### Safety ADV---1AC

#### Advantage one is SAFETY.

#### Russia is demo-ing unsafe satellite proximity maneuvers and refusing to coordinate flight paths. This is risking operator error and miscalc from collisions.

Nathan Strout 19. Reporter, Space and Intelligence Systems at C4ISRNET. 9-3-2019. "Russian satellite creeps up to Intelsat satellite." C4ISRNET. https://www.c4isrnet.com/battlefield-tech/2019/09/03/russian-satellite-creeps-up-to-intelsat-satellite-again/#:~:targetText=(Intelsat),or%20could%20cause%20a%20collision.&amp;targetText=On%20Aug.%2027%2C%20TS%20Kelso,now%20approaching%20an%20Intelsat%20satellite.

But little is known about Luch. The Russian government hasn’t been forthcoming with information about the secretive space vehicle and officials have not discussed their plans for the satellite. Attempts by commercial satellite companies to contact the Russians about the satellite have reportedly proven fruitless.

According to Todd Harrison, director of the aerospace security project at the Center for Strategic and International Studies, the United States’ understanding of Luch is also limited due to its location and the lack of public information about the satellite.

“It’s about 22,000 miles above the surface of the earth. So it’s not something we can see with great fidelity, even with a powerful telescope,” said Harrison. “But what we can do is observe it’s behavior, and it’s been up there for several years.”

“What we’ve observed is this satellite moves around the geostationary belt and it will sidle up close to other satellites and stay there for a while, and then move along to other satellites,” explained Harrison. “So that suggests that it’s some sort of inspection or data collection vehicle.”

Brian Weeden, director of program planning for the Secure World Foundation, a nonprofit focused on sustainability in space, agreed.

“In general, what we’re seeing from the U.S., Russia and China so far […] are growing interest in two activities related to national security. One is collecting intelligence and the other is space situational awareness,” said Weeden. “Our best guess for what Luch is doing is some form of electronic intelligence collection.”

Kelso added that Luch is moving on to new satellites faster than it used to.

“It looks like initially, the ‘visits’ were many months long but have gotten shorter over time,” he said.

While Kelso didn’t know every satellite Luch had visited, he said a number of them belonged to Intelsat, a major commercial satellite operator.

Intelsat did not respond to a request for comment.

One of the biggest concerns for operators who see Luch approaching their satellite is the possibility that Luch will be able to steal their transmissions. Because signals from earth to a geostationary satellite are broad, another satellite operating close enough to the intended recipient could pick up that signal as well.

However, it’s not immediately clear whether Luch is actually intercepting that data, making it difficult for operators to retaliate or cry foul or whether it is simply wreaking havoc. And while concern over data collection is real, Harrison added that to date observers have seen no offensive capability. That means that beyond encryption, there’s little that companies can do to protect their satellites or data–if they even need protecting.

“Just inspecting is not offensive. It’s not inherently destabilizing, but, you know, it does make people uncomfortable when the country doing the inspection is a potential adversary, like Russia,” said Harrison.

The only plausible response operators have is to encrypt the data passing through a targeted satellite, he said.

“Always encrypt everything,” said Harrison. “Encrypt, encrypt, encrypt. It may seem obvious, but if satellite operators think that any of the data they’re transmitting to or from their satellites or between satellites is going to be safe without encryption, they’re wrong.”

But even if there is no malicious intent behind Luch’s activities, Kelso warned that the game the Russians are playing is inherently risky.

“I am very concerned about LUCH (OLYMP)’s activities. I realize there is likely a larger geopolitical game being played here, but getting close to another satellite in orbit without any way to communicate intent is a recipe for disaster,” he said.

Satellite operators think they know exactly where their satellites are, but Kelso noted that there is a high degree of uncertainty when tracking an object that high in orbit. Additionally, operators can make navigation decisions based on different sets of data, meaning one satellite can zig while another zags or stands still. Differing delays in information only further complicate matters, leading to increased risks of collision. These factors compound with a satellite like Luch, where the operators decline to communicate with other operators.

“It’s only a matter of time before something goes wrong if operators don’t work together to share orbital data and communicate intent (upcoming maneuvers),” said Kelso. “It will only take one operator doing the wrong thing at the wrong time to jeopardize everything in GEO, so we all need to work together.”

A major issue in the debate over Luch is that the existing legal framework makes it difficult to call out the Russians for this activity. There are no widely accepted norms of behavior that apply to this situation and there’s no legal framework banning this sort of activity.

#### OST Article IX creates a legal obligation to consult over potentially harmful activity---BUT it lacks buy-in due to customary practice by the US.

James Luther Gilley 15. Louisiana State University and Agricultural and Mechanical College. 2015. Space Cops and Cyber Cowboys: An Institutional Comparison of the Governance of Space Exploration and the Internet. Louisiana State University. Semantic Scholar, https://pdfs.semanticscholar.org/91b1/fddd2a9a54d7a36f814cec711ea0829cfb9c.pdf.

Notification and Registration

One of the major principles for space flight as laid out by OST 1967 is the notion that SPTs shall inform other SPTs and the broader international community of their actions in space. This principle is laid out in Article IX, whose full text reads as follows:

In the exploration and use of outer space, including the moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of cooperation and mutual assistance and shall conduct all their activities in outer space, including the moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty. States Parties to the Treaty shall pursue studies of outer space, including the moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth 66 resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose. If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment. A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, including the moon and other celestial bodies, may request consultation concerning the activity or experiment.

It appears that the primary purpose of notification and registration of space launches and discoveries is based primarily upon the notion of safety, both for astronauts and the general public. Due to the early and uncertain nature of spaceflight at the time of writing OST 1967, it made sense for all SPTs to share scientific data about the dangers encountered during spaceflight. While Hurwitz (1986) suggests that SPTs are not necessarily required to notify other SPTs of their outer space activities, Article V does require states to disclose any information that may cause danger for any astronauts. Article IX requires, among other things, that any information and discoveries made in outer space that could possibly create public health concerns, especially due to “contamination from extraterrestrial matter.” Perhaps most interestingly, Article IX also allows states to request consultation in the event they believe another SPTs actions would cause harm to either the Earth or other outer space activities.

According to Ogunbanwo (1972) the last notion of consultation based on harmful actions, is also the most contentious part of Article IX. First and foremost, this clause does seem to create an awareness that as launches become more commonplace moving into the future, any new launch could potentially interfere with previously 67 occurring space activities. This clause presages the notion of space junk and orbital debris that has accumulated in the half-century or more since the launch of Sputnik. The treaty as a whole, and Article IX in particular, is predicated on the notion that SPTs should work together in outer space activities, especially in coordinating missions for the safety of both astronauts and the general public.

While the idea of working together to keep astronauts and the general public safe during outer space activities is not a radical idea, a problem does arise when focus shifts toward the idea of consultation between SPTs. The treaty itself does not provide any method for consultation, nor does it establish any institution to evaluate any potential experiments for possible harm. OST 1967 lays the legal foundations for institutions governing space exploration, but does little in the way of creating the more tangible aspects of institutions. While some SPTs have suggested using the Committee on Space Research of the International Council of Scientific Unions’ Consultative Group on Potentially Harmful effects of space experiments, 6 little has been done by way of actually setting up an institution to deal with these issues. Ogunbanwo (p108) notes that this issue will be of interest to future researchers and policy makers in the field of space law. It should be noted that eventually a framework for a brick and mortar physical institution, in the guise of the UN Office of Outer Space Affairs (UNOOSA), was established, but the original language of OST 1967 does not have much to say on how these consultations and oversight should take place. A further exploration of UNOOSA, and other physical institutions that govern and regulate spaceflight will follow in the next chapter.

One other article is highly relevant to the exchange of information between SPTs Article XI reads as follows:

In order to promote international co-operation in the peaceful exploration and use of outer space, States Parties to the Treaty conducting activities in outer space, including the moon and other celestial bodies, agree to inform the Secretary-General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of the nature, conduct, locations and results of such activities. On receiving the said information, the Secretary-General of the United Nations should be prepared to disseminate it immediately and effectively.

This article furthers the principles of scientific discovery that permeate the entirety of OST 1967, requiring any results of outer space activities to be disclosed not only to other SPTs, but also to the Secretary-General of the UN and the “international scientific community.” Like many of the preceding articles, while the sentiment may be for the free flow of information, the method by which this information flow takes place is not elucidated. OST 1967 does not establish a protocol or institution through which to provide notification and results. Nor does it provide for any way to verify that the data being disclosed is valid data. Yet this sharing of information is specifically an obligation, which legally speaking lies in the murky area between being purely voluntary and mandatory (Ogunbanwo : p. 115). So the actual degree to which SPTs are required to report their findings, and where they should report them, remains up for debate.

Rescue and Return

Building on the principles of safety and cooperation already elucidated in OST 1967, especially the notion of “for all mankind,” the treaty takes great care to establish rules for the rescue and safe return of astronauts should they become stranded in space or land outside the territories of the launching nation. OST 1967 itself only 69 spends the barest of time establishing rules for rescue and return in Article V, which reads as follows:

States Parties to the Treaty shall regard astronauts as envoys of mankind in outer space and shall render to them all possible assistance in the event of accident, distress, or emergency landing on the territory of another State Party or on the high seas. When astronauts make such a landing, they shall be safely and promptly returned to the State of registry of their space vehicle. In carrying on activities in outer space and on celestial bodies, the astronauts of one State Party shall render all possible assistance to the astronauts of other States Parties.

States Parties to the Treaty shall immediately inform the other States Parties to the Treaty or the Secretary-General of the United Nations of any phenomena they discover in outer space, including the moon and other celestial bodies, which could constitute a danger to the life or health of astronauts.

This article focuses primarily on safety issues, and is comprised of three distinct parts. First is the notion that all SPTs should regard astronauts as “Envoys of Mankind.” The new legal fiction of such an envoy raised many questions among those states that were parties to the treaty but not space powers themselves. Most notable was the objection by Austria that if astronauts were to be envoys of all mankind, then should not nonspace powers have a say in what these astronauts should be doing (Ogunbanwo: p125). Perhaps the most telling response to this objection came from Argentina, another non-space power which stated that this term had no actual definition, something that seems to be supported by other drafters of the treaty. This interpretation does not, however, have much bearing on the notion that SPTs should help astronauts in need. A distinct obligation is placed on all SPTs to render assistance in the event that astronauts require rescue or help. This obligation is placed on all SPTs, as it refers specifically to accident, distress, or emergency landing in the territory of the non-launching country or 70 on the high seas. This paragraph is fairly limited in scope, but still has a much larger audience than subsequent paragraphs.

The next paragraph in Article V has a much more limited scope than the first paragraph, but a scope which is much more high-minded and idealistic, while still having safety concerns for astronauts as paramount. This paragraph is aimed squarely at states that have the capacity to put astronauts into space. At the time of drafting, this audience consisted solely of the United States and the USSR. While the audience of this paragraph is rather limited, the implications are rather large. Simply stated, astronauts should help other astronauts in carrying out their missions. This simple principle, however, has great bearing on geopolitics. As the United States and the USSR were the only space powers at the time capable of putting astronauts into space, as well as the world’s only superpowers who were locked in a cold war, this paragraph could have essentially remained ignored. Yet this was not the case. This paragraph was used to foster fairly amicable relations between the space programs of the United States and the Soviet Union, including many reciprocal agreements and several joint missions, namely the Apollo-Soyuz Test Project (Ezell and Ezell, 2010).

The final paragraph of Article V has already been discussed in the previous section on notification and registration. This paragraph deals with notification of any discovery that may be harmful to astronauts. As was previously noted, the manner in which this disclosure is to take place, and the framework to assist in this disclosure is not established by OST 1967, and though the treaty states that such disclosure should take place immediately, this is still rather legally ambiguous. Yet the overall sentiment and meaning of the treaty remains, all activity in space should be done for the common 71 good of all mankind, and great care and attention should be paid both to the public and to astronauts specifically.

Other Articles

The other articles in the treaty are of much less importance to the overall legal structures governing outer space. They are more concerned with the diplomatic business of concluding a treaty, from the signature process through amendment procedures. Article XIV delineates the procedures for ratifying and signing the treaty. Article XV allows for amendment. Article XVI also makes it possible for any SPT to withdraw from the treaty, given one year’s written notice. Article XVII states that the official languages for this treaty are English, French, Russian, Spanish and Mandarin. What should be noted is that no procedure for the settlement of disputes is formally put into place, though both the United States and the Soviet Union had such provisions in their proposed drafts. No agreement was ever reached on this subject.

While this concludes the discussion of OST 1967, there do exist several subsequent treaties that delve into some of the aspects already covered in OST 1967. The subsequent treaties are the Rescue Agreement of 1968, the Liability Treaty of 1972, the Registration Convention of 1975, and the Moon Treaty of 1979. It should be noted that the Moon Treaty is considered a failed treaty, having only been signed by four states, even though two of those states are the United States and the Soviet Union. The remainder of this chapter shall take a very brief look at the modifications to the legal body created by OST 1967 as created by these subsequent treaties. 72

The Rescue Agreement of 1968

While OST 1967 was under negotiation, the first treaty that would modify international space law was already under negotiation as well. The Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Space of 1968, hereafter referred to as the Rescue Agreement, seeks to address the more humanitarian concerns of space travel, namely the bodily safety of astronauts who might find themselves in danger. While this agreement was adopted by the General Assembly, the major negotiating partners were practically limited to the only countries that could successfully put men into space, the United States and the Soviet Union. This new treaty did not serve as a great overhaul to the rules of conduct as laid out by OST 1967, but instead serves to clarify and elucidate some of the issues of astronaut rescue which remain occluded by the text of the previous treaty.

The first four articles of the Rescue Agreement deal directly with astronaut safety, both from the standpoint of launching nations and other SPTs. Article 1 creates an obligation of any SPT to notify the launching authority and the Secretary-General of the UN in the event of discovery of astronauts in distress, be they in space, on land, or in the oceans. This article also expands beyond the simple language of astronaut to include all personnel of the craft, meaning other persons on board a spacecraft. Article 2 places an obligation for all SPTs to promptly attempt to rescue and recover any astronauts who might land in their sovereign territory. A burden to assist in such a rescue is placed on the launching authority as well. This particular article received the most attention during the ratification process, as there were fears among potential signatories that this article would allow personnel from the launching nation to freely 73 enter any sovereign territory. The article as adopted makes allowances that the contracting Party, namely the party that is conducting the search and not the launching state, is responsible for the search. This position allows for states to call in the assistance of the launching party as necessary, but still allows for sovereign territorial integrity.

Article 3 deals with landings of astronauts on the high seas. In much the same way that SPTs that have spacecraft land in their territories must render assistance in rescuing the Astronauts, those nations closest to the landing site must render assistance in rescuing and recovering astronauts who land on the high seas. These SPTs must also keep the launching authority and the Secretary-General of the UN informed of their actions and next steps in recovery. Article 4 states that astronauts who land off course should be promptly returned to the launching authority. This article provides for a speedy return so that any recovered astronauts do not have to worry about becoming prisoners of the rescuing state.

The final amendment of any real consequence to international space law is Article 5, which shifts the focus from the astronauts themselves to spacecrafts and their components more generally. This article follows the same requirements as Articles 1-3, merely applying that logic to physical objects as opposed to people. The fourth paragraph of Article 5 removes any requirement to recover and return space objects or crafts if those objects are of a “hazardous or deleterious nature.” If those objects would cause harm, then any duty to deal with said objects is removed from that state and placed fully upon the launching authority. Paragraph 5 of Article 5 requires costs incurred in recovery of off-target spacecraft or components to be reimbursed by the 74 launching authority. This point is meant to help compensate those states less capable of conducting a recovery operation (read developing nations).

While the remainder of the Articles of the Rescue Agreement deal with standard treaty operations, two points should be noted. Article 6 sets out to define Launching Authority, and does so as the states or inter-governmental agency that is responsible for a space launch. It is interesting to note that private parties do not enter into the logic applied by this treaty, one of the many problems with international space law that will be further explored in chapter 6. Secondly, Article 7 paragraph 1 applies this treaty to “All States,” be they recognized by the United Nations or not. This clause creates a unique circumstance that could lead to non-UN members being party to a UN treaty. It should be noted that later negotiation made clear that SPTs could operate within the framework of the Rescue Agreement and still not recognize other signatories.

The Liability Convention

The question of liability for damage caused by space objects remains unsettled by OST 1967, but was quickly addressed in subsequent treaties, namely the Convention on International Liability for Damage Caused by Space Objects of 1972, hereafter referred to as the Liability Convention. The Liability Convention is perhaps the most complex piece of international space law yet crafted, and is most certainly the most detailed of the five major UN treaties on outer space issues. It is also the most legalistic in form and function, as the subject of this treaty, liability, is perhaps the focus of the majority of lawyers, be they concerned with space or more terrestrial matters. In its twenty-eight articles, the groundwork for the establishment of international liability for damage caused by space objects is detailed in such a manner as is consonant with 75 OST 1967, placing the burden of liability on the launching state. As is stated by Article II, absolute liability for damage on the surface of the earth or to aircraft lies solely on the launching state. Article VII limits claims of liability only to inter-state interactions, and only when foreign nationals are not invited participants in the space activity. National law or bilateral agreements will cover those cases.

The majority of this treaty deals instead with issues of in-space damages, possibly being related to crashes between craft in outer space. In these cases, Article III makes clear that only states that are proven to be at fault are to be given liability. Article IX states that liability claims must be made through regular diplomatic channels, and in the event that no diplomatic ties exist, another state may pass the claim instead, and such claims will be considered fully legal. Article XIV establishes a one-year statue of limitations on liability claims. If after that one-year period passes and no action is taken by the launching state to address the claim, then the claim can be brought to a Claims Commission as established in Articles XV through XX. The Claims Commission maintains responsiblity for assessing liability in these cases and meting out penalties as necessary.

