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Governing in a Crowded Space: The OST and Development of the Legal Regime for Space

A Virtual Think Tank (ViTTa)® Report

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What is ViTTa®?

NSI's **Virtual Think Tank (ViTTa®)** provides rapid response to critical information needs by pulsing our global network of subject matter experts (SMEs) to generate a wide range of expert insight. For this SMA Contested Space Operations project, ViTTa was used to address 23 unclassified questions submitted by the Joint Staff and US Air Force project sponsors. The ViTTa team received written and verbal input from over 111 experts from National Security Space, as well as civil, commercial, legal, think tank, and academic communities working space and space policy. Each Space ViTTa report contains two sections: 1) a summary response to the question asked; and 2) the full written and/or transcribed interview input received from each expert contributor organized alphabetically. Biographies for all expert contributors have been collated in a companion document.

[1] For access to the complete corpus of interview transcripts and written subject matter expert responses hosted on our NSI SharePoint site, please contact **gpopp@nsiteam.com**

Cover Art: Signing of the Outer Space Treaty. http://www.unoosa.org/oosa/en/ourwork/spacelaw/index.html

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Questions of Focus

[Q19] What international legal codes or norms are needed to govern the increasingly crowded space domain?

[Q23] Fifty years of space has seen much change. Which aspects of the Outer Space Treaty of 1967 are still valid and which need updating? Is it better to add to/amend the 1967 Treaty or to establish a new framework for the 21st century?

Expert Contributors

Anonymous Contributor;[2] **Major General (USAF ret.) James Armor**[3] (Orbital ATK); **Marc Berkowitz** (Lockheed Martin); **Dr. P.J. Blount** (University of Luxembourg); **Dean Cheng** (Heritage Foundation); **Faulconer Consulting Group**; **Jonathan D. Fox** (Defense Threat Reduction Agency Global Futures Office); **Joanne Gabrynowicz** (University of Mississippi School of Law); **Dr. Nancy Gallagher** (Center for International and Security Studies at Maryland); **Gilmour Space Technologies**, Australia; **Dr. Peter L. Hays** (George Washington University); **Dr. Henry R. Hertzfeld** (George Washington University); **Theresa Hitchens** (Center for International and Security Studies at Maryland); **Christopher Johnson** (Secure World Foundation); **Group Captain (Indian Air Force ret.) Ajey Lele**[4] (Institute for Defence Studies and Analyses, India); **David Koplow** (Georgetown University Law Center); **Tanja Masson-Zwaan** (Leiden University, Netherlands); **Paul Meyer** (Simon Fraser University, Canada); **Dr. George Nield** (Federal Aviation Administration); **Michiru Nishida**[5] (Ministry of Foreign Affairs of Japan, Japan); **Dr. Luca Rossettini** (D-Orbit, Italy); **Matthew Schaefer and Jack M. Beard** (University of Nebraska College of Law); **Dr. Michael K. Simpson** (Secure World Foundation); **Spire Global Inc.**; **Dr. Cassandra Steer** (Women in International Security-Canada, Canada); **Dr. Mark J. Sundahl** (Cleveland-Marshall College of Law); **Anne Sweet** (NASA); **ViaSat, Inc.**; **Dr. Frans von der Dunk** (University of Nebraska College of Law); **Dr. Brian Weeden** (Secure World Foundation)

Summary Response

The 1967 Outer Space Treaty (OST) is the lynchpin of the current international legal regime for space. 105 countries have ratified the treaty, while another 25 are signatories.[6] The OST extends the UN Charter and its underlying principles to outer space (Berkowitz), and provides additional principles to guide activities in space. These principles have been elaborated and further codified in three subsequent

[2] This contributor elected to remain anonymous.
[3] Armor's personal views, and not those of his organization, are represented in his contribution to this report.
[4] Lele's personal views, and not those of his organization, are represented in his contribution to this report.
[5] Nishida's personal views, and not those of his organization, are represented in his contribution to this report.
[6] COPUOS, Legal Subcommittee, 56th Session, Status of International Agreements relating to activities in outer space as at 1 January 2017.

UN treaties related to space activity: the 1968 Rescue Agreement, 1972 Liability Convention, and 1975 Registration Convention.[7]

OST: Retain, Amend, Replace?

The OST and the other "core" treaties were drafted in a relatively short time in the late 1960's to mid-1970s. The principles upon which they rest—peaceful use of space, free access, and non-territoriality—clearly reflect a shared contemporary concern that Cold War competition could spill over into space. Today, these principles can often be found at the center of arguments that the OST is obsolete, or at least in need of amendment.

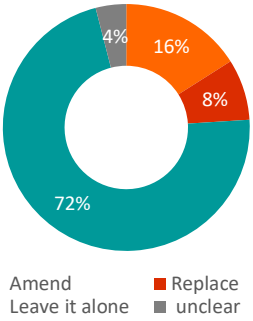

Figure 1: Future of the OST

However, when asked whether they thought the OST should be amended or replaced, a large majority of the contributors (see Figure 1) respond that the treaty should not be changed at all. Furthermore, contributors who favor amendment specified changes that are limited in scope, rather than a more comprehensive revision of the treaty.[8] As Figure 2 shows, opinion does vary between different groups of expert contributors. Academics overwhelmingly favor keeping the OST without change, while the majority of contributors representing commercial enterprises favor amendment or replacement.

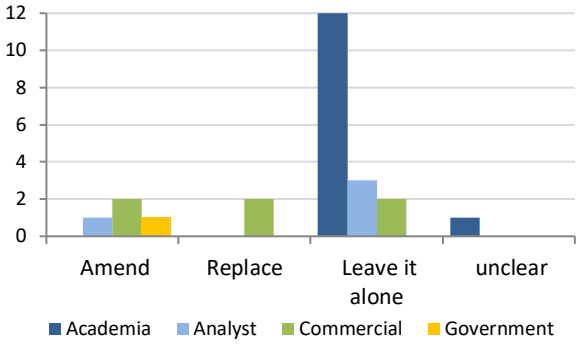

Figure 2: Support for Continuation of OST by Expert Type

OST: Comprehensive Law or Guiding Principles?

The division in opinion over whether to keep the OST unchanged, or amend or replace it, appears to derive primarily from how the contributors conceptualize the role of the OST in space governance. Those favoring amendment or replacement appear to be considering the OST as a stand-alone and independently comprehensive legal document. In light of the enormous changes in the actors involved in the space domain, this perspective leads them to conclude that the OST cannot provide the legal structure necessary for ensuring the development of either commercial space, or the national security interests of the US in space.

In contrast, those who oppose changing the OST consider it as a set of guiding principles for governing space, rather than a comprehensive set of regulations. David Koplow of the Georgetown University Law Center, Dr. Cassandra Steer of Women in International Security-Canada, and Dr. Brian Weeden of the Secure World Foundation compare its role to that of the US constitution. In a similar vein, Dr. Mark J. Sundahl of the Cleveland-Marshall College of Law and Koplow evoke the Magna Carta. However, as

[7] 1967 Outer Space Treaty; 1968 Rescue Agreement; 1972 Liability Convention; 1975 Registration Convention. The Moon Agreement was also created in 1979 and is regarded by some as the fifth core treaty. However, many experts noted, the Moon Agreement is by far the least influential as it has been ratified by only 17 states and no spacefaring nations, including Russia and the US, are parties to the treaty (Blount; Gabrynowicz; Hays; Kasku-Jackson; Koplow; Masson-Zwaan; Spire Global Inc.; Schaefer; Steer; Sundahl).

[8] Two of the four in favor of amendment specify the need for amendments to account for property rights (Cheng; Faulconer), and another supports changes "only at the margins" (Berkowitz).

Koplow notes,[9] just as statements of foundational principles are insufficient to govern a state, they are also insufficient to govern space.

> It's as if, in the case of the United States, we had adopted the Constitution, but then Congress did not get around to passing any laws after. The Constitution sets out the general principles, but you have to flesh those out.

Understood in this light, the continued relevance of the OST is not a function of whether it can address all contingencies and legal requirements for current and future activities in space. Rather, what matters is whether it provides an operative framework for creating subsidiary treaties, agreements, and norms to regulate activities in space. Those who support the continuation of the OST unchanged, judge it to be capable of doing this (Armor; Blount; Gabrynowicz; Gallagher; Hitchens; Johnson; Meyer; Steer; Sundahl). Furthermore, they state, it has been successful; enabling safe and secure access to space (Gabrynowicz; Meyer; Sundahl), blocking the placement of nuclear weapons in space (Gabrynowicz; Sundahl), and preventing national appropriation of the Moon or other celestial bodies (Sundahl). This success has, in turn, given the OST a level of legitimacy and influence that would be difficult to recreate in a new treaty. Christopher Johnson of the Secure World Foundation concludes:

> This demonstrates that, rather than the treaty showing its age after fifty years, this long-standing treaty has facilitated five decades of the peaceful and profitable uses of the access, exploration, and use of outer space, and that states respect and observe the treaty.

Arguments for Leaving the OST Alone

Supporters of the OST in its current form tend to see amendment (and even more so replacement) not only as unnecessary but as potentially perilous as well. They do not take this position out of a belief that there is no need to further develop international space law and norms. In fact, all identify very similar areas of activity that need further codification to those presented by the contributors who argue that the OST should be amended or replaced. Rather, their concerns arise from the potential threat to the legitimacy and support for existing space law, more generally, that changes to the OST could trigger.

Several argue that if the OST were opened to amendment, the process may be difficult to control,[10] as amending one section of the treaty would put other sections "on the table" as well (Hertzfeld). This, as Major General (USAF ret.) James Armor of Orbital OTK puts it, may "encourage mischief" and be counter to US interests. Similarly, Joanne Gabrynowicz of the University of Mississippi School of Law and an Anonymous Contributor[11] see opening the OST as inviting the potential loss of the prohibition on nuclear weapons and WMD in space. Although not in favor of altering the OST, Paul Meyer of Simon Fraser University notes[12] that some see a potential for supplementing the OST without running the risks of opening up the treaty text itself. In multilateral diplomacy this is often accomplished through developing an "Optional Protocol" that can supplement the original treaty in some way (e.g., extend the ban on WMD to all space-based weapons, or provide for the type of institutional support such as annual meetings of states parties that is common now but which the OST lacks).

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[9] See also the contribution from Weeden.

[10] Gabrynowicz; Hertzfeld; Masson-Zwaan; Spire Global Inc.; Steer.

[11] This contributor elected to remain anonymous.

[12] Clarification on this point was provided by Meyer during the final review of this report.

The OST has Provided a Durable Set of Principles

As Steer argues, recent negotiations over new legal codes for space, which have stalemated over key national security concerns,[13] should serve as a warning that the fundamental principles of the OST are not necessarily undisputed. Is this not an argument *for* amendment or replacement? Not according to a number of the contributors who provided input for this report.

When the OST and three core treaties were negotiated, there were only two nations active in space, and less than 20 members of the Committee on the Peaceful Use of Outer Space (COPUOS). There are now 85 members, as well as many countries with assets in space and a quickly expanding set of commercial space actors (Hertzfeld; Simpson; Steer). Given the current international and space environments, contributors are doubtful that a new or significantly amended treaty could reach greater consensus than the OST (Anonymous Contributor; von der Dunk), and any new treaty is expected to take years, even decades, to complete, if it is at all (Anonymous Contributor; Armor; Hertzfeld). During this time, as an Anonymous Contributor notes, "new customary international rules" for space may emerge[14] that may not work or serve US interests as well as the current treaty (Blount; Gallagher). That is to say, simply engaging in the process of renegotiation could undermine the authority the OST by creating competing principles for actions in space. Meyer makes an important point regarding the influence of the OST over the past 50 years:

> We are repeatedly told that space is 'congested, competitive, and contested' but not reminded that it has been a realm of remarkable international 'cooperation' as well. The Outer Space Treaty embodied this cooperative approach.

Spillover Effect

Steer notes that the key "principles and clauses are today considered to be customary international law, thus binding on all states, regardless of whether they are party to the OST or not." When considered in conjunction with the observation of Dr. P.J. Blount of the University of Luxembourg, that "there is a regime of treaties and UNGA resolutions that elaborate on particular aspects of the Outer Space Treaty, and there is a growing body of domestic law and policy that reveals how states are interpreting ambiguities in the treaty," the broader implications of amending or replacing the OST become clearer. If the legal regime in space is indeed rooted in the OST, then any changes to the substance or standing of the treaty would spillover to affect other legal codes for space.

Governance in Space

As noted above, regardless of their position on the OST (amend, replace, retain), when asked what changes to international legal codes or norms are needed to govern the increasingly crowded space domain, contributors raise a fairly consistent list of issues. Nevertheless, differences of opinion and interpretation do emerge.

[13] Particular barriers include issues of the nature of the use of force and self-defense as represented in the proposed "International Code of Conduct" (ICoC), and space weapons in the descriptively named "Treaty on Prevention of the Placement of Weapons in Outer Space, or the Threat or Use of Force Against Outer Space Objects."

[14] See also the contributions from Armor; Hertzfeld.

State-Centrism of Current Codes

Dr. Henry Hertzfeld of George Washington University sees the state-centric focus of existing legal codes as problematic given the rapid increase in the number of non-state actors involved in space activities. He suggests that while "[t]echnically, nations are responsible for their activities in outer space and even liable for them," there is "a whole set of commercial law that is not that precisely defined for space." Relatedly, Steer notes that the rise to prominence of commercial space actors was "either not foreseen by the drafters of the OST, or, given the political pressures at the time, simply not a priority."[15] As a result, many contributors identify commercial space activities as an area in which clearer legal codes and regulations are needed. Differences of opinion involve whether commercial activities can be accommodated within the OST in its present form. Dr. Frans von der Dunk of the University of Nebraska College of Law and Armor believe that they can. Among those who think not, Jonathan Fox of the Defense Threat Reduction Agency and contributors from Faulconer Consulting Group point to Article VI[16] of the OST in particular as needing "to be substantially modified to provide protection of space-related commercial rights arising in the coming years" (Fox).

Barriers to Commercial Development

As space actors are diversifying, so are the activities in which they engage. Article II and the non-appropriation principle[17] have been the focus of arguments that the OST stands in the way of commercial development in outer space (Blount). Article II is seen to present significant barriers to commercial actors and investors operating beyond Earth (space tourism, space hotels) (Cheng), as well as those interested in developing space mining (Faulconer Consulting Group; Fox). Fox contends that, as it stands, the OST prevents "legitimate exercise of market-based commercial activities (including natural resource mining, refining, exploration, extraction, transportation, and other related functions) as may safely and practicably be undertaken under the license and authority of space-faring nations, in accordance with their applicable laws."

Countering this, Armor notes: "the recent [US] Commercial Launch Competitiveness Act allowed 'ownership' of resources removed from planetary bodies. It does not violate the OST at all but clarifies commercial exploitation consistent with original intent of the Treaty."[18] Weeden agrees that there is a lack of clarity in the existing principle but notes that lawyers and economists have used fishing laws as a potential model which would enable resource extraction and use without requiring territorial ownership. This view is shared by Blount, who sees the implications of such changes as far-reaching and potentially detrimental to the United States' national security interests:

> It would be foolish to discard a foundational security treaty that helps to maintain international peace over the question of property rights…While the Outer Space Treaty may increase the cost of doing business for commercial operators, their investments would not be safe without such a treaty.

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[15] See also the contribution from Berkowitz.

[16] Article VI: "States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. 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."

[17] OST Article II: "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."

[18] See also the contributions from Blount; Weeden.

Governance of Space Debris and Traffic

As the space domain becomes more crowded the need for regulation to protect assets and valuable orbits has become apparent if space is to remain sustainable (Sundahl). Space debris is in many ways a classic collective action problem—it creates potential risk to every space actor, if not addressed it could ultimately render space unsafe for all, and it cannot be "solved" without cooperation between most or all space actors.

Orbital debris guidelines, such as those developed by the Inter-Agency Space Debris Coordination Committee (IADC), have been effective but need to be updated to account for new capabilities, such as large constellations of satellites (Spire Global Inc.). While Steer notes that these guidelines have generated "a very high level of compliance," Dr. Luca Rossettini of D-Orbit and contributors from Spire Global Inc. argue that binding rules and some enforcement mechanism are required. Matthew Schaefer of the University of Nebraska College of Law notes, however, that ownership issues may create a problem here. Specifically, whether objects owned by another actor can legally be removed without the owner's consent.

Space traffic is also seen by the contributors to be an area in which the need for better regulation is becoming more pressing, as it threatens the collective interest of all space actors in the long-term (Steer; Sundahl; Weeden). Commercial plans for satellite servicing, refueling, and outer-orbit inspections will involve getting close to and docking with satellites (Weeden), and Rossettini argues that regulation and clear norms need to be created "to ensure the use of space becomes a controllable or at least verifiable."

Surveillance and Irresponsible Behavior

Traffic and proximity issues also raise national security concerns. Sundahl and Weeden both give the example of a state actor flying satellites close to those of an adversary. As Weeden ponders:

> What is the space equivalent of an Incidents at Sea Agreement that is going to kind of give a bright line of 'you should do this, this is how you behave responsibly, and this is how we do it normally,' and if there is deviation from that, it suddenly becomes an indication or warning that something is not right.

Without agreed upon norms of behavior, the potential exists for either unintended escalation or loss of security. To this point, Steer suggests further development of data sharing and transparency norms. This approach is consistent with discussions by Tanja Masson-Zwaan of Leiden University, Dr. Nancy Gallagher of the Center for International and Security Studies at Maryland, and Johnson, and reflects the assessment of Marc Berkowitz of Lockheed Martin that there is a need to strengthen mechanisms for consultation, crisis management, and dispute resolution.

Bottom Line

Regardless of their stance on the OST, all of the contributors see existing space law and norms as insufficient to manage the rapidly evolving nature of space activities, and the current and potential threats these activities present. As space becomes more crowded, the risk of accidental or intentional harm to an actor's assets increases. And, as space capabilities become more critical to actors, the cost of losing those assets also increases. Both of these conditions create a collective action problem that the further articulation of international norms and regulation could potentially mitigate for all. However,

most contributors do not think that amending or replacing the OST is either necessary or advisable. These contributors warn that opening up the OST would likely trigger a long and uncontrollable process of negotiation that in itself would create uncertainty and undermine the legitimacy of the OST. Furthermore, there is no guarantee that the final treaty would work as well, let alone any better.

Subject Matter Expert Contributions

Anonymous Contributor[19]

n/a
10 October 2017

WRITTEN RESPONSE

[Q19] What international legal codes or norms are needed to govern the increasingly crowded space domain?

The relationship between national registration over a launched object under Article VIII of the Outer Space Treaty and the resultant jurisdiction and control over such space object should be addressed. Some commentators claim that it is only (national) registration that may generate jurisdiction and control, and others are of the view that ownership, operation or other elements are also the source of jurisdiction and control in view of the present State practice that arguably 20-25 percent of satellites are not registered at least in the UN registry maintained by the UNSG (the true situation of the national registry is most difficult to verify).

