urge the Subcommittee to address this issue with alacrity. Innovative space operations such as private sector space habitats, asteroid mining, commercial lunar rovers, and satellite servicing are all transitioning from dreams into reality. Yet, the question remains, where will these activities occur and which nations will benefit. Again, when a positive regulatory environment is aligned with technological growth, innovation flourishes. Countries such as the United Arab Emirates have already developed holistic national space laws that comply with the OST while empowering entrepreneurship. Similarly, Luxembourg has leaned forward and has not only developed laws that support asteroid mining, but is actually investing government dollars to fund such commercial endeavors. The U.S. should learn from the UAE, Luxembourg, and other nations to adopt a regulatory regime that implements and improves upon global best practices. American entrepreneurs, investors, engineers, and scientists are doing their part to create a bold new future for our country in the final frontier. Now we need Congress to support aerospace innovation by establishing a regulatory regime that provides certainty, transparency, and efficiency.

I appreciate this opportunity to testify before the Subcommittee and look forward to your questions.