One final note about this treaty should be stated, namely that while the focus is primarily on state agents, either as claimants or as the launching state, there is an explicit role for intergovernmental launches. International intergovernmental launching groups can be given full liability for launches according to Article XXII, with the various member states sharing liability. This feature of international space law is fairly consistent with OST 1967, especially with regard to the focus on states being the primary actors, even within international organizations. While it is clear that the focus of 76 the verbiage surrounding international intergovernmental organizations is primarily on the European Space Agency, there does appear to be a broad applicability for this approach. Yet one of the major flaws of this approach becomes apparent upon examination of recent developments in the field of space exploration. As international non-governmental organizations, namely multinational corporations such as SpaceX, Orbital, RSC Energia, and Untied Launch Alliance, become major players in space exploration taking over larger percentages of launches. the question of liability must be reopened. As the law stands currently, liability can only be assigned and designated through states. This flaw is one of the most damning for the current international legal regime on outer space and is representative of many of the other flaws that can be found, and which shall be addressed in Chapter 5.

The Registration Convention

Addressing one of the neglected mandates of OST 1967, the Convention on Registration of Objects Launched into Outer Space of 1975, henceforth referred to as the Registration Convention, is actually the shortest and simplest pieces of international space law. Standing at a mere 13 articles, of which the last 8 deal with the end matters of enacting the treaty and the first merely sets up definitions in exactly the same way as in the Liability Convention, only 4 articles actually deal with the details of establishing a regime of space object registration. Perhaps the most relevant of the various articles in this treaty is Article II, which establishes the duty for launching states (defined similarly in the Liability Treaty) to register the objects that they launch into space. They must then report their registry to the Secretary-General of the United Nations. 77

Article III mandates that the Secretary-General of the United Nations must establish a Register of space objects to coordinate and collate the data from the various national registries. This new registry, in turn, must be fully open to access by all. Article III goes the furthest of any of the outer space treaties in explicitly creating an institution following the reasoning of liberal international relations theorists as appropriate for creating institutions. This treaty has the explicit purpose of sharing information to reduce costs. Article IV details what information must be shared in the registry for space objects, which includes the following:

Name of launching State or States; an appropriate designator of the space object or its registration number; date and territory or location of launch; basic orbital parameters, including: nodal period; inclination; apogee; perigee; general function of the space object.

With this information, it should become possible to reduce the likelihood of collisions in outer space between objects launched into similar orbits. Article VI deals with registration regarding liability claims. Much like all of the other international space law treaties, Article VII places a particular focus on international intergovernmental organizations conducting space activities for registration while neglecting even the possibility of non-governmental organizations participating in launching space objects. The final five articles, as previously mentioned, deal with treaty signing and ratification processes for the treaty and follow an almost identical pattern as the other space treaties. All told, the Registration Convention furthers the general shape of international space law, while creating a mandate for registration, something that was left somewhat unsettled by OST 1967 78

The Moon Agreement

The final treaty that comprises international space law, the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies of 1979, hereby referred to as the Moon Treaty, is an attempt to clear up many of the previous problems that have existed with international space law. Yet even as the Moon Treaty attempts to fill in some of the gaps and deal with the contradictions in previous international space law, it is not typically considered to be a successful treaty, as it has not been ratified by the majority of SPTs for OST 1967. Among those states that have not ratified the Moon Treaty are all states currently capable of placing a man in space, much less onto another celestial body. While OST 1967 was written prior to any state landing on the moon, once the reality of states actually traveling to the moon was established, newer, clearer rules had to be established. It should be noted that the negotiation process for this treaty was very contentious, with battle lines being drawn with the space powers, including Cold War adversaries, on one side, and developing countries, on the other.

The primary concern during negotiations for this treaty was addressing the problems of material exploitation of celestial bodies, specifically Earth’s moon. To undertake this problem, a shift in language was required. While previously outer space and all celestial bodies were considered to be held as the Scientific Commons for all mankind, (OST 1967), the Moon Treaty adopts a new set of language to describe man’s relationship with outer space and celestial bodies. The newly modified regime places outer space in the same realm as the ocean’s floor by moving to a new category of classification, namely the Common Heritage of Mankind, henceforth abbreviated as CHM. This new approach, while only slightly changing man’s relationship to outer 79 space, does allow for the exploitation of natural resources on the moon and other celestial bodies (Christol, 1982). It should be noted at this point that the general international consensus is that this treaty, in its references to the moon and celestial bodies, applies to our solar system only. This scale is much more limited than the previous treaties, and it is perhaps this deliberate limitation that allows for a shift to possible exploitation.

In Article 11, the relevant article that shifts the language to CHM, there is a legal requirement to establish an international regime to manage the exploitation that is expected to occur in the future. During the negotiations for this agreement it was realized that the technical capability required to exploit the natural resources that exist in our solar system, so the necessity of establishing an institution or regime to govern and fairly administer the exploitation of said resources was not particularly pressing. This maneuver effectively tabled the tricky negotiation that would be required to establish an international regime governing non-terrestrial natural resources, delaying decision-making to a time when this exploitation would be technically feasible.

Article 11 is the major shift in space law that comes from the Moon Agreement, while the remainder of the Agreement follows very closely to the format as laid out by OST 1967. This particular agreement as a whole, while adopted without vote by the General Assembly, is considered to be a failed treaty. Unlike the other four treaties that comprise the international space law regime, this treaty was adopted and ratified by only a handful of countries. No country with space flight capability has signed on to this treaty, rendering it effectively moot. The evolved understanding of space as exploitable 80 remains un-adopted by the international community, especially by those who would potentially be doing the exploitation.

Conclusions

At this point several observations about the International Space Law regime can be made. First, the regime that was created was very much a product of the cultural and political forces of the day. In the middle of the Cold War, when relationships between the Soviet Bloc and the Western countries were tenuous at the best of times, any piece of far reaching legislation at the international level would require a great deal of compromise. It is particularly treacherous when the only actors capable of accessing space were embroiled in a cold war. This balancing act between the goals of the United States and the USSR led to the creation of a legal regime that ends up serving almost no one’s real interests.

Secondly, the regime of international space law reflects the general trends of decolonization inasmuch as the regimes are cognizant of the impact declaring ownership of space might have on non-spaceflight capable nations. Great care is given to ensure that the benefits of spaceflight were to be reaped by all mankind, not only those nations that were capable of launching in to space on their own.

Thirdly, the regime of international space law is not particularly forward-looking with regard to the technical advancement that would be possible in the realm of spaceflight. Specific gaps were left on the question of exploitation of space due to technical inability, and little work has been done to address these legal gaps. There is also a particular bias towards the nation-state as the entity that would conduct spaceflight. This situation leaves out advancement in technology to the degree that 81 private spaceflight operators might not only be possible, but also commonplace to the degree that they could be considered to be the leaders in spaceflight, as is arguably the case today, and described in chapter five.

Finally, and on a more positive note, the vast majority of the international community has chosen to adopt the legal regime as proposed by COPUOS in OST 1967 and the subsequent treaties. For all the various faults of the legal regime, it is generally considered to be a successful regime, one that is capable of mitigating potential disasters of the sole superpowers competing over the boundless frontier of space. The solutions arrived upon in the realm of space weaponization and militarization are rather exemplary and represent one of the first major steps taken in diffusing the tensions and scope of conflict during the Cold War. While the Moon Agreement is considered to be failed, the remaining treaties create at minimum a workable base from which state can cooperate in spaceflight and exploration.

Overall, the International Space Law regime is a rather flawed creature that leaves much to be desired and much to still be negotiated, especially on the front of a regime to oversee the exploitation of the resources in our solar system. The tensions of the Cold War, between avoiding conflict between two superpowers and newly independent states asserting themselves played out to create institutions that have highly uneven results. While militarization of space is well handled, as the primary actors with significant power were able to negotiate these clauses well, the question of resource allocation remains unresolved. Newly independent states were able to constrain technologically infeasible actions by western powers and assert their positions in the international system through relatively costless legislation at the time. Also, in 82 practice, the laws and treaties as written have little practical effect on the everyday governance of outer space. The disconnect between the International Space Law regime and the day-to-day institutional governance of space will be explored further in the next chapter.

CHAPTER 4: THE (IM)PRACTICAL INSTITUIONAL GOVERNANCE OF SPACE

“Us with our busy, busy little lives, finding no better way to pass our years than in competitive disdain” – Iain M Banks- Consider Phlebas This chapter serves as the second part of the three-part case study on outer space. The primary concern in this chapter is the horizontal integration between international institutions to create a functional regime for the governance of technology. As the previous chapter showed, there exists a high degree of dysfunction in the governance of space exploration. This chapter will reveal how a series of seemingly disparate institutions work together to create a functional governance regime for outer space.

The rules and legal institutions crafted to govern often bear little resemblance to the real world conditions and actions undertaken to govern. This situation has been often borne out in the governance of men and nations, and the same also holds true for technology. The practical, day-to-day governance of outer space resembles this disconnected situation quite nicely. While the previous chapter outlined the contours of the international space law regime, this chapter will explore the real world governance of outer space exploration and exploitation. The almost ad hoc hodge-podge of brick and mortar institutions that seek to practically govern outer space as described in Miles (1971) represent a series of intercommunicating institutions and agencies that should theoretically be coordinated by a central institution. Yet in practice this institutional arrangement experiences a high degree of variation in efficacy and efficiency. This chapter will attempt to make sense of this web of institutions that governs outer space by examining the role played by each institution as well as the effectiveness of the institutions together in governing space. 84

The individual international institutions that constitute the overall international space governance regime are as follows. The central coordinating agency is the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS7), \*\*\*FOOTNOTE BEGINS\*\*\* 7 COPUOS is, as this chapter will bear out, the UN committee responsible for the oversight of outer space, as well as a sub-group of a larger office that was created to oversee all matters of outer space from an international perspective. This larger group, the UN Office of Outer Space Affairs, is a rather interesting case in and of itself. However, for the purpose of this work, the major focus will remain on COPUOS, with only slight mention of UNOOSA. \*\*\*FOOTNOTE ENDS\*\*\* which is responsible to the United Nations General Assembly. Three major institutions which play large roles in governing space, and which should cooperate with each other and with COPUOS are the International Telecommunications Union (ITU), the World Meteorological Organization (WMO),the International Telecommunications Satellite Organization (INTELSAT8), and the Committee on Space Research (COSPAR), a subcommittee of the International Council of Scientific Unions. Some other minor institutions will also be examined, only briefly covered, as they play very small roles in the practical governance of outer space.

These institutions can be placed into two broad categories, those institutions that are primarily political in nature and those that are scientific in nature. The political institutions, in this case COPUOS, INTELSAT, and the ITU, deal directly with practical governance efforts for outer space activities. The scientific institutions, namely COSPAR and the WMO, exist to provide scientific advice and input to the political institutions, but also play a role in the actual governance of scientific activity in outer space. This chapter will examine the interplay between these different institutional types, exposing the many of the gaps and overlaps in governance mandates that have emerged from this patchwork approach to the practical governance of outer space.

#### The US reversing course by initiating a formal Article IX consultation solves AND prevents miscalculation.

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China's violation of the international consultation obligation must be considered in light of State practice. During the Cold War, The United States and Soviet Union experimented with various ASAT weapons. ASAT experiments against orbiting satellites were successfully carried out by the United States and Soviet Union. The last successful kinetic ASAT experiment was carried out by the United States in 1985 on the Solwind satellite.68 Neither the United States nor the Soviet Union conducted international consultations in accordance with Article IX prior to conducting their kinetic ASAT activities. The Chinese failure to undertake appropriate international consultations prior to conducting their ASAT tests is consistent with the Cold War practices of the United States and Soviet Union.

Do the Cold War practices of the United States and Soviet Union establish an agreement of State Parties to the Treaty to interpret Article IX as not requiring appropriate international consultations prior to conducting kinetic ASAT activities or experiments in outer space? Article 31(3)(B) of the Vienna Convention states: "It]here shall be taken into account, together with the context... any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation." "It is not necessary to show that each party has engaged in a practice, only that all have accepted it, albeit tacitly.-"9

Let us assume that the U.S. and Soviet kinetic ASAT activities did trigger the obligation to undertake appropriate international consultation. In that case, one can argue that the Cold War practice of the United States and Soviet Union establishes an agreement among States Party to the Treaty to interpret Article IX as not requiring appropriate international consultations prior to conducting kinetic ASAT activities or experiments in outer space. In support of this argument, one can present a lack of objection to the practice as tacit approval by other States Party to the Treaty. One can also argue that when taking into account subsequent State practice, more weight should be given to the subsequent practice of States that have actually conducted kinetic ASAT experiments in outer space. To date, only three States (the United States, the former Soviet Union, and China) are known to have conducted such experiments and none of these States presumably undertook appropriate international consultations prior to conducting kinetic ASAT activities or experiments in outer space. It can be argued that the subsequent practices of these three States establish an agreement among Parties that excludes kinetic ASAT tests from Article IX's obligation to conduct appropriate international. It can be further argument that all have accepted it by tacit approval.

While these arguments have merit, they fail to overturn the presumption that States intend to be bound by the terms of their written agreements in accordance with the ordinary meaning to be given to the treaty in their context and in light of its object and purpose.

First, consider that subsequent practice in the application of the treaty is much more effective at establishing agreement as to treaty interpretation when the treaty is bilateral or has a limited number of State Parties and that the Outer Space Treaty has almost half of the world's nations as States Party. While three States have presumably failed to conform to Treaty obligations, no State has formally supported an exclusion of kinetic ASAT tests from Article IX international consultation obligations. Furthermore, there is uncertainty as to what States have or had the technological capacity to monitor, detect, and verify a kinetic ASAT test has occurred and by whom the test was conducted. During the Cold War these technological limitations presumably only allowed a handful of States to verify firsthand an ASAT test occurred. It is unjust to argue tacit approval by States when States did not have independent methods of ASAT test verification.

Also consider that following the FY-1C ASAT test, Britain, Australia, Canada, Japan, Taiwan, India, South Korea and the European Union joined the United States in protesting and call- ing upon Beijing for consultations. ° While the lack of objection during the Cold War is an important subsequent practice, so are the objections raised after FY-1C.

The reasonable conclusion is that subsequent state practice has not yet established that Article IX's appropriate international consultation obligation excludes consulting for kinetic ASAT activities or experiments in outer space. However, if States continue to perform kinetic ASAT experiments without conducting appropriate international consultations, the argument in favor of subsequent State practice establishing an agreement among States Party to exclude kinetic ASAT activities from Article IX's international consultation provision is strengthened.

ii. Obligation to Avoid Harmful Contamination of Outer Space

Did China satisfy the Article IX obligation to avoid harmful contamination of outer space?

Polar (PO) and low-earth orbits (LEO) are used for a variety of purposes. Remote sensing, manned space flight, communication satellites, the International Space Station, and a variety of other space objects and personnel occupy PO and LEO at any given time. The Chinese ASAT test introduced thousands of pieces of potentially hazardous space debris into PO and LEO7 that will be in the outer space environment, in substantial amounts, for decades.72 This space debris has modified the PO and LEO environment making orbits that intercept the Chinese ASAT debris field unfit (or at the least dangerous) for use. Given the amount of debris released, it seems reasonable for this contamination to be considered harmful or of a kind likely to be injurious.

Article IX does not prohibit harmful contamination of outer space. Instead, states are obligated to avoid harmful contamination. China only violated this provision if they did not conduct the ASAT test to avoid harmful contamination. Determining whether an action satisfactorily avoided harmful contamination is difficult because the Treaty does not provide the procedure for appropriate international consultations nor designate an agency to which States should turn for an authoritative evaluation.73

Conducting an ASAT test on an orbiting satellite does not in and of itself constitute unavoidable harmful contamination of outer space. It is possible that the underlying target or technology of an ASAT test will generate unavoidable space debris. However, kinetic ASAT tests can be conducted against targets in orbits with altitudes and inclinations that would minimize harmful contamination.

It does not appear that the Chinese attempted to modify the target satellite's orbit in order to avoid harmful contamination or minimize the amount of time the resulting debris field would remain in outer space. On this basis, an argument exists that the Chinese did violate the harmful contamination provision of Article IX. However, this argument is tenuous due to the ambiguous and subjective nature of establishing a standard for avoiding harmful contamination. Therefore, it cannot be definitively assessed whether the Chinese ASAT test violated the harmful contamination provision of Article IX.

B. USA-193

In January 2008, the United States announced publicly that it had lost control of a satellite, USA-193 (a.k.a. NROL-21), whose orbit was decaying and would eventually bring the satellite into the Earth's atmosphere.74 On February 14, 2008, the United States Department of Defense held a news briefing publicly addressing the decay and planned kinetic ASAT intercept of USA-193. U.S. officials indicated they were communicating with other countries and various organizations (e.g. the U.N., NATO, and ESA) to inform them of the actions the U.S. planned to take regarding USA-193. However, the U.S. Deputy National Security Advisor stated:

The United States has certain obligations based on treaties and other agreements related to activities in space. The 1967 U.N. Treaty on Exploration and Use of Outer Space, in particular, calls on states to keep others informed of activities of potential concern. While we do not believe that we meet the standard of Article IX of that Treaty that says we would have to consult in the case of generating potentially harmful interference with other activities in space, we do believe it is important to keep other countries informed of what is happening.75

This statement reveals that the United States did not believe the planned intercept of USA-193 triggered the international consultation provision of Article IX. Was this statement legally accurate or did the planned intercept of USA-193 trigger the international consultation provision?

The U.S. planned on intercepting USA-193 with a kinetic ASAT missile just prior to it hitting the Earth's atmosphere."6 The U.S. estimated that over 50 percent of debris generated from the interception would be de-orbited within the two orbits. The U.S. did consider whether unmanned bodies in space, in low-Earth orbit, and the space station would be at increased risk of space debris collisions.77 The U.S. stated they were planning their activities with "due regard" to the safety of people in orbit. 78

On February 21, 2008, the U.S. successfully intercepted USA-193. In accordance with the Outer Space Treaty and Registration Convention, the United States notified the U.N.7 ' The interception occurred at an altitude of approximately 133 miles."0

i. International Consultation Obligation

Did the planned intercept of USA-193 trigger the international consultation provision or was the U.S. correct in asserting that their planned ASAT intercept did not meet the standard of Article IX?

