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Principles of Response to Aggression in Space

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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.

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Question of Focus

[Q18] What are the principles (e.g., flexible vs. controlled response; proportionality, etc.) upon which international policy makers should develop response options for aggression in space?

Expert Contributors

Major General (USAF ret.) James Armor² (Orbital ATK); **Marc Berkowitz** (Lockheed Martin); **Dr. Riccardo Bevilacqua** (University of Florida); **Dr. David Broniatowski** (George Washington University); **Caelus Partners, LLC**; **Dean Cheng** (Heritage Foundation); **Falconer Consulting Group**; **Joanne Gabrynowicz** (University of Mississippi School of Law); **Dr. Nancy Gallagher** (Center for International and Security Studies at Maryland); **Gilmour Space Technologies**, Australia; **Harris Corporation**; **Dr. Peter L. Hays** (George Washington University); **Dr. Henry R. Hertzfeld** (George Washington University); **Theresa Hitchens** (Center for International and Security Studies at Maryland); **Dr. Moriba Jah** (University of Texas at Austin); **Christopher Johnson** (Secure World Foundation); **David Koplou** (Georgetown University Law Center); **Tanja Masson-Zwaan** (Leiden University, Netherlands); **Michiru Nishida** (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); **Michael Spies** (United Nations Office of the High Representative for Disarmament Affairs); **Dr. Cassandra Steer** (Women in International Security-Canada, Canada); **Dr. Mark J. Sundahl** (Cleveland-Marshall College of Law); **ViaSat, Inc.**; **Dr. Frans von der Dunk** (University of Nebraska College of Law); **Charity Weeden** (Satellite Industry Association, Canada)

Summary Response

Upon considering the question of focus, several expert contributors argue that it is confusing or even misleading (Cheng; Gallagher; Hertzfeld; Masson-Zwaan). The contributors maintain that this confusion comes from two sources: the ambiguity of the language used in the question and the ambiguity of existing space treaty law. Noting the inherent contention in the legal realm of space, the contributors as a whole nonetheless work to articulate how the US might derive a set of principles for response to aggression in space. Contributors divide into two camps: those who argue that principles already exist that can be used to guide a response to aggression, and those who argue that these principles are—and must be—emergent. Although distinct reasons are given between the two camps, the chief principle on which all camps agree is what we might call the “precaution principle.”

Two Sources of Question Ambiguity: Terminology and Existing Space Law

Dr. Nancy Gallagher of the Center for International and Security Studies at Maryland believes that the phrase “international policy makers” is vague, and Dean Cheng of the Heritage Foundation contends that the phrase represents “the language of UN bureaucrats and academics in the arms control community” rather than a pertinent characterization of decision-makers with power. Cheng queries: “what is an ‘international policymaker?’ You mean US policymakers? Or, do you mean the international

² The subject matter expert’s personal views, and not those of his organization, are represented in his contributions to this work.

consortium of space policymakers that meets in Geneva or someplace like that?” His elaboration of his confusion is worth quoting at length:

One of the big problems we have when you use terms like “international policymakers,” is that you actually are talking about a conglomeration of different groups and entities with very different perspectives. You have space technical policy people. You have space policy people from different countries. You have experts on countries, some of whom have some knowledge of those countries’ space policies.

In addition to the ambiguity inherent in the language, contributors cite the ambiguity of current space law. For many expert contributors, it was difficult to articulate principles of response because the antecedent action—aggression in space—is poorly defined in the law. According to Dr. Henry Hertzfeld of George Washington University, “a lot of these things are still not well defined in the space environment. There is no good definition of a weapon, for example. There’s no good definition of what an armed attack might be.” Theresa Hitchens of the Center for International and Security Studies at Maryland echoes this viewpoint, noting that, “There is no legal or agreed definition of ‘aggression’ in space; either under the UN Charter or in any other body of law.”

Are There Already Principles of Response Appropriate to the Space Domain?

In determining specific principles of response to aggression in space, contributors divide into two groups: a camp that argues that principles of response apposite to the space domain already exist in international law, and a camp that forwards that whichever principles exist will require further development in order to be useful in the space domain. The first camp largely defends existing principles as requiring little to no amendment for use in developing responses to aggression in space. The second group postulates that the principles will emerge out of interactions in the space domain, as long as actors curate their understanding and responses to potential adversarial action with all deliberate speed. The most important principles articulated by each camp are summarized in Figure 1 below.

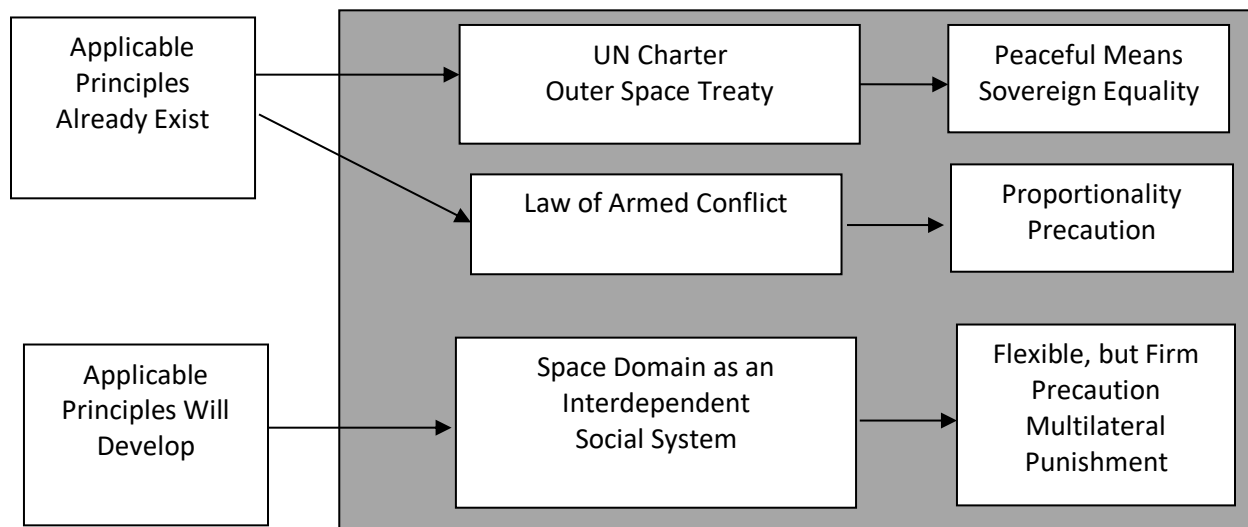


Figure 1: Summary of Response Principles and their Sources

Principles of Response to Aggression Already Exist

Contributors in the first group identify the United Nations Charter, the Outer Space Treaty (OST), and the Law of Armed Conflict as the three sources of principles governing responses to aggression in space (Hitchens; Johnson; Nishida; Spies; Steer). Christopher Johnson of the Secure World Foundation explains that, “Article III of the Outer Space Treaty makes it clear that general international law, including the UN Charter, apply to the activities of states in the exploration and use of outer space.” Michael Spies of the United Nations Office of the High Representative for Disarmament Affairs further points out that in the United Nations Charter there are “a number of principles applicable to the development of international policy responses to prevent aggression in outer space.” The experts argue that, just as they do in other domains, these principles can guide policymakers in formulating responses to aggression.

Principles from the United Nations Charters and the Outer Space Treaty

In fact, the principles of the UN Charter, reiterated in the 1967 Outer Space Treaty, are the foundational principles for policymaking in space, according to Johnson, because the language of the Charter itself specifies that there is “a hierarchical relationship between special regimes such as space law,” such that the UN Charter “takes precedence of any special regime of international law.” Michiru Nishida of the Ministry of Foreign Affairs of Japan buttresses this view, and suggests that the “most important principle that should be reaffirmed would be the application of existing international law and obligations to *all* outer space activities, scientific, civil, commercial and military.” He stresses the importance of existing international law governing *all* activities, inclusive of military activities, because “some states dispute the scope of agreements adopted at UNCOPUOS...claiming that the mandate of the UNCOPUOS only deals space activities other than military.”

The specific principles that Spies and Johnson explicitly identify within the UN Charter/OST treaty system as governing responses to prevent armed conflict in space are: The principle for states to “settle their international disputes by peaceful means” (Spies) and long-standing principles such as “good faith, *pacta sunt servanda*, the sovereign equality of states, non-interference, non-aggression, the prohibition on the use of force, the right of self-defense” (Johnson), as well as the precautionary principle.