Addressing the jurisdictional issue is essential not only in protecting high-value military satellites, but also a series of near future activities including the on-orbit servicing (OOS), active space debris removal (ADR) and asteroid mining.

This could be addressed in the form of non-binding guidelines in the UNCOPUOS or a code of conduct among like-minded countries. While there is a danger of flag-of-convenience problem similar to that seen in the ships could be brought about, yet the idea that nationality for space objects seems worth discussing, for it is the combination of territorial jurisdiction and personal jurisdiction that gives a stable order of jurisdiction to enforce under international law. (Today, as 105 States are parties to the Outer Space Treaty, among those, the registration can work as if it is a hidden nationality, but it is uncertain if Article VIII of the Outer Space Treaty is opposable to a non-party to this Treaty, e.g., Iran.)

[Q23] Fifty years of space has seen much change. Which aspects of the Outer Space Treaty of 1967 are still valid and which need updating? Is it better to add to/amend the 1967 Treaty or to establish a new framework for the 21st century?

Article IV of the Outer Space Treaty is most valuable as one of the most important multilateral arms control regulations. If Article IV is negotiated today, this provision will not possibly be agreed upon either at UNCOPUOS, or in other for a, due to the lack of political will to produce any legally-binding instrument.

Further, the aspect of the sensible silence in the Outer Space Treaty should be commended. For instance, the Outer Space Treaty does not explicitly provide for the inherent right to individual or collective self-defense unlike, e.g., Article IV of the PPWT (CD/1985 (12 June 2014)), thereby not causing unnecessary confusion about the drafter's intention. (In case of the draft PPWT, the relationship between the prohibition of use of force to "outer space object" and the self-defense has to be tackled, and this induces more distrust rather than trust among States.)

It is needless to say that the right of self-defense certainly exists irrespective of how the provisions of a treaty is prescribed. The Outer Space Treaty is reasonable in that it does not provide for unnecessary provisions. Another example is a non-reference of the prohibition of the use or threat of force, found in Article 2 (4) of the UN Charter.

[19] This contributor elected to remain anonymous.

Combination of Article IV of the Outer Space Treaty with Articles 2 (4) and 51 of the UN Charter can be said that constitutes a reasonable norm in the acceptable scope of military use of outer space.

It does not seem that the amendment of the Outer Space Treaty will enhance international security, for a certain elements which can complicate the holistic interpretation of the Treaty may be added. While a little discord of interpretation remains today, there is an overall consensus, or a reasonable degree of agreement with respect to what can be done and what cannot be done under the Outer Space Treaty in terms of military use. This fine balance may be compromised once the work to amend this Treaty starts. Worse, during the (perhaps long) years of negotiating an amendment, some new "customary international rules" in the exploration and use of outer space may be claimed by States which now support the draft PPWT and which have joined the declaration of not being the first to place weapons of any kind in outer space. New rules are needed, e.g., the source of jurisdiction and control, but such should be made in non-legally binding rules.

Major General (USAF ret.) James Armor[20]

Staff Vice President, Washington Operations (Orbital ATK)
7 August 2017

WRITTEN RESPONSE

[Q19] What international legal codes or norms are needed to govern the increasingly crowded space domain?

- Space traffic management (STM)
- Encourage commercial standards & protocols for activities (such as proximity operations and spectrum interference mitigation)
- Encourage "norms of behavior" conventions

[Q23] Fifty years of space has seen much change. Which aspects of the Outer Space Treaty of 1967 are still valid and which need updating? Is it better to add to/amend the 1967 Treaty or to establish a new framework for the 21st century?

- OST is valid – keep it.
- Don't change it. (It will take decades to modify, and will encourage mischief)
- US can help most by "interpreting" the OST and other existing Treaties to the benefit of free enterprise and geo-political stability.
    - FOR INSTANCE, the recent Commercial Launch Competitiveness Act allowed "ownership" of resources removed from planetary bodies. It doesn't violate the OST at all, but clarifies commercial exploitation consistent with original intent of the Treaty
    - FOR INSTANCE, the discussion of the American Free Enterprise Space Commerce Bill highlights compliance with the OST, Section 6 on "authorizing and supervising" commercial activities emanating from the US/US persons is positive in that it clarifies licensing & approvals for commercial business so they can raise financing.

[20] The response here represents the sole views of Armor, and are not intended to represent the position of Orbital ATK.

Marc Berkowitz

Vice President, Space Security (Lockheed Martin)
12 June 2017

WRITTEN RESPONSE

[Q19] What international legal codes or norms are needed to govern the increasingly crowded space domain?

Collateral transparency and confidence building measures such as a code of conduct, rules of the road, and/or incidents in space agreement could reduce the prospect of mishaps, misunderstandings, or misperceptions being created by ambiguous or provocative operational space behavior and thereby lessen the risk of unintentional or inadvertent conflict. In the absence of a formal international agreement, tacit norms for registration, launch, insertion into orbit, on-orbit operations, end-of-life, and deorbit for spaceflight safety that do not create economic or security disadvantages for the US would be useful to deal with the growing number of actors and objects in space. Such norms should address registration, launch notification, conjunctions, electromagnetic interference, anomalies, laser illuminations into space, and other unsafe or irresponsible behaviors that pose risks to flight safety and/or environmental sustainability.

[Q23] Fifty years of space has seen much change. Which aspects of the Outer Space Treaty of 1967 are still valid and which need updating?

The Outer Space Treaty should only be modified on the margin to address commercial space activities that were not envisioned at the time it was negotiated and ratified. In addition, the Treaty should be modified to strengthen or provide provisions regarding consultation, crisis management, and dispute resolution.

It would be wiser to amend the 1967 Treaty than open Pandora's Box and attempt an entirely new framework. Indeed, the US should follow the same process it used in the 1950s and 1960s that eventually established the basis for the Treaty: (1) determine its national objectives and national security interests regarding space activities; (2) establish precedents and standard operating practices through US Government space operations behaviors; (3) use those precedents and practices as the basis for establishing norms and eventually customary international law; and (4) negotiate treaty amendments to codify those desired rule sets.

Dr. P.J. Blount

Postdoctoral Researcher (University of Luxembourg)
7 August 2017

WRITTEN RESPONSE

[Q19] What international legal codes or norms are needed to govern the increasingly crowded space domain?

The space domain is inherently different from other domains, and as such, the strategy for maintaining peace and security within it differs greatly from those used in the domains of land, sea, air, or cyber. This is because of the unique physical attributes of outer space and the historical development of its use by states. From the initial days of human use of outer space, law and policy has been a critical component in ensuring the continued peaceful use of outer space. The legal framework that was developed in the 1960s, and that continues to develop, has been primarily focused on using space for peaceful purposes in order to achieve both national and international security goals.

The legal regime accomplishes this goal by establishing minimal restrictions on states operating within the space domain and coupling those restrictions with requirements for transparency of and accountability for state action in outer space. The principles that developed through a number of UN resolutions and multilateral treaties, primarily the Outer Space Treaty, are the product of the post-WWII Cold War environment, and reflect many values that were needed at the time to prevent great power rivalry from extending into outer space. Nevertheless, these values remain critical in maintaining the peaceful use of space in the post-Cold War world, and their normative force is important in the ongoing development of the law and policy governing outer space. Further, these values support US interests in the free use of a stable and secure space environment.

Before discussing the legal framework that helps to maintain space security. Two things should be noted. First, while there is a legal requirement that space be used for "peaceful purposes," this requirement should not be read as meaning "nonmilitary." Peaceful purposes has been consistently interpreted by most space powers as meaning "non-aggressive" consistent with the UN Charter's Article 2(4) prohibition on the use of force. This means that, in general, defensive uses of the outer space environment are permitted whereas offensive or aggressive uses are banned. Second, this response assumes that the factors that make outer space different as a domain are being covered elsewhere in the SMA questions, and little time will be spent explaining these. This is not meant to minimize these factors as they are critically important to understanding how law and norms function to regulate space security. For example, while peaceful purposes is interpreted to be consistent with the UN Charter, the unique physical nature of space creates a grey area in which some activities that would usually be non-aggressive may be considered to be non-peaceful. A prominent example of this would be the deployment of conventional weapons into Earth orbit for defensive purposes, which results in weapons that are often stationed over the territory of other states. Such actions could be potentially destabilizing in the space environment and could be interpreted as a threat of force.

Below the three essential components of the international legal regime for outer space activities are discussed. These components are minimal restrictions, transparency, and accountability. This discussion will focus almost entirely on the international legal regime, because space has an inherently international character, and it is the presence of international actors that lead to security issues in space. Further, the space treaty regime is most coherent when it is understood as an attempt to ensure mutual security among states.

A. Minimal Restrictions

Contrary to much of the popular commentary, the international space law regime is very permissive in terms of space activities. Indeed, the guiding principle found in Article I of the Outer Space Treaty is that space is open for use and exploration by all states so long as that use and exploration is for the benefit of all. It is important to note that the idea of benefiting all is ambiguous and subject to differing interpretations by states. As a result, this principle does not place a substantial bar to free access and use by states. At the same time, the benefits language can, and should, be read as a clause that promotes space for uses that increase international peace and security, which benefits the global population. Indeed, the benefits language has a direct legacy to similar language found in early documents surrounding the possible international regimes to regulate nuclear weapons. The benefits language represents an attempt to link space technology to the security of humankind, thus it is meant to promote the peaceful uses of outer space.

Free access to the use and exploration of space is not unfettered. There are two primary restrictions on the use of outer space found in the Outer Space Treaty, and both are rooted in the principle of promoting international peace and security. The first is found in Article II, which bans states from appropriating space as their national territory. While this article is hotly debated as to its effects on activities such as the mining of celestial bodies (see question 4 below), it's primary purpose is to disincentivize conflict in space by removing the possibility of a land rush in space. In the post-WWII environment in which the Outer Space Treaty was developed, this clause can be read as an anti-imperial compromise between the United States and the Soviet Union both of which (though for differing reasons) were ideologically opposed to empire as a form of governance. Regardless of its possible effects on private activities, this clause is a lynchpin in space security as it establishes space as a territory over which states cannot claim sovereignty thereby reducing the risk that armed conflict erupts over competing claims to areas in space. At

the time of the negotiation, the conflicts that resulted from European empires would have served as salient reminders of this possibility.

The second limitation to a state's free access to space can be found in Article IV which deals directly with the deployment of weapons in space. Article IV contains a two-fold prohibition. First, it prohibits states from deploying "weapons of mass destruction" in Earth orbit. Second, it prohibits states from placing weapons of any kind, including WMD and conventional weapons, on the Moon or other celestial bodies. The security implications of Article IV are obvious and self-evident, but three important observations should be made. The first is that the total ban on weapons and military fortifications on celestial bodies can be seen as a natural extension of Article II, discussed above, and its goal of preventing conflict over competing claims to territories in space. The second, is that the negotiators of the Outer Space Treaty did not ban conventional weapons from Earth orbit, which means that the Outer Space Treaty places no direct limitation on the orbiting of anti-satellite weapons, space based missile defense infrastructure, or space to ground, sea, or air weapons. However, the use of such weapons would likely trigger laws of armed conflict, which could place substantial limitations on how such weapons could be used. As a result, the space powers have showed general restraint in the deployment of such weapons, though such restraint is also fueled by technical capabilities and cost. The third observation, is that though the Outer Space Treaty bans the stationing of WMD in Earth orbit, this has never been interpreted as placing a limitation on WMD transiting through space. As a result, Article IV places no limitations on a state's ability to launch an ICBM with a nuclear warhead, so long as that weapons does not enter into a full Earth orbit. The reason for this is that while the US and the USSR were not willing to step back from ICBM technology, they were willing to agree to limit the arms race from developing in an uncertain domain that had the potential to reduce the temporal element of a nuclear offensive to nil, thereby undermining attempts at deterrence.

B. Transparency

The next important aspect of the norms surrounding space involve transparency. In light of the fact that space was an uncertain domain at the time of the Outer Space Treaty meant that states were in a unique position when negotiating how to best avoid conflict in space. Indeed, uncertainty, specifically in the form of verification techniques, plagues the domain to this day. Space presents the problem of being somewhat translucent rather than transparent. States can verify that another state has launched a space activity, and they can often observe that activity in the sense that they can track the satellite. At the same time, states have little indication of the specific capabilities of a satellite, though assumptions can be made based on orbital characteristics. The Outer Space Treaty does not attempt to create a verification regime. Instead, it attempts to create a regime that facilitates disclosure and discourse among states through a variety of transparency mechanisms. In a sense, one of the goals of the Outer Space Treaty is to get states to assure other states that their space activities are peaceful.

There are two primary Outer Space Treaty provisions that facilitate this regime. The first is Article VIII, which mentions that states should have a registry of space objects. This provision is further elaborated in the Registration Convention which requires that states establish a national registry of space objects and inform the United Nations of the information on that registry. The UN then compiles this information into an international registry open to all. This means that states disclose their space activities to the international community. The information required to be disclosed is minimal, but does include basic orbital parameters and "general function of the space object." While the information disclosure is minimal, it does serve the important purpose of giving notice of space activities and providing base line assurances that these activities are peaceful.

This disclosure requirement is combined with Article IX of the Outer Space Treaty, which encourages discourse among states. This article requires that states engage in consultations when they think that their space activities may "harmfully interfere" with another state's space activities. It also gives states the right to demand consultations in cases where they believe their activities may be harmfully interfered with. Article IX is at the heart of an information sharing regime that spans the entirety of the space law regime. The Outer Space Treaty, and the treaties that followed it, include numerous mechanisms facilitate the sharing of information among states, and the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) was established a political body that facilitates discourse among states.

It should be noted, that this transparency regime is bolstered by an emphasis, throughout the treaty regime, on the soft obligation of "international cooperation," which is intended to enhance communication among states as well. Overall, transparency mechanisms seek to accomplish the same goals as verification in a disarmament regime. They are meant to provide states with the information needed to evaluate their security and to build trust among those exchanging information.

C. Accountability

The final critical element to the outer space regime, is accountability. In the absence of verification and in order for states to feel secure in their trust of other states, there was a need to build in some sort of accountability. Space law, and international law in general, are often critiqued for their lack of enforcement mechanisms. This is true in the sense of there not being an enforcement mechanism that directly seeks compliance such as the policing function in a domestic criminal law system. International law, though, does contain enforcement in a sense similar to tort and contract law, meaning that states can pursue damages against other states for wrongs that they have suffered. This is often understood as state responsibility, which holds a state responsible for its breaches of international law. This general form of responsibility applies in outer space, and states may pursue damages against another state for damages incurred from breaches of international law in the space domain. The outer space legal regime augments this general principle in two distinct ways to enhance trust among states.

First, the Outer Space Treaty, in Article VI, makes states responsible for "national activities" of non-governmental actors. This provision is extraordinary in international law, which generally will not hold a state liable for the act of a non-governmental actors unless the act is attributable to the state. However, Article VI makes it the state's duty to provide authorization and continuing supervision to non-governmental actors, and burdens them with international responsibility for acts by those actors that breach international law. This regime is unique to space, but it serves as a critical component in the trust and transparency regime. This is because states are required to be on notice of their non-governmental actors activities via Article VI, and put the international community on notice via the registration requirements. This means that states cannot use non-governmental actors to destabilize the space domain and then claim a lack of knowledge or attribution. This provision is an important one in terms of space security as it also allows the state to use licensing as a method for ensure national security.

Second, the Outer Space Treaty's Article VII extends liability to states for their space activities. This provision is expanded on in the Liability Convention, which holds a "launching state" liable for damage caused by its space object. The Liability Convention details this regime in terms of fault, damages, and adjudication. What is important to note is that this makes states more accountable than under general international law. State responsibility requires that there be a breach of international law in order for the state to be held accountable for its actions. Liability holds a state accountable when there has been damage and the state can be shown to meet the requisite level of fault. Under the Liability Convention this means that a state must be at fault for the damage if it occurs in space, or if the damage occurs in airspace or on the surface of the Earth, then the state will be held strictly liable. The type of accountability mechanism helps to build trust by increasing the care with which a state must conduct its space activities and the care with which it must supervise its non-governmental actors.

[Q23] Fifty years of space has seen much change. Which aspects of the Outer Space Treaty of 1967 are still valid and which need updating?

The Outer Space Treaty is not perfect. It was designed to accommodate Cold War assumptions about the balance of power in a duo-pole nuclear world, and its broad language is often ambiguous in light of new technological developments. That said, the Outer Space Treaty is a foundational document for the maintenance of a peaceful and secure space domain that serves US interests. This is especially so, from a security perspective. The Outer Space Treaty gives states a wide latitude in determining how to pursue security interests in space, but balances that latitude with transparency and accountability measures that incentivize states to avoid destabilizing activities. Indeed, the ambiguity in the Outer Space Treaty should be considered an asset by the national security space operator rather than a hindrance.

In recent years the Outer Space Treaty has been under a perennial assault that argues that it stands in the way of the commercial development of outer space. Much of this commentary is centered on Article II and the non-appropriation principle. The argument is that the Outer Space Treaty should be abandoned if it interferes with private property rights in space. It would be foolish to discard a foundational security treaty that helps to maintain international peace over the question of property rights. Further, the United States has adopted legislation that arguably complies with Article II and allows US citizens to claim ownership of extracted space resources without relying on a territorial claim by the United States. While the Outer Space Treaty may increase the cost of doing business for commercial operators, their investments would not be safe without such a treaty.

The Outer Space Treaty should not be opened to renegotiation, at this time, as it is unlikely that states could negotiate a treaty that better served their security interests. Amendment could be an option, but in reality the Outer Space Treaty has been amended repeatedly during its existence. As a broad set of principles, the Outer Space Treaty is subject to being interpreted within the context of a broad range of subsequent law and policy documents as well as state practice and state interpretations. As noted above, there is a regime of treaties and UNGA resolutions that elaborate on particular aspects of the Outer Space Treaty, and there is a growing body of domestic law and policy that reveals how states are interpreting ambiguities in the treaty. The United States has been a leader in this method, and provisions of US domestic law and policy have repeatedly been adopted in the international arena. Further, there are numerous international bodies and industry associations that contribute to establishing rules that pursue the peaceful uses of outer space. Indeed, this ongoing method of elaboration at lower levels of the rulemaking process is exactly how the United States should pursue its interests in space rather than unnecessarily gutting a very favorable treaty.