As discussed above, before a State is obligated to undertake international consultations three conditions must be satisfied: (1) There is an activity or experiment in outer space (e.g. an ASAT activity or test), including the Moon and other celestial bodies, planned by the State or its nationals,81 (2) the State must have reason to believe the activity or experiment (e.g. an ASAT activity or test) would cause potentially harmful interference," and (3) that this potentially harmful interference must potentially interfere with the activities of other States Parties to the Outer Space Treaty in the peaceful exploration and use of outer space, including the Moon and other celestial bodies.88

It can be argued that the planned intercept of USA-193 was not going to occur "in outer space." The failure of international law to delimitate airspace and outer space leaves some ambiguity as to whether the height of the USA-193 intercept was in outer space. However,

since no State has ever claimed that a satellite orbiting the Earth was infringing its national airspace, it is possible to say that in international law, outer space begins at least from the height above the Earth of the lowest perigee of any existing or past artificial satellite that has orbited the Earth without encountering any protest.84

On this basis, the intercept of USA-193 did occur in outer space.

Article IX only requires international consultations when a State has reason to believe a planned activity or experiment would cause potentially harmful interference with other States Parties in the peaceful exploration and use of outer space. USA- 193's intercept was designed to limit the lifetime of space debris generated from the event by conducting the intercept as USA- 193 entered the final stages of a decaying orbit. It is questionable whether the U.S. had reason to believe the planned intercept would cause potentially harmful interference because it was estimated the debris would remain in orbit a short time and that the bulk of the debris would be in an orbit not often utilized. The intercept would definitely have caused interference, but whether or not it gave reason to believe potentially harmful interference with other State activities is not conclusive.

Comparing USA-193 to FY-1C, while the FY-1C interpret would certainly generate significant space debris that would remain in orbits that are utilized by other States, the USA-193 intercept would occur in a decaying orbit, at a low altitude, with a minimal lifetime for space debris generated.

It was concluded above that China should have had reason to believe that their planned experiment would have caused potentially harmful interference. In that analysis, China was appropriately held to the standard that when interpreting and applying Article IX Treaty obligations a State must do so in good faith and due regard to the Treaty. If one applies the principle of good faith and due regard to the USA-193 intercept, concluding that the U.S. had "reason to believe" is with merit even though the anticipated impact of USA-193's intercept would be significantly less then FY-1C's.

While concluding the U.S. had "reason to believe" has merit, the United States was also correct in stating the position that "we do not believe that we meet the standard of Article IX of that Treaty that says we would have to consult in the case of generating potentially harmful interference,"85 because this is a statement only of the United States own evaluation whether they have reason to believe their planned activities would cause potentially harmful interference. Solely on the basis of the U.S. evaluation, the intercept of USA-193 was not subject to Article IX international consultation obligations. The U.S. position is defendable because the objective evidence presented prior to the planned intercept of USA-193 does not conclusively establish whether the planned intercept would give "reason to believe" that interference would be generated that was potentially harmful to other State activities in outer space. Unlike FY-1C, the interception orbit of USA-193 would not result in a long lasting debris field of significant size and any debris generated would primarily be in a low altitude decaying orbit. It was within the discretion of the United States to conclude the planned intercept of USA-193 did not give "reason to believe" potentially harmful interference would occur because the facts did not definitely establish the U.S. should have had "reason to believe."

While this exercise of this discretion by the United States was within the bounds of Article IX, it was also arguably a strategic mistake. As discussed above, the Outer Space Treaty is primarily a treaty of principles, crafted for the purposes of proscribing norms to an area where uncertainty existed as to what law, if any, applied. These proscriptive principles, by their very nature, cannot embody their object and purpose by solely reviewing their text. As a result subsequent State actions play a role in the interpretation and application of the Treaty. The U.S. is able to defend its conclusion that Article IX consultation were not triggered in part because State practice has yet to clearly establish the scope of the consultation obligation.

Why was denial a mistake? Even though the U.S. denied Article IX applied to the USA-193 intercept, the U.S. still undertook international consultations and informed the international community of their planned activity. The U.S. essentially fulfilled the minimum requirements of appropriate international consultations: to contact States Parties to the Treaty whose peaceful explorations and use of outer space would experience potentially harmful interference and provide them with information sufficient to take appropriate action to prevent potentially harmful interference with their uses or explorations in outer space, the Moon and other celestial bodies.

The U.S could have proffered that Article IX international consultation obligations were applicable. If so, the procedure and substantive nature of the consultations the United States undertook would have established a precedent of State practice with regards to Article IX. This was a unique opportunity to guide the application of Article IX. Instead, the U.S. essentially fulfilled the Article IX requirements without establishing a precedent to clarify Article IX obligations. As a result, other States planning kinetic ASAT activities and experiments will not have an historical legal precedent of a State Party recognizing and adhering to Article IX international consultation obligations. If the U.S. had recognized Article IX's application, States that plan to conduct kinetic ASAT experiments would be under greater scrutiny if they failed to recognize Article IX's application and conduct appropriate international consultations. U.S. recognition would also have set a threshold of debris generation that clarifies when a State should "have reason to believe" their planned activity or experiment in space would cause potentially harmful interference.

ii. Obligation to Avoid Harmful Contamination of Outer Space

As discussed above, conducting a kinetic ASAT intercept on an orbiting satellite does not in and of itself constitute unavoidable harmful contamination of outer space. It is possible that the underlying target or technology of an ASAT test will generate unavoidable space debris. However, kinetic ASAT tests can be conducted against targets in orbits with altitudes and inclinations that would minimize harmful contamination.

The Treaty is silent on appropriate measures or authoritative evaluations to determine whether a State has taken appropriate measures to avoid harmful contamination; however, the United States recognized USA-193 would create harmful contamination and took measures to avoid it by intercepting the satellite in a decaying orbit at a low altitude, minimizing the lifetime of space debris generated and other potentially harmful contaminates in the outer space environment. These actions were in accordance with the principle of due regard enumerated in Article IX and the U.S. fulfilled the obligation to avoid harm- ful contamination by taking these actions. As an example of subsequent State action, the harmful contamination and debris mitigation measures undertaken by the U.S. will contribute to interpreting the obligation of harmful contamination avoidance, as least with regards to kinetic ASAT satellite intercepts.

VI. CONCLUSIONS

China's FY-1C ASAT experiment violated the appropriate international consultation provisions of Article IX of the Outer Space Treaty. The orbit of FY-1C was of such a nature that is was reasonable to conclude prior to conducting the ASAT experiment that a successful intercept would create a debris field of size and duration that would cause potentially harmful interference with the peaceful uses and explorations of other States Party to the Treaty.

In the defense of China, their lack of consultation prior to the ASAT experiment is consistent with the Cold War practices of the United States and the Soviet Union (assuming the Cold War kinetic ASAT experiment of the United States and Soviet Union triggered the international consultation obligation). Nonetheless, State practice has yet to definitively establish that kinetic ASAT activities and experiments are granted an exception to Article IX obligation to conduct appropriate international consultations.

The USA-193 intercept arguably did not violate and may not have been subject to Article IX's international consultation obligation. If the planned USA-193 intercept did trigger the obligation to conduct appropriate international consultations, the United States met the ad minimum requirements of this obligation.

The United States denied that Article IX's international consultation obligation was applicable to the planned USA-193 intercept. By denying its application and not recognizing its application and establishing precedent of State practice, the United States lost a strategic opportunity to shape the interpretation and development of Article IX.

The violation of Article IX's international consultation provision by China continues a disturbing trend of States not recognizing the application of this provision to kinetic ASAT activities. If this trend continues, the argument in favor of subsequent State practice establishing an agreement among States Party to exclude kinetic ASAT activities from Article IX's international consultation provision is strengthened. Fortunately several States protested China's failure to consult in the days following FY-1C's destruction, reversing the trend of States' tacit approval implicit by silence.

One reason Article IX has failed to ensure States fulfill their obligations is because the Outer Space Treaty does not provide a procedure for appropriate international consultations nor designate an agency to which States should turn for an authoritative evaluation of their planned activities.8 As a result Article IX's procedural and substantive application is largely left to the discretion of States, and States determine themselves whether the obligation to consult is triggered. In our anarchic system of international relations, States have little motivation to interpret and apply agreements to restrict their freedom of actions without assurance that other States will act in kind. This failure is a manifestation of the much greater problem: the vacuum of supranational authority in international law. Today no supranational authority exists that can rule on the legality of State action and enforce this judgment independent of State influence. As a result, the immediate self-interests of States support restrictive interpretation and application of Article IX.

Even with self-interest supporting restrictive interpretations, as discussed supra, an interpretation of the Outer Space Treaty based on the Vienna Convention methodology does provide some degree of objectivity for States who are assessing their planned activities. For example, States are obliged to consider their planned activities in light of the principle of due regard and interpret provisions of Article IX in good faith.

In instances of ambiguity, the Outer Space Treaty does not provide a mechanism of interpretation or dispute resolution. Fortunately, in the event of dispute arising due to interpretation and application of the Treaty States can rely on and should make use of the U.N. Charter's mechanism of pacific settlements of disputes.87 When a State clearly violates Article IX, the international community should react with unified condemnation, take appropriate actions to discipline the violator (in accordance with the U.N. Charter), and ensure violations are not repeated in the future. It is critical for States to appreciate that at this point in history, State practice and application of Article IX will largely determine whether or not Article IX is rendered ineffectual. It is in the interests of all nations for Article IX to be a substantive provision and not just empty words. As the FY-1C experiment demonstrated, the failure of States to consult prior to conducting activities increases mistrust, raises tensions, and undermines international peace and security.

#### Otherwise, extinction.

Lt. Gen. Vijay Kumar Saxena 16. Former Director General of the Corps Army Air Defence, regularly published in a host of Professional Magazines and Journals, NLSIU scholar with qualifications in Human Rights and Child Rights Law. May 2016. “Anti Satellite Weapons: A Likely Future Trajectory.” https://www.vifindia.org/sites/default/files/anti-satellite-weapons-a-likely-future-trajectory.pdf

It is an open secret that all the leading space-faring nations are actively pursuing counter-space capabilities which broadly include Direct Ascent Anti Satellite Missiles, Co-orbital Anti Satellite Systems, Computer Network Operations, Ground Based Satellite Jammers, and Directed Energy weapons.

If we go by the open source, then China seems to be leading the ASAT race with Russia in a close tow. These are capable of directly threatening the US space lifeline in any future conflict. Though many a lamenting voices are being heard on US strategic vulnerabilities, on how the Congressional cuts in space funding is putting US at a strategic disadvantage, this analyst believes that no one is any less. If you nearly control the global open source, you tell less about you than others. However, a discerning mind knows that there is more than what meets the eye. I say this in context of US though some of their SOS cries are viable.

The technology revamping up the ABM capability from the terminal to mid-course interception has come as a shot in the arm for the ASAT capability that has got a quantum range-altitude boost, especially in the category of hit-to-kill ASAT weapons. In fact, all midcourse Ballistic systems have inherent ASAT capabilities.

There has been a self-defeating effort on the part of US to create a duality between the midcourse BMD systems (say SM 3) and the direct ascent Kinetic energy interceptors (like the Chinese SC 19). By calling the former as low-altitude direct ascent interceptor and the later, as kinetic energy weapon . It is like calling the Peter, Pam when both are same. The typical Mine OK yours Not OK syndrome. It doesn't really carry.

The race to acquire ASAT capability is going on unabated. One nation setting a challenging pace and putting the others in a vicious merry-goround.

Are ASATs legal?

Before seeing the legality, let me put the weaponisation and militarisation argument to rest. How does it sound when I say that with all the humdrum at the global level of using the outer space - the ‘province of mankind’ for ‘peaceful purposes’, the same, technically speaking, long stands weaponised, what to talk of its militarisation, that happened ab-initio. That is the truth, as I will unfold in technical terms in due course.

Moreover, putting legality aside, the ASAT tests of the leading spacefaring Nations are going unhindered- Chinese ASAT test in January 2007, 2008, 2013, 2016...US ASAT tests 2008, 2010.. Russians ASAT tests 2010, 2014 ,2015.... The world is crying hoarse over the debris issue causing an EXISTENTIAL THREAT to the common asset of the humanity on which the entire Planet has come to depend LIKE NEVER BEFORE .... Who cares?

Why? The Big Question. Why it is happening unabated? Why nobody can crack a whip. Sample this commentary:-

The OST, 1967 or more formally, ‘The Treaty or Principles Governing the Activities of States in Exploration and Use of Outer Space, including Moon and Other Celestial Bodies’, not only forms the basis for International Space Laws, but also, has the widest acceptability in the world community (as of Sep 2015, 104 countries are a party to the treaty, another 24 have signed but not completed the ratification).8

In its essence, the OST lays down (only relevant portions quoted) the following:-

It bars the States Parties from placing nuclear weapons or any other weapons of mass destruction in the orbit of earth, installing them on Moon or any other celestial body or to otherwise station them in space9.

It exclusively limits the use of Moon and other celestial bodies to peaceful purposes and explicitly prohibits their use for testing of weapons of any kind, conducting military manoeuvres or establishing military bases, installations and fortifications.

It forbids any government from claiming a celestial resource such as Moon or a planet. It forbids natural opportunities of outer space, including Moon and other celestial bodies.

A State Party to the Treaty which has reasons to believe that any activity or an experiment planned by other State Party in outer space including the Moon and other celestial bodies, would cause potentially ‘harmful interference’ with activities on peaceful exploration of outer space including the Moon and other celestial bodies may ‘request consultation’ concerning the activity or experiment.

The above provisions have glaring inadequacies. For instance:

● The treaty does not prohibit the development, placement and testing of conventional weapons in the outer space.

● It does not prohibit a ground based weapon making a direct/ indirect ascent into outer space and killing an orbital body.

● It also does not prohibit a space based weapon (Kinetic Energy or Directed Energy) to kill another satellite or orbital target in outer space or to kill ballistic missiles transiting outer space in the post boost/re-entry phase.

● By implication, military activities in outer space are allowed unless specifically prohibited by any Treaty.

● Also, there are glaring definitional inadequacies in the legalese of the OST. Some examples :-

▪ What constitutes space or a space weapon is not defined.

▪ Accepted demarcation of the boundary between the air space under national sovereignty and outer space has not been defined.

▪ What constitutes ‘peaceful use of space’ (by exclusion, what is not peaceful?) What the US understands it as ‘non aggressive’ while the Russians see it as ‘wholly non-military’ is actually not specifically accepted/defined.

▪ What constitutes ‘harmful interference’; is shrouded in ambiguity.

The Treaty, adopted through the UN process, is non-binding and devoid of any enforcement mechanism. Responsibility towards discharge is only ‘assumed’.

In fact, under the garb of ‘peaceful use’ and ‘scientific research for peaceful purposes’, as enshrined in the OST, US, China and Russia have put a perfectly legal cover over their hectic development of space technologies capable of military applications.

Judging against the above loopholes, the ASAT tests of China, US and Russia would appear to be perfectly legal. That is however not the whole truth as the same could be faulted under Article IX of OST, as also, under Liability Convention.

This is how Article IX of OST mandates the State Parties to conduct activities in outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other State Parties to the Treaty.

It forbids them from conducting such activities which would cause ‘harmful interference’ with activities of other State.

State Parties are also to avoid harmful contamination and adverse changes in the environment of the Earth resulting from the introduction of ‘extra-terrestrial matter’ (in outer space)10.

A Sample Case.. Let’s talk about one sample case--the Chinese ASAT test of 2007 which as I said, has been classified as the highest manmade debris generation event in the history so far11. Sample this:-

➢ As of September 2010, the US Space Surveillance Network (SSN) has picked a total of 3037 pieces of debris greater than 10 cms, 97% of which have remained in the orbit12.

➢ Scientists estimate about 1,50,000 debris particles in altitudes between 200-4000 kms, 79% of which will remain in orbit for 100 years13.

➢ The debris has spread throughout the entire orbit resulting in a cloud of debris around earth. This is the largest debris cloud ever generated by a single event in the orbit.

➢ As of January 2007, there were 2864 active or inactive satellites in LEO out of which 1899 pass through the region now affected by Chinese debris.

➢ In April 2011, debris of the Chinese test passed close to the ‘International Space Station14.

➢ In January 2013, a Russian nano satellite [Ball Lens in The Space (BLITS)] was destroyed by the debris15.

The Illegality Continues. The illegality of the Chinese ASAT lays bare not only in the gross violation of Article IX of the OST, but also, a potential threat to the space assets of other State Parties for decades ahead. Similar is the story of US and Russian ASAT tests.

Liability Convention. Also, under the Liability Convention 1972 (The Convention on International Liability for Damage Caused by Space Objects), a State Party is responsible for all the objects launched from its territory into space and is full liable for the damage that may arise from that object. The damage (done/likely) from the Chinese ASAT must also therefore rest equally on their shoulders.

Other Legalese Also Ambiguous. While the other space laws like the Rescue Agreement 1968, the Registration Convention 1975, the Moon Agreement 1979 and International Space Laws governing disbursement of finite GEO slots by the International Telecommunication Union (ITU) are all full of crippling inadequacies, the space constraints prohibit the author from a detailed commentary on each one of the above.

A Revisit. Though mentioned in passing earlier, lets revisit the technicalities in militarisation/weaponisation from the point of view of a legal argument.

Militarization. As per the definition, militarization of space simply implies the placement and deployment of weapons and military technology in the outer space. By this definition, the Space was militarized ever since the earliest communication satellites were launched, since that implied the deployment of military communication technology in the Space. Today, militaries all over the world rely on satellites for command, control, communication, monitoring, early warning and navigation with GPS. Peaceful uses of outer space thus include military uses. This includes even those satellites which are not at all peaceful such as using satellites to divert bombing raids or to orchestrate a ‘prompt global strike’ with a view to control any situation or to defeat any adversary across the range of military operations. With more than 90% of all satellites dedicated to military use, truly speaking militarisation of outer space occurred with the first satellite16.

Weaponisation. Talking of Weaponisation, the same is generally understood to mean the placement in orbit of space-based devices that have a destructive capability. What about millions of pieces of space debris created by the deliberate acts of the countries (ASAT tests) which have tremendous destruction capability for the space assets of other countries? What about the ongoing cutting-edge research on the ‘kinetic kill’ or ‘Directed Energy kill weapons’ placed in space orbits, ready to take on incoming ballistic missiles in their post-boost phase, when these missiles are transiting the outer space. These dual use weapons, taking on a Ballistic Missile could as well take on the space assets? The bottom line is that the weaponisation of outer space is now a reality. In fact the same is fast fuelling the global arms race17.