Principles from the Law of Armed Conflict

Offering a concurring, but more narrowly-tailored view, several experts (Beard; Simpson; Steer) identify the Law of Armed Conflict (*jus in bello* and *jus ad bello*) as the most applicable principle of response to aggression in space. Jack M. Beard of the University of Nebraska College of Law agrees that the more concrete legal debates about principles and responses to aggression are situated within the Law of Armed Conflict, noting: “The more you study space and the importance of things like GPS satellites, the more that you are able to make an argument that an attack generating huge debris fields might violate the Law of Armed Conflict.”

According to Dr. Cassandra Steer of Women in International Security-Canada, the most important principles drawn from the Law of Armed Conflict for the space domain are the “principles of proportionality and precaution in attack.” Dr. Michael K. Simpson of the Secure World Foundation notes, however, that the principle of proportionality, when applied in the space domain, “may be complicated by the asymmetry of impact of actions in space.” Expounding further, he warns that “eliminating a single satellite upon which a country depends for critical terrestrial services clearly has an effect that is disproportionate to that of eliminating a single satellite in the fleet of major space faring countries with multiple options to work around the loss.” Responses to aggression that target space assets trigger

proportionality concerns through their humanitarian impact, according to Spies: the “destruction of dual-use satellites could negatively impact essential civilian infrastructure, health-care services and humanitarian operations,” which rely on “satellite communication, navigation and timing, and imagery networks.” Precaution, as a principle guiding militarized responses in the space domain, dovetails with the doctrine of necessity, Steer observes, because the “use of force must only be employed when the aggression is “instant, overwhelming, and leav[es] no choice of means, and no moment for deliberation.”

Principles of Response to Aggression Are (and Must Be) Flexible

The second group of contributors, which argues that principles of response are emergent, prefer to categorize “aggression” as an unwanted behavior in an interdependent social system (Bevilacqua; Broniatowski; Caelus Partners, LLC). Dr. David Broniatowski of George Washington University notes that systems that operate in the space domain are designed and therefore possess an architecture that defines how specific components will carry out functional requirements to achieve needed capabilities. Appropriate selection of this architecture can enable flexible response options, such as the ability to carry out new capabilities, or resilience to attempts to disrupt existing capabilities, in the event of unexpected behaviors or other changes in the space environment. Conversely, selection of an inappropriate architecture can inhibit flexible response options by making changes too complex or costly to implement after the system has been fielded. The contributors from Caelus Partners, LLC hypothesize that this architecture can be leveraged to “create a community for the purpose of the coordination and management of participant activities.”

The contributors in this second camp jointly identify three specific principles of response as being effective within the emergent social system of the space domain: flexibility with firmness, precaution, and multi-lateral punishment.

The first principle of response is being “flexible, but firm,” as Adam Gilmour of the Gilmour Space Technologies elegantly puts it.³ Gallagher delineates the mechanisms of how this principle would work in practice. Respondents to aggression should “*determine the objective of the response*”:

If something bad happens, you could say, ‘Well, our primary objective really is to just condemn the bad thing.’ Or, the US could say, ‘Our primary objective is to punish the bad thing, or to reverse whatever gains the bad actor achieved so they don’t get any kind of military advantage for it.’

In other words, actions taken in response to aggression should have end goals in mind before they are undertaken. Because the goals of the response may vary by actor and technological capability among other factors, flexible but firm responses are seen as ideal in this view.

The second principle of response is best described as a “precautionary principle.”⁴ Gallagher describes this principle in the space domain as one of prudence, so that responses to aggression occur with all deliberate speed because an “*informed response is better than a quick one*”:

³ See also the contributions from Broniatowski; Gallagher; Jah; Rossettini; and ViaSat, Inc. for a constellation of similar viewpoints.

⁴ The precautionary principle has its roots in international environmental law, such as the Montreal Protocol, the Rio Declaration, and the Kyoto Protocol.

Don't act before you know what actually happened. And it may or may not be obvious what happened—whether it was a deliberate attack, whether there was some form of inadvertent or human interference, whether it was a satellite malfunction, whether it was a result of a natural hazard.

Information helps prevent a combination of errors inherent in the space domain that could result from mis-attribution, mis-estimation (of harm), and mis-identification of what the event was. Specific factors used to determine response “could be derived from three elements: characteristics and purpose of the spacecraft; operational environmental factors, and demonstrated behavior,” the contributors from ViaSat, Inc. maintain. It should be noted, however, that Broniatowski does *not* endorse the precautionary principle as equal to the principle of flexibility. In his view, precaution is not applicable in all cases, whereas flexible response options should allow for selection of a response based upon what is contextually appropriate.⁵

The third and final principle identified by this camp is that of multi-lateral punishment. For these contributors, acting as a community grants coordinating nations a number of agenda-setting and distributional advantages. As one example of the potential role of this community, Dr. Riccardo Bevilacqua of the University of Florida posits that “a nation engaging in aggressive behaviors in space should be banned from operations for a certain time, in proportion to the gravity of its actions.” Nations operating within the community, if they possess a technological advantage over the aggressive actor, could, according to the contributors, enforce such a ban.⁶

Conclusion

In conclusion, though several subject matter experts note sources of ambiguity in the question of focus, the experts as a whole go on to identify sources of principles that can govern responses to aggression in the space domain. These experts can be categorized into two groups: one that draws principles of response from *existing* laws and practices; and another that believes that new or *emergent* principles, specific to the space domain, are necessary. Across these two groups of experts, several explicit principles emerge:

1. The resolution of conflict by peaceful means
2. Respect for the sovereign equality of states operating in the space domain
3. The principle of proportionality
4. The principle of precaution
5. Flexibility with firmness in response
6. Multi-lateral punishment

Although distinct reasons are given between the two camps, the chief principle both camps articulated is the principle of precaution, largely due to the potential for suboptimal outcomes resulting from the low-information environment of the space domain.

⁵ Correspondence with author (20 February 2018).

⁶ However, it would be difficult to imagine this principle of response being used against the United States, Russia, or China, as attempting to do so would likely cause a war.

Subject Matter Expert Contributions

Major General (USAF ret.) James B. Armor, Jr.

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

WRITTEN RESPONSE

Same as every other domain. Difference: robotic, non-human, “spacecraft have no mothers.” As more humans go into space this will evolve, but right now space is mainly robotic.

Marc Berkowitz

Vice President, Space Security (Lockheed Martin)
25 August 2017

WRITTEN RESPONSE

U.S. and allied or coalition policy makers should implement a “comprehensive” or “whole of nation(s)” approach that leverages all elements of national power and instruments of statecraft to develop response options for aggression in space. First, diplomacy and strategic communications lines of operations should seize the initiative to gain the high moral ground to explain to domestic and international audiences the values, principles, and interests at issue, the stakes of the contest, the legitimacy of the US and allied/coalition position. Similarly, diplomacy and strategic communications should also convey the issue and stakes as well as US political will and resolve to the adversary to deter further aggression, incentivize de-escalation, and control escalation in the scope or intensity of conflict, while reassuring allies, partners, and friends. Diplomacy and strategic communications should also inform friends and noncombatants of their interests in defending the domain against such aggression and to support the US position in order to create international opprobrium against the adversary, diminish the adversary’s prestige and influence, isolate the adversary in international fora, foment domestic unrest, and constrain the adversary’s decision-making flexibility.

Second, information lines of communication should seize the initiative acting in concert with diplomatic and strategic communications to reinforce the US narrative while undermining and counteracting the adversary’s narrative. Concurrently, information operations should influence adversary and other foreign audiences’ perceptions as well as usurp, corrupt, and manipulate adversary decision-making while protecting US, allied or coalition decision-making. This line of operations should also provide the US and its partners with actionable information to enable all courses of action, steal secrets and counter adversary denial and deception, help achieve strategic, operational, and tactical advantages, and operate within the adversary’s sense-decision-action cycle. In addition, deception operations should influence adversary perceptions of US intentions and capabilities as well as misdirect or channel threats into advantageous ways.