This is of course not to say that there are not contemporary challenges to the Outer Space Treaty Regime. These challenges include: the emergence of new commercial space activities; the emergence of new state space actors such as Iran and North Korea; the emergence of cyberspace as a global phenomenon that intersects the space segment; and the reintroduction of ASAT testing by China breaking the long moratorium held between the United States and the USSR/Russia. Each of these challenges creates tensions in the notions and assumptions that underlay the Outer Space Treaty, but it is important not to throw the baby out with the bath water. These challenges require international communication, coordination, and cooperation to be dealt with in a manner that does not put the space environment at risk. Isolated destabilizing and non-compliant activity is not a reason to leave an effective multilateral system. Quite the contrary, such activities require the use of the multilateral system to hold other states accountable and encourage compliance. The Outer Space Treaty provides these mechanisms, without placing undue limitations on the United States as it pursues its interests in the space domain. In short, the best way for the United States to pursue its interests – civil, commercial, and military – is to remain engaged with the international space community and to advocate for the core principles of the space law regime that have maintained peace in the uncertain environment of outer space.

Dean Cheng

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2 August 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: Okay. So, given these levels of ambiguity and uncertainty around who's actually making space policy internationally, and then also the ambiguity surrounding some of the laws, treaties, and agreements that currently govern space, plus some of the ambiguity that is naturally inherent in actual space activity and operation itself, it would seem that developing and solidifying norms is especially important in the space domain. So, I'm wondering, what can the US do to best facilitate the development of verifiable norms that maintain a peaceful space domain?

D. Cheng: Well, first of all, I fundamentally challenge your assumption that we need more norms. Norms are great among people who already think alike. That is a nice lubricant to minimize friction. But, … [speaks in Mandarin Chinese] … norm. So, did you understand any of what I just said?

Interviewer: No.

D. Cheng: Right. Because what I just said in Chinese is, "if I only speak to you in Chinese, how exactly are we going to establish norms?"

So, my point here is that we talk about creating norms because we live in a rule of law society governing through mediation, and we believe that the law itself has value, separate from whoever comes before it. If I am the Chinese, laws and norms and principles and treaties exist, like space and other things, for me to achieve political ends—those ends take precedence, not your norms. So, you can go ahead and create as many norms as possible and you can make them as restrictive as possible, and I will sign on to them and I will try to hold you to them. I will make you live by your rules; you will not make me live by them. And the more restrictive they are, the better they are because you are self-straightjacketing.

So, to begin with, I fundamentally question this constant American reiteration that we need more norms. Now, after that, the question becomes, what is the purpose of these norms and when are these norms supposed to operate? I'm willing to accept that there's certain norms that might be useful in peacetime, because they help establish a baseline and channels of communication that may be able to avoid a crisis. But the farther you go down the road of crisis and conflict, the less positive role norms play.

I mean, as one of foreign diplomat observed about the Chinese: for the Chinese, hotlines only work when they're cold. We have lots of evidence of this in other domains, but not in space—but it doesn't really matter because, as I keep coming back to, we keep sort of saying it's about space, but it's not. Chinese behavior at sea in the South China Sea region, on land with India, on many issues with the Japanese, etc. demonstrates that in a crisis, China doesn't pick up the phone. China just does not abide by norms. For example, "Thou shalt not send troops out 20 miles into your nuclear-armed neighbor's borders," but China doesn't abide by those kinds of norms even though it expects you to abide by them.

So, again, in peacetime, can you create norms? Wonderful. China will sit down and negotiate and have a chance to have a conversation. However, the minute a crisis hits, China won't pick up the phone, and they don't call you, so what exactly are these norms creating?

Interviewer: Okay. So, it sounds like you believe that the establishment of these norms during peacetime then just puts the US at a disadvantage during periods of conflict because on one hand, the US will be sitting there obeying the norms and following the norms and playing by the rules of the norms, while on the other hand, an actor like China could fully go along with the norms during the peacetime but then just totally disregarding them once things start getting tense?

D. Cheng: Exactly. So, creating norms with France, with Britain, with Japan, that all makes perfect sense. With China? No, not so much.

Certain folks from both the arms control community and … will inevitably say, "Well, look at what happened after the 2007 ASAT test when China was demarched." But my question has always been, "Well, what did happen?" Well, so China hasn't conducted a test like that since. Okay, so, what does that prove? The argument is that we by protesting somehow demonstrated to China and persuaded them not to conduct a destructive ASAT test like the 2007 test. Well, guess what, I personally, Dean Cheng, have not conducted a destructive ASAT test like that since 2007, either. Is that evidence that those demarches have made a difference to me? The assumption is, and

this is translated into policy recommendation, that China does not do X after we do Y. So, we have drawn a causal-effect relationship by people who themselves have demonstrated a lack of understanding and knowledge of how China is even governed in the broad name. If I talk to you about the Republic of Great Britain and its presidents, why would you pay any attention to my recommendations about Anglo American security? And yet, we have made the equivalent arguments about China and then we say, "See, this proves that demarches and norms work." That is problematic.

Interviewer: Thank you for running through all of those questions with me. I just have one last general question for you, but before I get to that question I was hoping to open up the floor for anyone else on the line that would like to ask Dean a question.

AAC[21]: Hi Dean, this is Allison. Thank you for speaking with us. I'm wondering, would you concede that norms, at least down the road, can represent an additional cost in the sense of a "should I take this action or not" and "what are the costs and the benefits" kind of calculation?

D. Cheng: Well, that depends on what cost we have demonstrably inflicted in the past. So, if I violate those norms, what is the cost to me? If the answer is, I will be demarched, then the question becomes, why do I care about a demarche? Do I even care about a demarche? If the answer is, we will suspend foreign direct investment in your country, then that may or may not make a difference, but it will be a more demonstrable effect of violating a norm.

AAC: So, basically, you're saying that if you are talking about norm development or international regimes even, that you have the same issues with credibility and demonstration that we typically think about with regards to deterrence?

D. Cheng: Correct. Because norms are part of the pathway towards deterrence. Why do you create norms? You create norms in order to shape everybody's actions and to hopefully prevent (aka deter) bad actions, right? So, it is a very, very polite, evolved version of deterrence.

Now, there are commercial norms (i.e., best practices, etc.), and there you do see direct effects. If you have a very bad launch system that creates lots of debris as your first stage separates, you can persuade people to boycott you. That is a cost of violating the norm. Think about why we don't have dolphin meat anymore in our tuna? Because there was a backlash against that bad practice.

AAC: So, you bring up one of the things that I have been thinking. The military and national security state is a tiny sliver of the space endeavor? I mean, commercial is much larger obviously in capitalization, in revenue, and in numbers. So, maybe we are in a position here to enact some of those kinds of costs for norm violation that are similar to creating debris by blowing up your satellites in space.

D. Cheng: Okay, so let's roll with this scenario for a second. Let's say China blows up two satellites next week in an upward trajectory that pollutes the LEO orbit. What is it exactly that commercial space is now going to do to China? We already don't have China doing much in the way of commercial satellite launch—China isn't directly competing with commercial satellite sales. China's commercial space companies are state-owned enterprises, so you can't really affect China's space industries unless you're going to really hurt the overall Chinese economy. So, your threat is very, very hard to enforce, and it automatically goes outside the space domain, unless you're going to start arresting the Chief Executives of China Aerospace Science and Technology Corporation, etc., which, by the way, you have no legal basis for, right? Yeah, sure, they polluted outer space, but that's not against the law—it's a bad thing to do, but it's not against the law.

[21] Dr. Allison Astorino-Courtois (NSI)

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15 August 2017

WRITTEN RESPONSE

[Q19] What international legal codes or norms are needed to govern the increasingly crowded space domain?

The biggest thing we have seen is the need for enforcement provisions and stated consequences in international treaties and agreements.

[Q23] Fifty years of space has seen much change. Which aspects of the Outer Space Treaty of 1967 are still valid and which need updating?

Amend, starting from scratch is too much work. The 1967 treaty should be expanded to address emerging technologies and business interests, particularly around the ownership of precious metals, commodities from space.

Jonathan D. Fox

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(Defense Threat Reduction Agency Global Futures Office)
21 July 2017

WRITTEN RESPONSE

The Outer Space Treaty at Age 50: A Reconsideration

Current Juridical Shortcomings The 1967 "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space (including the Moon and other celestial bodies)" was promulgated in a time and strategic context that has long since been overcome by events. That space could be "free to all and belong to none", governed purely by selfless consideration and altruistic motives, was then and now neither a realistic nor fair depiction of human motivation. A new vision, incorporating the best aspects of the old, is necessary to better reflect mankind's inherently acquisitive nature and desire of achievement. To accomplish the exploration and use of outer space under the rule of law promoting orderly expansion beyond mankind's ancestral home, with equitable treatment for those bearing the greatest risk in this venture, should be the overriding motivation of any future legal framework governing human activity in space.

An equally compelling reason for reconsideration of the 1967 Treaty involves the fundamentally changed circumstances of the international geopolitical and economic context surrounding the negotiation of the original compact. Military exploitation of, and reliance upon, space at that time was still in the process of achieving

operational robustness. There were two primary space-faring nations, and exo-atmospheric commercial activities were embryonic. The United States was the global creditor state, and it's relatively easy to be humanitarian in a time of solvency.

A half century later, the geopolitical and economic context of the world has been fundamentally altered to such a substantial degree as to bring into doubt the essential equity, fairness and wisdom of continued adherence to the original terms of the agreement. Both military and civilian space systems clutter the Earth's orbit, and the number of space faring nations has grown exponentially. Military reliance on space platforms and capabilities has become essential, and the adversarial threats to those platforms real and repeatedly demonstrated. The United States (and with few exceptions the entire world) is awash in a sea of debt, with an increasing share of revenue devoted to servicing that debt and a decreasing share available for such historically fundamental sovereign functions as space exploration. What governmentally-sponsored space activities are undertaken have become increasingly reliant upon a growing private sector space industry. This industry is steadily outpacing (in both capability and inventiveness) its traditional state sponsors. While still highly speculative and risky, space-based economic ventures are becoming increasingly common (and more importantly, profitable).

As global governments become more constrained by the stranglehold of debt, the private sector is well situated to assume a greater share of functions previously the sole province of the nation-state, including those associated with the exploration and use of space. Yet the driving imperative for state solvency, identifying new sources of sovereign revenue and national economic growth will hardly lessen despite the worsening forecasted long-term fiscal restraints. Contemporary governments may find themselves compelled to rely on the services of private sector entrepreneurs prepared to endure the risks associated with commercial space efforts in return for the potential of significant profit and the benefits of state-afforded sponsorship and associated legal protections. This symbiotic relationship would benefit nation-state governments (and conceivably their equally hard-pressed citizens) through fees, taxes, employment, commercial & technological competitiveness and access to potentially transformative energy, scientific and mineral resources and discoveries (with the concomitant enhanced standards of living these benefits have accrued in the past).

Justification for Renunciation These considerations are a textbook illustration of the traditional legal concept of Rebus Sic Stantibus (a fundamental change of circumstances allowing for the renegotiation or renunciation of a previously concluded treaty), and would justify withdrawal from the 1967 agreement under the provisions of that document's Article XVI. This spectral shift is as substantive as the rise of the new geo-strategic reality engendered by the dissolution of the Soviet Union and the subsequent issues of state succession that led to the U.S. renunciation of the 1972 ABM Treaty. There is more than sufficient precedent to support this proposed adjustment of previously negotiated terms governing space-faring nation-state activities.

Suggested Reforms Any modernized agreement would have to reflect this fundamental on-going transformation affecting the geo-political realities of the 21st Century. The rising importance of the private sector entrepreneur in space exploration and commerce has to be legitimized and protected. The terms of the 1967 treaty's Arts. I and II need to be renegotiated to enable legitimate exercise of market-based commercial activities (including natural resource mining, refining, exploration, extraction, transportation and other related functions) as may safely and practicably be undertaken under the license and authority of space-faring nations, in accordance with their applicable laws. The Moon and other celestial objects could be surveyed and mined (competing claims governed by the order of discovery), and procedures analogous to those of the Law of the Sea's International Seabed Authority provisions applicable to resource mining and extraction adopted as a beginning framework with such adjustment as necessary to reflect the specialized requirements of space operations. Commercial rights (and such territorial inviolability as necessary to protect the integrity of those rights and privileges) would be enforceable under the national laws of the nation-state of license, and where a conflict of laws or legal issue of first impression would arise, an arbitration tribunal procedure similar to that used to resolve Law of the Sea treaty disputes would be employed. The legal standard originally enunciated by the treaty's Art. VI would have to be substantially modified to provide protection of space-related commercial rights arising in the coming years.

Space vessels of any and all types, whether military, civilian, scientific or governmental, would be registered to and inspected by nation-states of license and bear appropriate nationality identification. The provisions of the 1967 treaty's Art. VIII in this regard would serve as a global minimum standard. All such vessels would be afforded the right of innocent and safe passage in accordance with traditional rules of navigation analogized and modified as appropriate from maritime law and practice. The obligation to provide assistance to space vessel crews in distress would be adopted unchanged as a modern analogy to the rights of mariners, and the language of the 1967 treaty's Art. V would be adopted as a minimum standard. Conversely, the pecuniary liability standards of Articles VI & VII are long overdue for detailed reform, particularly with the growing proliferation of commercial spacecraft likely to accelerate.

The deployment of military systems and armaments of a purely defensive nature (and for that matter any weapons systems other than weapons of mass destruction), while not specifically allowed, is nowhere either in the 1967 treaty as a whole nor in the specific Art. IV addressing military use of space specifically prohibited (other than a general disallowance of any weapons testing or military facility on celestial bodies). Even though detailed rules addressing military technology deployment would most probably be ignored (other than very general "Rules of the Road' concerning navigation and notification of the exercise of the right of innocent passage), a statement of the general legal principal that space faring vessels may possess such military technology as necessary for the exercise of lawful self-defense might be sufficiently innocuous as to be achievable in negotiations.

Finally, renegotiation of the 1967 treaty would be an opportunity to define, with certainty, the rights and obligations characterizing the various classes of nation-states and other entities utilizing space to varying degrees. Differentiation of the rights and obligations of space-faring parties (those providing space launch and cargo bearing capabilities) as opposed to those that function solely as third party clients and users might serve as an effective cost-sharing approach and enhance affordability of space-related services to an increasing market of both nation-state and private sector consumers.

Joanne Gabrynowicz

Professor Emerita (University of Mississippi School of Law)
16 August 2017

WRITTEN RESPONSE

[Q23] Fifty years of space has seen much change. Which aspects of the Outer Space Treaty of 1967 are still valid and which need updating?

- LEAVE OST ALONE. Contains elements that cannot be achieved again today.
    - Leave OST alone; don't put the treaty on the table
    - No such thing as "only touching a piece of it" It's a political process. Once it is opened, everything is on the table including the most important provision: prohibition of nuclear weapons and weapons of mass destruction
    - If reopened, there would be a big push from some countries wanting to not allow a lot of things that are now allowed: military use of space and commercial activities, for example
        - Could be a disadvantage for the US
    - OST works because USSR and USA "looked over the abyss" and chose law over war.
- Analogy: US had a constitutional convention in the 1700s, and although there have been numerous proposals, there has never been a serious attempt at having another constitutional convention to open it for negotiations
    - Same thing applies to the Outer Space Treaty

Dr. Nancy Gallagher

Director (Center for International and Security Studies at Maryland)
10 August 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: Do you think the international agreement and treaties that are currently in place for the space domain are well-suited to handle some of these new types of threats and aggressions that we may face given some of the advancements in technology and new actors that are more and more likely to be operating in space?

N. Gallagher: Part of what I actually like about the Outer Space Treaty was that it was written at a time when there already was a lot of technological change going on, and people didn't know exactly what the technological developments were going to be and exactly who was going to be using space for what purposes, but they knew that there was going to be a lot of change, so what they were primarily trying to do was to come up with a set of principles that could be adapted and applied as circumstances changed over time.

So, I actually think the Outer Space Treaty framework and the principles of the treaty and the specific obligations of the treaty are still quite valid, and I think it would be hard to get international agreement on any set of principles that would be better than what is currently laid out.

I definitely don't think we should try to amend the treaty or replace it, because both of those are sort of potential recipes for losing this foundational agreement altogether. I do think there needs to be a lot more work to figure out what these principles actually mean in the practice under the current circumstances, and how we should apply them to new technologies and new situations. For example, how do we apply these principles in a situation where space is increasingly being used for support for the war fighter as opposed to straight-up deterrence? How do we apply these principles when you have many companies that are operating in space that don't really have a clear-cut country that's responsible for their activities?

But, ultimately, I think those are all questions that we should be talking about, and figuring out how to elaborate the basic agreement, not replace it.

Interviewer: Yeah. This is something we have heard—both the difficulties with trying to amend and ratify the treaty itself in the first place, but also the risk of unintended consequences that could arise from trying to open up the Outer Space Treaty for amendment or ratification.

N. Gallagher: Yeah. I think that there is just no absolutely no reason to do that (trying to amend and ratify the Outer Space Treaty itself), and that everything that you could want to do could be built on the foundation of the Outer Space Treaty through some combination of either protocols or additional supplemental legally binding agreements or voluntary agreements the same as the principle. Because so much of the technology is dual-use, I think that a lot of the rules that you would be elaborating are going to be focusing on behavior rather than capabilities. And that's sort of what the Outer Space Treaty tries to do anyways in terms of saying, "space is free for all to use for peaceful, lawful purposes," as opposed to saying, "these capabilities can be put up there and those capabilities can't." But we haven't spent a lot of time talking with other countries about something like: "okay, so in this context, what's the line between military uses of space that count as peaceful?" It used to be the case that those capabilities that help stabilize deterrence were peaceful, and those capabilities that are directly being used for war fighting are not peaceful.

But I think that there may well be some things that are technically possible now that maybe we were okay with in the past as long as it was only the United States that was technically capable of doing it, which we will now start becoming increasingly less comfortable with anybody doing now that other countries can do it too. However, that doesn't require amending or changing the Outer Space Treaty—that requires talking about what the rules of behavior are and whether there are certain capabilities that are just so threatening that we really do want to rule them out completely—even if that means that, as a result, there are some potentially beneficial applications that you don't get.

Gilmour Space Technologies

Adam Gilmour
Chief Executive Officer

James Gilmour
Director

13 July 2017

WRITTEN RESPONSE

[Q19] What international legal codes or norms are needed to govern the increasingly crowded space domain?

Stricter rules on space junk and de orbit.

[Q23] Fifty years of space has seen much change. Which aspects of the Outer Space Treaty of 1967 are still valid and which need updating?

New framework given the context of commercial space and the low risk of damage from returning space assets and launches.

Dr. Peter L. Hays

Adjunct Professor of Space Policy and International Affairs, Space Policy Institute
(George Washington University)
19 July 2017

WRITTEN RESPONSE

[Q19] What international legal codes or norms are needed to govern the increasingly crowded space domain?

Development of enhanced norms for responsible behavior in space would be helpful in identifying and sanctioning irresponsible behavior. I believe that building on commercial best practices is the most useful and likely route for further development and acceptance of enhanced norms. The guidelines being developed under the Long-Term Sustainability of Space Activities (LTSSA) negotiations at the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) also hold great potential for advancing comprehensive and accepted norms.

[Q23] Fifty years of space has seen much change. Which aspects of the Outer Space Treaty of 1967 are still valid and which need updating?