The examination of the above legalities thus brings out the following :-

 The current regime of Space Laws have glaring inadequacies, both in the ambivalence and ambiguities of the legalese, as well as, the nonspecificity of the rules-of-the-road.

 Though the ASAT tests by China, US Russia and others have been executed, these are not only illegal in terms of the OST 1967, but also, the same have created a near permanent existential threat to the space assets of other nations.

 While militarization of outer space happened with the first satellite the outer space is fast being weaponised leading to a crippling and self-defeating arms race in the future18

And now the bottom-line:

● Technically, the ASAT tests are illegal.

● Notwithstanding, these are likely to continue unabated.

● In the coming years, ASATs are poised to grow, caught in a dubious and self-destructive arms race.

● As future technology makes more and more countries to afford and launch satellites, worldwide satellite vulnerability to ASATs will continue to grow.

● Ever increasing space debris has reached a tipping point. This growing monster is plunging the space assets of the planet in a crippling existential threat. ( this is a vertical demanding separate analysis)

Like someone said:-

World War III in space?

It is closer than you think......

#### Piloting errors in benign proximity maneuvers are the most likely short-term spark for escalating space conflict.

Ted Adam Newsome 16. Institute of Air and Space Law. 08/2016. The Legality of Safety and Security Zones in Outer Space: A Look to Other Domains and Past Proposals. McGill University. http://digitool.library.mcgill.ca/webclient/StreamGate?folder\_id=0&dvs=1573776445829~851

A. Why Consider the Security Implications of RPO Now? The Case of the Luch and Intelsat Satellites5

As a starting point and to properly contextualize the security issues at hand regarding RPO, the first chapter will examine the interaction of a Russian state-owned Luch satellite with two privately-owned Intelsat satellites in GSO in late 2015 (Luch-Intelsat Interaction). The review of the Luch-Intelsat Interaction exposes the security and safety concerns RPO presents in the space environment and provides an example of the difficulties presented by uncoordinated and non-transparent RPO activities. The purpose of this review is not to highlight Russian behavior, nor to couch this thesis as a critique of Russian action. Several States, including the US, are developing and testing RPO technologies, thus the roles in the Luch-Intelsat Interaction could be reversed.

Between 25 June 2015 and 25 September 2015, Russia displayed unprecedented behavior by operating a suspected military satellite, named Luch, in close proximity to two privately-owned Intelsat6 satellites in GSO.7 This activity was curious, because there were no Russian satellites in the vicinity8 and Luch moved within five to ten kilometers of one of the Intelsat satellites.9 A spokesperson for the US Department of Defense (DoD) confirmed that Joint Functional Component Command-Space (JFCC-Space)10 and representatives of Intelsat contacted Russia. The contact consisted of “emergency close approach notifications…, based on predictions of a close approach with another space object of 5km (three miles) or less within 72 hours.”11 Russia did not respond to the notifications.12

This behavior was preceded by three Russian RPO activities in 2014 and early 2015 that caused concern within the US government that Russia may be preparing to use RPO in an adversarial manner. The 2014 and early 2015 actions demonstrated Russia’s ability to maneuver small satellites in close proximity and “bump” rocket stage bodies in the low-earth orbit (LEO). These launches were tracked, as are all rocket launches, by analysts at the US Strategic Command’s (USSTRATCOM) Joint Space Operations Center (JSpOC)13 and were believed to be military satellites. The JSpOC was particularly challenged by these Russian activities, because it initially identified the small satellites on each launch as debris and assigned each one the generic label, “Object E.” It was not until the satellites began to conduct RPO and emit S-band signals that the JSpOC identified the three “Object Es” as operational satellites.

Russia’s RPO activities in GSO, with their intentions never confirmed, are an example of the confusion and misunderstanding that can result when States exercise their rights of freedom of exploration and use in outer space, as guaranteed in Article I of the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty),14 in a manner that poses a security and safety risk to another State’s space object. Since Russia never confirmed the purpose of their close proximity operation, observers are left to speculate. Without evidence to the contrary, the assumption is Russia was conducting normal military RPO activities such as intelligence gathering, surveillance, reconnaissance, or carrying out a test of the satellite’s systems.15 The resulting difficulty is the possibility of the same technology and capabilities being used as an ASAT without prior warning. Even if Russia’s RPO activities were not intended to be hostile, the encounter can serve as a test of future ASAT capabilities.16

While there has been no official response by the US government to the Luch-Intelsat Interaction, it has been reported that Luch’s behavior was the subject of classified briefings at the Pentagon and before members of Congress.17 The incident also appears to be of continued interest to senior military officials as evidenced by comments made by Admiral Cecil D. Haney, Commander USSTRATCOM, several months after the Luch-Intelsat Interaction.18 While speaking at the 32nd Space Symposium,19 Admiral Haney stated that the US needs to better understand its adversaries so it can “deny enemy action, hold critical nodes at risk and prevent perceptions, misperceptions and actions from escalating.” Later in the speech, he reminded the audience of the Russian “Object E” and how it was initially thought to be debris, but began acting in a “non-debris fashion.” He warned the audience to expect more of this type of behavior.20

The use of autonomous RPO in GSO is not unique to Russia and this fact likely played a role in the US not publicly condemning the Luch behaviors. Prior to the Luch-Intelsat interaction, the US Air Force (USAF) announced it had launched two satellites into GSO as a part of the GSO Space Situational Awareness (SSA) Program (GSSAP). These satellites move through a near-geostationary (GEO) orbit21 for the purpose of viewing other satellites.22 In an interview with the news program, 60 Minutes, General John Hyten, Commander of USAF Space Command (AFSPC), described the importance of GEO to the US and the lengths the US would take to secure its assets. His primary message regarding GEO was:

We want people to understand that we’re watching. There will be no surprises in GEO. And we want everybody in the world to know that there will be no surprises in that orbit. It’s way too valuable for us to just be surprised….Deterrence in the space world… [is] the ability to convince the adversary that if they attack us, they will fail.23

The US is not only concerned with Russian capabilities, as it also estimates that in 2014 China possessed the fastest developing space program in the world and its space assets underpin its “national civil, economic, political, and military goals and objectives.”24 Of particular concern to the present issue is China’s demonstration of “increasingly complex close proximity operations between satellites while offering little in the way of transparency or explanation.”25

Along with the US government, Intelsat was concerned about the close, uncoordinated operations of the Luch satellite. Kay Sears, President of Intelsat General, the government services arm of Intelsat, put the situation bluntly, “This is not normal behavior and we’re concerned…We absolutely need responsible operators.” Although alarmed by the Russian behavior, Ms. Sears noted the Russian satellite did not interfere with Intelsat satellite services.26 She did say however that she believed the “‘safety of flight’ of the Intelsat satellites was at risk.”27 She continued, “They’re not collaborating with us. The ‘safety of flight’ that’s so important to operators is being put at risk and that’s concerning. That’s just irresponsible. If we all did that, we would have a lot of accidents.”28

Although Russian satellite operators were unresponsive to calls for coordination by the US and Intelsat, the lead scientist at the Russian-based Institute of Space Policy, Ivan Moiseyev, did discuss the activity after Luch had maneuvered away from the Intelsat satellites. He acknowledged the US concern about the Luch satellite movements; however, he stated “the possibility of a collision or some kind of interference is extremely small.”29 He further stated, “There were no violations in this case” and the Luch “is simply a relay satellite, sending signals from spacecraft to Earth, for example from the ISS – we have communications problems there – and from one satellite to another.” He continued, “In no way can it be an ‘aggressor’, any satellite can make some clumsy manoeuvers – but collisions are extremely rare.”30 In fact, Mr. Moiseyev is correct in saying that there were no violations in this case. The lack of a “rules of the road” regime in outer space results in States only being responsible to show “due regard” to the corresponding interests of others.31

As stated earlier, the purpose of reviewing the Luch-Intelsat Interaction and other Russian satellite operations in the beginning of this thesis is not to highlight potentially dangerous behavior by Russia, but it does appear to be the first publicly documented close encounter between a commercial satellite and a foreign military satellite.32 Rather it is to demonstrate that as satellite movements become more sophisticated, more routine, and interactions between satellites from different States increase, the potential for miscalculations and avoidable collisions will rise. Each uncoordinated interaction has the potential to serve as the spark that ignites the long dreaded “space war.”33 The Luch-Intelsat case did not cause such a spark, but represents how States are likely to interact in the future. Instead of calling for the apparent need for a robust, agreed upon STM system,34 this thesis will examine the lawfulness of one response States may take in securing their space assets – the establishment of safety and security zones around critical space objects.

B. The Development of Autonomous RPO

Before looking at RPO in the context of space security35 and the lawfulness of safety and security zones, it is important to understand what is meant when an activity is described as RPO. A rendezvous operation is the intentional movement of two space objects close together, while a proximity operation consists of “on-orbit operations that deliberately and necessarily place and maintain a space object within a close distance of another space object for some specific purpose.”36 Current and future space activities such as On-orbit Servicing (OOS) and Active Debris Removal (ADR) are two RPO technologies that will serve to sustain the space environment by reducing the production rate of space debris and removing existing debris from orbit.37 Similarly, co-orbital ASATs are also RPO activities. This inherent dual-use capability is a source of both space security concerns and difficult legal questions related to RPO.38

RPO is not new to outer space; however, the emergence of autonomous39 RPO which are capable of operating above the human flight zone is a relatively recent phenomena and present challenges to SSA that are not presented by manned RPO.40 As early as 1965, the National Aeronautics and Space Administration (NASA) demonstrated the ability to rendezvous the Gemini VI and Gemini VII spacecraft.41 The experience gained in the Gemini rendezvous activity provided the groundwork for the eventual Apollo lunar landing missions.42 As spaceflight advanced, so did RPO as shown by the fifty-seven Space Shuttle missions that conducted at least one RPO objective.43 Throughout the history of spaceflight, a common characteristic of RPO is the direct human control of one of the participating spacecraft. Whether it be in-flight maneuvering by an on-board crew or remote control by ground personnel, the final stage of the mission had remained a human function.44 The need for human control has required space objects capable of conducting RPO to be relatively large and slow moving, such as the Space Shuttle.

The level of human control required for RPO has decreased over time, and now autonomous RPO is conducted by relatively small satellites that perform highly complex maneuvers. Autonomous RPO has now been demonstrated in LEO45 and GSO,46 thus the most critical satellites are now in reach for both peaceful and non-peaceful RPO applications.

1. On-Orbit Servicing

The first RPO capability to be considered is OOS, which at its basic level is the rescue, refueling, repositioning, repair, or inspection of space objects in orbit.47 OOS has been successfully performed during manned space missions on several occasions, including servicing of the Hubble Space Telescope and the ISS, but the commercial viability and ability to be accomplished autonomously in GSO is a recent development.48 Because of the inherent dual capability and need for transparency in conducting OOS, this new phase will only be accomplished if the national security, civil and commercial sectors work together.49

The collaboration between the various sectors is feasible, because “the significant costs associated with building and launching replacement satellites have spurred both the US government and private industry to explore alternate means to prolong a satellite’s life.”50 A national security initiative announced in 2016 is the Defense Advanced Research Projects Agency’s (DARPA) Robotic Servicing of GEO Satellites (RSGS) program, which envisions, “a DARPA-developed modular toolkit…joined to a privately developed spacecraft to create a commercially owned and operated robotic servicing vehicle that could make house calls in space.”51 RSGS hopes to provide the anticipated service available to both military and commercial GEO satellite operators.52 In the commercial sector, one company plans to launch a space object that extends the life of another satellite by attaching itself to the target satellite and performing the maneuvering and station keeping functions for the host satellite.53 For the civil sector, NASA announced its Restore-L mission in 2016 with a launch in 2019. Restore-L will rendezvous with, grasp, refuel, and relocate a US government satellite in LEO.54 The ultimate goal of OOS is to restore satellites to their original capacity and decrease the creation of space debris.

2. Active Debris Removal

While OOS will facilitate a decrease in the creation of space debris by sustaining operational satellites, space debris is created at a higher rate than the natural decaying process is able to remove debris from orbit. Some studies have concluded that even with no further human actions, collision cascading could substantially increase the hazards of operating in space.55 As a result, governments and commercial operators are developing remediation technologies. One such technology is ADR which physically removes debris from orbit.

This technology is seen as critical to the future of the space environment. The European Space Agency estimates that there are over 170 million pieces of space debris larger than one millimeter, 670,000 larger than 1 centimeter, and 29,000 larger than 10 centimeters. 56 Debris pieces as small as 1 millimeter could destroy sub-systems on a space object, while a 10 centimeter object would likely disable a space object and penetrate the ISS shields.57 Just as with OOS, the technology that will allow ADR to accomplish its mission will also allow it to operate as an ASAT.58 The challenge for States with national security concerns will be the ability to determine the intent behind missions and not the technological capabilities of the system.

3. Co-Orbital ASATs

Space weapons, that is those weapons based in space or on the ground and intended for space, have been a concern even before Sputnik I was launched in 1957.59 The US, Russia, and China have demonstrated ASAT capabilities and the willingness to test weapons in space. While the US and China have publicly demonstrated their ability to target an on-orbit satellite with air and ground-based kinetic weapons, the USSR is the only State known to have tested and declared operational co-orbital ASATs.60 It is believed these weapons became operational in 1971 at altitudes up to 5,000 km. 61 Between 1971 and 1983, the USSR suspended and resumed testing of ASATs on several occasions, although the USSR never officially acknowledged the development and testing of co-orbital ASATs.62

The interest in and development of co-orbital ASATs by the USSR and the willingness of China and the US to demonstrate ASAT capability provide insight into the situation faced today. Any satellite that can approach another satellite can be used as a weapon against the target satellite. Because these types of weapons are not sophisticated weapons systems and may not be easily identifiable, inspection of these satellites before or after launch may not provide insight into capabilities or intent.63

In recent times, US military commanders have lamented the effects of a space-based attack and it is sometimes portrayed as a new or emerging problem; however, in 1984, the US DoD was keenly aware of the effects an attack on their space assets would have. The Assistant Secretary of Defense for International Security Policy, Richard Perle told the US Congress,

We believe that this Soviet anti-satellite capability is effective against critical US satellites in relatively low orbit, that in wartime we would have to face the possibility indeed the likelihood, that critical assets of the US would be destroyed by Soviet anti-satellite systems.64

The concern in the US today regarding the vulnerability of its most critical space assets is a continuation of an assessment that started decades ago. At the time of Mr. Perle's statement there was already concern regarding the USSR’s future use of highly maneuverable spacecraft with non-cooperative rendezvous capability as an ASAT. 65

During the Cold War, a time of increasing concern about the vulnerability of space assets, there was a realization that “rules of the road” were needed for outer space, but the likelihood of such an agreement was dire. As a result, different unilateral measures were considered for securing space assets. One such proposal was “keep-out zones.” The idea of declaring regions in space or areas surrounding space objects as off-limits to other States received consideration by the US government due to the fear of nuclear weapons, space mines, and co-orbital ASATs. Some of the same fears that led to the consideration of “keep-out zones” have once again presented themselves along with advancements in technology and an increasing number of space actors.

C. Avoiding Conflict in Space – Role of Safety and Security Zones

While the Luch-Intelsat Interaction did not lead to a catastrophic result, it provides an example of how “uncoordinated intentional or unintentional approaches to space objects of other states may create a danger of military confrontation in outer space.” 66 The threat of unintended confrontation in outer space is the overarching concern that drives the consideration of the lawfulness of unilaterally declared safety and security zones in outer space, because a military confrontation in outer space would be catastrophic for future access to outer space by both government and commercial entities.67

#### It goes nuclear

Joan Johnson-Freese 16. Professor and the Charles F. Bolden, Jr. Chair of Science, Space & Technology at the Naval War College in Newport, Rhode Island, US. She writes extensively on space security, military education, and gender and security. 11/08/2016. “1 Protecting Space Assets,” “2 Congested, Contested, and Competitive,” through “3 Avoiding Thucydides’ Trap.” Space Warfare in the 21st Century: Arming the Heavens, 1 edition, Routledge. pp 17-65.

The Imperative for Balance

A robust US military space program is an absolute imperative. But it needs to be a piece of a larger, well-thought-through, comprehensive, budget-responsible, non-fear-driven approach to achieving the ultimate goal of sustainability through stability. A provocative, primacist space strategy runs counter to deterrence goals and risks escalation. Bruce MacDonald’s 2008 study for the Council on Foreign Relations addresses the potential for escalation of a space conflict between the United States and China, thus jeopardizing stability and sustainability. He says:

As a result [of that potential escalation], both countries have interests in avoiding the actual use of counterspace weapons and shaping a more stable and secure space environment for themselves and other spacefaring nations, which could easily be caught in the undertow of a more militarily competitive space domain.85

Space warfare runs two untenable risks: the creation of destructive debris and escalation to terrestrial, even nuclear, warfare. Kinetic warfare in space creates debris traveling at a speed of more than 17,000 miles per hour, which then in itself becomes a destructive weapon if it hits another object—even potentially triggering the so-called Kessler Syndrome,86 exaggerated for dramatic effect in the movie Gravity. Ironically, both China and the United States learned the negative lessons of debris creation the hard way. In 1985, the United States tested a miniature homing vehicle (MHV) ASAT launched from an F-15 aircraft. The MHV intercepted and destroyed a defunct US satellite at an altitude of approximately 250 miles. It took almost 17 years for the debris resulting from that test to be fully eliminated by conflagration re-entering the Earth’s atmosphere or being consumed by frictional forces, though no fragment had any adverse consequences to another satellite—in particular, no collisions. China irresponsibly tested a direct-ascent ASAT in 2007, destroying one if its defunct satellites. That test was at an altitude almost twice that of the 1985 US test. The debris created by the impact added 25 percent to the debris total in low Earth orbit87 and will dissipate through the low Earth orbit, heavily populated with satellites, for decades, perhaps centuries, to come. Perhaps most ironically, because of superior US debris-tracking capabilities, the United States—even though not required to do so—has on more than one occasion warned China that it needed to maneuver one of its satellites to avoid a collision with debris China itself had likely created.88 In 2013, a piece of Chinese space junk from the 2007 ASAT test collided with a Russian laser ranging nanosatellite called BLITS, creating still more debris.89 The broader point is that all nations have a compelling common interest in avoiding the massive increase in space debris that would be created by a substantial ASAT conflict.