Third, military lines of operations should provide a cost-imposing, dynamic, defense-in-depth that supports deterrence through denial and punishment, escalation control, protection and defense, and defeat denying the adversary the political-military benefits of aggression and seizing the initiative to punish the aggression. Such a defense is necessary to assure mission support to terrestrial military forces and other users to continue to deliver space effects under contested, degraded, or operationally limited conditions. Defensive space control operations with passive and active countermeasures will enable US forces to evade, withstand, or operate thru attacks in order to survive, endure, and ensure continuity of operations. Space control prevention operations will preclude

the adversary's use of US or Third Party space systems or services for hostile purposes. Suppression and destruction of adversary space object surveillance and identification, command and control, and space control weapons systems will limit damage to US forces. Space control negation operations to deny, disrupt, degrade, and destroy space systems and services employed the adversary for hostile purposes will deny the adversary freedom of action in space.

The military lines of operation should be planned and executed in accordance with the enduring principles of warfare: (1) *Objective*: direct every military operation toward a clearly defined, decisive and attainable objective; (2) *Offensive*: seize, retain, and exploit the initiative; (3) *Mass*: mass the effects of overwhelming combat power at the decisive place and time; (4) *Economy of Force*: employ all combat power available in the most effective way possible; allocate minimum essential combat power to secondary efforts; (5) *Maneuver*: place the enemy in a position of disadvantage through the flexible application of combat power; (6) *Unity of Command*: for every objective, seek unity of command and unity of effort; (7) *Security*: never permit the enemy to acquire unexpected advantage; (8) *Surprise*: strike the enemy at a time or place or in a manner for which he is unprepared; and (9) *Simplicity*: prepare clear, uncomplicated plans and concise orders to ensure thorough understanding.

Response planning should provide decision makers with a broad range of flexible deterrent to major attack options across the conflict spectrum. This should include diplomatic demarches and self-restraint, economic sanctions and legal recourse, tit-for-tat or responses-in-kind, preventative and preemptive options, as well as asymmetric (horizontal and/or vertical) cross or multi-domain escalatory responses. Joint and combined planning must ensure the operational linkage to strategic-political intentions, war aims, political-military objectives, and desired end-state. In addition, such planning should include establishing space postures, conditions, rules of engagement, and (pre)delegation of authorities as well as triggers and thresholds for responding to declarations of hostile intentions or actions. Moreover, planning must take into account different national policies, red lines or caveats, and rules of engagement among alliance or coalition members for effective shaping, deterrence, and warfighting options.

Finally, economic lines of operations should constrain or deny the adversary's access to markets, resources, goods, and services while sustaining the US arsenal. To the extent the US chooses to federate or augment our dedicated national security space architecture with foreign and/or commercial space capabilities or services, then it must use its financial resources to ensure those capabilities or services can be relied upon in crisis and conflict.

Dr. Riccardo Bevilacqua

Associate Professor, Department of Mechanical and Aerospace Engineering
(University of Florida)

WRITTEN RESPONSE

The United States and the former Soviet Union set a bad example of uncontrolled orbital injections, especially during the Cold War, and now emerging countries are leveraging on decades of technology development, to behave in the same reckless manner. Several nations are developing technology that can attack the three segments of a space operation: ground, satellite-ground link (communication, data, and control), and satellite. Such actions have already occurred in the past. Focusing on aggressions on the space segment - either remotely taking control of the space vehicle, i.e., hacking actions, or physically attacking the satellite – the steps to be taken to defend a nation's capabilities in space must live on different levels.

Before entertaining the idea of policies and international agreements, it is my opinion that technological superiority must be developed, in order to demonstrate the ability to realize certain defensive/offensive actions in space.

Current capabilities to launch and operate satellites are shared by several nations. This implies that the US should develop the capabilities of the future. These may include, but not be limited to: 1) the ability to detect hostile spacecraft via orbital assets, autonomously; 2) the ability to efficiently approach a hostile space asset and disable it, autonomously; 3) the ability to detect hacking attempts, to locate the source, and to engage in protecting and retaliating actions; 4) the ability to dock to a hostile spacecraft, and possibly control it to a convenient orbital regime for further investigation, or even control its re-entry to examine it on the ground. The last point, for example, requires a major step in technology development, to guarantee controlled re-entry to a specific geographical location, and survival of the vehicles.

History teaches us that technological superiority is the starting point for global regulations. At this time, no nation has taken the leadership in drafting clear and enforceable regulations about accessing space, guaranteeing removal of space assets at the end of life, and on what operations classify as friendly versus hostile. It is my opinion that, only after developing effective measures like the points listed above, the UN, NATO, and other nations can join efforts into developing regulations, including on what response is appropriate to a space aggression.

Only after the required abilities are demonstrated, and punitive actions can be enforced, then space-active countries can engage into conversations to create a global equilibrium and a “space Interpol”. Unfortunately, there can be no rule without the appropriate fines and consequences for when the rule is broken.

With the above in mind, my final response to the question “what are the principles upon which international policy makers should develop response options for aggression in space?” is the following. I believe that space is one of the most important resources for the future of humankind, and a nation engaging in aggressive behaviors in space should be banned from operations for a certain time, in proportion to the gravity of its actions. However, the specifics of such measures can only be defined after the appropriate technology is developed.

Dr. David Broniatowski

Director of the Decision Making and Systems Architecture Laboratory
(George Washington University)

WRITTEN RESPONSE

This white paper argues that response options for aggression in space should be informed by the theory of systems architecture, and especially by an understanding of the tradeoffs between flexibility, complexity, and controllability. Such an approach is necessarily interdisciplinary and must be grounded in relevant research in space policy, systems architecture, and systems engineering.

Capability, Function, and Form

Response options to adversarial actions in the space environment are typically phrased as “capabilities”. For example, to prevent aggressive action by a foreign power, domestic forces may wish the capability to deny that power the ability to strike at allied space assets. This capability could be implemented using multiple functions. For example, one function would be the construction of a deterrence regime that would ensure that any strike at an allied asset would be met with a counterstrike against the adversary’s assets. Another function might be defensive: strikes against domestic assets would be blocked, etc. Each of these functions is, in turn, implemented by a certain form. For example, a deterrence regime would have to be instantiated in a system that could credibly determine the source of the adversary’s strike, the location of the adversary’s assets, and the ability to strike at those assets. If the adversary utilized an anti-satellite system, a defensive function might require kinetic interceptors, whereas if the adversary struck at friendly assets using software, a defensive function might require cybersecurity measures. The ways in which a system’s capabilities, functions, and forms interrelate are called the system’s architecture.

Flexible Response Options:

Flexibility is a system's capacity to respond to changes in the environment. A system is flexible if it is possible to carry out its capabilities despite changes in its forms (this type of flexibility is also called *resilience*). Similarly, a system can be flexible if a single form can carry out multiple functions, capabilities, etc. Thus, international cooperation in space can enable flexibility via functional redundancy. For example, if one nation's launch capability is interdicted by an adversary, another partner nation may be able to launch in its place. Often, flexibility comes at the cost of complexity. For example, if a system is designed to carry out one function or capability, it may not be easily used to carry out another capability without major modifications. Similarly, a system that is designed to carry out multiple capabilities from the outset may do none of them well (see Logsdon, 1986 for a discussion of this problem in the context of the development of the US Space Transportation System).

Broniatowski (2017) discusses two approaches to incorporating flexibility into a system: modularity and layering.

- Modular systems map a single form to a single function and swap out forms to add new functions to existing systems. For example, one might create a new bilateral relationship with a foreign partner to gain access to some of their space assets. In contrast, a layered system does not have a simple mapping between form and function. One function can be carried out by multiple forms and one form can carry out multiple functions. For example, several international partners might each have independent space launch capabilities that are used redundantly. In general, modular systems are more efficient and cost-effective, but they are also more fragile when the environment is volatile. For example, if one cannot fully trust an international partner within a modular system, one may lose access to a needed capability if there is a sudden shift in geopolitics.
- In contrast, layered systems are more "expensive" but are also more resilient. Importantly, these two strategies are synergistic and a system can be both layered and modular, increasing its flexibility while decreasing its susceptibility to changes in the environment; however, these synergies are costly.

Controllable Response Options:

Controllability is the ability of one decision-maker to accomplish a given capability independent of other decision-makers. A system is controllable if one can be certain that a given capability will be implemented when called for under a wide range of different policy environments.

Requiring that all capabilities to be domestic is one hedge against loss of control in international collaboration.