There is very little international appetite for reopening or amending the OST regime. To the best of my knowledge, there have never been any amendments proposed or adopted, there is no standing body established to interpret signatory obligations and adjudicate international consultations, and the regime has very seldom been used to resolve specific issues (the crash of nuclear powered cosmos 954 in Canada in 1978 being a notable exception although details regarding that settlement are closed).

Dr. Henry R. Hertzfeld

Research Professor of Space Policy and International Affairs (George Washington University)
17 July 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: What international legal codes or norms are needed to govern the increasingly crowded space domain?

H. Hertzfeld: What we have, of course, and I'm sure you know, are a set of treaties. Parts of the Outer Space Treaty, are considered to be customary in our national law by some, but even that's not particularly clear. The treaties are, by their very nature, compromises and many provisions are subject to varying interpretations. Also as our technology changes, the practical application of treaty provisions may be different than it was 50 years ago when they were drafted. There's resistance to doing that in the law. Amending the treaties is not a simple, easy, or quick process. In fact, it's a very difficult one. In place of that, particularly in these days when treaties are a little bit more difficult to negotiate among 70 or 80 nations than when were when you had less than 20 nations in the 1960s involved in drafting the space treaties. We have developed various codes of conduct, proposals, or rules on the road that are in the category of soft law. It's something that you hope nations and eventually courts, if necessary, will uphold. But, soft law is not like a treaty where a treaty that has been ratified by a nation becomes the sovereign or the supreme law of the land. But even that is not enough. The space treaties are not self-executing, so each nation is obliged to interpret and enforce the provisions through specific national laws. There is no guarantee that these will be entirely consistent among all nations. So, we do need more definition for their activities as we have more private sector players and actors in space. Technically, nations are responsible for their activities in outer space and even liable for them. It's not quite the same as when the government owns and operate its assets. So, you got a whole set of commercial law that is not that precisely defined for space. It often involves dual-use technologies where there is both a national interest and a security/military interest These affect terrestrial infrastructure such as navigation which is a prime example, but some telecommunications and remote sensing also are heavily dual-use. All of these are part of our critical technologies such as electricity and water supply These sectors are now rapidly adjusting their equipment to be more efficient and more productive because of the inputs that we get from satellite data. If you want to include the entire infrastructure of the economy as space-related, then that also has a very significant national security as well as economic impact. In the last 10 years, more than that, you've seen space move from just serving the military to a commercial and private sector adoption and usage for a whole long list of applications. The space component becomes very important, and therefore, the problem comes back to providing resilience. If things were interrupted, we need to have a way to keep it functioning, regardless of cost. The more competitive we are, the more productive we are, and more efficient we are, the more competitive we are internationally as well.

Going back to the essence of the question, the law is going to have to adapt to that because space law is currently more focused on inter-governmental actions than it is at private actions.

We need to focus on a lot on these laws because they expand security as well as the operation of the economy. Anyway, this is a long winded way of saying that the governance and management of space assets is complex and difficult. Governance should not be defined as establishing a government of space or in space. It's finding mutual ways of solving common problems among many nations that involve commerce as well as government activities. It happens when there's a direct need. It happened with aviation, with formation of international organizations like ICAO for which almost every nation in the world has signed up. Even though it's hard to enforce international law, ICAO has been given certain powers such as to conduct audits of airports, which can have a major competitive effect on a nation whose airports are found to be substandard from a review by ICAO. We don't have anything like that in space. Even the treaties at most have been ratified by only 2/3 of all UN nations,. The ITU is similar to ICAO in having almost all nations as members and it works by providing a place for nations to negotiate and ultimately allocate radio spectrum to minimize interference. Both ICAO and the ITU illustrate that when there have been specific global problems in human activities, people have worked to solve them so that all nations can benefit. We're not at that point yet in space. We may have partial solutions, but I don't see them as international agreement that have reached that level

Interviewer: You mentioned the Outer Space Treaty. Would you say it's better to add or amend the 1967 treaty or to establish a new framework for the 21st century?

H. Hertzfeld: Changing, adding, amending because of technical reason is a very long process, if it happens at all. According to the Outer Space Treaty itself, an amendment requires ratification by at least 50 percent, half of the states or parties to the treaty. Out of those 130 nations, I believe about 105 of them are actual radical accessions to the treaty. The others are signatories. You need 50 or 60, just over 50, to ratify any amendment to that treaty. Even if you do get an amendment, it only technical applies to those nations who have ratified it. To try get some sort of international consensus on these type of changes that you want in that treaty is a very long, very difficult process politically and technically. If you open up a treaty like that to amendments, you're also placing everything in that treaty on the table. I can see 20 years of negotiations before you ever have some agreement. It could happen faster if there was some sort of emergency, but if you take it through the process we've developed and through the UN copious and the other parts of the UN system, that's not going to happen fast enough for us. Now, we're talking about other types of multilateral agreements. If the US ever agree on anything these days with Russia, China, Europe, Japan, and so on, some of the issues that are out there that are difficult in space, likely SSA and other things and conjunction analysis and warnings and all the rest. That would be probably a faster way of doing this because there is handful of nations have most of the space assets out there. They're trying to do something through an organization that is a very useful one but has involved so many different political jurisdictions and general cultural, social and political theories. You're up against a very difficult set of negotiations. Unlike the 1960's when we were 18 or 19 members of the UN copious, there are 85 now. It's one nation, one vote. You've got lots of nations, and I doubt that we'd see real consensus very quickly.

Interviewer: Would you say the US could best facilitate their influence in space through more norms and soft law and leading by example rather than international legal avenues?

H. Hertzfeld: We do that. I think we could do a better a job at it.

Interviewer: How so?

H. Hertzfeld: As you know, we've not done the best job over the last 10 or 15 years of showing leadership, as we had done many years ago. I think we have the capability of doing that, but I would question in many areas whether we've really done that as much as we should have.

Interviewer: What would that leadership look like? Does it mean more NASA missions? Does it mean more growth in the commercial sector? What would that look like exactly?

H. Hertzfeld: This conversation right now is talking about the law. We're not talking about NASA or commercial sector. We're talking about consistency. We're talking about doing the right thing. For example, we have adopted guidelines on debris and debris mitigation. The UN has a set of guidelines, and we implement them. The DOD has its set, NASA does also, and so on. There is nothing wrong with that. They do it well. But, my understanding is… they're also hard to follow, and we're pretty liberal with deviations from the rules when costs or expedience intervene. Some other nations have far stricter rules, and there are stronger penalties associated with the rules. It's not a question of we don't know how to; it's a question of following through and consistency. On the other hand, we have the Air Force that manages our SSN and SSA networks, and we are spending a lot of money on satellites to do more surveillance in space and to be able to track things and predict conjunctions better. We do make some of that information available internationally. I think that is a very good thing that is respected around the world. There is a question, though, about how much other nations trust our information? They need their own verification. We have shown that we can do that very well through the management of the free GPS signal that's available and the world. It is operated by the military. It's very useful not only to us but to others as well. We've agreed not to downgrade it with a formal agreement within our Government. So, there's much work for us to do on space surveillance, but others are also developing their own systems. Ideally, these various future national systems should also have an important element of cooperation among nations where the sharing of information will help insure that space operations are secure and sustainable.

[…]

H. Hertzfeld: Let me add a couple of things to the legal end of this. On the treaties, and with all these soft laws, what we're dealing with is the beginning of the development of international norms and rules. That is good. We need incentives, we need to operate consistently and safely, and so do others. But currently with the commercial sector, we don't have any effective penalties for not abiding by the norms. We don't even have a good dispute resolution system for an accident in space. It's vague, and it's left up to diplomatic negotiation, which up to now, we've been okay. There hasn't been an accident up there that has generated enough economic monetary damage to warrant a lawsuit. There have been accidents of course, but with the commercial sector, that's just not going to be enough. So, I think you need not only incentives, but you need some source of dispute resolution and forcible, binding penalties or decisions when such an accident happens because it eventually will. With the communication satellite business, almost every contract that's written between the manufacturer and the customer, or the supplier and the customer, has arbitration clauses, and it's usually binding arbitration that is agreed on. When we're talking about a possible accident in space, what kind of contractual relations are there to support it? Whatever may accidentally come in contact with each other in outer space, satellites or assets from different nations, there likely isn't a contractual relationship, so you can't contractual agreements. We need a system to adjudicate that sort of thing. That too can act as an incentive for companies to be even more careful and more cognizant of safety than they already are. Most are very careful because these assets are valuable. As we move forward, I think we need an international system, more akin to on what's available in the commercial sector in other domains. That is one important thing that's lacking right now because it hasn't been necessary up until now. Also, possibly better, more clear definitions of fault with regards to liability. In the maritime area, you do have limits on liability internationally in the high seas. In space, governments have agreed in the treaties to unlimited 3rd party liability (monetary payments for damage to assets of those not involved in an incident). Governments can transfer that through a license that requires companies under their jurisdiction to purchase insurance. Nevertheless, if something really bad happened, whatever government was involved as a the launching state,

they could be held liable. They are signing up for a potential responsibility and liability that may not occur until 100 years from now. This is an issue there that has not been adequately addressed and probably should be in some way. We need some more thinking about liability for on-orbit activities, particularly as we do more things like servicing satellites or extracting. Those are new activities, particularly to the commercial sector, and they may be exceedingly valuable and useful, but they're also risky.

Theresa Hitchens

Senior Research Associate (Center for International and Security Studies at Maryland)
19 July 2017

WRITTEN RESPONSE

[Q19] What international legal codes or norms are needed to govern the increasingly crowded space domain?

This of course is a matter of opinion. I'm of the belief that we first need a high-level norm setting, accompanied by practical agreements like the work of the Committee for the Peaceful Uses of Outer Space Working Group on Long-Term Sustainability of Outer Space, which is developing guidelines for "best practices" on orbit and is discussing SSA data sharing to ensure safety of operations. We need to begin implementing the 2013 UN Group of Governmental Experts on Transparency and Confidence Building Measures in Outer Space Activities recommendations, which lay some top-level norms and some practical actions to reduce risks of misperception, misunderstanding and mistaken conflict. Secure World Foundation has a good fact sheet on the GGE.[22]

We will eventually need an international Space Traffic Management regime to deal with crowding. Whether we need new legal agreements – especially arms control – depends on whom you ask. Contrary to popular belief, there are legal restrictions right now on certain activities – including via LoAC and International Humanitarian Law, but also directly through OST. I'm of the opinion that we don't right now need new laws, but eventually will. I'd eventually like to see a legal (i.e. treaty) agreement to bar testing and use of debris-creating weapons at a minimum. Personally, I'd also like to see a treaty on non-use of space-based weapons, but I have no hope for that now – train has left the station at least for non-kinetic – but the dangers to strategic stability among the nuclear powers are HUGE. Space-based weapons are likely to create new incentives for ASATs and endanger the safety of commercial and civil operations in space even further.

[Q23] Fifty years of space has seen much change. Which aspects of the Outer Space Treaty of 1967 are still valid and which need updating?

This is also a biased question. The 1967 OST remains valid in its entirety. It is a framework agreement. There is no need to update it or amend it. The issues at hand are political, regulatory and national security issues for national governments, and – with the exception of the ban on WMD and the establishment of sovereignty in space -- the OST does nothing to impede national governments regarding how they regulate their space activities, either government or commercial – this is specifically left up to individual states, who are responsible for the activities of their governments and private entities within their jurisdiction. There are needs for new international agreements, yes. But they can and should fit under the OST framework. The Aerospace Corp. has just released a study on this that everyone should read.[23]

[22] https://swfound.org/media/109311/swf_gge_on_space_tcbms_fact_sheet_april_2014.pdf
[23] http://www.aerospace.org/news/pressreleases/aerospace-policy-paper-examines-outer-space-treaty/; http://www.aerospace.org/publications/white-papers/the-outer-space-treaty-assessing-its-relevance-at-the-50-year-mark/

Christopher Johnson

Space Law Advisor (Secure World Foundation)
11 September 2017

WRITTEN RESPONSE

[Q19] What international legal codes or norms are needed to govern the increasingly crowded space domain?

Issues of increasing urgency are related to space debris threats, including the **necessity of legal pathways to capture space debris and non-functioning satellites**, **preventing the creation of new debris**, and a **robust and reliable space traffic management system**. Diverse challenges from a growing number and diversity of actors in the space domain, with a growing diversity of activities and technologies such as numerous small satellite constellations, are already and will increasingly impose pressure on the existing governance structure, and on the space domain itself.

Norms existing in other domains outside of state territory, from the high seas, the deep seabed, international airspace, the arctic, and the Antarctic, and perhaps even cyber space, may be investigated for their similarity in addressing concerns in outer space.

For example, the Antarctic treaty system (upon which space law took early guidance) is a regime expressly aimed at enabling international cooperation, scientific investigation, exclusively peaceful uses, and with a prohibition on claims of territorial sovereignty. This is similar to foundational elements of space law. In contrast, however, the Antarctic system is between fewer states, and placed a moratorium on development. These differences are not substantial so as to preclude borrowing examples from this system. The Antarctic is a domain from which armed conflict has been excluded, and where peaceful international cooperation and scientific investigations have progressed. In summary, there will be elements of Antarctic governance which can be adapted to space, and there will likely be lessons learned from the history of Antarctic governance. What elements of Antarctic governance fostered this success?

The same investigations can be repeated in the other domains as mentioned. International civil aviation is a decades-long success story of peaceful and prosperous civil and military success, with very few instances otherwise. There are likely to be lessons to be learned from the international governance structure of international and national airspace.

[Q23] Fifty years of space has seen much change. Which aspects of the Outer Space Treaty of 1967 are still valid and which need updating?

All aspects are of the Outer Space Treaty are still valid. As of 1 January 2017, 104 States are party to the treaty, having signed, ratified, accepted or acceded to it.[24] A further 25 states have signed the treaty but not yet taken the final step of ratifying, accepting, or acceding to it (according to their respective internal procedures on the conclusion of treaties).[25] Signing a treaty obligates the state to not take measures or actions which contradict the spirit of the treaty.[26] Many of the provisions of the Outer Space Treaty are so well respected that its provisions are considered by experts to also reflect customary international law, and therefore binding on all nations, even those

[24] Legal Subcommittee to the Committee on the Peaceful Uses of Outer Space, 'Status of International Agreements Relating to Activities in Outer Space as at 1 January 2017' (2017) A/AC.105/C.2/2012/CRP.3; Available at: http://www.unoosa.org/res/oosadoc/data/documents/2017/aac_105c_22017crp/aac_105c_22017crp_7_0_html/AC105_C2_2017_CRP07E.pdf

[25] Id.

[26] United Nations Treaty Series and United Nations, Vienna Convention on the Law of Treaties 331 Art. 10, 18 http://untreaty.un.org/ilc/texts/instruments/english/conventions/1_1_1969.pdf; See also: Dag Hammarskjold Library, 'What Is the Difference between Signing, Ratification and Accession of UN Treaties? - Ask DAG!'; Available at: http://ask.un.org/faq/14594.

not party to the treaty, but as the customary international law applicable to space activities.[27] This demonstrates that, rather than a treaty showing its age after fifty years, this long-standing treaty has facilitated five decades of the peaceful and profitable uses of the access, exploration, and use of outer space, and that states respect and observe the treaty.

However, our use of outer space is changing. Both more state actors, and more non-state actors are engaging in space activities. There are more uses and activities in outer space, and a greater range and diversity of uses and activities.

Additionally, the Outer Space Treaty is a treaty on principles. Its seventeen short articles reflect the principles (of states) in the exploration and use of outer space. It gives us broad guidelines in how to access, use, and explore space, and very basic obligations and commitments which are balanced against the broad and expansive freedom of access, exploration, and use contained in Article I of the Treaty. These broad principles have served us well for five decades, but as more advanced and complex space activities are emerging, the limits of the treaty's language have become evident.

Emerging and proposed activities which challenge the continuing suitability and adequacy of the Outer Space Treaty are numerous. Actors are increasingly diverse, and include academia, small groups, civil society, start-up companies, and projects composed of teams with increasingly diverse citizenships and nationalities. Programs include constellations, swarms/clusters of small satellites, new space stations, and may evolve into on-orbit servicing, manufacturing in space, and even crewed deep space exploration, the European Space Agency's vision of a Moon Village, as well as eventual asteroid mining and celestial resource use. Internet from space, real-time Earth Observation are also quite likely. This means that the traditional categories of launching state, registering state, internationally-responsible for national activities state (Art. VI), and potentially-liable for damage state (Art. VII) are categories which will have worked adequately for 50 years, arguably, but will not be adequate for the next 50 years, or even the next 10 years.

Rather than modify or amend the Outer Space Treaty, we can look to history to see that space law has grown through addition of new instruments. International space law is an open system. The 1968 Astronaut Agreement expanded upon Article V of the Outer Space Treaty. The 1972 Liability Convention expanded upon Article VI and VII of the Outer Space Treaty. The 1975 Registration Convention expanded upon Article VIII of the Outer Space Treaty. The ITU Constitution, Convention and Radio Regulations supplement this COPUOS framework with a binding regime for the use of frequencies and orbits. The IADC space debris mitigation guidelines also supplement this framework, especially Article IX of the Outer Space Treaty, with a non-binding guidelines document. It is likely that international frameworks (in a form to be determined later) will be needed to address the international legal issues of space debris capture/remediation, space traffic management, issues of launching vs. registering vs. responsible state, and later, of celestial resource use, and of crewed deep space and lunar stations. These will be seen as adding to and expanding upon existing provisions of the Outer Space Treaty. They may take the form of hard or soft law, but their need is already apparent, and will increase.

[27] Francis Lyall & Paul B. Larsen, Space Law - A Treatise 411 (2009).

Group Captain (Indian Air Force ret.) Ajey Lele[28]

Senior Fellow (Institute for Defence Studies and Analyses)
9 August 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: Do you think that the current treaties, agreements, and laws that are in place are well-suited to effectively serve as these necessary legal mechanisms? Or, do you think there is a void here?

A. Lele: We presently have a good mechanism of fortified treaties that are essentially recognized by all individuals—from the Outer Space Treaty to the Liability Convention to the range of other agreements. So, all of those things are definitely good, and I think that's the reason why for the last 6-7 decades things have been going pretty well, as far as outer space is concerned.

But, as the number of players continue to increase, and it's not only the state actors but the number of private parties is also going to increase, one has to really look at whether these mechanisms will be totally helpful, because the various actors operating in space today are very responsible actors, but this is unlikely to always be the case. For example, North Korea is entering into space and Iran is developing their own space program, so I'm not pointing a finger at anyone but, at the same time, one must understand that getting involved in space activities is unquestionably becoming easier. The way in which we used to talk about space as rocket science is not the same today—it's not that difficult for other players to join the game now.

So, under those circumstances, one has to really have a look at whether the prevailing treaty mechanisms are useful and whether they will serve their intended purpose as more amounts of activities start happening.