Gen. Hyten has said that not creating debris is “the one limiting factor” to space war. “Whatever you do,” he warns, “don’t create debris.”90 While that might appear an obvious “limiting factor,” preparing to fight its way through a debris cloud had been a Pentagon consideration in the past. Now, however, sustaining the space environment has been incorporated into Pentagon space goals.

Beyond debris creation, MacDonald points out that as China becomes more militarily capable in space and there is more symmetry between the countries, other risks are created – specifically, escalation.

That is, the United States could threaten to attack not just Chinese space assets, but also ground-based assets, including ASAT command-and-control centers and other military capabilities. But such actions, which would involve attacking Chinese soil and likely causing substantial direct casualties, would politically weigh much heavier than the U.S. loss of space hardware, and thus might climb the escalatory ladder to a more damaging war that both sides would probably want to avoid.91

MacDonald isn’t alone in concerns about escalation. Secure World Foundation analyst Victoria Samson has also voiced apprehension regarding US rhetoric that does not distinguish between actions against unclassified and classified US satellites, stating that “things can escalate pretty quickly should we come into a time of hostility.”92

Theresa Hitchens explained the most frightening, but not implausible, risk of space war escalation in a 2012 Time magazine interview.

Say you have a crisis between two nuclear-armed, space-faring countries, Nation A and Nation B, which have a long-standing border dispute. Nation A, with its satellite capability, sees that Nation B is mobilizing troops and opening up military depots in a region where things are very tense already, on the tipping point. Nation A thinks: “That’s it, they’re going to attack.” So it might decide to pre-emptively strike the communications satellite used by Nation B to slow down its ability to move toward the border and give itself time to fortify. Say this happens and Nation B has no use of satellites for 12 hours, the time it takes it to get another satellite into position. What does Nation B do? It’s [unaware] ~~blind, it’s deaf~~, it’s thinking all this time that it’s about to be overwhelmed by an invasion or even nuked. This is possibly a real crisis escalation situation; something similar has been played out in U.S. Air Force war games, a scenario-planning exercise practiced by the U.S. military. The first game involving anti-satellite weapons stopped in five minutes because it went nuclear – bam. Nation B nuked Nation A. This is not a far-out, “The sky’s falling in!” concern, it is something that has been played out over and over again in the gaming of these things, and I have real fears about it.93

While escalation to a nuclear exchange may seem unthinkable, in war games conducted by the military, nuclear weapons are treated as just another warfighting weapon.

Morgan also voiced concerns about escalation generally and nuclear escalation specifically in the 2010 RAND report, stating:

The adversary would also likely be deterred from damaging U.S. satellite early-warning system (SEWS) assets to avoid risking inadvertent escalation to the nuclear threshold, but that firebreak would almost certainly collapse with the conclusion that such escalation is inevitable and that it is in the adversary’s interest to launch a preemptive nuclear strike.94

Only recently, in contrast to past analyses, has the risk of escalation been downplayed—dismissed—in favor of moving forward with war plans. Analyst Elbridge Colby authored a 2016 study for the Center for a New American Security 20 Protecting space assets (CNAS) in which he stated “no one really believes that a limited space attack would necessarily or even plausibly be a prelude to a total nuclear war.”95 As evidence, he says “senior responsible U.S. officials have telegraphed that the United States would indeed not necessarily respond massively to attacks against its space assets.”96 Whether that message was received or buried amidst other telegraphed messages of control, domination, and denying access is tenuous. That study, however, also argues for the need for the United States to prepare for a limited space war with tacit rules and (while not desirable) acceptable actions.

Colby offers an alternative goal to either stability or annihilation: nonannihilation. It is built on several premises and assumptions, including the assumption of “the consent of one’s adversary.”97 Among the foundational premises of the framework are, for example, that “being the first to carry war into space is escalatory and irresponsible” and would be considered “presumptively illegitimate.” But the framework goes on the reject a “no first use” pledge, stating that such a pledge “might unduly constrain the United States over the long-term if the space military balance develops unfavorably.”98 So apparently, the United States should reject the first use of space weapons unless it decides first use is in its best interest. Whether the United States would get the space war it wants, a limited space war, or something else is a significant risk.

Given the dangers of space warfare, MacDonald pointed out how space strategy was misaligned in 2008, applicable again in 2016. First, since 2002, US space policy documents have included language about the imperative of being able to deny the use of space assets by its adversaries—primacist language that has caused considerable angst among countries increasingly using space in many of the same ways as the United States. The United States has ranged from hinting to overtly stating its desire to “control” space. And yet, second, since the 2006 NSP, space has been considered a “vital interest” of the United States for all the reasons already explained. MacDonald then points out the incongruous nature of those two points.

Identifying one’s own space capabilities as a vital national interest while reserving the right to attack others in space (which would likely provoke retaliatory attacks against our “vital” space assets), appears internally inconsistent, even contradictory. … Attacking others’ satellites would invite retaliation, putting at risk a “vital national interest” where the United States has much more to lose than the attacker.99

Rational decision-making is goal directed with internally consistent choices. Therefore, if the United States wants to maintain access to its vital interests, then avoiding an attack becomes equally as imperative as defending and defeating an attack. Yet to the detriment of US security, far less effort is being placed on deterrence by denial than deterrence by punishment.

A closer look at the “congested, contested, and competitive” space environment is important for understanding the backdrop within which threat assessments and strategies are being developed. While management of the environment is both Protecting space assets 21 useful and necessary, control of the environment is already out of reach of any one country. Pursuing control is not just a futile, costly quest but can be, and in some cases already has been, counterproductive.

[[NOTES OMITTED]] [[CHAPTER 2 BEGINS]]

Whatever happens will be for the worse. Therefore it is in our interests that as little happen as possible.

Nineteenth-century British Prime Minister Lord Salisbury1

Describing the space environment as congested, contested, and competitive presents an ominous picture, apparently to indicate an across-the-board threatening change from the past. The environment has certainly changed, and change bodes ill for those the status quo favors. Even in the 1960s though, “dominance” was likely an overstatement of the US position in the space environment. Then, it was the National Aeronautics and Space Administration (NASA), as the civilian face of the US space program, which established US preeminence(-cum-dominance) with the Apollo Program.2 Apollo was part of a techno-nationalist “space race”3 with the Soviet Union. While the United States handily won the race, its occurrence evidences that it was not the only country with considerable space capabilities. Even then, it was unlikely that the United States was able to “dominate” in the sense of being able to control Soviet access to and activity in space. The club of spacefaring nations, however, was clearly very exclusive.

The strategic environment of space has been described as congested, contested, and competitive—the terms used individually and in combination and often without definition—even before it was first officially used as a descriptor in the 2011 NSSS.4 Analysts noted that it took longer for government officials to clarify exactly what was meant by congested, contested, and competitive than for the catchy phrase to be accepted as fact and as part of not only the US national security lexicon but internationally. Initially it was, as one analyst noted, part of a trend whereby “reducing complex strategic problems to acronyms, metaphors, or catch phrases is what passes these days for strategic thinking.”5 Another pointed out the Congested, contested, and competitive 27 danger of oversimplicity and that use of the “three Cs” continues “the ‘lamentable tendency’ in policy discussions to reduce complex ideas to slogans of three or fewer words … this consonantal alliteration is seriously misleading.”6 That the phrase was used for a considerable period before being defined suggests an intended use as a marketing tool for instituting the idea of “threats” to the public and Congress as much as it being meant as a serious descriptor.

Ambassador Gregory L. Schulte, as Deputy Assistant Secretary of Defense for Space Policy, provided definitions in 2012 in a presentation given in Singapore,7 useful as a basis for further inquiry. Quite simply, space is considered congested by virtue of the quantity of “stuff” in orbit, including both active systems and trackable debris. In addition, space is considered increasingly competitive based on the growing number of actors in aerospace, including countries, consortiums and companies. But these two attributes of the space environment could be considered part of the natural evolution of space as both an industrial sector and space as an environment for exploration and development—both goals long supported by the United States. Each aspect presents both opportunities and challenges, and these are considered first. Then the “contested” aspect of space—defined as the number of countries developing counterspace capabilities and integrating them into their military doctrine and forces—is considered. It is the contested aspect of the space environment that appears to drive US national security space strategy and, consequently, signals of US intent that potentially influence other countries.

Congested

Space was the exclusive, expensive domain of the United States and the Soviet Union for many years. Both countries used the space domain to their own advantage in order to ameliorate strategic weakness. For the United States, being able to position reconnaissance satellites to look behind the Iron Curtain provided important intelligence information that was otherwise unavailable. For the Soviet Union, intercontinental missiles provided the Soviets with the capabilities required for a nuclear standoff with the United States—mutually assured destruction (MAD). Satellites also provided the means for both countries to monitor the treaty activities (primarily nuclear) of the other; hence, in the Strategic Arms Limitation Treaty (SALT) signed in 1972, both parties agreed not to be first to interfere with these “national technical means of verification” (satellites). Additionally, the SALT negotiations led to the Anti-Ballistic Missile (ABM) Treaty, also signed in 1972, placing limitations on systems intended to shoot down missiles in order to avoid an arms race neither thought winnable.

In 1965, France became the third country to have space launch capability. It was followed by Japan and China in 1970. Between 1971 and 2012, the United Kingdom, the European Space Agency (ESA), India, Israel, Ukraine, Iran, and North Korea joined the list. While some countries have consolidated their efforts, especially the European countries through ESA, there are now more countries with space launch capability. Countries consider access to space to be important 28 Congested, contested, and competitive and their right, codified as a fundamental principle of the 1967 Outer Space Treaty. For the United States to expect other countries to accept anything less now would be to say that it expects other technologically and economically capable countries to forego capabilities that the United States not only admits but proudly proclaims provide it significant across-the-board advantages.

Further, it is not just the number of countries able to launch payloads into orbit that is growing. A number of private sector companies are now providing (relatively) low-cost access to space as well. They are part of the growing “NewSpace” companies that will shape the future and will take “control” even further away from government hands.8 SpaceX, Blue Origin, Bigelow, Orbital ATF, Kistler, Starchaser, ARCA, and Virgin Galactic are among the firms developing new launch technology.

Beyond the increasing number of actors capable of providing launch capability, which inherently facilitates congestion, analysts and government reports have cited other indicators of “congestion,” including debris, radio frequency access, and limited orbital real estate.9 The increased number of small satellites (of various sizes) potentially to be launched in the future, and even space tourism, will further exacerbate the relatively congested nature of space, simply in terms of the number of objects in orbit. Debris is the most potentially threatening near-term issue of congestion.

Aerospace Corporation defines space debris as “any nonfunctioning humanmade object orbiting Earth.”10 Everything from tools left by astronauts, rocket stages, and moribund satellites are among the tens of thousands of pieces of space debris larger than 10 centimeters that are detected, tracked, identified, and cataloged by the US Space Surveillance Network (SSN). The SSN encompasses the assets used to track space debris and follow-on operations. It is operated through the Joint Space Operations Center (JSPOC) located at Vandenberg Air Force Base in California. Some data is shared through the Space Track program. There is also an unknown number of smaller pieces, some too small and overall too many to keep track of, that are nevertheless dangerous. Because of the high velocity at which these small pieces travel, they can act like sandblasting or shrapnel when they come in contact with a satellite sensor or surface. More than once, the Space Shuttle had to have the windshield replaced after a mission due to damage from impact with even a small piece of debris. Nicholas Johnson, chief NASA scientist for space debris, has said the greatest debris risks come from non-trackable items.11 Big pieces can be a threat too though. In 2011, the International Space Station (ISS) crew had to take emergency precautions when a substantial piece of space junk was determined to be on a potential collision course traveling at a speed of 29,000 miles per hour. While there is usually time to maneuver the station out of harm’s way, that time there was only 15 hours’ notice—not long enough to maneuver. The debris missed the station by only 1,100 feet.12

Before 2007, most space debris was junk from space missions. But China’s 2007 kinetic anti-satellite test against one of their own moribund weather satellites added thousands of pieces of debris of various sizes.13 Then in February 2009, a defunct Congested, contested, and competitive 29 Russian satellite collided with and destroyed a functioning US Iridium commercial satellite. That collision added more than 2,000 additional pieces of trackable debris to the inventory of space junk.14 These were not the first space collisions. In 1996, the French military reconnaissance satellite Cerise had a gravity gradient boom severed by impact with a fragment of debris, making it the first verified space collision.

But what are the odds of a catastrophic accident? According to NASA, very low.

Operational spacecraft are struck by very small debris (and micrometeoroids) routinely with little or no effect. Debris shields can also protect spacecraft components from particles as large as 1 cm in diameter. The probability of two large objects (> 10 cm in diameter) accidentally colliding is very low. The worst such incident occurred on 10 February 2009 when an operational U.S. Iridium satellite and a derelict Russian Cosmos satellite collided.15

Beyond collisions, debris is created other ways as well.

In February 2014, a Defense Meteorological Satellite Program (DMSP) spacecraft exploded, caused by what engineers concluded was a battery rupturing in the spacecraft due to a design flaw; this created considerable debris in its polar orbit. Then in November 2015, a National Oceanic and Atmospheric Administration (NOAA) satellite broke up, again in a polar orbit, creating more debris. Fortunately, the JSPOC found the debris caused by the NOAA satellite posed no threat as of that time. A Japanese astronomy satellite malfunctioned in March 2016, also creating debris.16 With the number of spacecraft in orbit on the rise, though, the number of collisions and accidents can be expected to increase.17

Therefore, perhaps the right question to ask is not by how much the data is increasing but whether the probability of a collision is increasing. Analyst Bob Butterworth provides an analogy: “For travel purposes, I don’t care how many cars there are in northern Virginia; I care about how many are on the road at the same time and place as I.”18 Answering that question requires more exact knowledge about where objects are in space than the currently imperfect intelligence (which is partly due to not all space actors being willing to share information). In 2014, the JSPOC issued 671,727 conjunction (collision) warnings.19 Not all of those result in avoidance maneuvers, and some are false positives—not mistakes, but non-threats identified as threats using good data and good processing.20 Nevertheless, the need for increased space situational awareness (SSA) regarding the active and inactive material in orbit is clear, as reflected in its inclusion as a DoD policy directive21 and it being the topic of multinational forum discussions. There have been efforts to address the debris issue nationally and internationally.

In February 2013, the Steering Committee of the Inter-Agency Debris Coordinating Committee (IADC)—a 12-member, intergovernmental agency that has worked since 1993 to follow and study the space debris issue—made a presentation to the UN Committee on the Peaceful Uses of Outer Space (COPUOS) on the stability of the future low Earth orbit (LEO) environment; 30 Congested, contested, and competitive here, the IADC considered the risk of a catastrophic collision, concluding that it was increasing. Since 2005, some IADC members had independently studied the evolution of the far-term LEO satellite population under a variety of scenarios. The study aimed to answer the question: If serious mitigation efforts were undertaken, would the risks of space debris to space assets decrease? In 2009, the IADC decided to assess the stability of the LEO space object population and the need to use active debris removal (ADR) to stabilize the future LEO environment. In other words, did the world have to do more than watch carefully and act when needed? The IADC’s Environment and Data Bases Working Group did the assessment, the principal participants in the study being from Italy, the ESA, India, Japan, the United States, and the United Kingdom. Subsequently, the IADC concluded that action is needed to protect the sustainability of space and that if only five large pieces of space junk were removed each year, the odds of a catastrophic event go down significantly.22

NASA issued the first guidelines for the mitigation of space debris in 1995. These were followed in 1997 by US Government Orbital Debris Mitigation Standard Practices.23 Those US government guidelines were further developed by the IADC and issued as consensus guidelines in 2007, and these were then largely adopted by COPUOS with UN endorsement.24 Basically, those guidelines require satellite owners to provide for a 25-year satellite lifetime with either post-lifetime atmospheric re-entry so that the satellite will burn up in orbit and not become space debris or placement of the satellite in a designated storage orbit. But the guidelines are executed nationally. In the United States, for example, a Federal Communications Commission (FCC) license is required for all US satellite radio transmissions. In 2004, the FCC amended its licensing rules to require a narrative description of the satellite operator’s plan to mitigate orbital debris. In other words, at least theoretically, the creation of more satellite-related debris will be mitigated in the future. Whether all countries or operators abide by the prescribed guidelines, however, remains to be seen.

The technical challenges and cost of removing space junk, while formidable, are not the only showstoppers preventing taking action on the 2013 IADC recommendations. Removal would in all probability need be a joint international venture or, at the very least, require tacit international approval. Every piece of junk in orbit is the property of some country. While there have been proposals for space salvage laws to allow “abandoned” debris removal,25 under the Outer Space Treaty, nations currently retain “jurisdiction and control” of their spacecraft even when inoperable or in pieces. Further, many of the proposed methods for removal, such as lasers and grappling hooks, have other potential applications as well, including as ASATs. Therefore, debris removal by even a single country would require “trust” among nations, a commodity sorely lacking and likely to get worse with global space militarism on the rise, and so would be impossible. Sadly, the most likely scenario that would bring about serious cooperation is a debris-caused space catastrophe that leads to deaths on Earth.26 So while it is technically possible to do something about the debris congestion that the United States and other Congested, contested, and competitive 31 countries profess concern about, the politics of fear, inertia, and delay will likely prevail in the interim. In the meantime, more and more satellites are being launched into space.

Real estate in space, just as on Earth, is limited, at least in desirable orbits. Geostationary orbit is perhaps the Beverly Hills of space because the gravitational pull of the Earth, Moon, and other planets allows a satellite to remain in orbit over a single point of the Earth’s surface. Geostationary orbit is located at an altitude of approximately 35,786 kilometers (22,236 miles) from the Earth’s equator and has a radius of 42,164 kilometers (26,199 miles). While that is a substantial radius, it is not limitless. In addition, a satellite occupying a slot in space requires a specific radio frequency in the electromagnetic spectrum; hence, a link between radio frequency issues and real estate issues. These radio frequencies must be different, and satellites must maintain enough distance between them so there is not interference among transmissions. Moreover, only a limited number of slots exist appropriate for “bouncing” signals from Europe to North America and across the Pacific. There are currently 493 satellites in geostationary equatorial orbit (GEO),27 which may be approaching capacity under current parameters.