The Role of System Architecture:

Recent research indicates that there are fundamental tradeoffs between controllability, flexibility, and complexity in large-scale complex systems, including space systems. Different system architectures manage these tradeoffs differently (specifics of these tradeoffs are discussed in the paper by Broniatowski and Moses, 2016). Systems that emphasize more control tend to emphasize less flexibility and vice versa. Traditionally, space capabilities within the United States have emphasized a "tree structure", in which each capability is implemented by a single function, which is implemented by a single, or small number, of forms. For example, the US launch heavy lift launch capability is implemented by a single function – rocketry – and a relatively small number of forms: the Atlas and Delta rocket systems. Such an approach is highly controllable. The United States does not have to rely on foreign powers for access to space.

Other capabilities, such as geospatial intelligence gathering, may be less controllable but more flexible. For example, geospatial data are gathered by multiple allied nations' remote sensing systems, each of which may be implemented in multiple forms (e.g., satellite constellations in multiple orbits, data gathered from high-altitude aircraft, etc.). Sharing between allies enables significant flexibility. If one member's capability is disrupted due to adversarial action, others can supplement the existing gap with their own assets. However, this approach is less controllable because it depends on the goodwill of all parties to an international agreement.

The above examples illustrate how selection of a system architecture is highly contingent upon the environment in which one may expect that system to operate. Broniatowski and Moses (2016) discuss four “generic” system architectures that modulate this tradeoff in different ways:

- Tree-structured hierarchies: A single decision-maker specifies a structure, in which each form meets a specific function, and each function meets a single capability, are highly controllable, yet relatively inflexible. These should be used when the environment is well understood and the need for new capabilities, functions, or forms can be anticipated and planned for.
- Grid networks: Multiple decision-makers interact with one another in a series of bilateral relationships. This is a highly flexible system but with low controllability. These should be used when large-scale systems are required and the environment is very difficult to characterize requiring large amounts of flexibility. One should not expect controllability using this structure.
- Teams: A multi-lateral structure in which decision-makers supplement one another’s capabilities. This structure is highly flexible but loses controllability for large scale systems. These should be used when smaller-scale systems are expected and the environment is very difficult to characterize requiring large amounts of flexibility. Controllability erodes quickly as new decision-makers join the team as full-fledged members.
- Layered hierarchies, in which each form can address multiple functions and multiple functions can meet multiple capabilities (and vice versa) are moderately flexible and moderately controllable. Layered hierarchies are the “happy medium” between tree structures and grid networks in that they allow for large-scale systems with multiple capabilities and decision-makers; however, they also allow some degree of flexibility and some degree of controllability at the cost of complexity in their specification.

In practice, a layered hierarchy might consist of multiple teams collaborating at multiple levels. For example, at the level of system’s capabilities, team members would consist of top-level decision-makers who would agree on what capabilities are needed, which should be unique to a given partner, which should be shared among all partners, and which should be developed in a redundant manner to enable multiple pathways to carry out that capability. Next, functions would be allocated among international partners in a manner that allows combinations of functions to carry out the capabilities specified at the higher level. Finally, at the level of system forms, each nation’s engineers and designers would coordinate on the design of common interfaces, protocols, and standards that would enable interoperability of different forms, while retaining proprietary design features.

In conclusion, leading theories of system architecture are directly relevant to questions of how best to incorporate flexibility and controllability into existing international policy.

Flexibility and controllability are often competing factors, but a systems architecture that emphasizes layered hierarchies can moderate this tradeoff.

References

- Broniatowski, D. A. (2017). Flexibility Due to Abstraction and Decomposition. *Systems Engineering*, 20(2), 98–117. <https://doi.org/10.1002/sys.21381>
- Broniatowski, D. A., Cardin, M.-A., Dong, S., Hale, M. J., Jordan, N. C., Laufer, D. R., ... Weigel, A. L. (2008). A framework for evaluating international cooperation in space exploration. *Space Policy*, 24(4), 181–189. <https://doi.org/10.1016/j.spacepol.2008.09.012>
- Broniatowski, D. A., & Moses, J. (2016). Measuring Flexibility, Descriptive Complexity, and Rework Potential in Generic System Architectures. *Systems Engineering*, 19(3), 207–221. <https://doi.org/10.1002/sys.21351>
- Logsdon, J. M. (1986). The decision to develop the space shuttle. *Space Policy*, 2(2), 103-119.

Caelus Partners, LLC

Jose Ocasio-Christian
Chief Executive Officer

24 August 2017

WRITTEN RESPONSE

Caelus Partners believes that the only effective deterrence strategy for the US and every other nation is to create a community in which scientific collaboration, nation-state interests, and commercial competition can be coordinated and managed. We have provided our effort to support this concept through a document named the Community in Space™ Campaign Plan, which is working to build the principles, policies, and investments necessary for this collaborative community.

Caelus Partners is leading a global effort in the Community in Space™ to address the challenges of space law and norms as they impact scientific collaboration, nation-state interests and commercial / economic competition. We believe that the US, acting as a participant rather than the lead in a global discussion, will be able to maximize its national security interests as well minimize the cost.

Our hypothesis is that if we *define, build, inform, and get others to support and operate from within or from a derivative of the Community in Space™ Framework*, then the cost of space exploration will be lower (in resources and time), and economic growth will occur with greater participation and opportunities. Ultimately, the Space Market/Domain becomes a sustainable and resilient economic environment.

The purpose of the Campaign Plan is to answer the following questions: What are the attributes that facilitate the sustainment and/or improvement of the Space Market today? How do we connect Space with general audiences and increase economic interest? Caelus Partners has designed a Campaign Plan that is inclusive and collaborative for the betterment of space by focusing on resiliency and transparency. While the opinions of what a Community in Space™ will be differ greatly, the point of the campaign is to capture some of the different concepts that are being considered in the industry. From these discussions and writings, we will understand the differing approaches in the industry and present the decisions needed to make those ideas financially viable. The Campaign Plan is designed around four lines of effort. Lines of Effort are areas that focus a team's work on specific objectives and milestones, enabling a higher-level organization to synergize these efforts to achieve a desired end state. The Lines of Effort are not presented in order of priority — each works simultaneously and collaborates with other efforts. The lines of effort are listed in the paragraph below.

The Community in Space™ Framework will be built over the next 24–36 months, starting in 2018 in four overlapping phases: Phase I – Inform and gather information from the community; Phase II – Develop partnerships with key entities in the industry (foundations, government, private sector); Phase III – Build and publish the Framework; Phase IV – Take action and achieve objectives in the campaign by building the Community in Space™ from the framework developed.

The End State for this Campaign: It will be safe and structured to participate and operate in the Space Market and the Space Domain and do business regardless of where you reside on Earth. The goal is to ensure sustainable utilization of the Space Market and Space Domain as they continue to expand beyond geosynchronous orbit.

Dean Cheng

Senior Research Fellow

(The Heritage Foundation; Asian Studies Center, Davis Institute for National Security and Foreign Policy)

2 August 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: Okay. So, let's move in to some of the space law and norms questions that I was hoping to ask you. As more and more actors are operating in space, it seemingly also brings with it an increased risk of facing aggressive or threatening activity, whether intended or unintended. So, I'm wondering, what are the principles upon which international policymakers should develop response option for dealing with aggression in space?

D. Cheng: Well, first off, what is an "international policymaker?" You mean US policymakers? Or, do you mean the international consortium of space policymakers that meets in Geneva or some place like that? I mean, again, that is the language of UN bureaucrats and academics in the arms control community. So, I can't tell you what "international space policymakers" are thinking or should be thinking. I think American policymakers need to be thinking about robust active responses to bad actions in space that goes beyond the 'demarche-mallows' that we tend to throw around.

Interviewer: So, how would that differ from what you think a Chinese policymaker needs to be thinking about?

D. Cheng: I mean, Chinese "policymakers" who go to Geneva, etc. are often largely irrelevant to actual Chinese policymaking, so they can say almost anything they want. They are given instructions to do things like promote convention proposals, but they aren't the ones who are actually making any of these policies. There are no "international space policymakers" in China. In China, the Foreign Ministry is irrelevant.⁷ One of our common big mistakes is giving any credence to speeches made by the Chinese Foreign Minister in Geneva. The Chinese Foreign Minister has not been on the [Chinese Communist Party] Politburo since 1999, and the Politburo sets policy.