David Koplow

Professor (Georgetown University Law Center)
15 August 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: Hi David. This is George Popp. I want to thank you for speaking with us today. This conversation has been really insightful. I do have one question. I found it interesting that you noted the relative speed with which the initial treaties and laws were crafted and established, yet despite that initial speed and efficiency, there hasn't really been any new updates. As such, I am wondering, is this problematic, particularly for the space domain, which is evolving so rapidly in terms of evolutions of technology, barriers to access, and even the actors involved? Basically, do you think that the laws that are in place right now are well-suited to handle this rapidly evolving and developing domain?

D. Koplow: From my perspective, what we have got in these first four treaties is really a sound, beneficial, useful, structure in international law, and I do not think, from my perspective, there is anything in these first four treaties that is wrong or is out of date or needs to be erased. But, they are incomplete. They are the beginning of a structure. It's as if, in the case of the United States, we

[28] The responses here represent the sole views of Lele, and are not intended to represent the position of the Indian Air Force, Indian Space Research Organization, or Government of India.

have adopted the Constitution, but then Congress did not get around to passing any laws after. The Constitution sets out the general principles, but you have to flesh those out.

Interviewer: Would a soft law approach be sufficient here, or is hard law required to meet this goal? What kinds of things need to be fleshed out?

D. Koplow: In my view, soft law could certainly make a contribution. The term "soft law" is ambiguous, and is used in many different ways in the literature and discussions. But to me, in includes, at least, non-legally-binding (or politically-binding) norms that have proven their utility and their ability to contribute to satisfactory order, so they have drawn considerable support and are, in practice, often followed. In that way, even if no treaty is produced, the informal lawmaking process can still be of value.

Regarding the kinds of things that need to be fleshed out, there are lots of possibilities. In the military space sector, I would identify as the most pressing the need for additional legal restraints upon the testing in space of debris-creating anti-satellite weapons. That sort of measure would not suffice to prevent an incipient arms race in counter-space capabilities, but it would be a good place to start; it's an easy first step toward re-energizing what should be an important area of law-making.

Interviewer: So do you think that the current treaties need to be amended or ratified, or would you suggest keeping them as is and/or maybe adding new treaties? Do you have a preference?

D. Koplow: From my perspective, that is a sort of small detail in the legal drafting. Whether you provide the additional details by amending the existing treaties or by creating new treaties. In either instance, what you need is to provide more detail and you could structure it either way. Generally, not always but generally, the mechanism is new treaties rather than amending the existing treaties, but that is mostly a detail of the drafting that could be done either way.

Tanja Masson-Zwaan

Assistant Professor and Deputy Director, International Institute of Air and Space Law
(Leiden University)
13 July 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: What sort international legal code or norms do you think are needed to govern the space domain?

Masson-Zwaan: This is a relevant question and this is topical one that's on the agenda in the UN on the Committee on the Peaceful Uses of Outer Space. Space is becoming more crowded and contested and congested. There are discussions taking place about the need for a space traffic management system. That is eventually what we will have to come up with. That is the process, of course just like you have air traffic management. We believe we may need some rules of the road for use of outer space that states will have to agree on. That includes rules on debris mitigation and remediation and removal or end of life disposal of satellites and so on, as well as general guidelines on the long-term sustainability of use of outer space which the UN is also working on. So, there's a whole field of discussions that is taking place. There's not really a hard law yet on this, and I'm not sure that there will be some kind of space traffic management treaty or anything in the near future.

As you may know, the UN created a body of International Space Treaties but the last one of those was in 1979. The Moon Treaty, as you know, is not a very successful treaty, and since then the UN has more legislation in terms of what we call soft law: guidelines and principles. You can wonder whether something like space traffic management is ideal for soft law making or whether a treaty would be ideal. I always say of course a treaty would be ideal, but it's not very probable that any progress will happen in the short-term. For debris, of course, we do already have some guidelines by the IADC, the Inter-Agency Debris Coordination Committee, which have been more or less taken over by the UN as well. There are some standards, ISO standards. It is a process. It is gradually evolving, but there are no real hard legal rules about this yet. It is really an emerging awareness of the need for sustainable use of outer space.

[…]

Interviewer: Yes, would you like to elaborate I guess on the Outer Space Treaty of 1967 which you mentioned earlier?

Masson-Zwaan: Yeah, absolutely because I really feel that the Outer Space Treaty is sometimes misunderstood as being a barrier to the use of the outer space. I think that the Outer Space Treaty facilitates use of outer space. I'm very afraid if anyone is going to propose to amend the Outer Space Treaty because I really think that we would never get to a consensus like that which was agreed upon in the 1960s. If you open up the treaty to amend anything, there will be many states that are now, space aspiring states, that will want to also put in their grain of salt, and it will be a proverbial can of worms. So, I'm definitely not a fan of opening up the treaty. Actually, there was a hearing recently in the United States, and it was quite remarkable that even the industrial players in the United States as well as all the others who were involved in this hearing more or less agree that the treaty should not be amended.

That does not mean that the treaty is all encompassing and that it answers all questions because obviously there are many issues that were not thinkable back then that are issues now. Activities like space mining or the problem of space debris or that space traffic management issue that we discussed earlier are examples of on-orbit servicing, and all these activities that are emerging at an exponential speed and so on. There are legal questions that need to be answered, but I believe that we should be supplementing what is in the outer space treaty by means of codes of conduct or guidelines because it's not very likely in current global politics that there is going to be any new treaty. But I am hopeful that with the emergence of all these questions, states can come together and see some of the questions that were not treated back then, but any new rule should be in line with the principles of the treaty. I believe and think that it is useful to maintain those basic principles of state responsibility, peaceful uses, no harmful interference, and so on, which actually protect even the commercial and private uses of outer space as well as national security interests.

I'm a fan of the Outer Space Treaty. I believe that it deserves compliments for its simplicity but at the same time its comprehensive coverage of items. The tendency to say that it prohibits or prevents future uses of outer space I think is not right. I would keep the treaty as is, but I think we do need some supplementing provisions to foresee all the new problems of the new space era that we are in.

Interviewer: Hi, this is George. I have a question. You've mentioned several laws and treaties and guidelines, some of which are binding, some which are not, but given sort of rapid advance from technology and capabilities in this sort of space realm, do you think that these treaties and guidelines and laws are sufficiently keeping pace to properly regulate things in space or might we get to a situation where technology starts developing so quickly at a rate that might start to outpace the laws that we have?

Masson-Zwaan: Yeah, it's a very good question. That's of course very typical for space activity, where technology does go super fast. Things are happening as we speak, which is why the law should always follow with technology and not precede it. That is also why, for instance, in the UN COPUOS, you have the Scientific and Technical Subcommittee and then a Legal Subcommittee, and space debris or long-term sustainability are discussed first in the Scientific and Technical Committee before they go to the Legal Subcommittee. That makes perfect sense, and I think this is another argument why soft law is actually good at this point in time because that can also be made much, much quicker than a treaty. Actually, if you want to make a new treaty, it might take you ten years or twenty years, and guidelines generally can be agreed on because they are not legally binding and done in a much quicker way. And, of course, they should put any technical details for instance not in the main document but in an annex so you can find ways to deal with the technology; that was done in the Nuclear Power Source Principles that were adopted by the UN. That has a technical annex, so that can be amended much easier.

There are ways in law-making that you can take into account that technological advance that you have to deal with. But yes, that is typically a problem that we have. There's also I think the force of the Outer Space Treaty because despite all those developments, the main principles can still be applied, such as the principle of authorization, supervision, registration. Also, in the example of registration, you can mention the example of satellites that are sold in orbit to another company or in the country. We need to make revisions of transferring the registry, and that is not currently foreseen in the treaty but this is also not prohibited in the treaty, so whenever something is not prohibited in an international treaty and in an international law, you can conclude that it is allowed. That also leaves enough openness to address these ideas and then to make agreement on how as a community of states we're going to build it, because space is by definition an international domain where it is very important that we have agreement with other states and also for our own interest to be protected by those other states. We're all in the same game, that goes to say.

Paul Meyer

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14 July 2017

WRITTEN RESPONSE

"The Outer Space Treaty at 50: An Enduring Basis for Cooperative Security"

On October 10, 2017, the 50th anniversary of the entry into force of a foundational treaty will occur: that of the Outer Space Treaty of 1967.This treaty represents an apogee for international cooperation in a unique environment that has only grown in importance in the intervening years.

It might have been expected that the golden anniversary of such an achievement would have been hailed and celebrated with great fanfare by the global community that has benefited enormously from the regime it established. And yet this occasion is likely to come and go with barely an acknowledgment by the 105 states parties to the treaty, let alone the wider stakeholder community. This benign, or perhaps malign neglect of the Outer Space Treaty should be of concern. It reflects serious negative trends in space security and casts a shadow over the prospects for future cooperative security arrangements.

The enduring importance of the Outer Space Treaty resides in its crucial foundational principles and provisions. At their core was the designation of outer space as a "global commons", "the province of all mankind" in the language

of the treaty. This special status for outer space meant that it was "not subject to national appropriation by claim of sovereignty". The significance of this designation as a conflict prevention measure is apparent if we recall how often disputes over territorial and sovereignty claims have triggered war here on earth.

The treaty called for the exploration and use of outer space to be carried out "for the benefit and in the interests of all countries" and provided for consultation in the eventuality that an action by one state might cause "harmful interference with activities of other States Parties". This enshrined a progressive understanding that the many and not just the few should benefit from the exploitation of outer space and that use should be carried out in a manner that did not interfere with anyone else's activity.

The treaty affirmed that outer space should be a realm "for peaceful purposes" and backed this up with specific prohibitions against the stationing of Weapons of Mass Destruction in space as well as any militarization of celestial bodies. The treaty provided for measures to reinforce this cooperative orientation via observation of space launches, visits to facilities on celestial bodies and consultative arrangements.". All in all, the treaty provided an impressive, legally-binding and cooperative framework for maintaining safe and secure access to outer space.

On the basis of this peaceful regime established by the Outer Space Treaty, activity has expanded greatly in the decades following its entry into force. Today some 1500 satellites are currently active and over 60 states or consortium own space assets. A burgeoning private sector is generating ever more ambitious plans and projects for accessing space and introducing into orbit hundreds if not thousands of new satellites. Every country on the globe is benefiting from space-enabled services and the collective contribution of space to the world's security, prosperity and general well-being is vast. All of this activity is premised on continuation of the benign operating environment of space, essentially free up to this point from man-made threats against space assets.

This politico-legal regime conducive to further productive use of outer space is regrettably being challenged and even undermined. The three depositary governments of the treaty are not only inactive in officially marking the treaty's major anniversary, but seem to be ignoring its very existence and that of the cooperative security paradigm it represents.

This neglect of the Outer Space Treaty by the very states that championed its creation, points to a disturbing trend in contemporary space security affairs. This trend ignores the constraints on the behavior of actors in space in favor of emphasizing unrestricted freedom of action and the development of national security-related capabilities in support of unilateral moves.

The testing of anti-satellite weapon capabilities has revived the long dormant threat of the weaponization of outer space and the targeting of satellites. Allegations of further developments of ASAT capabilities reaching into even geo-synchronous orbits have been traded amongst the three leading space powers. The realities of these military programs are largely concealed from public scrutiny, but what is clearly on display is escalating threat perceptions and associated rhetoric by relevant officials. We are repeatedly told that space is "congested, competitive and contested" but not reminded that it has been a realm of remarkable, international "cooperation" as well. The Outer Space Treaty embodied this cooperative approach.

Against a backdrop of deteriorating geopolitical relations, accusations of hostile intent in the space arena, provide ready substantiation for building up of national counter-space capabilities thereby fueling an incipient arms race. Diplomatic alternatives to the readily self-fulfilling prophecy of "inevitable" space conflict are apparently not being considered or pursued. The international community need to find advocates of space peace rather than space war.

It is perhaps time for the rest of the international community and the broad stakeholder community to respond to these negative trends. Countervailing diplomatic initiatives to shore up the "peaceful purposes" regime based on the Outer Space Treaty and fill in some of its lacunae are needed. It would be timely to mobilize "Friends of the Outer Space Treaty" to defend its authority and reject those who seem bent on ignoring its constraints.

Such a diplomatic effort in support of the Outer Space Treaty could have several elements; but the following four would be priority actions. The first step could be a revival of the multilateral negotiations of an International Code of Conduct for Outer Space Activities. The origins of the Code lie with the EU-initiated proposal for a voluntary set of measures designed to promote the safety, security and sustainability of space activity. This initiative suffered a diplomatic "failure to launch" when the proposed Code was brought before a multilateral meeting in July 2015 in the hopes that the text could be finalized. This was rejected however by a significant number of states which insisted that such a Code needed to be developed under a mandate authorized by the UN General Assembly. The most innovative aspect of the Code was its provisions for institutional support and on-going discussion by states of its implementation, elements which would compensate for the lack of such institutional support in the Outer Space Treaty. The promising elements of the Code merit being re-introduced as part of an UNGA-mandated negotiation that would ensure that any product would have legitimacy and serve to reinforce the regime centered on the Outer Space Treaty.

A second avenue of action would be to follow-up on the 2016 achievement by the UN's Committee on the Peaceful Use of Outer Space (COPUOS). The Committee was able to agree on an initial set of guidelines emerging from the multi-year working group on the long-term sustainability of outer space. Although somewhat tangential to space security concerns per se the guidelines suggest the possibility of further international cooperation. An early agreement on the next set of admittedly more demanding proposed guidelines would generate much needed positive momentum.

The third course of action would seek to re-establish, on behalf of the international community, a clear common purpose with respect to outer space. The fiftieth anniversary of the Outer Space Treaty provides a unique occasion to reaffirm the peaceful purposes orientation of the treaty. It is not too late for one of the 105 signatories to host what would be the first ever meeting of its states parties. Such a meeting would constitute both a fitting commemoration of this key treaty as well as serve as an impetus for re-instating international cooperation as the preeminent aim for the outer space regime. It could also energize a campaign to promote universalization of the Outer Space Treaty, to bring onboard the almost one half of states not yet party to this vital agreement, starting with the 24 states that have signed but not ratified the treaty.

A fourth step that could take diplomatic energy from the 50th anniversary would be consideration of elaborating a Protocol to the treaty that would extend his ban on WMD to all weapons and destructive action in outer space. This would be a way of responding to the international community's interest in the non-weaponization of outer space without running the risks of attempting to amend the treaty itself.

To conclude, the Outer Space Treaty has well served global interests for half a century and merits positive acts of affirmation. The 'peaceful use' regime it established has enduring security value and with reinforcement via certain complementary measures the treaty can continue to provide a solid foundation for responsible state conduct in outer space.

Dr. George Nield

Associate Administrator, Office of Commercial Space Transportation
(Federal Aviation Administration)
1 August 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: What are international legal accords or norms that are needed to govern an increasingly crowded space domain?

G. Nield: I think that is a very important subject, and I do believe that all space-faring nations need to have a set of guidelines or standards or best practices or rules of the road that are developed by, supported by, and adhered to by the international space community. Why? In the interest of enhancing the safety of space operations and preserving the space environment. That's something we really need to strive for. It is not something that the US can dictate necessarily. We can be a leader though. So this is a tremendous opportunity for the US to be a leader, if we're willing to allow and even encourage international participation.

Potential topics that we would want to include, include things like orbit selection, specific altitudes and inclinations that we would want to encourage people to use if they did not care where they were going in space, trackability, including things like the use of beacons or transponders or corner reflectors, so that we can make sure we can track these things and make sure we do not have collisions. Maneuvering capability -- maybe there are things we want to encourage there if you are going to go to certain orbits or have certain lifetimes. Orbital lifetime itself. Rendezvous and prox-ops procedures and notification of coming orbit changes like turn signals for spacecraft, if you will. Lots of great subjects.

I think the US has sort of ignored the rest of the world in this area and just assumed that we were the leaders and we could do whatever we want. That is no longer the case. We need to play a role, or else we are going to find other countries or other organizations like the United Nations and other new groups that are going to be writing rules and they may not be the rules that we would write if we were leading the parade.

Michiru Nishida[29]

Special Advisor for Arms Control, Disarmament and Non-Proliferation Policy
(Ministry of Foreign Affairs of Japan)
29 March 2018

WRITTEN RESPONSE

With the increasingly crowded space domain with the accelerated pace of generation of space debris, the creation of codes or norms designed to prevent generation of further space debris is urgently needed. Considering the absence of political will in any international fora such as UNCOPUOS and CD to establish new legally-binding instruments, non-legal politically-binding codes or norms would probably be a better way to proceed. Such codes or norms should prohibit debris-generating outer space activities such as intentional destruction of outer space objects and should be applicable to all outer space activities, civil and military, as mentioned above. The UNCOPUOS did adopt the Space Debris Mitigation Guidelines in 2007, but following the destructive ASAT test in 2007 by China that created thousands of debris, a dispute arose as to the scope of the Guidelines, citing the mandate of the UNCOPUS. Since then, China has not conducted such a destructive test, but there still remain possibilities. Therefore, the creation of international codes or norms applicable to all space activities that prohibit space debris is urgently needed.

[29] The response here represents the sole views of Nishida, and are not intended to represent the position of his organization.

Dr. Luca Rossettini

CEO and Founder (D-Orbit)
16 August 2017

WRITTEN RESPONSE

[Q19] What international legal codes or norms are needed to govern the increasingly crowded space domain?

At this point it is clear how increasingly crowded orbits present danger and jeopardize our future in space. With this respect, traffic control and space debris are the two most important aspects to clarify at international level. With a normed use of space and especially a "clean space" policy working, all the national and international security measures will become easier to be applied and adopted.

- Traffic control: today anyone can launch anything in space. However, I cannot drive a car without getting a driving license first. Where to "drive", how to "drive", where to "park" and to manage "yield rights" in space should be decided and agreed.
- Space debris: this is probably the most important problem for the maintenance and future development of the space sector. A poor approach to solutions may result in a complete loss of this environment. And it is already costing a lot especially to the US. Collision reactions in space will have the same effect as a nuclear explosion (with one big difference): a massive disaster that will prevent the use of that "territory" for decades. However, while the nuclear contaminated area on ground may be restricted, this will not happen in space. The entire space region around the earth will be affected. All new satellites leaving earth should implement fast and independent decommissioning capabilities. All satellites should be able to perform fast collision avoidance manoeuvers when an alert message is received. Satellites have to be protected – cybersecurity. During its life in space, a satellite should be checked and proof of good health should be given to the relevant authorities: if the satellite is not feeling well it should be disposed of immediately, avoiding the risk of creating a new junk in orbit. Eventually, at end of their missions, satellites shall be disposed of quickly and safely in a controlled way, via an independent system installed before or after launch, and which functions in the event the satellite dies.

[Q23] Fifty years of space has seen much change. Which aspects of the Outer Space Treaty of 1967 are still valid and which need updating?