The job of allocating orbital slots and radio frequencies falls to the International Telecommunications Union (ITU), an organization created in 1865 to govern transnational telegraph communications. It then moved on to governing radio links and, from there, orbital slots. During “the good ol’ days” when it was largely just the United States and the Soviet Union that had the capability to place satellites in orbit, the job of the ITU was primarily to record satellite locations consequent to registration by the owners. With the advent of more place players complicating things, though, it has had to take on the thankless job of regulation.

There has already been competition for valuable orbital slots, the winner often declared by who gets there first. In 1993, Indonesia occupied an orbital slot claimed by Tonga.28 In 2015, the Philippines complained that China had grabbed and occupied a slot that belonged to it.29 These disputes often end up at the ITU for resolution.

Sometimes countries have tried to “squeeze” a satellite into a position despite the protests of other countries fearing signal interference with their own satellites. Such was the case of China’s Apstar-2 satellite, which faced protests from the United States and Japan when Apstar-2 squeezed into a position next to Japan’s Sakura 3a satellite in 1994, potentially interfering with Sakura 3a transmissions. A diplomatic spat between Tokyo and Beijing ensued with the stakes seen as potentially higher than just this one situation.

Some analysts fear that if China flouts global rules, there could be a destructive and expensive breakdown of international order in satellite transmissions. China is aggressively seeking to promote its satellite-launch services as an inexpensive alternative to Western competitors.30 32 Congested, contested, and competitive

While international order did not collapse, this case made the value of GEO real estate and the need to address crowding issues clear.

With GEO slots heavily utilized, industry has had to step up its game and find ways to make the most of the valuable real estate. By 2008, advances in satellite technology made it possible to decrease the amount of required space between satellites from the original 3-degrees to 2-degree spacing31 and, more recently, sometimes even less. Because real estate is so valuable, “paper satellites” have become a particular issue of late. These are satellites crafted only on paper and registered with the ITU in order to hold an orbital slot for a given country, with no actual intent to build or operate it. Consequently, the ITU has mandated that a satellite must be placed in orbit within seven years of registration rather than the previous nine years.

Certain radio frequency bands are also becoming in short supply, and there has been significant growth in radio frequency “congestion” as a result of increased band use. In 2011, Schulte explained the problem thus:

As many as 9,000 satellite communications transponders are expected to be in orbit by 2015. As more transponders are placed in service, the greater the probability of radiofrequency interference. This congestion is complicating space operations for all that seek to benefit from space.32

The military has and continues to work with industry to find ways to mitigate interference issues, especially regarding electronic warfare.33 Unquestionably, more satellites and the seemingly unquenchable demand for more bandwidth will mean more complex issues needing to be addressed internationally—and potentially more space debris.

Low Earth orbit (LEO) is also increasingly crowded because countries other than the United States want to reap the same benefits from space assets it has enjoyed for many years and because low(er)-cost launch services make LEO more accessible. Particularly relevant for the future is the expected proliferation of (variously named according to size) smallsats, nanosats, picosats, and cubesats,34 many of them originally developed by universities for low-cost access to space. The British firm Surrey Satellite Technology was spun off from the University of Surrey, the brainchild of scientists who decided to build a satellite using commercial, off-the-shelf (COTS) components. It now proudly proclaims it has the world’s most extensive track record in small satellite missions.

Cubesats were originally developed at California Polytechnic State University and Stanford University to allow universities worldwide to perform space science and exploration experimentation, and universities and others are doing just that. Cubesats can be do-it-yourself, shoebox-sized objects, made and launched for around $65,000 or even less. Tyvak Nano-Satellite Systems, a small company in California employing less than 25 engineers, sells their satellites starting at $45,000. Their client list ranges from well-funded high school science clubs to NASA.35 But Cubesats cannot maneuver in orbit to avoid collisions, and some users have Congested, contested, and competitive 33 insufficient, or nonexistent, plans for deorbiting their assets. A team of researchers using a sophisticated computer model has predicted that “Cubesats will be responsible for millions of orbital near-misses, with a handful of these orbital encounters resulting in collisions, by 2043.”36 A Cubesat collision had already occurred in May 2013 with Ecuador consequently losing its first Cubesat, NEE-01 Pegaso. More LEO collisions can be anticipated.

Congestion, in short, means that there is more going on in space than there was in the past, and that increased activity creates issues. It also means that space is “developing” in a way that was always anticipated, indeed desired, unless mankind was supposed to remain terrestrial or The Jetsons were only to be Americans. Air space is congested as well; however, this is not considered a threat but, rather, a situation to be managed. The Federal Aviation Administration (FAA) began registering drones in 2015 as part of its management of US air space.37 There are rules for managing global airspace that are in the interests of all stakeholders to obey. There are no such rules for space although both airplanes and spacecraft are dual-use technology. While each of the issues created by congestion is important and must be addressed for long-term sustainability, none of them can be “fixed” because the utilization of space will inherently continue to grow. But they can be, and must be, better managed. Otherwise, the first effects to be felt will be economic.

More space debris collisions will not mean that space orbits will not be used, but it will make utilization more expensive. Ambassador Roger Harrison succinctly stated the reality of the situation.

Despite the alarms and excursions, the civil and commercial space sectors are proceeding as if all is well. One would think that people with actual money in the game would act like the proverbial “canary in the mineshaft.” But long-term projects continue to go forward with no discount for the possibility that future satellites will be operating in a battle zone or a space junk yard. Underwriters and investors seem unconcerned. New commercial launcher companies proliferate. There is, after all, still a lot of space in space, and we are not a species that cares very much about the long term. Congested space may be a long-term reality, but the impact of that reality on what we actually do is, and will likely remain, negligible.38

Equally as important, none of the issues related to a congested space environment requires a military “counterspace” solution. They all require international cooperation.

Competitive

If there are more actors in space challenging each other for orbital slots and bandwidth (and there are) and if all countries want the right to pursue their own aims in space (and they do), then by definition, space is more competitive than it was in the past. It also means that the relative dominance of the United States in 34 Congested, contested, and competitive space is less. Whether that then means that the security of the United States is inherently compromised by competitiveness is more tenuous. But exceptionalists, and the US military, are often uncomfortable with relativism and more comfortable with absolutism, despite this being increasingly unrealistic.

With the influx of new players, the United States is facing competition in space in a variety of ways—some positive, some negative, some appropriately addressed in military terms, and some made worse by sabre rattling. A positive aspect of competition has been lowered launch costs. Though the United States bemoaned high launch costs for decades, nothing was really done about it until upstart private companies like SpaceX came along, successfully launching its Falcon 9. Only then did the behemoth heritage companies begin to think about revising their business plans. Harvard historian Niall Ferguson, in his 2011 book Civilization: The West and The Rest, attributed competition among warring European countries as the spur to technical advances, allowing the West to eventually triumph over oncedominant China.39 Competition can be a positive force, but staying ahead of competitors is both imperative and self-determinative, not achieved by trying to stifle others. History has shown repeatedly that attempts to quash others will be both ineffectual and potentially counterproductive.

The United States initially held a virtual monopoly on commercial launch services. But US restrictions on the launch of two Franco-German communication satellites called Symphonie-A and Symphonie-B in the 1970s, in order to protect Intelsat’s monopoly on international satellite communications, at least partially facilitated the French goal of developing an independent European launcher. Hence, the Ariane launcher was approved as an ESA optional program in 1973.40 In 1981, Ariane signed its first commercial payload contract, for an American GTE Spacenet telecommunications satellite. By 1985, Ariane was launching half of the ten commercial satellites sent into space in a 14-month period.41 The American commercial launch monopoly was no more. Balancing cooperation with competition can only be expected to get more difficult in a connected, globalized world.

Beginning with the 1958 Space Act that created NASA, the United States has advocated international cooperation in space, but it has had to deal with the realities of economics and national security in doing so. That requires thinking through the second- and third-order effects of anticipated actions or non-actions—or dealing with unintended consequences later. Trying to stifle competition in telecommunications resulted in launch service competition in the 1980s. However, the United States maintained the largest market share in satellite sales for much longer—specifically, until after the 1999 report of the Select Committee on US National Security and Military/Commercial Concerns with the People’s Republic of China, commonly known as the Cox Committee. In fact, the competitive satellite business environment that the United States now faces is, in many ways, one created as a self-inflicted wound consequent to that report.

The Cox Committee report presented findings of an imminent threat to US national security based on dubious claims of China stealing vital US nuclear secrets through Los Alamos scientist Dr. Wen Ho Lee42 and being given assistance for its Congested, contested, and competitive 35 missile program by US aerospace companies through lax adherence to International Traffic in Arms Regulations (ITAR). The result was the imposition of draconian, Byzantine regulations on the US satellite industry, basically placing them under the same export restrictions as are applied to weapons systems. Consequently, US satellite companies began losing sales, and other countries were motivated to develop their own satellite industries beyond the reach of US controls.43 Within two years of the Cox Committee report being issued and the new regulations being imposed, the US portion of global satellite sales plummeted from 75 percent to 45 percent.44

Advertising satellites as “ITAR free” became an advantageous marketing tool for European aerospace firms. In other words, the United States took careful aim and shot itself in the foot as countries took their satellite business elsewhere, and the United States ended up with less control of dual-use space technology than it had previously. It was not until the National Defense Authorization Act for Fiscal Year 2013 (NDAA 2013) that commercial satellites were removed from the ITAR list and clarification was given as to what was under ITAR control and what was not—ambiguity having been part of the problem since 1999.45 These changes have allowed the US satellite industry to again become competitive in the export market though imports and exports from certain countries (from China, for example) remain prohibited. Nevertheless, while long discredited by the technical community,46 die-hard Cox Committee supporters (still) tout the findings as justified and bipartisan. Many political and technical analysts then and now, however, have characterized it as a partisan ploy to jab at President Bill Clinton through his engagement policies with China; engagement with China has always been an easy target in Washington.47 But the United States must move beyond the canard that it can stop the spread of space technology. The United States has always been perhaps the world’s strongest proponent of a free market, so competition for commercial profits should be neither unexpected nor considered nefarious. Beyond profit, competition for prestige must be considered as well as it strongly links to leadership, which then links to exceptionalism and geopolitics.

European countries, for example, were motivated to initiate space programs in the 1960s due to fears of an unbreachable technology gap being created between spacefaring nations—then, the United States and Soviet Union—and all others. Further, space means technology, technology means industrialization, and industrialization means economic growth. Hence there are pragmatic reasons for space program development, then and now. Beyond pragmatism, however, there is more. Space represents the future in a way that stirs imaginations and indicates leadership.

Iran created a space agency in 2004, reconfigured with a substantial budget boost in 2010 and then unceremoniously disbanded in 2015. While most observers assumed it a cover for development of missiles—and there certainly are benefits accrued from development of rocket technology to development of missile technology—some analysts felt that international prestige and national pride was as much, or more, motivation for the Iranian satellite launch efforts.48 As President, Mahmoud 36 Congested, contested, and competitive Ahmadinejad was quoted as saying, “[w]hen we launch a satellite into space, there is a huge boost in the morale of the public.”49 Plans for numerous launches were announced in 2010 and left largely unfulfilled, though Iran did manage to launch some turtles and monkeys into orbit. The Iranian Space Agency seemed to fall victim to the realization that space travel is difficult and costly and that perhaps the price of prestige was more than anticipated or more than Iran was able to pay.

Even the names of spacecraft and space programs evoke powerful, prestige-generating imagery. Mercury, Gemini, and Apollo were critical programmatic steps in taking Americans to the Moon, while Thor, Atlas, and Titan, originally designed to carry warheads, were converted to carry satellites. Satellites named Voyager and Pioneer explored the solar system and beyond. The Russian Mir space station is alternately translated into English as “world,” “peace,” or “village.”50 The Chinese Shenzhou spacecraft that carries its astronauts aloft translates as “heavenly boat” or “divine craft.” The Chinese robotic lunar program Chang’e is named after a mythical lunar princess. Iran’s rockets include Kavoshgar (explorer) and Safir (ambassador). Sir Richard Branson cleverly named his space transportation company Virgin Galactic, only a slight variation from his transoceanic airline Virgin Atlantic, perhaps intending to indicate that eventually space travel will soon be as commonplace as terrestrial travel is today. Beyond stirring the imagination, space programs are indicators of technical prowess, prowess that can have leadership and, hence, geostrategic implications.

Two Telstar satellites developed by AT&T were the first able to transmit television signals across the Atlantic. Countries vied for which would be the first signal recipient—a signal showing a flag waving outside a receiving station in Maine—with France winning apparently only because the British had mistakenly set its antenna incorrectly.51 Polls showed that in 1962, Telstar was better known in the United Kingdom than Sputnik had been in 1957. A British band called The Tornadoes immortalized the satellite in a 1962 song called “Telstar,” which reached Number 1 on the US top 100 Billboard chart.52 The fact that countries competed to be the first to receive the signal indicates that they thought doing so had some value. Similarly, countries have made significant investments in the development of launch technology53 and satellites when there appeared no real business rationale (or even business plan). In 2015, Laos joined Nigeria, Venezuela, Pakistan, and Bolivia as countries with satellites in orbit, all financed, built, and launched by China. Belarus launched a satellite in orbit in 2016, making a point to state it was for commercial purposes and not just prestige.54 Human spaceflight, however, is the ultimate brass ring for prestige.

As Roger Harrison has pointed out:

The rational and economic arguments against human spaceflight are compelling, and the opportunity costs enormous. What might have been done in the advancement of science with the $120 billion so far invested in a space station whose crew members spend the overwhelming percentage of their time maintaining the station and staying alive?55

Congested, contested, and competitive 37 Critics of China’s human spaceflight program have made similar economic arguments, especially early in the program.56

India’s space program once specifically rejected human spaceflight. Dr. Vikram Sarabhai, considered the father of India’s space program, clearly linked heavenly goals to terrestrial responsibilities. Until recently, the following quote from Sarabhai was on the homepage of the Indian Space Research Organization (ISRO) website:

There are some who question the relevance of space activities in a developing nation. To us, there is no ambiguity of purpose. We do not have the fantasy of competing with the economically advanced nations in the exploration of the moon or the planets or manned spaceflight. But we are concerned that if we are to play a meaningful role nationally, and in the community of nations, we must be second to none in the application of advanced technologies to the real problems of man and society.

But India’s outlook and plans for space have changed dramatically over the past decade.

India’s space plans are outlined in Space Vision 2025, released in 2009. While still including such goals as satellite-based communications and navigation systems for rural connectivity as well as enhanced imaging capability for natural resource management and weather and climate change studies, it also now includes planetary exploration, development of a heavy lift launcher, reusable launch vehicles, and human spaceflight. The specifics initially included a man on the Moon by 2020 and robotic missions to Mars, to a nearby asteroid, and to an observable distance from the sun. In discussions with Indian analysts, this philosophical change is often explained as simply “evolutionary.” In all likelihood, feeling pressured to not be seen as technically usurped by China has played into India’s change of philosophy as well, most vividly demonstrated in India’s successful quest to beat China to Mars in 2014.57

In September 2014, the Indian spacecraft Mangalyaan began orbiting Mars. With that, India became the first Asian country to reach Mars, the first country to orbit Mars on its first attempt, and the fourth country to orbit Mars. Only the United States, the Soviet Union, and Europe had reached Mars previously. With Mangalyaan, India made it into the space record books, and the importance of that should not be undervalued. Whereas China had been the primary Asian beneficiary of the prestige and corresponding regional and geostrategic influence that accompanies space achievements, now it was India’s turn. The success of Mangalyaan also raised the credibility of sophisticated space technology produced by Anthrix—the commercial arm of India’s Space Research Organization— credibility accompanied by potentially substantial economic returns.58 And then, of course, there is the dual-use technology important to the aspiring Indian military space program. Space activity, in many ways, is the gift that just keeps giving.

India achieved its success reaching Mars in record-breaking time and on a comparatively shoestring budget. Feasibility studies for Mangalyaan, also called the 38 Congested, contested, and competitive Mars Orbiter Mission (MOM), began in 2010. Spacecraft development commenced in 2012, the satellite was launched only 15 months later in November 2013, and Mangalyaan reached Mars only 9 months after that. ISRO states the mission cost as $76 million, far less than the American Maven mission costing $671 million (Maven, however, is significantly more complex) that entered Mars orbit the same week as Mangalyaan or even, as noted by Indian Prime Minister Narendra Modi, the $100 million Hollywood space blockbuster Gravity.59 India’s remarkable achievement wasn’t, however, the result of India perfecting warp drive or having better science and engineering geeks than anyone else. It was the product of a confluence of domestic and geopolitical factors that worked out well for India.

Geopolitically, India had been left looking like one of several distant “also-ran” competitors in the Asian space race—along with Japan and, more recently, South Korea—compared to China’s Shenzhou human spaceflight program and Chang’e robotic lunar program. Given that space exploration has traditionally carried with it significant technology leadership implications—witness the American Apollo program—India could not allow China’s regional space leadership to go unchallenged.

India needed to do something that China had not done before; India needed to “beat” China. Going to the Moon wouldn’t do it, but going to Mars would. China had attempted a Mars mission with Yinghuo-1, launched in 2011 by Russia. But the mission failed. That failure provided India with an open spot in the space record books and the geostrategic prestige that accompanies those coveted spots.

China’s successes in space have occurred while the US human exploration program has been largely focused on ISS missions, giving the American public little to follow with the exception of astronaut Scott Kelly’s one-year stay in space, which did generate considerable public interest. NASA’s Journey to Mars is too distant and too amorphous to catch the public’s attention. Consequently, the perception has been created that China is “beating” the United States in space. While China is not doing anything that the United States hasn’t already done, years ago, perception becomes reality over time with the United States sometimes appearing an also-ran in a space race with China.60 So when India sought NASA’s help with deep space navigation and tracking support for Mangalyaan, NASA was happy to oblige. In return, American scientists were given the opportunity to have access to importance scientific data from the Indian spacecraft and US politicians got to watch China lose a spot in the space record book to a democratic country the United States has pledged to work with in space.61

The leadership connotations that accrue with spaceflight are considerable. The Space Studies Board (SSB) of the National Academies of Science regularly considers the leadership aspects of space in their studies, including America’s Future in Space (2009); NASA’s Strategic Direction and the Need for a National Consensus (2012); and Pathways to Exploration (2014).62 Unfortunately for the United States, the general public often equates space leadership with human spaceflight; and with the US human spaceflight earthbound since the Space Shuttle was retired in 2011 except when it can hitch a ride from Russia to the ISS, this reliance on the Russians for transportation further adds to the perception that US space leadership is slipping Congested, contested, and competitive 39 away.63 Juxtaposed against that perception, however, is the imagery and perception created by Gen. Hyten in “The Battle Above.”