So, one of the big problems we have when you use terms like "international policymakers," is that you actually are talking about a conglomeration of different groups and entities with very different perspectives. You have space technical policy people. You have space policy people from different countries. You have experts on countries, some of whom have some knowledge of those countries' space policies. So, you wind up with people who, for example—I hate to say this, but—there aren't that many American folks who look at China's space policy. We have a lot of folks who look at China and various pieces of China (e.g., the military, the foreign policy, etc.), but we don't have many people look at Chinese space policy. Conversely, you have people who look at space policy and they talk to the various Chinese, but they often don't understand China. And then you have the technical folks who can you tell you all about the Long March 5, and that's a whole different aspect of China and space. And I have a bad feeling that we have the same problems with Russia, and to a lesser extent with the West. We certainly have this problem with Japan. I will tell you right now that with respect to the way the Japanese are approaching space security policy, a lot of our space people don't understand that and it's not clear how many of our Japan experts understand that, because what is needed are people that are familiar with both Japan and specifically Japanese space policy.

⁷ During the final review of this report, Cheng noted: "This may change since the 19th Party Congress of November 2017. The elevation of Yang Jiechi, State Councilor for Foreign Policy, to the Politburo MAY presage a larger voice for the Chinese Foreign Ministry establishment (although there is still quite a bit of debate and doubt about that)" (Dean Cheng, February 2018).

But, when you talk about, “what will be various countries’ response options in the realm of principles and codes, etc.,” for what you’re talking about, in China for example, it’s not going to be the Foreign Ministry that makes that decision—it is going to be the [Chinese Communist Party] Politburo, which is going to be heavily influenced by the military, and by a worldview that is only marginally informed by the Foreign Ministry. Russia, for example, is going to be completely different. Though, I won’t speak to Russia because I’m not a Russia expert. But I have done a little work on Japan, and I will tell you that the Japanese, for example, are looking at space increasingly through a National Space Policy Secretariat, which is within their new National Security Council, which is far smaller than the US NSC, but it’s really the Prime Minister, the Prime Minister’s Office, and a couple of other people. That increasingly is going to define Japan’s national security space approach, again, with more limited input from the Foreign Ministry, although it will be more substantial than in the Chinese case.

Falconer Consulting Group

Walt Falconer
President

Mike Bowker
Associate

Mark Bitterman
Associate

Dan Dumbacher
Associate

15 August 2017

WRITTEN RESPONSE

All the above to handle all the probable future scenarios.

Joanne Gabrynowicz

Professor Emerita (University of Mississippi School of Law)

16 August 2017

INTERVIEW TRANSCRIPT EXCERPT

- Role of norms:
 - Norms are good because they decrease uncertainty and fosters stability.
 - Anything that increases uncertainty is a good thing
 - The reason human beings have law is to create stability and certainty to the degree possible
- Where it gets difficult is political will.
- Do nations have the political will to abide by the norms?
- Can fix these things if you want them to be fixed, but with a lack of political will, norms are not going to serve their function.
 - Difficulty arises due to a lack of political will to create and abide by norms.
- Issue of ambiguity can be solved IF sufficient political will exists
- Despite the difficulty, norms should be pursued

- If a conflict arises, norms can lose significant value and re-defining norms and other informal law may be needed.

Dr. Nancy Gallagher

Director (The Center for International and Security Studies at Maryland)

10 August 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: Okay. So, I want to transition to one of our other questions, which has to do with dealing with threats and responding to threats and aggression in space. I'm wondering, what are the principles upon which international policy makers should develop response options for aggression in space?

N. Gallagher: So, here again, it depends. I actually write public opinion poll questions sometimes, so I've spent a lot of time parsing all the words on your questions.

The first thing I wrote down was that this question assumes that there has been some aggression in space. As such, one principle ought to be, don't act before you know what actually happened. And it may or may not be obvious what happened-whether it was a deliberate attack, whether there was some form of inadvertent or human interference, whether it was a satellite malfunction, whether it was a result of a natural hazard, etc. Even if you can determine that it was definitely something deliberate, it still may very well be difficult to figure out who did it and why. So, I would never just assume that you're dealing with an act of aggression before you've actually determined if that's what you are really dealing with.

Then, the question talks about international policymakers, and I was trying to figure out, well, what does "international policy makers" mean? Are you really talking about US policy makers here? Or, are you talking about the US and its allies and how they are going to respond? Or, are you talking about some sort of international body, which would be either the Security Council or who knows what?

Then, the other question I had was, what are you trying to accomplish? If something bad happens, you could say, "Well, our primary objective really is to just condemn the bad thing." Or, you could say, "Our primary objective is to punish the bad thing, or to reverse whatever gains the bad actor achieved so they don't get any kind of military advantage for it."

Ultimately, though, how you responded would depend a lot on how confident you were that you knew what had happened, who you were making the decisions with, and what you were trying to accomplish.

Gilmour Space Technologies

Adam Gilmour
Chief Executive Officer

James Gilmour
Director

13 July 2017

WRITTEN RESPONSE

Flexible but firm, anyone who knocks out a GPS satellite or communications satellite should get hit with an immediate financial freeze on assets and trade.

Harris Corporation, LLC

Brigadier General (USAF ret.) Thomas F. Gould
Vice President, Business Development, Air Force Programs

Colonel (USAF ret.) Jennifer L. Moore
Senior Manager, Strategy and Business Development, Space Superiority

Gil Klinger
Vice President; Senior Executive Account Manager for National Security Future Architectures

21 August 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: Moving on to discussing the current ambiguous declaratory policy that the US have. I may be wandering into diplomatic territory here but, I'm wondering if revitalizing and reviewing the current policy to make it more robust and current. Would that constitute a direct escalation or present the possibility of being construed of such? Is that something the industry is worried about? The next time the US government decides to review and update their space policy, perhaps it can be again construed as maybe aggressive. So is that a fear or a possibility, is that something the industry is aware of?

T. Gould: I think from an industry perspective, industry would only benefit from that one. But we think it is more of a political and diplomatic discussion.

Dr. Peter L. Hays

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

19 July 2017

WRITTEN RESPONSE

Building on the OST regime, international policy makers should use principles, inter alia, from the laws of armed conflict and anticipatory self-defense to develop response options for aggression in space. I believe this effort

should not be initiated first and cannot be completed effectively unless more clarity, consensus, and adherence is achieved regarding foundational concepts and processes in the OST regime. Foundational concepts and processes in the OST regime that lack such clarity include: the concept of “peaceful purposes,” processes for state authorization and continuing supervision of space activities by non-governmental activities, processes for determining liability for damages caused in space, and processes for undertaking or requesting international consultations for potentially harmful interference.

Dr. Henry R. Hertzfeld

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

17 July 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: What are the principles upon which international policy makers should develop response options for aggression in space? For example, flexible versus controlled response, proportionality, etcetera.

H. Hertzfeld: Just speaking a little bit to the law... first, a lot of these things are still not well defined in the space environment. There is no good definition of a weapon, for example. There’s no good definition of what an armed attack might be. Some things out there are obvious but many things aren’t in the space environment. It’s not the same as the land and sea in many ways. I know people have written papers, and there are conferences, and there is discussion about this. “What is self-defense?” is another question that’s related, and there’s no clear answer to that right now. We don’t even know the terms of engagement let alone how we might engage. There are some obvious extremes where somebody actually attacks you with on purpose. But there are so many in-betweens where things can happen either purposely or accidentally. What might be a necessary or proportionate response is also not very clear or well-defined. I think we need to look carefully at that so that we at least minimize false responses and actions that might be wrongly interpreted.

Interviewer: How should we go about developing that calculus? What should it be based off of?

H. Hertzfeld: That calculus is going to vary by the technology of the moment and the time and the capabilities that are out there, so not only do we have to be prepared if somebody’s words or actions engage us up there, but we have to be prepared to make sure that if it’s not intended, that we know that it’s well-meaning and to be as clear as we can so that responses are appropriate. I’m talking around your question because without specific examples, and even with them, it will take a lot of study, a lot of work, and a lot of internal discussion in order to really come up with answers and respond appropriately in space. I think it will be different for almost every type of incident because space is a lot of different things that we’re lumping into one category. Are you talking about something in orbit? Are you talking about something on a celestial body? Are you talking about something that will come back to Earth? All have different types of responses.

Interviewer: Okay, so there’s no easy answer, right?

H. Hertzfeld: Certainly not at the moment. If we’re presented at some point with a very specific incident then, again, there isn’t an easy answer, but at least you can begin to develop a framework or hopefully in real time (or an appropriate time) coming to some sort of policy or decision.