50 years ago decision makers were not forecasting the change we are experiencing now in the space sector. In few decades space will become another environment in which human being will do business, travel, have fun.

The Outer Space Treaty is a fundamental document that could act as enabling factor for a completely new and re-addressed framework on the use of space. Although quite comprehensive of all different aspects, it is still based on poorly legally implementable rules.

Space debris: we need binding rules, based on principles that do not suggest a "reduction" of the problem but the "absence" of the problem. We cannot forecast the future and we don't know if the measures we may consider effective today for space debris mitigation may work five years from now. The basic concept is that every object leaving earth for space should not constitute a menace for other space assets, for people and assets on ground and in general for the environment. Every satellite should implement adequate solutions (see previous chapters) and comply without waivers.

Commercial space: the use of space and space traffic management should be regulated and clear norms have to be created to ensure the use of space becomes a controllable or at least verifiable.

Interplanetary actions: asteroid mining, colonies, etc. If and when this will be implemented, UN should be put in charge of managing the procedures and collecting the fees. In the very long term future with colonies established

in different environments outside earth, a common international entity will deal at interplanetary level, and it is likely this entity will be UN.

For the very same reason of the last sentence, if the US wants to keep its competitive position today and in the future, it should act immediately by example, pushing for a new set of rules, the use of specific technologies and solutions, and work for their adoption.

Dr. Michael K. Simpson

Executive Director (Secure World Foundation)
23 August 2017

WRITTEN RESPONSE

[Q19] What international legal codes or norms are needed to govern the increasingly crowded space domain?

I am increasingly convinced that a rigorous regime of traffic management in space is required. Given current geopolitical circumstances this may be difficult to achieve, but if we do not find a way to manage crowding with political agreements, Newton's Laws of motion will begin to impose their own constraints on us.

[Q23] Fifty years of space has seen much change. Which aspects of the Outer Space Treaty of 1967 are still valid and which need updating?

Truth be told, most of that change has been pretty beneficial.

For the most part the OST has facilitated the last fifty years of space development. It presents few obstacles and many pathways. The best path would be to allow us to develop a broader base of practice under it as commercial space raises questions that do not lend themselves to easy answers. Critical to the application of the OST is its core prohibition to asserting a territorial claim of sovereignty in outer space. Were we to eliminate that we would certainly face a new era of territorial competition and the conflict, diplomatic, economic, and military that that would provoke. That same prohibition of course means that no state can grant clear title to a specific piece of natural, extraterrestrial real estate. That complicates business planning as we have done it for centuries. A solution is to create a new regime for resource development that does not require title to the underlying fee but only to the extracted resources. In the late 1700's before the American Revolution, early frontier entrepreneurs made good livings West of the Appalachians even though the Royal Proclamation of 1763 banned all settlement or land claims there. These folks worked a simple but operational system they called tomahawk rights that worked by marking off a piece of land no bigger than a single trapper, hunter, prospector, etc. could work. They had no title, but they were able to pursue their business. Amazing abundance of resources facilitated the solution as did the knowledge that extreme territoriality facilitated by violent conflict was a waste of time in the face of an embarrassment of riches. Such embarrassment seems to be the case in space as well.

Do we really want to take the risk that a new framework would not ban claims of territorial sovereignty? Even a brief hiatus between the current OST and a new framework could lead to a flurry of claims, which the new framework might not be able to fully extinguish. We could be left with a situation like Antarctica where claims are suspended but not renounced. Such claims could always reemerge as new resources were discovered and new applications developed. It would be much better to live with the OST as a somewhat vague statement of principles and occasionally add principles to it than to risk replacing it in an environment where so many countries have independent ability to reach the Moon, the near planets, and everything in between. Keep in mind that the Rescue and Return Agreement, the Liability Convention, and the Registration Convention have all amplified and clarified the OST in the years since 1967. The Moon Agreement tried to do the same but never assembled a large political consensus around its clarifications.

Matthew Schaefer and Jack M. Beard

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16 August 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: What international legal codes or norms are needed to govern the increasingly crowded space domain?

J. Beard: Okay, so, I'd like to answer that question in conjunction with another question from your list. The two particular questions are, “what international legal codes or norms are needed to govern the increasingly crowded space domain?” and “what can the US do to best facilitate development of verifiable norms that maintain a peaceful space domain?”

So, what legal codes or norms are needed to govern the increasingly crowded space demand? Matt has just spoken to real efforts to try to reduce the space debris, which could eventually make it impossible to use space.

So, to move on to the security world, what can the US do to best facilitate the development of verifiable norms that maintain a peaceful space domain? Again, I'd like you to look at my article because these are sort of arms control issues. I practiced for 15 years in the Office of General Counsel at DoD, and I was an expert on arms control. As you start talking about what you can do here to create conventions, treaties, or norms to limit or constrain space operations, I have one key principle for you to bear in mind: it is almost impossible to regulate technology in space because it is almost all dual use. In fact, anything that moves in space can hit another object, and thus represent a potential weapon. For example, our space station has always been viewed by the Russians as an evil weapon, a space maneuverable vehicle (SMV). Anything that can maneuver and crash into something else is a weapon. Our other space law professor here, Frans von der Dunk, writes in his space law handbook that just about everything in space has a military application.

So, regulating technology is elusive in space—you can't go up and verify it, and no one is going to let you verify it before it takes off. Seeing what's up there and arguing whether it's a weapon or not, gets to the issue of intent, and there's no defensive or offensive capabilities that can't be merged or confused. So, if you're going to try and regulate space, weapons in space, and military activities in space, then your best bet is going to be regulating conduct, and not technology—you can regulate conduct and verify some conduct, but technology is elusive.

The Russians and Chinese have tabled a proposal right now there called the Prevention of the Placement of Weapons in Space, and it’s the only arms control proposal for space that is currently out. It’s dead on arrival for the United States because it would regulate space activities in a way that can't be verified—as the Russians say, "Well we’ll work that out later." It completely neglects all sorts of terrestrial-based and satellite weapons system.

Anyways, I think the key on this is that you're going to have an incredibly hard time regulating technology, and I speak to that in my article that I’ll send to you.

So, to go back to the question of, what international legal codes or norms are needed to govern the increasingly crowded space demand? A norm, again, if you're going to have a legally binding norm in space, you're going to have to work out a very difficult international agreement regulating conduct in the military sphere. The Chinese are completely uninterested in doing that, so you're left with joining in regimes that don't include our adversaries, which is a loser of the first order.

So, for your question of verifiable norms, I need for you to distinguish between a truly international agreement that is legally binding and includes all these countries, which is so unlikely. Since 1979, and the ill-fated Moon Law Treaty, there have been no legally binding international agreements for outer space

M. Schaefer: There are some people that say you're never going to be able to prohibit ASAT weaponry because the incentives for certain countries to create them are always going to be there, but Jack was talking about maybe actions. So, in other words, you might have a ban on testing ASATs but you can't ban the development of ASAT because you wouldn't ever be able to verify that

The other thing that creeps in, I guess, that I've heard a little bit of discussion about is, as this gets more into kind of controlling technology—although it leaps into actions as well as technology—it is indiscriminate. So, when you're developing an ASAT, you shouldn't do ones that are going to cause indiscriminate harm—in other words, like the Chinese ASAT test, the kinetic device in 2007, because it created thousands of pieces of debris that are going to last there for decades. Though, that might be captured by test ban anyway, because that's what they were doing—testing an ASAT.

J. Beard: Those are really good points, and I'd like to build on those points Matt's making about ASAT tests. It is probably very much in the interest of the United States of America to agree to some sort of ASAT test ban, at least for destructive ASAT tests that generate debris, because we have no interest in doing that—our weapon systems are developing to disable satellites without creating a debris field. We have no interest in Israel, or Japan, or France, or India conducting any satellite tests that create more debris. It is an area where we could cooperate with the Russians and Chinese if they could agree—we could pick the sort of tests that would be prohibited and the altitudes and so forth. So, that's a possibility. But, here's the problem, right now, no ASAT tests are legal. The ASAT test by the Chinese in 2007 was an extraordinarily bad and unhappy development for everyone in space because of the debris field it generated. Yet, except for Japan, there was no country on Earth that condemned that test as illegal, because they're still preserving their options. So, you have to be careful about what is law and what is not.

So, moving to your question of, what are the principles (e.g., flexible v. controlled response; proportionality, etc.) upon which international policy makers should develop response options for aggression in space? A disproportionate attack is a type of indiscriminate attack that causes more harm to civilian objects than is justified by their concrete and direct military necessities of the attack. And there is a debate right now about whether generating these huge debris fields that threaten all these other satellites in space is a disproportionate attack. Some of my expert friends at the Naval War College and elsewhere would suggest that you have to be talking about loss of human life and so forth for it to be a disproportionate attack. But, I think that the more you study space and things like GPS satellites, the more that you might be able to make an argument that an attack generating huge debris fields might violate the Law of Armed Conflict, but it's a debated issue.

M. Schaefer: So, just to add a few more points, particularly on the question of, what international legal codes or norms are needed to govern the increasingly crowded space domain?

We have the problem of small satellites, and dumb (non-trackable) satellites, as there are now a lot more miniature satellites up in space. This sort of falls under the topic of space traffic management a little bit. We don't want to turn things over to ICAO or anything like that. So, there are questions about norms regarding trackability, particularly whether or not small satellites should be able to be tracked. If not, and there are certain satellites that aren't trackable, should these be limited to certain orbits?.

I've also seen some discussion about "dangerous approach." What should constitute a "dangerous approach" in space so that there's no misunderstandings.

But, I think the trackability or the orbits for the non-trackable satellites is becoming important. And this technology that's relatively inexpensive now that would allow for trackability is also important, because it can help keep space safe because these collisions are the things that create the largest amount of debris.

[…]

M. Schaefer: With respect to the question of, can international agreements effectively protect high-value space assets in time of crisis and/or conflict? I agree with Jack's comments. International agreements are a tool to use to help protect space assets, but you can't rely just on those alone. The international agreement can help assist technology that's developing in other things—it's a tool in the toolbox to use—but to totally rely just on an international agreement, particularly given the problems with verification, it obviously can't be done.

With respect to your questions about the Outer Space Treaty, "Fifty years of space has seen much change. Which aspects of the Outer Space Treaty of 1967 are still valid and which need updating? Is it better to add to/amend the 1967 Treaty or to establish a new framework for the 21st century?" I actually had the opportunity to provide testimony in front of the Senate Commerce Space Subcommittee in late May. I think the US should stay in the Outer Space Treaty. The US should not withdraw from the Outer Space Treaty. The US also shouldn't seek to re-open the Outer Space Treaty. There are a lot of nations that have very similar viewpoints with us, and there are some that do not, and I believe that we won't get a good result out of re-opening the Outer Space Treaty. We should do other things on the sideline—bilateral and trilateral if circumstances arise.

The Outer Space Treaty is minimally burdensome. It allows for commercial activities. There are a few restrictions, but, by the way, we would want those restrictions, those minimally burdensome set of restrictions, in place even if we were to do something new today. In other words, the Outer Space Treaty strikes a pretty good balance. Yeah, sure we're frustrated at times because it's not more limiting of others' actions, but, on the other hand, we don't want our actions overly limited either. So, I think the Outer Space Treaty has mostly good stuff in there, and I think our best bet is to use bilateral negotiations and trilateral negotiations, as circumstances arise, to flesh out some of the details for things like due regard, free access to all areas of celestial bodies, etc. For example, Article 12 of the Outer Space Treaty is about visits to other space stations, and that currently has some of our commercial companies worried, but I think that there's sufficient wiggle room in there—and if you look at the purposes of it, it doesn't have to be a costly or negative thing for commercial actors.

J. Beard: Let me echo those remarks, and add a couple of additional nuances here. There's always someone suggesting a great idea to add to the Outer Space Treaty—there's always someone. And, you know, you could try to re-negotiate what the term "interference" means, but, in the real world, and this was my sad world as DoD General Counsel, whenever you do this to multilateral agreement, you are opening it up for discussion. This would be particularly risky with

respect to the Outer Space Treaty because, unfortunately, a good number of the countries that signed the Outer Space Treaty feel screwed over by the Outer Space Treaty.

The Outer Space Treaty was signed in 1967. And, of course, Verizon, AT&T, cable television, etc. didn't exist in the world when the big guys—the Russians and the Americans—set up a regime that was basically favorable to them, to their space industries, to their national security interests, etc. And, basically, the United States and the Soviets said it was all being done in the name of peace, but, realistically, the United States and the Soviet Union were getting great deals for their advanced space industries at the expense of other emerging space powers. So, this is one of the major problems—I don't think you can open up the Outer Space Treaty without dealing with all the unhappy countries, and particularly those that are along the equator because the ideal placement of certain types of satellites is right around the equator and hovering right over these states at the equator. Notably, there was an international declaration at Bogota, Colombia between these states suggesting that the placement of Verizon's, AT&T's, and all these other countries' communication satellites at the equator, hovering over their countries, represented a taking of their national resources because that space above them is so valuable.

So, there are other countries now that have other interests and various emerging space law programs that don't feel like the Outer Space Treaty represented a very good deal for them now. It may have in the past, but they just didn't know what technology was going to become today.

My last comment about this, and it really applies to all your topics, is that anytime you try to regulate future technology and you're the United States of America, you're going to be screwed. We are so dependent and focused on the latest, greatest new technology to solve our problems, that eliminating different avenues of technological approaches to problems in space in advance, is extremely dangerous. For instance, everyone wants us to restrict a certain type of space vehicle, but, who knows, at some point that might be the ideal way to remove space debris. The United States got burned once, and I don't think It will ever get burned again, when it signed up to a statement in the ABM Treaty in which the Russians asked us to prohibit any future technology and any physical principle that would serve as an anti-ballistic missile system wherever it was located. And we signed up with that, but then in a few years, the United States wanted to build a Strategic Defense Initiative ("Star Wars"), and the Russians properly noted that it probably violated our own agreement about extending the ABM Treaty to any possible new technical physical principle, which included space. And the Russians were probably right there, and we were foolhardy in signing that agreed statement.

So, regulating future technology is probably not good for the US Department of Defense, and it is unlikely that the Americans are going to sign up for it. A continuing example of that is with the Russians and Chinese continuing to demand we define where space begins—what the outer limits of the atmosphere are and where space begins. And the United States always resists doing this, because we have no interest in disadvantaging ourselves—if we have some new technology that operates in that area in between space and the atmosphere, we're going to take it because, remember, someone's airspace is completely under their jurisdiction control, so as soon as you cross into outer space, they leave "American space." So, why would we want to define that place? There are a lot of interesting geopolitical strategic treaty negotiations that have been going on here.

M. Schaefer: The final point I'd like to make here is that on the commercial side, there has been debate in the past year about whether OST obligations apply to commercial actors. They don't directly, but Article 6 in the OST was sort of part of a tradeoff—the Soviets really wanted to ban private commercial activity in outer space, and only have governments, but the US obviously rejected that, and part of the tradeoff was that Article 6 of the OST makes countries internationally responsible for their non-governmental actors' activities in outer space. So, countries have to

ensure compliance by their non-governmental actors, their commercial actors, with OST provisions, and the countries have to have an authorization and supervision regime in place to do so. And, that's something Congress is working on right now. But, through Article 6, in essence, the US government has to ensure that its commercial actors comply with OST obligations. And, again, I think most commercial companies now understand this given the debate that's gone over the past year that's true, but also that OST obligations are very minimally burdensome—they don't have to impose high costs. It's essentially just some basic norms in the OST.

Though, there are few that cause worry for commercial actors. I mentioned Article 12, which provisions visits to stations, but there are a lot of caveats in there and wiggle room, and the actual object and purpose and context of that provision may be for arms control reasons, in which case you could exclude commercial actors or reject a request of another country if it looks like they are simply trying to harass or steal ideas, intellectual property, or design of a commercial company by scheduling a visit to such a station (e.g., a commercial research lab, an out of orbit hotel, or a commercial asteroid mining facility). There's obviously going to be budgetary limits and technological limits amongst the countries that can actually go up and make visits to US commercial stations—it's going to be limited to probably just a couple of countries. So, that's why I mentioned the bilateral and trilateral negotiations. These things can be negotiated to as they arise. They don't require a re-opening of the Outer Space Treaty, because that would lead to not good results.

The other thing I'll mention is asteroid mining and property rights. The US Congress in 2015 made clear that you can have property rights in extracted resources, and that clearly confirms long-standing US interpretations of the OST going all the way back to the 1970's. Article 2 of the OST prohibits claims of sovereignty, but that doesn't mean you can't have property rights in extracted resources, and the US Congress has confirmed that.

And, about a third of the countries in the UN COPUOUS agree with that. And then there is a third of the group that agree, or could agree, with it as long as there is proper authorization and supervision of the activity. And then there is a third of the group that would reject that idea for matters of their own national interest. So, are you going to reopen the OST and try to put in a new provision into Article 2 to say that you can have property rights from extracted resources? No, because you won't get that. The better way to work it is to enshrine it in US domestic law like that Congress has done, and putting authorization and supervision regime in place, which the US Congress is currently working on. By doing this, now you have about two-thirds of UN COPUOUS countries that are on-board with your idea. China, by the way, is noticeably silent on the issue, even though the natural reaction would be to contest any US interpretation because, of course, they have designs on doing similar types of activity themselves. Russia and Brazil, I guess, would be the one mostly sort pushing the anti-property rights charge.

So, again, there is no benefit to withdrawing from the OST just because a few countries disagree with us on that issue. There's no point in reopening the OST and trying to get those few countries to agree. And the main point is that we continue to do really, really compliant things with the OST, and continue to build a larger group of countries that are willing to hop on board with US desires and interpretations that are in the United States' interest.

[…]

Interviewer: Okay. Great. So, I find it really interesting that on one hand, the space domain is so rapidly evolving, and technology is developing so quickly and more and more actors are getting involved, but, on the other hand, I believe you noted that there have been no new treaties or charters since 1979, I think it was. I find that really interesting. You both clearly emphasized that it is a bad idea to walk away from or reopen the Outer Space Treaty, but, I'm wondering, do you think the

current treaties and charters that are currently in place for the space domain are well-suited to handle the rapid evolution and development that is clearly underway in the space domain?

M. Schaefer: I think they largely are. And I think there is a proper approach to take when it comes to legal instruments. First, you have to identify a specific topic of concern. The specific topic, and desired agreement, should be narrowly focused, because I don't think a broad-scoped agreement is going to work. You also have to consider several other factors. Do you want a legally binding agreement or a legally non-binding agreement? Which countries need to be involved or should be involved, and what's the topic? And I think it's the narrow topics that stand some chance.

So, a couple topics that we mentioned. A destructive ASAT testing ban is one. Another is trackability requirements on all satellites, or, if you can't meet the trackability, then you are limited to certain orbits. Another could be something like determining what a dangerous approach would constitute to a satellite. Other ones I could see having a chance would include some of the commercial issues, which I believe overlaps with visits to government facilities and Article 12 of the OST. Once we get US commercial companies up there at research facilities or doing asteroid mining and China, or another country, makes a request, then you would try to do a bilateral agreement with that country saying something like, "No, we're not going to allow tests here. It's commercial. This is really to test weapons to make sure there is no WMD placed on a celestial body."