Contested

The difference between space being considered both contested and competitive took a while to sort out, and there still are no definitions in the DoD dictionary64 or space doctrine publication.65 Roger Harrison suggested that “an interagency process in the United States … arrived at a definition of contested space, which is some combination of capability, motive and intent.”66 Harrison further submitted that it was Air Force Space General Robert Kehler (Space Command Chief from 2007 to 2011 and Strategic Command Chief from 2011 to 2013) who first utilized the term “contested” as an alternative to the illusory quest for “dominance,” though without definitional specificity.

Philosophically, dominance and “space control” was part of the rhetoric of the unipolar post-Cold War world with the United States as the benevolent hegemon. The United States would, with an implied degree of noblesse oblige, keep space safe for “good actors” and deny it to “evildoers,” as the United States determined them, for the benefit of all mankind. In contested space, the environment becomes a Hobbesian place where mankind has to look for itself and the devil take the hindmost. Though space control has a temptingly exceptionalist allure, in reality, space dominance and control are aspirational fallacies. So the threats to be addressed by space control had to be modified, made more achievable, in order to continue building technology to counter them—threats like a “contested” space environment. Together, capability, motive, and intent do constitute the constructs behind space being construed as contested. But since the overwhelming amount of space technology is dual-use, making motive and intent impossible to decipher, in actuality, it is capability that defines space as being contested. That characterization is also in line with traditional military thinking wherein capabilities equal threats. By definition, anything that is dual-use has a military capability and so can be, and has been, considered a threat. A consideration of Chinese space activities provides an example.

Deciphering Chinese intent regarding space is considerably more difficult than surveying known capabilities.67 Analysis must be based on information from a variety of official and unofficial sources, interpretations falling along a spectrum. Underestimating capabilities and best-case intent evaluations risk being unprepared to deal with the threats posed; overestimating capabilities and worst-case intent evaluations can lead to actions which produce unintended consequences and potentially increase the threat to US capabilities. Therefore prudence, regarding both research and drawing conclusions, is imperative.

Open source material, particularly technical journals, are often used as sources of information regarding what space-related programs the Chinese are working on or even just thinking about. However, most technical journals are very technical, focusing on detailed discussions of optics, trajectories, sensors, etc. Those that do 40 Congested, contested, and competitive discuss intent have limited utility as well. As pointed out by longtime China watcher Larry Wortzel, part of the difficulty with “intent analysis” is that “most technical articles from the science digests in China, admittedly, only deal in the theoretical aspects of how to fight war in space and analyze U.S. strengths and vulnerabilities.”68

Beyond technical journals, the volume of information and analysis produced within China and commercially available is increasing exponentially. Wider ranges of “tolerable” opinions are appearing within Chinese academia and the media. Media outlets are proliferating, driven by market competition. Whereas, however, (most) Americans understand the risks of relying on the National Enquirer or a lone blogger for “fact,” the need for similar discrimination with open Chinese sources does not always seem similarly understood by US analysts. For example, while a statement on defense policy from a university professor or a War College student being encouraged to “think outside the box” is understood by Americans as not necessarily reflective of US government policy, the same appears not always true about the output of Chinese authors.

One of the most often cited Chinese quotes on “intent,” dating back to 2000, is that of a junior military officer named Wang Hucheng: “For countries that can never win a war with the United States by using the methods of tanks and planes, attacking an American space system may be an irresistible and most tempting choice.”69 The quote is one of braggadocio—attempting to make the point that the United States, the sole superpower at the time, having demonstrated its military prowess and space capabilities during the 1990–91 Gulf War, could still be beat. Much of his “analysis” of US space vulnerabilities was simply copied from US government documents, including the 1997 and 2001 Quadrennial Defense Reviews and the 1998 Space Command Long-Term Plan.70 It was propaganda intended to draw a reaction from the United States; and it did. The increase in information available from China from numerous sources also increases the potential for communication misfires. That being the case, careful source-checking by analysts is imperative. Unfortunately, both sensationalist interpretations and lax fact-checking was not uncommon during the “quest for domination” years and, according to some analyses, still continues.

For instance, Pentagon annual reports for fiscal years 2003 and 2004 on the military power of the People’s Republic of China71 contained references to Chinese “parasite” satellites for potential use as anti-satellite weapons. Union of Concerned Scientist researchers Gregory Kulacki and David Wright, however, found that a relatively easy Internet search in Chinese places the origin of the story about those satellites with a self-proclaimed “military enthusiast” named Hong Chaofei from a small town in Anhui.72 After Hong’s story first appeared on the Internet in October 2000, multiple iterations and citations followed, and it then found its way into Pentagon analyses. Hong’s website also contained scores of stories on “secret” Chinese weapons to defeat America in a war over Taiwan. China is working on small satellites, but the parasite satellite appears more one man’s fiction than fact.

There are other instances of misinterpretation as well. Challenges to Space Superiority, published by the National Air and Space Intelligence Center at Congested, contested, and competitive 41 Wright-Patterson Air Force Base in March 2005, highlighted quotes by Liying Zhang of the Langfang Army Missile Academy suggesting that China will pose a threat to on-orbit assets.73 Kulacki and Wright again tracked down the quotes and the source, finding several key errors, which are fully documented in a Union of Concerned Scientists research paper on Chinese military space capabilities.74 Key words were omitted from the original Chinese quote, and there were misinterpretations of what was included. For example, “should” (indicating a recommendation about a decision not yet made) was misinterpreted as “will” (indicating what China intends to do or is doing). Further, the author was found to be a junior faculty member at a facility primarily responsible for live fire and simulated training of junior artillery officers where ASAT research is likely not going on and which has subsequently been shut down. It was not exactly an authoritative source for US government planning purposes.

Besides the annual Pentagon report, the US-China Economic and Security Review Commission (USCC) also issues an annual report on Chinese military capabilities, including those relating to space, where information has been questioned. In 2008, for example, testimony used in the report was found, through relatively easy Internet checking, to be factually incorrect.75 The errors included referencing of a defunct Chinese organization as still in existence; reporting the successful launch of a Pioneer rocket that had not actually occurred; and suggesting China does not have a dedicated relay satellite when in fact one had already been launched with a considerable amount of Chinese press coverage. Problems continued, as pointed out by Kulacki in a 2014 blog post titled “The 2014 USCC Report: Still Sloppy After All These Years.”76 There, Kulacki cited problems with the USCC analysis of a Chinese nuclear submarine and suggested broader, ideological concerns about the Commission and the consistently ominous reports it releases regarding Chinese intentions, which are then used for policy and budget planning by organizations like Congress and the Pentagon.

Even without having ideological bents, organizations encounter not inconsequential difficulties in analyzing information regarding Chinese intentions in space. Three in particular stand out: language skills, poor source selection, and insufficient attention to assessing source material. Individuals with no, or limited, Chinese language skills are limited to assessment of only those sources translated into English by individuals themselves perhaps limited in their language abilities. Agencies, such as the Foreign Broadcasting Information Service (FBIS), who translate material for official organizations may not have familiarity with the technical language of aerospace and so limit their sources to, for instance, Chinese newspapers, magazines, and weblogs, some with questionable reliability and perhaps having ideological bias that is not noted. And finally, without a careful assessment of sources, opinion and advocacy pieces (such as often found in the United States as well) are equated with Chinese policy.77 All of these issues complicate an issue already muddied by dual-use technology.

Deciphering the motivations and intentions behind the development of dualuse technology is speculation at best. It is important to remember too that most 42 Congested, contested, and competitive countries do not have the financial or industrial luxury of having a civil space program separate from a military space program and, thus, consider dual-use technology development as a good return on government investment. In order to maximize resources, many countries, including China, France, and Japan, deliberately develop technology or establish organizations and operations for dualuse purposes. They have far less separation between military and civilian space activities and organizations than in the United States, though the lines between US programs are often blurred as well. For example, prior to the Space Shuttle, US civilian launchers were born from missile programs, and the Space Shuttle cargo bay was specifically designed to be large enough to carry large US reconnaissance satellites. Overall, though, the United States is more the exception than the rule in its use of what can be a duplicative approach to space administration and technology development via its civilian and military space programs.

Because of the largely dual-use nature of space technology, virtually any space activity can be deemed as military. Therefore it is (relatively) easier to know what China, or any country, is doing in terms of space activities than why they are doing it. For example, a co-orbital rendezvous and proximity operation satellite in space can be observed. Whether the satellite is intended for such benign operations as assessing damage to another satellite or for nefarious purposes such as ramming into another satellite, or both, can rarely be determined based on hardware.

In 2008, “taikonaut” Zhai Zigang conducted China’s first spacewalk as part of the Shenzhou 7 mission, an expected step in phase two of China’s three-phase human spaceflight program. A small satellite, Banxing-1 (BX-1) dubbed Companionsat, was released from atop the spacecraft. It “relayed back images of Shenzhou 7 from close range, then backed to a distance of several kilometers, testing network technology with the Shenzhou and the orbital module after the deorbit of Shenzhou 7.”78 Subsequent speculation was rampant about BX-1’s true purpose, real intent, and even whether it tried to approach (and thereby threaten) the ISS. For example, Richard Fisher, Senior Fellow at the International Assessment and Strategy Center in Washington DC, stated that

[w]e do not know how close the BX-1 actually approached the ISS. But for me, at closure speeds of 3.1km/second, the Shenzhou-7 was already too close at 45 kilometers. I expect that in time leaks or questions from the Congress will lead to revelations of more data about the BX-1 pass-by of the ISS.79

While the actual danger posed by Companionsat to the ISS was highly questionable,80 the allegations made for great hype.

Hardware does not disclose intent, only capabilities. China has launched a number of experimental satellites in recent years, specifically the Shiyuan, Chuangxin (Innovation) and Shijian (Practice) satellites. Their stated missions have included Earth observation, space weather experimentation, space debris observation, mechanical arm observations, and testing space maintenance technologies capabilities including close proximity operations. Chinese media Congested, contested, and competitive 43 refers to China’s Yaogan (remote sensing) satellite series as intended for disaster relief, Earth observation, and scientific experimentation. However, the highresolution optical or radar satellites are fully funded by the People’s Liberation Army (PLA). Launches of these satellites have been accompanied by a considerable amount of speculation regarding their intended use. Speculation regarding these missions might be compared to the international curiosity concerning the intended use of the X-37B Orbital Test Vehicle by the United States—a classified project that has sparked speculation around the globe as to whether it is, or is intended to be, a space weapon.81

It isn’t just China that is giving Washington headaches. In the post-Cold War years, the Clinton Administration saw cooperation with Russia in space as being in US interests, culminating in 1993 with an offer to Russia of full partnership in the ISS program. Not only could Russia bring considerable space experience to the program, and potentially some cost savings, there were also broader foreign policy considerations as well.82 Specifically, it was not considered in Western interests to have unemployed Russian aerospace engineers roaming the world seeking employment after the collapse of the Soviet Union. But the political environment has changed. In 2014, the Obama Administration slapped sanctions on targeted Russian officials and in economic areas in the hope of persuading Russian President Vladimir Putin to change his aggressive and anti-American foreign policy. Subsequently, Russia’s Deputy Prime Minister Dmitry Rogozin used his Englishlanguage Twitter account to send a message to the United States: “After analyzing the sanctions against our space industry, I suggest the U.S. delivers its astronauts to the ISS with a trampoline.”83

While the United States has been reliant on Russia for astronaut transportation to and from the ISS since the Shuttle retired, it is unlikely Russia would give up the millions it gets to run that taxi service. The ISS is also controlled by centers in both Houston, Texas, and Korolev, Russia, outside of Moscow, which jointly handle operations. Further, the sustained cooperation on the ISS even during periods of intense political strife between Russia and the United States is worth noting as a “lesson learned” for the future. Ironically as well, the workhorse US Atlas rocket uses Russian-made RD-180 engines. There are considerable crossdependencies between the United States and Russia in space. Right now, however, the United States seems more fixated on the resurgence of the Russian military space program. That resurgence, however, should not come as a big surprise.

Russia, in its Soviet Union days, led the world into space with Sputnik and Yuri Gagarin. While the United States won the gold medal in the space race through the Apollo Program, the Russians hold a considerable number of places in the space record book. Early Russian space accomplishments were, and remain, a source of considerable national pride, which had suffered in the post-Cold War years. Russia went from being a global superpower to being referred to as “Upper Volta with missiles,”84 a reference Putin is acutely aware of. The United States assured Russia it would not expand NATO eastward to former Warsaw Pact countries in the 1990s in conjunction with Russia’s acceptance of a unified 44 Congested, contested, and competitive Germany85 but, soon thereafter, did just that because it could and Russia was too weak to do anything about it. Republican candidate Mitt Romney was ridiculed when he said Russia was the number one foe of the United States in a 2012 presidential debate. Romney’s prescience has been vindicated lately though. Rejuvenation of Russian space capabilities is just one way Putin intends to restore the loss of national pride, and respect, that Russia has suffered. The resurgent aspect of its military space program adds to that goal and also serves key national security interests.

Like China, Russia became determined not be left vulnerable by some unbreachable space technology gap after observing the advantages the US military has gained from space since Kosovo. Three space-enabled capabilities are highlighted in Russia’s 2014 military doctrine as main external threats to the Russian Federation: “global strike,” the “intention to station weapons in space,” and “strategic non-nuclear precision weapons.”86 Clearly Russia feels compelled to be able to respond to each.

The Russians see the future of warfare as driven by information and have focused on development of information-strike operations. “An information-strike operation consists of coordinated ‘information-strike battles, information-weapon engagements and information strikes, which are being conducted with the goal of disrupting the enemy troop command and control and weapon control systems and the destruction of his information resource.’”87 Those goals require Russia to maintain access to space, which is why it, like China, refuses to be denied such. Like China, Russia sees its nuclear deterrence as the main guarantee of its national security; hence, Moscow’s continued and bellicose objections to US missile defense on its perimeters— objections that can be more politically based than technically cogent.88

Whereas the United States has consistently argued that deployment of missile defense capabilities into Europe is not aimed at Russia (but, rather, Iran), Russia believes otherwise, or at least claims to. In 2013, to reassure Russia, Deputy Assistant Secretary of State Frank Rose restated a declaration of missile defense intents previously made at the Chicago NATO summit in 2012.

“The NATO missile defense in Europe will not undermine strategic stability. NATO missile defense is not directed at Russia and will not undermine Russia’s strategic deterrence capabilities.” Through transparency and cooperation with the United States and NATO, Russia would see firsthand that this system is designed for ballistic missile threats from outside the Euro– Atlantic area, and that NATO missile defense systems can neither negate nor undermine Russia’s strategic deterrent capabilities.89

Nevertheless, in Russia’s 2014 military doctrine, missile defense was ranked fourth in its prioritization of threats, and Russia has threatened a range of countermeasures in response to missile defense deployment.90 As with many other issues, Putin’s defiant, aggressive, even provocative anti-Western (particularly anti-US) attitude serves him well with domestic audiences and distracts them from Russia’s economic woes.

Russian needling doesn’t seem to have terrestrial limits. In 2015, after some curious maneuvers, Russia parked one of its military satellites between two Intelsat satellites. The US military uses some Intelsat satellites for operations, including drone missions and communications, so the Russian satellite drew angst from the Pentagon. The Russians, however, shrugged off US concern, saying that “in no way can it [the Russian satellite] be an ‘aggressor’”91 and that the chances of a collision were small. This was not the only Russian activity in space that drew US attention though. Russian launches in 2013 and 2014 carried declared communications satellites and also small undeclared objects that conducted maneuvers around the declared payload, maneuvers watched and questioned by analysts regarding whether Russia was testing ASAT capabilities.92

Russia currently has advantages and disadvantages if it wants to reach, and potentially surpass, the United States in military space capabilities. Because many Russian military space systems were allowed to become moribund after the Soviet collapse, Russia is not as reliant on space systems as is the United States. Therefore, Russian satellites are not the attractive targets that US satellites might be; this is especially important to a country like Russia where favoring offense, even preemption, has been traditional military doctrine.93 Whether by choice or necessity, Russia has historically opted for numerous less complex satellites which do not last long but which they are able to rapidly replace. They have a resilience capability that the US military must envy. But Russia also has a steep upward curve to climb in terms of matching space aspirations to capabilities, including both development of across-the-board capabilities and integration of those capabilities into operations. It is also, politically, offering use of what capabilities it has, such as its navigation and positioning system GLONASS, to other countries toward drawing users away from GPS and US influence. Russia is not alone in its use of deliberately provocative tactics to draw US and international ire.

On February 7, 2016, when North Korea successfully launched the country’s second satellite—an Earth observation satellite called Kwangmyongsong-4— Pyongyang celebrated with fireworks and a government spokesman referenced international efforts to block the launch as nothing more than a “puppy barking at the moon.”94 Grandiosity, provocation, and defiance clearly remain the key elements of North Korean foreign policy. While claiming the satellite launch a peaceful use of outer space in accordance with international norms, the international community has viewed North Korean actions differently.

Whether a launch is actually intended to put a satellite into orbit can be discerned technically. Comparing the trajectory of a typical liquid-fueled intercontinental ballistic missile (ICBM) and the North Korean Unha launcher used for satellite launch attempts, David Wright from the Union of Concerned Scientists explains:

The trajectory of a satellite launch and a ballistic missile are very different. … They differ in shape and the length of time the rocket engines burn. … ICBM engines burn for 300 seconds and the Unha-3 engines burn for nearly 46 Congested, contested, and competitive twice that long. The ICBM gets up to high speed much faster and then goes much higher.95

Nevertheless, North Korea can learn a considerable amount about how to develop a successful ballistic missile from a successful satellite launch.