Theresa Hitchens

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

19 July 2017

WRITTEN RESPONSE

There are LEGAL requirements re proportionality etc. that apply in space via Law of Armed Conflict (LoAC), an UN Charter Article 51. These are not “principles!” And then there are actual UN principles we have signed up to. There are four treaties we are parties to and a series of principles that directly relate to space. *I have written a paper on this: see attached.* In addition, we have to think about creation of debris – re a variety of principles agreed and normative efforts underway to mitigate debris, including the UN Debris Mitigation Guidelines (most of which we have integrated into our satellite licensing processes). Oh, and I should point out that there is no legal or agreed definition of “aggression” in space; either under the UN Charter or in any other body of law. This is a nuanced field, and the question above does not reflect that fact.

Dr. Moriba Jah

Associate Professor, Department of Aerospace Engineering and Engineering Mechanics
(University of Texas at Austin)

3 October 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: Okay. So, the idea of reinforcing space as global commons actually transitions nicely into the next question that I was hoping to ask you. Do you think international agreements can effectively protect high value space assets in a time of crisis and/or conflict? And, additionally, what are the principles upon which international policy makers should develop response options for aggression in space?

M. Jah: We have UN treaties and the Outer Space Treaty and those kinds of things, which provide the only framework existent with regards to space. I’d say that we should build upon those things that are currently in place.

With respect to the question of, can international agreements effectively protect things, I think the more relevant question is, “What’s enforceable?” When you ask, “What’s enforceable?”, that leads into “What’s known?” One of the things that my research group makes as a foundation is, if you want to know it, you have to measure it, and if you want to understand it, you have to predict it. So, there are a lot of people talking about norms of behavior in space, and that we should just create these things, but that just leads me to wonder, “Okay, what are you going to create?” If what you’re going to create is not based on empirical data or is not evidence based, then it doesn’t make sense. The norms of behavior have to be things that promote transparency and are things that are measurable, and not measurable just by one entity but measurable by the community at large. If these norms are measurable and quantifiable by a global community, then that becomes the thing that allows for enforcement because it’s something that there is actually measurable evidence for—it’s not a “he said, she said” situation, but, rather, it’s a community that can corroborate or refute any given event and then quantify to some level the harmfulness of that event. So, I think that the way in which we protect ourselves is by knowledge and by making that as ubiquitous as possible.

Christopher Johnson

Space Law Advisor (Secure World Foundation)

11 September 2017

WRITTEN RESPONSE

Article III of the Outer Space Treaty makes it clear that general international law, including the UN Charter, apply to the activities of states in the exploration and use of outer space. Therefore, while space law is considered a special set of rules for space activities, both the UN Charter and other applicable treaty rules, customary laws, and general principles apply to space. These principles include long-established rules such as good faith, *pacta sunt servanda*, the sovereign equality of states, non-interference, non-aggression, the prohibition on the use of force, the right of self-defense, the peaceful settlement of disputes, as well as newer principles of such as the precautionary principle.

In possible conflict between the special regimes of space law and the law of armed conflict or between other special regimes of law, the outcome between regime conflict amidst the network of international law is uncertain. However, a general principle of international law is that any special rule of international law can be complied with in a way that also complies with general international law. In other words, there is a presumption that space law and the law of armed conflict can simultaneously be complied with, and do not impose conflicting obligations. Guidance on resolving conflicts between competing regimes of international law has been addressed by the International Law Commission's study on the fragmentation of international law, and offers principles for harmonization (or 'systemic integration') between competing regimes. Again, there is a strong presumption against normative conflict between special regimes of international law.

In contrast, Article 103 of the UN Charter states that the Charter prevails over any treaty obligations of states. Therefore, a hierarchical relationship between special regimes such as space law or other special regimes with the UN Charter is clear, and the UN Charter takes precedence of any special regime of international law. Additionally, *jus cogens* and pre-emptory norms of international law also take precedence over any special regimes, and states cannot contract out of them.

It should be kept in mind that the UN Charter has prohibitions on the use of and threat of force, and this bedrock prohibition undoubtedly applies to the actions of states regardless of domain, and therefore also in space activities. Logically therefore, the right of self-defense also applies to outer space, although it is difficult to conceive how this right could be legitimately exercised in outer space—a domain beyond state territory and therefore substantially de-linked with the justifications for the right of self-defense contained in Article 51 of the UN Charter and with reference to the concept of an armed attack upon a state.

The MILAMOS project currently being undertaken may help to clarify the state of the law applicable to military activities in outer space, including which principles might be used to respond to aggression in outer space so as to 1) prevent immediate harm; 2) allow for the de-escalation and cessation of tension and conflict; and 3) allow for the peaceful *status quo* to resume.

Principles to be employed in response planning should allow offending actors the widest freedom to cease their offenses, and to not repeat them; and these principles should make the cessation and non-repetition of offensive actions the most attractive option (politically, militarily, legally, socially, and otherwise) for offending actors.

These principles and norms (whatever they may eventually be) may be socialized and promoted internationally so as to foster a political and legal environment where the use of force and aggressive acts are not easily considered tenable options. States and other actors are free to act as norm "entrepreneurs" to promulgate norms which conform to, do not subvert, and which refine and/or clarify the existing laws applicable to military activities and aggression in space.

Although space assets may be critical military infrastructure, promoting and socializing a **possible norm that space assets are not permissible military targets** will require norm promoters to obligate themselves to not target space assets. However, analogous self-restrictions have been adopted by the United States Government since the dawn of the space age, with Article IV of the Outer Space Treaty prohibiting states from placing nuclear weapons, including weapons of mass destruction, into Earth orbit or stationing them in space. At the time of the negotiation of the Outer Space Treaty, this was seen as a security-enhancing arms control obligation by the United States Government.

In game theory, the traditional model of a prisoner's dilemma, sometimes applied to disarmament, does not apply to outer space. This is because, in distinction to a prisoner's dilemma, actors can 1) exchange information and monitor each other, and 2) the actors play the game continually, rather than once or a few times. Consequently, 'cooperation' between actors for individual benefit and better collective outcomes is possible. As such, self-imposed restrictions such as the above possible norm may be understood to increase overall long-term "gains" (i.e., security). Long-term rationality by actors in space, where actors continually interact and can respond to defections (violations) from the rules, dictates that removing possible negative outcomes or costs, such as the targeting of space assets, can be achieved by mutual self-imposed restrictions on options.

Next, socializing the **possible norm that aggressive acts in space will not be responded to in the space domain itself** would foster the notions that: 1) space is a domain where aggressive actions can have very long-term (even permanent) deleterious effects on the space domain; 2) aggressive actions taken against space assets, rather than being a safe, grey target ('satellites don't have mothers'), is actually a serious, transgressive, and escalatory action; and 3) responding to aggressive acts with responses in space is not a permissible, lawful, or legitimate response.

Admittedly, norm entrepreneurs of the above norms will face hurdles in promoting and socializing the above norms, but getting a multiplicity of actors to internalize them will foster norm acceptance, resulting in the long-term gains of security mentioned above.

David Koplow

Professor (Georgetown University Law Center)
15 August 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: That is a great basis for that. We'll expand on a few of the points you made and we'll keep it captured at, sort of in the spirit of the questions from the list that we sent to you. I'll begin by asking you, what is the best legal avenue for the US to revitalize discussion on space law and space policy? What is the best opportunity we have to regain the initiative and remain the leader of international space law and maintaining the norms to our advantage?

D. Koplow: There's a couple of different ways to think about regaining the initiative and how the United States might proceed to exercise leadership. One way is to think about the venues, the places where international law is developed and agreed upon. There are multiple different places different places in international law where treaties or other international legal principles have been developed. One is the Conference on Disarmament. Something called the CD. Do you know about the CD or should I tell you a little bit about that?

Interviewer: Please go ahead.

D. Koplow: The CD, the Conference of Disarmament, is a body that has 65 member countries that participate, essentially, in Geneva and it has been the primary venue for the countries to negotiate treaties about weapons. The CD has developed the treaty about chemical weapons and

the treaty about biological weapons and the treaty about non-proliferation of nuclear weapons. It would be the logical place to turn to for the development of a treaty about space weapons. The CD has repeatedly had on its agenda repeatedly had on its agenda the discussion about the possibilities for developing new international law on preventing an arms race in outer space and something of that sort. The difficulty with the CD is that it operates by a very strict rule of consensus, which means that any one country can block anything from happening there, and that power has been exercised by various countries, often by the United States, often it has been Pakistan. The CD has been basically frozen for about 20 years and unable to develop anything having to do with new treaties, having to do with outer space or anything else. One important step if you are thinking about articulating international agreements on weapons in space is to figure out what to do about the CD, whether to prevail upon Pakistan and others to agree to open negotiations in the CD. Or alternatively, to abandon the CD and pursue in some other format because this one is dysfunctional.