So, I just see more limited topic scope or limited country scope agreements being sufficient to plug in some of these holes, rather than big broad multilateral treaties, regardless of whether it is reopening an existing one or creating new ones.

J. Beard: Matt is absolutely right about picking a very narrow topic to work on, and then trying to achieve that. I completely agree with that, and would add two other things.

First, let me step back and ask, and you have to do this with respect to the Outer Space Treaty in particular, does the OST serve US interests? Emphatically, yes, it does. We built it for us. And one thing it does, which the US DoD has to have as a matter of policy stated by administration after administration, is that it preserves flexibility for the US in space to navigate, to communicate, and to strike. We have to have that flexibility. An agreement that compromises that flexibility is fundamentally not good for our national security, defense, and intelligence activities. We can agree to specific prohibitions on certain things if we have some sort of ability to rely on other factors, making the other side also not want to do that, so long as we can verify it as well. But, to be talking about large activities or broad programs and so forth, that could restrict US operations in space, and that's just not a good starter.

The second thing Matt mentioned, which is absolutely right, is that you have two ways of doing this: a legally binding approach, or a legally non-binding approach. I cannot emphatically stress how bad the non-binding approach is, because there is no way to ever monitor a non-binding international document because you can't define cheating. If you don't have precise definitions of cheating and a monitoring regime, you can't ever enforce, monitor, or verify when cheating occurs.

So, because there have been no legally binding agreements since 1979, there is an entire industry of bozos, in academia and elsewhere, tracking over to Geneva, New York, and London, to constantly generate these wonderful new non-binding norms for space. These non-binding norms easily represents something that would restrict US national security activity. They never include China, and China is never going to sign on to these things anyways. Even if China did sign off on a non-binding document, if the United States signs it, and Russia and China signs it, they can compete in whatever they want and they don't have any Congress or free press to monitor

what they're doing—they can just do whatever they want—while the US on the other hand actually would have to try to comply with the terms of the non-binding document.

Given this, I argue in my article, and no one I've met in any conference can dispute it, that the United States is at a disadvantage in signing these things because people are going to expect the United States to comply with these non-binding principle. For example, China could say to the US, "Hey, why are you building that fancy new military satellite when in fact you're prohibited from doing things like that in this non-binding document. The Chinese and Russians could just laugh because the Chinese space program, and China really is an adversary in space, is one of the most secretive institutions and activities in the world. China only just recently allowed a camera in to show one of their launches, for the glorious state propaganda—the Chinese have been really nervous about sharing information about their space program.

So, ultimately, it's an inequitable arrangement for the US to sign these non-binding documents. But, it seems that these are all people are talking about at the moment—I guess because it's been so long since a legally binding agreement has been done.

M. Schaefer: Just to add one caveat. Jack is primarily talking from an arms control national security perspective. I think there can be some situations where it works to start with a non-binding code like litigation guidelines, as long as you have a process in place to ensure the national implementation of them. So, there are some situations where soft law can ultimately evolve into legally binding norms, or you get to keep it as a soft law instrument that has an implementation mechanism or a military mechanism to ensure it. But, as Jack has noted, we wouldn't want to do that for arms control and important national security things.

J. Beard: Yes, Matt's caveat is an important one. In other fields of law, like human rights, you'd see that the non-binding, soft law, "let's establish a principle" thing has worked really well. For example, "let's get as many champions as we can to agree that we're not going to torture." That would be a great principle to start with, and then you could start building codes and legally binding documents around this principle that has been agreed on. And in fact, in space law, the Outer Space Treaty started out as UN General Assembly Resolutions and other non-binding statements saying, "Hey, countries shouldn't assert sovereignty over objects in space." And, "Hey, countries should be able to overfly other countries' territory and not violate their territorial sovereignty." So, the Outer Space Treaty started out as non-binding principles that became rules of international law. But, when you start entering into the world of arms control, if you start going down the road of trying to create a norm that you support, but then other actors don't support it, well then you're asking for trouble in the arms control world. But, Matt's caveat is a really important one.

Spire Global Inc.

Peter Platzer
Chief Executive Officer

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15 August 2017

WRITTEN RESPONSE

[Q19] What international legal codes or norms are needed to govern the increasingly crowded space domain?

In terms of the potential for a crowded space domain, the Inter-Agency Space Debris Coordination Committee (IADC) is the primary entity of interest. The orbital debris guidelines developed by IADC are valuable in protecting space assets and valuable orbits. Many entities proclaim to follow those guidelines, which is a positive aspect. But, the guidelines were created in a period when large constellations of satellites were not in existence. So while guidelines exist, they also need to be updated in some fashion. One possibility is to have an enforcement mechanism. Along those lines, there may need to be some updates to the relevant space treaties.

[Q23] Fifty years of space has seen much change. Which aspects of the Outer Space Treaty of 1967 are still valid and which need updating?

There are some portions of the Outer Space Treaty that could be modified. For example, what is meant when a nation is "procuring a launch" is no longer clear. When National Aeronautics and Space Administration books a launch, it is fairly clear that the U.S. is procuring the launch. But, that clarity shrinks when a commercial entity such as Spire (based in the U.S.) purchases a launch for satellites registered with Singapore, manufactured in the UK, and integrated and launched from New Zealand. There is no clarity as to which nation is procuring that launch, and thus who is the launching state and has the ultimate liability for that payload.

However, the Outer Space Treaty was developed principally for dealing with the issue of weapons in space. Although parts of the treaty may seem antiquated (as there is currently less of a concern about nuclear weapons deployed in space), certain parts of the treaty could be better defined. But, the level of general certainty and clarity that the treaty provides for long-term planning is currently very beneficial to countries and entities. The structure of the treaty outlines high-level guidelines, and provides a basis for legislators in various countries to create laws that allow compliance with the treaty and development in the space sector.

Opening up the Outer Space Treaty for possible changes or modifications would potentially create more problems than it would potentially solve. There is no guarantee that all participating nations would agree on how to update any or all aspects of the treaty. (To highlight this concern, witnesses at a recent hearing in the U.S. Senate offered a nearly unanimous message that the Outer Space Treaty is not in need of updating, and that any effort to amend it could open it up to potentially detrimental changes.[30]) At minimum, the current structures of the treaty provide a good deal of certainty. Although the treaty may be better suited to the Cold War era, it has provided upper level norms, guidelines, and conventions for countries to reference as they tailor their own space-related legislation. Although there are certain provisions of the treaty that do not function as well as would be desired in recent years (and may likely also be the case for the near future), re-drafting of the treaty is not necessarily required at this time.

[30] For example, see http://www.thespacereview.com/article/3256/1

Dr. Cassandra Steer

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1 September 2017

WRITTEN RESPONSE

[Q19] What international legal codes or norms are needed to govern the increasingly crowded space domain?

This question ties in with the previous one, in terms of whether a new treaty would be advisable or likely as a governing regime. As I have argued in a paper co-authored with space security expert Gilles Doucet, key issues such as space debris and space traffic management may not immediately threaten national interest. However, they threaten the collective interest in the long term, and the question is how to incentivize States towards creating new space governance instruments to ensure sustainable use of space (Doucet & Steer, forthcoming). In that paper, we propose a system of technical annexes containing standards and recommended practices which could be attached to the OST as Protocols, or to a new treaty regime, and which can be updated as technology develops. This is modeled on the highly successful Chicago Convention for civil aviation, the annexes to which are updated regularly by area experts rather than by inter-State negotiations.

Aside from new binding regimes, the role of soft law has become increasingly important and influential, and it may be that the U.S. government's support of such instruments would contribute to better governance of SSA and space traffic management. For instance, the UN Group of Governmental Experts (GGE), established in 2001, recommended the development of transparency and confidence building mechanism (TCBMs) in outer space (UNGA Res 65/68, UN Doc A/RES/65/68 (2011)). The experts agreed upon a set of substantive TCBMs which include in particular the exchange of different types of information relating to States' space policy and activities, risk reduction notifications and expert visits to national space facilities, transparency and operational measures and consultative mechanisms. The GGE recommended that States and international organizations implement the suggested TCBMs on a voluntary basis and without prejudice to the implementation of obligations deriving from existing legal commitments. It also called on States to develop further TCBMs.

The U.S. should take the lead in developing international data-sharing and transparency norms. Increased transparency regarding intentions behind actions and maneuvers in space, and increased data sharing between all players, are key factors in reducing space traffic management problems and improving SSA. They are also key in avoiding unnecessary escalation towards potential conflict: in war games scenarios, lack of information regarding intentions is a consistent major factor in a situation rapidly escalating to conflict. International agreement on a common set of guidelines and principles can ensure more players will act responsibly and can also make it easier to identify exactly what amounts to deliberate irresponsible behavior and to accurately attribute such behavior. In turn, this makes it easier to respond appropriately (Steer, 2017, p. 13).

While it may seem counter-intuitive to call for increased transparency with States or players with whom there are existing tensions, in fact this notion enjoys wide support among commercial space actors, international organizations, space agencies, and governments. Recently China joined the existing majority of States calling for this at a meeting of the UN Working Group on the Long-Term Sustainability of Outer Space Activities. Russia remains the only outlier in the international consensus that increased transparency is the best guarantee against a conflict in space.

The draft International Code of Conduct (ICoC) could be considered to be a TCBM, and it deserves renewed attention. Originally an EU proposal, it had early support from the U.S., however in 2015 it was stonewalled during an international meeting held at the UN Headquarters in New York (Meyer, 2015). Its central purposes are to have subscribing States: agree to abide by the principle of freedom in outer space; to recognize the right to self-defense in outer space, while at the same time refraining from the threat or use of force in outer space; and refrain from damage to or destruction of space objects, unless this is justified by "imperative safety considerations", the

reduction of space debris, or the "inherent right" to self-defense. It also urges States to implement the Space Debris Mitigation Guidelines. The main reasons it was stonewalled were procedural, with many States objecting to the process by which it had been developed as being Western-centric and not inclusive enough. However there were also debates about the exact wording with respect to the clauses on self-defense. It should be noted that, by virtue of Article III of the OST, the prohibition on the threat or use of force applies in outer space, as does the right to self-defense, as in any other domain. No amount of debate about wording in a non-binding instrument will change this. On the other hand, a non-binding code of conduct could contribute to international standardization, best practices, increased transparency among actors, and political pressures such as shaming and ousting, all of which will benefit international governance of space.

The ICoC refers to the Space Debris Mitigation Guidelines, another soft-law instrument. This already has a very high degree of compliance, as many States have implemented these guidelines into national licensing requirements for the development or launch of a satellite. Building in de-orbiting or other methods for dealing with the end of life of a satellite is a first requirement for space debris mitigation. It would be worth considering adding to these guidelines or developing similar ones with respect to active debris removal technologies, since many States have concerns about the possibility to repurpose such technologies to capture space assets of an adversary.

Another governance mechanism exists with respect to the weaponization of space. In 2014, the UN General Assembly adopted the *No First Placement of Weapons in Outer Space* resolution (UNGA Res 69/32, UN Doc A/RES/69/32 (2014)), and a number of States have gone on to register with the UN unilateral binding statements that they will not be the first to place weapons in outer space. This is a politically positive step to take, and the International Court of Justice has recognized unilateral statements as creating an obligation (Nuclear Test Cases, 1974) but there are no direct enforcement mechanisms if a State were to go against such a statement.

[Q23] Fifty years of space has seen much change. Which aspects of the Outer Space Treaty of 1967 are still valid and which need updating?

The OST is, in its entirety, still valid. It remains the constitutional, framework treaty, with important governing principles regarding to freedom of access to and use of space, the non-appropriation clause, the prohibition on the placement of nuclear weapons and weapons of mass destruction in orbit around the Earth, strict liability of States for all activities which take place in outer space under their jurisdiction, and the requirement of due regard and consultations with other States. All of these principles and clauses are today considered to be customary international law, thus binding on all States, regardless of whether they are party to the OST or not. It would therefore be ill-informed to consider the OST or any part of it invalid.

The question as to whether there are aspects of OST which need "updating" is more complex. Certainly the OST is inadequate when it comes to recognition of the complexities of commercial actors in space. At the time it was negotiated, the only two players in space were the U.S. and the Soviet Union, and the prospect of commercial entities having the economic and technological wherewithal to dominate space activities was a distant future possibility. There was some recognition of their potential role, since Article VI provides that States shall bear international responsibility for *all* national activities taking place in outer space under their jurisdiction, "whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity" with the OST. Furthermore, the activities of non-governmental entities "shall require authorization and continuing supervision" by the State; in other words, national regulation and licensing is required as a matter of international law. But the extent to which commercial entities have become prominent players in the space sector was either not foreseen by the drafters of the OST, or, given the political pressures at the time, simply not a priority.

The U.S. takes this obligation seriously, and many other States look to its national legislation as a model. There are complaints by commercial entities that they are over-regulated, and that this stymies innovation. In recent years commercial entities have lobbied for looser regulation, and in 2017, a new proposal has been put to U.S. congress to create a "free enterprise" environment for the commercial space sector. However, it must be remembered that

the obligation under Article VI of the OST was put in place in order to ensure continued State oversight, and in times of rapid proliferation of the number and types of actors in space, this is an important framework to maintain. Space traffic management, and SSA, both of which are critical for space security, would become nigh impossible without State oversight.

There are also some weaknesses with respect to clarifying the "due regard" obligation under Article IX of the OST, and its relationship with the freedom of access and use of space. There are suggestions that the desire to close negotiations and ensure a framework treaty would be adopted speedily, meant that this article was not fully developed (Hobe et al., 2009, pp. 170, 172). In essence, the article codifies principles regarding co-operation, mutual assistance, non-harmful interference and non- contamination, however there are insufficient international technical standards to implement these principles in a concrete fashion. The safety and security of outer space would benefit from better developed international standards, under a binding regime. However opening up the OST to amendments would not be the ideal platform for this change; rather a protocol would be preferable, or a set of technical standards and practices which could be updated as technology develops, similar to the model of the Chicago Convention for Civil Aviation (Doucet & Steer, forthcoming).

With respect to the notion of the OST as a framework arms control treaty for space, it has been relatively successful thus far, however it is limited in that it only prohibits nuclear weapons and weapons of mass destruction. Any other types of weapons, including ground-based ASATs, dual- purpose technologies, the use of cyber attacks as a weapon, fall outside its ambit. The general limiting principles of international law do apply, such as necessity and proportionality, due to the effect of Article III OST that all activities must be in compliance with international law. But if an arms control treaty for the 21st century is desired, it would be more prudent to consider negotiating a new one, than trying to update or amend the OST.

Amendment of a framework treaty such as the OST is not very likely and also ill-advised. Opening up a treaty for renegotiation risks bringing into question the fundamental principles, especially given that the most contentious areas will be with regards to use of force and self-defense (which is part of what stymied the ICoC negotiations, see below), weapons on outer space (which is currently at a stalemate with respect to the proposed PPWT, see below), and appropriation of resources. Once a treaty is opened up, it risks never being closed again.

A new framework treaty for the 21st Century could be a better option, were it not that there appears to be a lack of political will to do so. The OST and the other four core space treaties were all drafted in a short span of years, during the Cold War, when the geopolitical interests were aligned to prevent any single State claiming a monopoly in space, and there was a rapid need for framework agreements. In today's geopolitical environment, we have moved away from bi-polar or uni-polar interests, and the number and type of actors has increased dramatically.

What might be a more likely route for dealing with framework issues such as general standards and norms of behavior, would be to create either an Annex to the OST, or Additional Protocols which could be open for signature to any State Party to the OST, or any State willing to commit to signing the OST.

Dr. Mark J. Sundahl

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19 July 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: What are the current international agreements, treaties, conventions, etc. governing the use of space, and what specific limitations and constraints are placed on space operations?

M. Sundahl: There are five UN treaties: 1) the Outer Space Treaty, 2) the Rescue and Return Treaty, 3) the Liability Convention, 4) the Registration Convention, and 5) the Moon Agreement.

The Moon Agreement, the fifth one, has not been ratified by any major space powers. For those 13 states that have signed the agreement are subject to some different rules about exploitation of natural resources. That's the core issue there.

But setting the Moon Agreement aside, the Rescue and Return Agreement elaborates on Article V of the Outer Space Treaty regarding the duty to rescue astronauts and return space objects, I think that's not worthy of a lot of discussion from a military perspective, except to say that governments should recognize that these duties apply even in time of war.

The Liability Convention focuses on who is liable if something happens, either on the ground, in the air, or in space. The basic rule regarding liability is that you're strictly liable if your spacecraft destroys anything on the Earth or in air space, and if your spacecraft hits anything in space, then it's a question of fault. That's a big question, what does "fault" mean? I think that's an interesting question. Like when the Chinese blew up their own weather satellite, which created massive clouds of debris that are going to be in orbit for 500 years and may destroy untold numbers of satellites over the 500-year span, are the Chinese at fault? No one has really answered that question. I'd venture to say no even though it was an intentional act.

The Registration Convention is maybe the most used and successful space law convention because it's all about registering your space objects and describing where they're going to be and what they are so that the world can have some kind of space traffic management and be aware of what people are doing at space. On this issue, I would encourage the US government to continue to encourage others to comply with the Registration Convention and provide accurate information about what they're putting into orbit, because this really helps with transparency.

But the big one, the big convention is the Outer Space Treaty. You asked about the constraints on countries. So, the starting point is the free use—that we're allowed to use space freely, and we see that when we fly over other countries with no restrictions. So, what are the restrictions? Well, you can't put weapons of mass destruction in orbit. You can't be militarily aggressive in orbit—you've got to be peaceful, although that includes operations for self-defense. I don't think anyone believes that all weapons are banned from space, but no nuclear weapons, you can't be aggressive, and you have to avoid harmful interference with the activities of other countries and their nationals. That is a rather soft prohibition on interference because all it really requires is that if you are going to harmfully interfere with the operations of others, then the governments have to consult with each other. It doesn't say that interference is outright prohibited, only that there have to be consultations. You have to operate with due regard for the activities of others, and this kind of goes hand-in-hand with avoiding harmful interference. You also have to avoid harmful contamination of outer space and back contamination of the Earth—that's why we clean and sanitize the spacecraft before they are sent anywhere. That's good too so that we don't introduce Earth bodies and Earth organisms to other celestial bodies. Another restriction is the prohibition of appropriation—you can't go to the moon and plant a flag on it and claim it as the territory of the United States. We did plant a flag there, but we did so explicitly that it was not for any purpose of appropriation, but instead it was just a symbol of peace on our arrival on the moon. So, you can't claim the moon, but can you occupy it? Are there any rights that a private entity or a government can assert over part of a celestial body that is short of appropriation? Could you issue temporary licenses to mining companies to use for part of the celestial body or for the government to mine a celestial body, and therefore exclude others from that mine because it would constitute harmful interference or a lack of due regard? So, is there something short of appropriation that would allow the permanent use of a celestial body? That's kind of an

open question. I believe, yes, we can do that, otherwise we should all just pack it and go home if we can't establish a base on the moon.

Another limitation on space activity that comes to mind concerns telecommunications, particularly regarding the use of a certain orbits, geo-synchronous orbits. You need to go through the ITU and FCC to get one of those orbits, which are limited in number to 180 due to a requirement of two degrees of separation between every satellite. The use of frequencies is also regulated by the FCC and the ITU.

So, those are some of the restrictions that come to mind.

[…]

Interviewer: From your perspective, is the Outer Space Treaty well-suited to keep pace with the rapidly evolving space domain? Do you think the Outer Space Treaty is in need of updating or the addition of some further clarification? If so, do you feel as though it would be better to add to and/or amend the Outer Space Treaty, or might establishing a new framework for the 21st century be the better bet?

M. Sundahl: I think that something even less than amendment would suffice. I think that even an amendment would be asking a lot, so I think we could achieve objectives by having resolutions or clarifications that are agreed on by countries. I say that for a few reasons. One, it's just so difficult and time-consuming to negotiate a new treaty, even an amendment, and I just don't see this happening—the world in general has lost its appetite for treaties. I've been involved in treaty projects that stretched for decades just to write them, let alone attract broad ratification by the space powers.

So, I really think to be timely about it, we should shoot for something that just clarifies what the meanings of certain terms are. Also, I think politically, trying to amend the Outer Space Treaty would not go over well. The Outer Space Treaty in general is viewed as the Magna Carta of outer space. It's a very successful and valuable treaty. So, if the US were to say, "we would like to withdraw and create a new treaty," I think that would be extreme. Really, the Outer Space Treaty has been a successful treaty—it has kept nuclear weapons out of space, it has prevented any one state from claiming the Moon, it has allowed for the orderly use of space.

There are efforts that are going on now like the long-term sustainability guidelines that are being worked on at the UN. This is a softer kind of law that has also been very beneficial. It's basically about preventing orbital debris so space is sustainable for the long-term.

So, I don't see a new treaty or even an amendment happening. I would recommend a softer legal solution (such as a resolution, a joint statement defining terms, guidelines, declarations, etc.), just because it's a political reality.

[…]

M. Sundahl: I guess I will conclude with a few points. First, by emphasizing space debris, which is an important issue to focus on. We have talked about the long-term sustainability guidelines and certainly NASA's a very good citizen, but we never want to see again what China did by blowing up their own satellite.

We also need to continue to strengthen commercial space programs. The more launch providers that the US can choose from, the more secure the country is in case one of them goes down or two of them go down. I think that is important, and we need to continue to promote private industry.

Space traffic management is also going to become more of an issue. I know the US government and the FAA are working very hard on this issue of space traffic management.

The last thing I would say is that we should also be thinking about the kinds of things that are even in the near future that government programs such as DARPA are working on. As new technologies and capabilities continue to develop, we will need to continue to think about what legal issue these new technologies and capabilities might raise. For example, what will the Russians and the Chinese think about satellites that can fly right up to theirs and take close-up pictures to see what exactly they have in space? Or what will the Russians think if we take one of their defunct satellites and remove it from orbit because it's polluting the orbits and poses a risk? Can we touch their satellite? Is it abandoned? Questions like this are important to think about.

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27 September 2017

WRITTEN RESPONSE

[Q19] What international legal codes or norms are needed to govern the increasingly crowded space domain?

In a Congressionally required report (re: Public Law 114-90, Section 108), the Executive Office of the President, Office of Science and Technology Policy (OSTP) stated that "The United States has a legal obligation under Article VI of the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies ("Outer Space Treaty"), as follows:

States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. 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."

There is disagreement within the US Government as to whether additional legal authorization is needed to carry out the international treaty obligations of "authorization and continuing supervision" for some of the emerging commercial space sector activities. The same OSTP report recommends legislation to put in place a mission authorization framework, while some members of Congress maintain that no additional legal authority is required, but that some clarification "to address misperceptions of legal uncertainty" would be prudent (draft legislation proposed as H.R.2809 - American Space Commerce Free Enterprise Act of 2017, dated June 1, 2017).

However, as non-US Government and international actors play an increasing role in outer space, there has been little debate that it would be advisable to establish an internationally-recognized set of best practices for the highly utilized orbit regimes in LEO and GEO. NASA should be involved in helping to establish such norms, especially with respect to protecting the safety of space-based personnel and assets. For orbital debris mitigation, best practices or guidelines were first developed within the US Government in 1997 for its own purposes. This led the way for the development of international guidelines in 2002 (Inter-Agency Space Debris Coordination Committee (IADC) Space Debris Mitigation Guidelines). A similar path could be taken here, to first develop a recognized set of norms of behavior for US operations in outer space, and then facilitate the adoption of similar guidelines internationally.

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15 August 2017

WRITTEN RESPONSE

[Q19] What international legal codes or norms are needed to govern the increasingly crowded space domain?

Other domains have established norms of behavior and codes of conduct for the safe and reliable operations in a given domain. Space, like cyberspace, is relatively new areas of operations that do not have a long tradition of operations. "Law of the Sea" and maritime laws were established over a long period of time and have been recognized across the international community. A complication in establishing legal codes, norms and treaties is that with most agreements there are verifiable methods to ensure compliance. The basis of any behavioral norms should be derived from the right of space fairing entities to be able to operate their missions without interference or threat to mission or systems. Limitations in space situational awareness make attribution and verification difficult. Establishing protocols to register, track and report space activities are necessary. This can be done using beacons that could be verified with ground and space-based systems. The commercial space industry has adopted certain norms of behavior most conducive to successful operations in support of their business objectives. This is a starting point for a topic requiring further analysis. This would be a worthy topic for discussion within the newly re-established National Space Council.

[Q23] Fifty years of space has seen much change. Which aspects of the Outer Space Treaty of 1967 are still valid and which need updating?

This could be an interesting topic for a thoughtful discussion to explore various issues and concerns of International posturing that would likely accompany any changes or new framework.

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: So, in the last paragraph on page 18 of your written submission, you note that to control escalation the US should articulate red lines to drive a controlled the response while reserving the flexibility to provide a proportional response in space and other red lines. This seems like quite an ask of the government. Is this sentiment shared across the industry especially within SatCom, or is it even expected?

F. Taylor: We think they are there already...within the commercial sector, and space in general, there are operations considered norms of behavior. We have international codes to register your payloads and operationally you're assigned your ITU slot. There's common understanding in terms of what your slot space is, how much distance is between different satellites. There's things that are considered provocative behavior where we, or others, have seen behavior that resulted in

complaints or formally through the UN and demarches are issued. We are attentive to activities that are contrary to safe and continued operations vice things most would say are commonly acceptable operations. We have to put this in the context of a geopolitical environment as well, in that normal behavior in peacetime could be viewed as provocative or escalatory in conflict.

Behavior in terms of normal stated behavior would be considered one thing, but if you are lining up a known spacecraft that has some type of hostile attack ability or a hostile intent drives different understanding. Articulating different systems and capabilities is important. For example we can take the GSSAP satellite which is a neighborhood watch, which is just trying to keep its' eyes open and understand what's happening, is one way of understanding what behaviors are happening. When observed, you can then articulate behaviors that might not be considered safe operations that could put other people's missions at risk. Now redlines in terms of articulating what we think is safe behavior, or behavior that we would consider more provocative can be made. In heightened tensions, where you see things like the massing of troops and readying weapons while moving a space system that is known to have an aggressive stance, posture, or capability would be considered something more provocative because of strategic context and maneuvering of a tactical space system. This degree of understanding helps manage escalation and responses.

Dr. Frans von der Dunk

Professor (University of Nebraska College of Law)
25 July 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: With the rapid development of technologies, which is helping to allow more and more actors to get involve space and space operations, it seems like the space realm is rapidly advancing. So, I'm wondering, do you think that these existing legal treaties and norms are well-position to govern this rapidly changing domain? Or, do you think that advancements and/or updates to the laws are needed?

F. von der Dunk: That's an excellent question, and this is one of the leading questions right now that space lawyers are discussing all of the time. I think the answer is a bit of both.

I think that most space lawyers and also most nations agree that the space treaties and the ITU and some of the other stuff are too worthwhile to simply throw away, but, on the other hand, could do well with some remediation. Overall, though, the general consensus is that while we currently fall short and do need certain additional legal regimes or requirements to address for the new technical and operational developments, the best approach is NOT to start from zero again because we would throw away too much of the baby with the bathwater, and it is preferable to just work with the Outer Space Treaty and some of the other treaties and just try to enhance them wherever possible—whether this be by new treaties or by more fluid, less formal ways of lawmaking (i.e., in particular, customary international law).

One example, for instance, is going back to what I've just said about the Chinese ASAT test. When China did its ASAT testing, there was no prohibition, as such, on the creation of space debris, which is basically what China did, of course. Now, over the last few decades, increasingly countries and operators are coming to the conclusion that this is not a good thing—that we should establish some way to limit the random creation of space debris, because at the end,

everyone will be worse off if space becomes a complete junkyard or if specific orbits become complete junkyards.

So, we do see a move towards trying to establish rules, binding rules, on the prevention of space debris, the mitigation of space debris, and perhaps even on taking out different satellites that run the risk of creating space debris by banging into other stuff. Given the political environment, which is pretty dispersed, I don't think it's realistic to accept that there will be another treaty that can stand a chance of success of being globally ratified, at least by the major space faring countries. But, there might be a more bottom-up approach in which states increasingly behave according to a certain matter, which then at some point in the future becomes effectively customary international law. This is an example where we certainly do need to do something because, again, if we go on the way we have behaved towards space over the last decade, then sooner or later space will be inaccessible or simply not safe to use anymore, and ultimately that will be to the detriment of everyone.

Interviewer: Okay. So, in thinking about space as a global commons, in addition to the laws and rules that are in place, it would seem like a big part of ensuring the access to and the safety of space for everyone would be by building and solidifying norms. So, I'm wondering, what can the US do to best facilitate the development of verifiable norms that maintain a peaceful space domain going forward?

F. von der Dunk: This may sound a bit cheesy, but, ultimately, I think the best thing the US can do is to set a good example for everyone else. Since the Soviet Union fell apart, the US is certainly seen as the sole super power in space, not just in the military context but also in the civil and commercial area. So, everyone looks at the way the United States is going to address these issues.

One of the beauties of the Outer Space Treaty is that it provides for state responsibility and state liability, also for the operations of private operators, which means that, for example, if Boeing launches a satellite and then that satellite comes crashing down in Mexico, it's not Boeing that has to compensate Mexico for any damage caused, it's the United States government that is liable. The beauty of that is that it incentivizes the US government, and other governments in the same position, to make sure that they only allow space activities that are duly licensed and have provisions for liability derogation.

The beauty of that is that you, for example, will most likely prevent something like flags of convenience, which we have struggled with in the laws of sea for many decades. Again, if the United States is the first, for example, to license asteroid mining companies, which it looks like it's going to do pretty soon, then that is the standard that will be set by other actors in legislating nationally and licensing nationally on how to properly balance the benefits of allowing private enterprise to go ahead and the public interest in keeping space a safe, relatively peaceful, and relatively beneficial place to operate.

So, it sounds a bit cheesy, but I think that by pushing that example, the United States climbs the moral high ground and then can also strongly incentivize others to follow suit. Then, of course, this similarly applies if we talk about commercial environments and markets. So, for example, if we talk about space in the context of aviation, the position of incredibly high standards of safety observed in United States and the rest of the Western world then become relevant and forces anyone else to either comply with those high standards or not be allowed into the US market. So, that's the kind of mechanism that might start working in space, at least in the commercial arena. I understand, obviously, that if we talk about the more public side and the maintenance of security and peace in outer space, then it becomes a little bit more tricky—but I still think it can play a major rule in that regard.

Interviewer: Yeah, that makes sense. So, I'm wondering, if a situation where maybe a crisis or even potential conflict started to arise in space, how do you think the current international agreements, treaties, and laws that are in place would do in response? Do you think they'd be able to effectively protect high-value space assets that are currently up in space?

F. von der Dunk: Well, to a limited extent. But that is not something that is limited to space—it applies everywhere in the international environment—because obviously we don't have a global legislature, a global judiciary, and a global police force, which can enforce sanctions on wrong behaviors.

This is the imperfection of the international world. It means that by just having a legal rule, it doesn't mean that you can actually enforce it in the normal manner that a state can enforce national law in its own territory. But that is not to say that it doesn't have an effect, and certainly, in democracies, it becomes very tricky for governments to be seen as violating the rules because it undercuts their own legitimacy. That even applies in non-democratic states. Even when North Korea says, "Yes, we violated the Security Council resolution, but so what?", They are trying to come up with a kind of legal argument that the Security Council resolutions in themselves are not lawful and are in violation of all the rules. If you go back to Saddam Hussein, he tried to defend what he was doing, not by ignoring the rules but by trying to hide what he was actually doing. So, even in those contexts, there's always some political value for even those rogue states to try and not be seen as a violator or as simply ignoring international rules out of arrogance, because there might not be legal punishment but there will be political punishment somewhere along the road.

So, if you talk about high-value space assets, well, the fact that you're not allowed to shoot them down may not keep one or the other from actually shooting them down in some case, but it will certainly limit the cases where someone is likely interested in doing so, and if it does happen, then it may still lead to consequences in the political realm. Another thing that we should realize is that what happens up in space can inflict damage on anyone, and in particular the other space faring nations. So, even though China and Russia may, in the current political climate, be tempted to do things against US interests in space, even in the military realm, the more they are entrenched in that realm themselves and the more that they have at stake there as well, the more careful they will be in not destroying that environment either, which includes physical destruction with respect to highly-valuable space assets. Though, the more hacking-like and technical approaches or electronic-type attacks, which is not actually physically destroying a satellite but instead just taking it out of operation, may be more difficult to prevent.

But, in general, I think that the lack of verification and the lack of enforcement possibilities is not all decisive. There's more to it, I would say.

Dr. Brian Weeden

Director of Program Planning (Secure World Foundation)
31 July 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: So, let's transition to some of our space law and norms questions. Unquestionably, space is becoming increasingly crowded. So, I'm wondering, do you think the international treaties, agreements, laws, etc. that are currently in place to govern space are sufficiently suited to keep pace with an increasingly crowed and rapidly evolving space domain? And, if not, what kinds of

international legal codes or norms, or updates and/or ratifications to current laws, are needed to govern this increasingly crowded space domain?

B. Weeden: So, that's kind of a complicated question. I think the existing treaties lay a sufficient framework for international principles. The challenge is that a lot of the principles they established haven't really been further defined over the last 50 years. Take, for example, the peaceful usage question. As I said earlier, we enshrined peaceful uses of outer space in the Outer Space Treaty with definitely some planned of strategic ambiguity incorporated—we, the US, knew that it would include military intelligence activities, and we were okay with kind of making the aggressive stuff off limits, but there are still countries today in the UN COPUOS that will argue that peaceful use means non-military, despite the fact that the military has been involved in space for over 50 years. So, that's one example.

There is a lot of stuff in the liability regime that exists, but it's never been further clarified. So, if you think about it, we have the US Constitution, but we also have dozens and dozens of Supreme Court cases where people have gone to the court to challenge part of the Constitution or to challenge a law based on a premise in the Constitution, and the courts have ruled on how things in the Constitution should be applied and how things should be interpreted. However, there is none of that for the liabilities stuff in space—there is not a single court case in the international courts on liability from a space accident. There have only been two cases that could have been launched: one is the 1979 crash at the Cosmos satellite carrying the nuclear reactor into northern Canada and the second is the 2009 Cosmos collision. In the first case, basically the US and Canada raised the issue with the Soviets and the Soviets basically paid a few million dollars, but an actual liability claim was never brought within the international organization. In the second case, the US Cosmos collision, basically the US and Russia got together and said, "Hey, I am good. Are you good?" "I am good." "Okay great." And the US and Russia just kind of settled it out of court.

So, we have nothing about how this stuff is applied or defined. I think across the board, that's the biggest challenge that we have with space. It's not that the underlying international treaties are wrong or bad, it's that a lot of stuff these treaties lay out has never been further implemented, either in national law or through actual court decisions and determinations on how they apply.

Another example I will bring up is the asteroid mining space resource use. There's a big debate going on right now. Article 2 of the Outer Space Treaty says that there is no such thing as national appropriation, but there is a significant portion of the lawyers and economists that will say, "I can go out and I can fish the ocean without claiming the ocean as my own territory," and they are basically applying that same analogy to saying, "I can go to the Moon or I can go to an asteroid and I can mine some of it up. I can track water or whatever else and then fly off to go use that water without actually having a title or deed to the asteroids or the Moon." The US has put some of this in national law, and so has Luxemburg, but this is a very active area of debate where, again, there is tension between this broad kind of principle at the top, but no one has ever really clarified it before—there's not a lot of state practice in how to interpret certain things.

So, in my mind, that is the biggest challenge we have in the space world. Again, I think as it becomes more normalized, we are going to find that, because people are going to start doing stuff. There is probably going to be some accidents and some incidents that are going to go to the courts. There are going to be more things regarding the laws on asteroid mining, where countries are going to say, "this how we take the supplies," and other countries may disagree, which will lead to debates and maybe some court cases, and in the end we will probably find out what's going on.

So, as far as what new stuff is needed, I don't really think there is a lot of work needed at the treaty level. I think a lot of the new stuff is more at a much lower level. So, for example, I think of things that exist in other domains that don't exist in space. A perfect example is something in the maritime domain called the Incidents at Sea Agreement, which was signed in the late 1970s between the US and Soviet Union after several incidents where US ships and Soviet ships got in to situations at sea that could have precipitated either a serious accident or collision or triggered some sort of armed conflict. So, the US and Soviet Union came up with this agreement where they outlined how they would maneuver in close quarters with each other and how they would interact on the high seas, and it really kind of helped stifle some of the worst chances for accidents or misperceptions.

We just don't have anything like the Incidents at Sea Agreement for the space domain. This whole category of rendezvous and proximity operations is going to be a huge issue. It's probably one of the biggest issues to deal with in the near term, both because you have commercial companies that are planning things like satellites servicing, satellite refueling, and outer-orbit inspections that are going to involve docking and getting close to other satellites, and then there is the whole national security concern over exactly the same thing. So, for example, when a Chinese satellite is doing stuff in space and perhaps coming close to US satellites, what is the space equivalent of an Incidents at Sea Agreement that is going to kind of give a bright line of 'you should do this, this is how you behave responsibly, and this is how we do it normally,' and if there is deviation from that, it suddenly becomes an indication or warning that something is not right. We just don't have anything like that at the moment that I know of in the space world.