That is, I think, a first fundamental procedural question, and it has the diplomatic aspects and strategic aspects on whether abandoning the CD in the long run is a good move for the United States, or a bad move, but that's the traditional place on which they're stuck. Aside from the weapons-related aspects, the other places in outer space... in international law... where outer space is discussed and debated and some of the kinds of principles dealing with congestion might be more appropriately debated and the leading international institution there is the Committee on the Peaceful Uses of Outer Space, which is a United Nations body, and they've done and continue to do, some very productive and useful important work on civil aspects of outer space. COPUOS completely stays away from weapons-related stuff. Anything having to do with debris in outer space or radio frequency interference in outer space, or on the long-term sustainability of operations in outer space, COPUOS is the place to go. They are a regularly functioning body and they have a scientific subcommittee and a legal subcommittee and for some of the issues that you're concerned about, that might be a valuable place to go, but not the weapons-related side. Does that help?

Tanja Masson-Zwaan

Assistant Professor and Deputy Director
(International Institute of Air and Space Law at Leiden University)

13 July 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: Okay, just making sure. Let's get started. First off, just a little bit of background on the project. This effort is being conducted for Department of Defense space decision makers who brought up a series of questions for which they thought we could elicit expertise from subject matter experts on. We're collecting responses from experts on the questions from the list that we sent you, and we're going to be compiling those answers into final reports and sending them out to a wider audience. As you noticed, we sent you a few specific questions that we hoped that you would answer today. We'll try to get through as many questions as we can, but as we know, there's a time constraint.

So first off, given your expertise in space law, we thought that the questions in the space law and norms category of the Word document that we sent out would be appropriate for you to answer. So, the first question is "What are the principles upon which international policy makers should develop response options for aggression in space? What sort of principles do you think policy makers should keep in mind when dealing with aggression?"

Masson-Zwaan: Yeah, I had a look at those questions of course. I'm not sure really if I can answer this first one because that's very much about policy I guess not to develop response options. I can tell you what the law is, but I'm not really sure if I can answer such a policy question. Can you clarify a little bit more so that I can see if I can jump in on something or what kinds of things... you mentioned here flexible versus controlled responsibility as well, and so of course there are rules of international law that apply so that you cannot... it's prohibited to use or threaten to use force in outer space as said in rules like UN Charter and things like that, but I'm not quite sure if that's what you're looking for in this question.

Interviewer: Yeah, and feel free to let me know if you feel like a question is a little bit out of your expertise. If you feel you'd be more qualified to focus on other questions, you can let me know.

Masson-Zwaan: Of course, the proportionality you mentioned, that is an international law principle. It is in Article 2.4 of the UN Charter. If there is a use of force, members states of the United Nations have an individual and collective right to self-defense according to article 51 of the UN Charter, and then there is a whole body of international law that applies, one or two conditions being that there is an actual threat and that response is proportional. I think that I get that you're referring to that kind of principles but I was not quite sure.

Michiru Nishida

Special Advisor for Arms Control, Disarmament, and Non-Proliferation Policy
(Ministry of Foreign Affairs of Japan)
3 October 2017

WRITTEN RESPONSE

The most important principle that should be reaffirmed would be the application of existing international law and obligations to outer space, namely, amongst others, 1) freedom for all States to access and use outer space, 2) responsibility of States to refrain from the threat or use of force under the UN Charter, and 3) avoidance of harmful interference with outer space activities. This reaffirmation of application of existing international law and obligations would naturally encompass such principles as necessity and proportionality. Existing international law does allow certain activities flexible enough but controlled response based on the principles of proportionality and necessity.

Another important principle would be the application of above-mentioned principles to all outer space activities, scientific, civil, commercial and military. This is crucial since some States dispute the scope of agreements adopted at UNCOPUOS, which set forth important principles for the conduct of outer space activities, claiming that the mandate of the UNCOPUOS only deals space activities other than military. They argue that any agreements that regulate military space activities should be only negotiated in the Conference on Disarmament (CD) in Geneva, which is comfortably deadlocked for some States.

Dr. Luca Rossettini

CEO and Founder (D-Orbit)

16 August 2017

WRITTEN RESPONSE

International policy makers should set a clear set of rules with clear consequences explained. If rules are not observed, the response should be according to what is defined within the rules framework.

The message – but I believe it is clear – is that we should make sure that regulations include “to-do practices” but also “consequences” for misbehaving. Like it works on Earth. For example, we should start imposing an annual check-up on satellites, like it happens for cars. If my car fails the compulsory check-up, I cannot drive it anymore. If a satellite’s reliability goes below a certain threshold, say 80%, it shall be immediately removed. Satellite insurance companies already check the overall status of satellites before insuring them, hence at least one procedure is already there. Basically: set the rule (the check-up) and set the penalty (removing satellites not compliant). This first step will enable a series of initiatives that could apply to satellite hacking or jamming. It is a long process, but it has to be negotiated at the international level also.

Matthew Schaefer and Jack M. Beard

University of Nebraska College of Law

Matthew Schaefer

Professor of International Trade Law and Co-Director of Space, Cyber, and Telecom Law Program

Jack M. Beard

Associate Professor of Law

16 August 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: Okay. Sounds good. So, moving on to the next question, 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 incidental loss of civilian life or damage to civilian objects which is excessive in relation to the concrete and direct military advantage anticipated. And there is a debate right now about whether actions generating huge debris fields that threaten many satellites in space is a disproportionate attack. Lawyers generally focus on the loss of human life in determining whether an attack qualifies as a disproportionate attack. But, I think that the more you study space and the importance of things like GPS satellites, the more that you are 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.

Dr. Michael K. Simpson

Executive Director (Secure World Foundation)
23 August 2017

WRITTEN RESPONSE

Proportionality is pretty well rooted in the law of armed conflict *ad bellum*. The concept may be complicated by the asymmetry of impact of actions in space, however. Eliminating a single satellite upon which a country depends for critical terrestrial services clearly has an effect that is disproportionate to that of eliminating a single satellite in the fleet of major space faring countries with multiple options to work around the loss.

Michael Spies

Political Affairs Officer, Strategic Planning Unit
(United Nations Office of the High Representative for Disarmament Affairs)
15 August 2017

WRITTEN RESPONSE

The Charter of the United Nations elaborates a number of principles applicable to the development of international policy responses to prevent aggression in outer space. Key principles in this regard include the requirement for all Member States to settle their international disputes by peaceful means in such a manner that international peace, security and justice, are not endangered. Furthermore, all Member States are required to refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any state, or in any manner inconsistent with the Purposes of the United Nations.

The primary organs of the United Nations have various responsibilities with respect to the maintenance of International peace and security and to the implementation of the principles of the Charter. These responsibilities relate both to the prevention of acts of aggression, including armed force, and responses to armed attacks.

The Security Council has primary responsibility for the maintenance of international peace and security. It could therefore play a role in any response developed by international policy makers to aggression in outer space. The Council has broad authority to decide on measures, which can be legally binding on all Member States, in response to a threat to the peace, breach of the peace or act of aggression.

With respect to preventing acts of aggression (i.e. the principle of ensuring the peaceful resolution of disputes), the General Assembly has the responsibility to consider the general principles of co-operation in the maintenance of international peace and security, including the principles governing disarmament and the regulation of arms, as well as to make recommendations for the purpose of encouraging the progressive development of international law and its codification. Under the auspices of the General Assembly, States have developed several voluntary and legally binding measures ultimately aimed at preventing aggression through various means in outer space, including the 1967 Outer Space Treaty and the 2013 transparency and confidence-building measures in outer space activities.

The implementation of transparency and confidence-building measures (TCBMs) in outer space activities has great near-term potential to prevent aggression in outer space, as the United Nations continues to deliberate on other political and legally binding measures. The goals of TCBMs in outer space activities are to reduce misperceptions and miscalculations and thereby help to prevent military confrontation, build confidence as to the intentions of States in order to establish a predictable strategic environment, and augment the safety, security and sustainability of day-to-day space operations.

In the event that any internationally agreed measures fail to prevent an armed attack in outer space, a State may exercise its right to individual or collective self-defense. There are various views as to the definition of an armed attack in the context of the United Nations Charter. International experts consider that an armed attack involves the invasion or attack on a large scale by a State's armed forces on another State's territory. Agreement on the definition of an armed attack could be important factor in the development of international policy responses aimed at preventing aggression in outer space.

Any response by a Member State to an act of aggression in outer space must comply with applicable principles and rules of international law. In the context of armed conflict, these include the principle that the right of parties to an armed conflict to choose methods or means of warfare is not unlimited, the rule of distinction, the prohibition against indiscriminate attacks, the rules on proportionality and precautions in attack, and the rules for the protection of the natural environment.

The application of these rules and principles in a response to any possible use of force in outer space remains a matter of debate in the international community. The development of policy responses must take into account the unique nature of the outer space environment, the dual-purpose nature of many satellites, and increasing congestion caused by the growing number of actors in outer space. From a safety and security perspective, kinetic attacks against outer space objects may generate long-lasting debris and pose a hazard to space operations and nuclear detonations in outer space could destroy or disrupt satellites over a wide area. From a humanitarian perspective, the disruption or destruction of dual-use satellites could negatively impact essential civilian infrastructure, health-care services and humanitarian operations that depend on satellite communication, navigation and timing, and imagery networks.

Dr. Cassandra Steer

Executive Director (Women in International Security-Canada)
Interim Executive Director, Center for Ethics and Rule of Law (University of Pennsylvania)
1 September 2017

WRITTEN RESPONSE

To begin with, the same fundamental legal principles should apply as apply in all other domains when responding to aggression. This means that the doctrine of necessity must first and foremost be applied: the use of force must only be employed when the aggression is “instant, overwhelming, and leaving no choice of means, and no moment for deliberation”, according to the age-old Caroline doctrine. This has already been accepted as a leading principle in the cyber domain (Sloan, 2016, p. 152; Tallin Manual, 2015), and it must be assumed to apply in space.

The principle of proportionality is also critical when considering a response to aggression. The impact of responding in the space domain on other actors must be given particular priority especially given the prevalence of dual-use technologies in space, and multiple users of commercial space based services. Terrestrially, the consequential impact of destruction of a lawful military object such as electricity-generating stations or water purification facilities that supply both military and civilian purposes requires careful assessment, and the same requirement exists when assessing a target in space and the potential impact on a civilian population as a result of that object’s destruction (Stephens & Steer, 2015, p. 23).

The principle of precaution in attack must also be taken into account in specific ways. This principle requires taking all feasible precautions in the choice of methods or means of attack with a view to avoiding, or at least mitigating, loss of civilian life, injury to civilians and damage to civilian objects (as recognized in the US Navy Commanders Handbook, para 8.1). While loss of civilian life in space is unlikely, the impact of targeting some satellites for civilians on the ground must be considered, as must the impact of targeting a ground station in order to interrupt satellite services. As well, the potential creation of space debris has become such a great international concern that there may be an imperative against employing kinetic responses in space. General Hyten is quoted as saying that the potential for creation of space debris may be the one limiting factor to conflict in space: “Whatever you do, don’t create debris” (Billings, 2015).

Indeed, physical environment of space, and the risk of causing space debris by use of kinetic weapons, mean that the principles of proportionality and precaution in attack must weigh particularly heavily. Due to the difficulty of identifying an object as a legitimate military target given the increase in dual- use space applications, and the potential for catastrophic reverberating collateral effects when destroying or disabling a dual-use satellite, the principle of distinction may not be enough on its own to determine whether there is sufficient “definite military advantage” to targeting such an object. (Stephens & Steer, 2015, p. 31). It may be that responding terrestrially would be a preferred tactic, although then the same principles would have to be applied.

Another solution may be the use of cyber operations to disable or disrupt functionality of a satellite that is assessed as constituting a military objective. The Tallinn Manual highlights that cyber may be the preferred option where the real-world impact would be less than another form of attack, according to what is “practicable or practically possible, taking into account all circumstances ruling at the time, including humanitarian and military considerations” (Tallinn, p 168). But use of force in response to aggression, while a lawful right, may not always be the best response. The principle of reciprocity should also be taken into account. Because space is of national vital interest, then attacking the satellites of other parties, even in response to aggression, would invite further retaliation in kind, putting at risk these national interests (Johnson-Freese, 2017, p. 20). Avoidance of escalation is in the interests of the U.S. for protection of its space assets from further attack. It is also in the interests of the U.S. as some war games scenarios have suggested that escalation in space can happen rapidly, and can lead to escalation terrestrially, including leading to the use of nuclear weapons. Therefore, response to aggression in space would be better focused on terrestrial targets that will interrupt the space architecture of an adversary, without attacking their space assets directly.

Dr. Mark J. Sundahl

Charles R. Emrick Jr.- Calfee, Halter & Griswold Professor of Law; Director, Global Space Law Center
(Cleveland-Marshall College of Law, Cleveland State University)

19 July 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: So, in terms of constraints, it seems like a big part of that would be building and solidifying norms, particularly as technologies are rapidly developing and more actors are getting access to space and to technologies that can help them get to space or get involved in space. So, I'm wondering, what sort of things can the US do, or what sort of things should the US do, to best facilitate the development of these norms so that we help to maintain a peaceful space domain?

M. Sundahl: I think you put your finger on it. I made a couple of notes before this call, and a large part of it is about exactly that. I think it's important for the government to identify which of these terms, restraints, and legal terms in the treaties present uncertainty that affects our operation in space—where are the problems in the international treaties? We need to identify those problems, and then become active participants at the United Nations and have discussions at diplomatic levels (i.e., bilateral talks, multi-lateral talks, and be involved in other working groups and other initiatives) that clarify these issues. I think the United States should take the lead because the risk is that if the US doesn't and then is involved in something like asteroid mining and extraction from ice on the Moon, then it runs the risk of being viewed by many around the world as having acted unilaterally by allowing for the ownership of extracted resources.

Currently, the international community is somewhat enflamed, and there are active discussions going on at the UN, but I wouldn't say that the US is necessarily at the lead of those conversations. I think there may have been a miscalculation that critics would not arise.. I think America should learn from this and try to take the lead in clarifying these terms for the benefit of everyone.

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.

ViaSat, Inc.

Richard A. VanderMeulen
Vice President of Space and Satellite Broadband

Ken Peterman
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21 August 2017

WRITTEN RESPONSE

International policy makers should be able to execute flexible response options and proactive defensive actions in response to aggression in space. Factors used to determine responses could be derived from three elements: characteristics & purpose of the spacecraft; operational environmental factors and demonstrated behavior.

- **Characteristics:** Spacecraft has the capability and intent to disrupt, destroy or degrade another space system.
- **Operational Environment:** Heightened geo-political tensions coupled with large force movements, posturing, and testing.
- **Behavior:** Provocative behavior to prepare or align a spacecraft with known or suspected capability to disrupt, destroy or degrade in the most advantageous position for hostile action.

To control escalation the US should articulate redlines which could drive a controlled response while reserving the flexibility to provide a proportional response in space or in other domains. Recognizing hostilities in space have the potential of impacting third parties, such as commercial space systems, not involved in the dispute the international community should actively engage in preventing and limiting hostilities.

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: 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.

Charity Weeden

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Former Assistant Attaché, Air & Space Operations (Canadian Defence Liaison Staff, Washington, DC)

24 July 2017

INTERVIEW TRANSCRIPT EXCERPT

Interviewer: Okay. We'll move to the last three questions, which have a legal focus. So, to start, 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?

C. Weeden: For these two questions, one thing that stuck out was transparency. Transparency is key between commercial and governments, but it's also key between the international community as well.

I attended the UN COPUOS, in February, where a long-term sustainability working group meeting was held, and I think this is a key point in advancing norms of behavior. If you're not fully clear

what the others are doing then you're less apt to adopt anything. The fact that the UN has moved forward on some guidelines, I think that's fantastic and we're moving in the right direction there. I'll also say that the commercial satellite industry crosses all borders. The business imperative for making a sustainable space environment also crosses all borders, especially for the commercial industry.

If the commercial industry comes together on norms of behavior, it will eventually spread across borders instead of having to have a more formal method. It should be an all of the above kind of effort for the UN: governments and commercial industry working together. Advisory committees and ad hoc meetings help to ensure industry is at the table when making decisions that will affect billions and billions of commercial assets in space. Having a sustainable space environment is not just good sense, it's good business. There is the business imperative of the commercial industry to help develop norms.