North Korea has become adept at taking advantage of the dual-use nature of space technology, mixed with sometimes nonsensical propaganda, in testing longrange ballistic missiles. While North Korea has a stable of missiles capable of reaching much of South Korea and Japan, it has, officially, yet to flight-test any missiles capable of reaching a distance of more than about 1,500 kilometers. But, North Korea has attempted to launch a satellite into orbit five times, and because the technology is basically the same, they can learn a great deal about long-range missiles from these attempted satellite launches.

The only successful North Korean satellite launch prior to February 2016 was in December 2012; even though the satellite reached orbit, it has appeared to be nonfunctioning. North Korea claimed the satellite transmitted the revolutionary “Song of General Kim Il Sung” and “Song of General Kim Jong Il” after achieving orbit, but that claim has never been substantiated by observers outside North Korea—and there are many who pay close attention to North Korean space activities. In 2009, North Korea had also proudly proclaimed a successful satellite launch and stated that the satellite was transmitting revolutionary songs back to Earth. North Korean officials were, then too, the only ones hearing such songs. That was not surprising because, as tracked by both the United States and South Korea, the satellite had failed to reach orbit and dropped into the sea.96

In 2016, however, US Strategic Command said it detected two items in association with the North Korean Kwangmyongsong-4 launch: a satellite and the final stage of the rocket booster. US officials reported soon after the launch that the satellite was tumbling in orbit and incapable of any useful functions.97 If it had been able to communicate with the satellite, North Korea would have become more adept at satellite operations—a future concern of the increasing number of countries that have shown interest in counterspace operations. In the nearer term, the success of the launch puts North Korea one step closer to having an ICBM; though they have several issues, such as re-entry, still apparently out of their reach. But North Korean persistence in obtaining these capabilities, considered alongside their recent purported test of a hydrogen bomb, has the international community rightly alarmed given North Korea’s often at best erratic behavior.

An emergency meeting of the UN Security Council was held in conjunction with the 2016 launch, resulting in condemnation of North Korea’s violation of UN resolutions banning them from testing ballistic missile technology—under any guise—and a pledge of “significant measures” in response. What those measures will be, however, remains to be seen. Some UN officials have suggested that further economic sanctions on the already largely isolated country would be an appropriate response. China—North Korea’s most important ally—has voiced objections to the “more sanctions” option. China is North Korea’s primary trading Congested, contested, and competitive 47 partner and the country’s main source of food, arms, and energy. China has helped to sustain Kim Jong-Un’s regime and has been historically opposed to harsh international sanctions on North Korea as it fears an influx of refugees across their almost-900-mile, porous border if the regime were to collapse. The recent launch, however, puts pressure on China to get North Korea in line with the international community—a job China has become increasingly weary of given its own financial woes and North Korea’s near constant antics.

The launch also complicates already prickly Asian geopolitical relations. Almost certainly, consequent to the February 2016 launch, the United States will expedite plans for a buildup of US missile defense systems in Asia. Specifically, US and South Korea officials have already said they will consider deployment of the Terminal High Altitude Area Defense system, or THAAD, to the Korean peninsula at the “earliest possible” date.98 China, at odds with the United States over its construction of artificial islands in the South China Sea, objects to placement of a system that includes radar capable of penetrating Chinese territory. To complicate things further, China is also South Korea’s biggest trading partner. As well, Japan and Australia are considering what responses each might take against North Korea as part of a UN response or unilaterally.

Meanwhile, North Korean officials continue to spout provocative declarations about intended further launches. This is a country that timed its satellite launch according to weather predictions and the Super Bowl, wanting to draw as much attention as possible from television viewing audiences. Nuclear and missile technology in the hands of such a narcissistic national actor tests the mettle both of the international community to address challenges to peace and of China to be a responsible part of that community and do its part. Hopefully both will step up forcefully as nobody wants North Korea to become another country creating doctrine and setting up structures to integrate military space capabilities into their defense plans. There are plenty of those already.

In June 2008, Indian Defense Minister Shri A. K. Antony announced the formation of an Integrated Space Cell under the aegis of the Integrated Defense Services Headquarters. The stated purpose was to counter the growing threat to Indian space assets. But further progression of India’s ability to develop and integrate military space capabilities has been slow, largely due to inter-service bureaucracy issues. In 2012, V. K. Saraswat, then chief of the Defense Research and Development Agency (DRDO), emphasized a defensive strategy for India in the space domain, focused on the principle of no space weapons. Nevertheless, Saraswat went on to say that space security entails the creation of “a gamut of capabilities,” including the protection of satellites and communications and navigation systems as well as denying the enemy the use of their own “space systems.”99 The cover of ambiguity courtesy of dual-use technology leaves lots of options for “protection,” especially through missile defense development and testing.

In 2015, Russian Defense Minister Sergei Shoigu announced the creation of a new branch of the Russian armed forces: the Aerospace Force. That restructuring brings the Russian air forces, anti-air, anti-missile, and space forces under one 48 Congested, contested, and competitive unified command. Further, an article in the Moscow Times reported that the government is

pouring 20 trillion rubles ($320 billion) into replacing 70 percent of the military’s hardware with shiny new gear by the end of the decade, it’s rejigging its military doctrines and organizational structures to reflect modern Russia’s threat perceptions – which in recent years have largely centered on NATO expansion.100

Reportedly, 20 percent of that money was allocated to buy and develop systems such as the S-500, intended to have the ability to intercept targets, including ballistic missiles, at the edge of the atmosphere. Russia is expanding not just its military space capabilities but also its ability to use them, and they are not alone.

Reports began circulating in 2015 of a Chinese “space force” being stood up within the PLA. Subsequently, on December 31, 2015, the Second Artillery, which had been responsible for strategic missile forces, was renamed the Rocket Force. This was more than a name change; rather, it was part of what has been tectonic-level reorganization of the PLA to include widespread bureaucratic reforms initiated by Chinese President Xi Jinping. The Rocket Force will be responsible for all three legs of China’s nuclear triad – as opposed to just the landbased nuclear missile under the control of the Second Artillery – as well as conventional missiles.

Similarly, the US Air Force stood up its first Space Mission Force in February 2016 as part of reorganization toward streamlining the chain of command. Earlier, Air Force Maj. Gen. Martin Wheeler, director of future operations, explained the rationale for the reorganization shortly after it was announced in 2015. Whelan said, “We’ve had a hard time integrating and synchronizing air, space and cyber” due to problems with the chain of command for space missions being sometimes dispersed.101 Another part of the rationale was to make better use of skills learned by those in operational positions.

All of the reorganization and modernization efforts demonstrate both the utility of space assets and the challenges with integrating them into operational force use. Space provides capabilities that are needed everywhere, which inherently creates questions about who’s in charge and, potentially, internal conflicts. Additionally, these efforts point out the necessity of both broad and narrow troop training to best fill crucial positions within the bureaucratic space structures.

In the context of a “congested, contested, and competitive” space environment, contested clearly takes on an aggressive, militaristic, zero-sum connotation – one that must be countered in a similar manner. Everyone wants assured access to space; having that access has been considered a universal right. But countries are becoming more proprietary and nationalistic, with the military as protector and guarantor of national rights. From that flows the long-standing assumption within the (many) militaries regarding the inevitability of space warfare. If space warfare is inevitable, then the United States would be remiss not to prepare to defend itself Congested, contested, and competitive 49 and, it has been suggested, perhaps strike first to get a tactical advantage; hence the need for expanded “offensive counterspace” programs. If, however, space warfare is not inevitable, then as much attention ought to be spent on prevention as on “defend and defeat” programs, which may serve as little more than totems of protection. And it is certainly not in the best interests of the United States to create self-fulfilling prophecies. Therefore, a closer look at the “inevitability” debate is in order.

[[NOTES OMITTED]] [[CHAPTER 3 BEGINS]]

Peace is not the absence of conflict, but the ability to cope with conflict by peaceful means.

Ronald Reagan1

In a 2015 article for The Atlantic magazine, Harvard Professor Graham Allison stated that based on historical evidence, the odds of the United States and China going to war were “much more likely than recognized at the moment.”2 His assessment was based on an examination of 16 cases of a rising power confronting a ruling power over the past 500 years, a situation the fifth-century Greek historian Thucydides had considered in relation to the Peloponnesian War. Thucydides wrote, “It was the rise of Athens, and the fear that inspired in Sparta, that made war inevitable.”3 In the 16 cases considered by Allison and his team, war had occurred in 12 instances. Yet, Allison says, war with China is not inevitable. Chinese President Xi Jinping echoed that rejection of inevitability, saying: “There is no such thing as the so-called Thucydides Trap in the world. But should major countries time and again make the mistakes of strategic miscalculation, they might create such traps for themselves.”4 And therein lies the problem and the link between the Thucydides Trap generally and space specifically. Strategic miscalculation is often driven by structural inertia— the same kind of structural inertia created by the powerful and expansive military— industrial complex that is deeply embedded in and exacerbating the security dilemma gripping the United States and China regarding space.

Toward avoiding inevitability, Allison tells strategists looking for a (often politically necessary and budget-friendly) quick fix to step back.

What strategists need most at this moment is not a new strategy, but a long pause for reflection. If the tectonic shift caused by China’s rise poses a Avoiding Thucydides’ trap 57 challenge of genuinely Thucydidean proportions, declarations about “rebalancing,” or revitalizing “engage and hedge,” or presidential hopefuls’ calls for more “muscular” or “robust” variants of the same, amount to little more than aspirin treating cancer. Future historians will compare such assertions to the reveries of British, German, and Russian leaders as they sleepwalked into 1914.

The rise of a 5,000-year-old civilization with 1.3 billion people is not a problem to be fixed. It is a condition—a chronic condition that will have to be managed over a generation.5

Whether US politicians have the patience, the wisdom, and the wherewithal to manage a fundamental, chronic challenge remains to be seen. Similarly, the leadership of China, Russia, North Korea, and other nations must rise to the challenge of seeing beyond the “soda straw” perspective of their own knee-jerk actions. Professor and diplomat John Stoessinger focused on the pivotal role of the personalities of leaders who take their nations, or their followers, across the threshold into war in his book Why Nations Go To War, originally published in 1971.6 Leadership, and the character of leaders, matters.

The Thucydides Trap metaphor holds especially true for space because, as Allison points out in his example of Germany challenging Britain’s naval power, all that mattered in Britain’s assessments was capability, not intentions. Similarly, the US military characterization of space as “congested, contested, and competitive” is based on an assessment of potential competitor capabilities; regarding space, this refers largely to China, but, increasingly, Russia as well. Avoiding the Thucydides Trap therefore requires, as Allison says, more than trite strategy aimed at maintaining an unsustainable status quo; rather, it needs a serious reassessment of an inevitably changing situation.

Is Space War Inevitable?

Four basic schools of thought have traditionally dominated space warfare debates in the United States, including one that says war in space is inevitable7. In his 1999 book Space Power Theory, James Oberg said, “At its core, the notion of weapons in space pits military pragmatists against idealistic futurists.”8 Since 1999, a more nuanced spectrum of views has emerged though those who viewed war in space as inevitable then, largely still do.

The first school argues that US reliance on space for both military and civilian capabilities makes space dominance essential as space represents the “ultimate high ground.” The second states that weaponization is simply inevitable and therefore the United States would be remiss not to prepare. The third school asserts the military importance of space but seeks to maintain limits on the militarization of space, toward avoiding the weaponization of space, and advocates arms control agreements toward that end. Last, there is the space sanctuary school. In its purist form, the sanctuary school advocates for space to maintain a status much like 58 Avoiding Thucydides’ trap Antarctica. How to manage globally expanded space capabilities warrants a closer look at each school in the space warfare debate.

The view that space is the ultimate high ground is analogous to cavalry soldiers holding a hill as the best position to view the surrounding terrain and, if necessary, fight. Similarly, if air superiority is required to win wars, then space is the ultimate high altitude from which to gain military advantage on Earth. Space assets such as reconnaissance satellites can offer the military access to areas otherwise beyond its physical reach. It is important to note that none of the schools are pertinent only to US analyses. Kevin Pollpeter finds references to space as the high ground in Chinese space analyses as well. He states, “Chinese writers make the oft-repeated statement that ‘whoever controls space will control the Earth’ and that outer space is the new high ground of military operations.”9

Space being perceived as “the high ground” comes, in large part, from the stillevolving nature of differentiating air and space domains. The US Air Force has described itself by various names:10 an “air force,” an “air and space force,” an “aerospace force,” and an “air, space and cyber” force. The Chinese appear to be having much the same dilemma in terms of defining and differentiating domains.11

But the “high ground” analogy between Earth and space goes only so far due to differences between the basic physical characteristics of space and the capabilities of ground and air forces. Ground troops can defend and conceal themselves atop a hill. Aircraft can perform rapid self-protective maneuvers in defense of air space. But space assets are bright objects against a dark sky that travel in a determined and predictable path, making them “sitting ducks.”12 Consequently, the advantages offered by space as the high ground come with risks as well. The “high ground” school simply extends a basic principle of military operations to another domain, though the validity of the transference assumptions is limited. The second school is based on a broader assumption.

The adage “Earth is two-thirds water and one-third space studies, most of them chaired by me” is often attributed to the former commander of Air Force Space Command, Gen. Tom Moorman, Jr. For better or worse, most of those studies were promptly relegated to a desk drawer or coffee table. That was not the case, though, when the chair of the study stepped immediately into the position of Secretary of Defense, as was the case with Donald Rumsfeld in 2001. The National Defense Authorization Act for Fiscal Year 2000 created a Commission to Assess National Security Space Management and Organization, to be chaired by Donald Rumsfeld. The report of the Commission, known as both the Rumsfeld Commission report13 and the Space Commission report, was published in January 2001 just as Rumsfeld was about to become Secretary of Defense. Consequently, it was hardly forgotten but, instead, became the basis for US space policy. Key among the conclusions reached was that

we know from history that every medium—air, land and sea—has seen conflict. Reality indicates that space will be no different. Given that virtual certainty, the U.S. must develop the means to both deter and to defend against hostile acts in and from space.14

The inevitability of space weapons was assumed. The United States, the report warned, must act quickly and decisively if it was to avoid a “Space Pearl Harbor.”15 Consequently, the “ahooga” horn sounded throughout not just the Pentagon, but Washington generally.

Among the military officers agreeing with the inevitability of conflict in space was (then, in 2002) Air Force Colonel John Hyten. Writing in Air & Space Power Journal, Hyten charted a course forward from the assumption of inevitability, but also noted the need for space “rules.”

Conflict in space is inevitable. No frontier exploited or occupied by humans has ever been free from strife, but the United States has a chance to mold and shape the resolution of such conflict in the future. Opportunities exist through both formal and informal negotiations to define the commons of space and the rules of the road. At the same time, the United States cannot afford to be caught off guard in the future—and cannot afford to allow another country to deploy a space-based weapon first. To ensure that this doesn’t happen, it must develop a robust program for an entire spectrum of space-control capabilities—deferring the decision to deploy operational, space-based weapons until a clear requirement exists.16

Admirably, Gen. Hyten still talks about rules of the road, but with qualifications.

In response to a question after the keynote speech he delivered at the Small Satellite 2015 conference, Gen. Hyten said,

I hope the State Department has a role in it because I would like to make sure—I always believe that we should talk first, so I hope we do down that path and we develop—you know, we jointly develop what we believe are, you know, rules for responsible behavior in space across the international community.17

But the rapid speed required to keep up with adversaries, he said, means that “everybody is moving fast,” and he sees the need to move even faster. Diplomacy, unfortunately, takes time. He again spoke of the need for rules of the road in space at the February 2016 Air Warfare Symposium in Orlando, Florida, saying there are defined rules in all other domains of military operation. He further stated that norms are important “because it’s hard to develop rules of engagement without international norms.”18 History has shown, however, that the United States cannot dictate to other countries. Therefore, there must be some basis for other countries to be interested in rule development—a benefit to them as well as to the United States.

Just as the 2015 Allison study uses history as its basis for analysis, history is usually the basis for inevitability premises. It has happened in the past; therefore, it 60 Avoiding Thucydides’ trap will happen in the future. History lessons are valuable, but as Allison points out, history does not dictate the future, especially if the lessons of history are learned and considered. Rather than beginning from assumptions regarding military operations or inevitability, the arms control school begins by asking what is in the long-term interest of the United States, since it is the United States that has the most assets in space and is most dependent on them, and then sets a course most likely to achieve those goals.

Arms control advocates argue that while space weapons might offer the United States a short-term advantage, in the long term they would actually weaken US security by instigating an arms race that cannot be won, by anyone. Further, space weapons could potentially provoke a first strike by an adversary, create a “use it or lose it” mentality among US forces, and risk rapid and dangerous—perhaps even nuclear—escalation.

The arms control approach was clearly rejected during the George W. Bush Administration. John Bolton, as Undersecretary of State for Arms Control and International Security, stated the US position clearly and succinctly as follows: “We are not prepared to negotiate on the so-called arms race in outer space. We just don’t see that as a worthwhile enterprise.”19 The rationale was that the United States was ahead of everyone else and arms control would only serve to limit US efforts to maintain that position. Arms control is not specifically rejected now. Frank Rose stated in March 2016, “I would like to point out that the United States is not opposed to arms control in principle.”20 However, his qualifications in terms of “if they are equitable” and “effectively verifiable” nullifies many areas of effort.

A study on verification was conducted by the Eisenhower Center in 201021 with several interlocking key points emerging. First, the idea that maintaining the stability of the space environment could be done without reciprocal constraints on the behavior of all major actors was said to be an illusion. Second, no country will trust verification to another country. Rather, countries will insist upon independent verification and so agreement on constraints will be limited to those measures verifiable by the least capable country. Since the United States has the most capability, serious proposals (vice diplomatic feints) are unlikely to exceed its verification constraints. And third, verification depends both on technical capability and precision of language in describing specific measures. Key in this regard is that “[i]f specificity is sacrificed to consensus, the resulting regime of non-binding, qualified and/or vaguely-worded ‘norms’ may undermine rather than increase stability in space.”22 Arms control efforts are largely unknown to the public, neglected by the media and given far less focus by government officials than counterspace operations. Yet, they can garner the United States far more international traction toward space stabilization efforts than threats of punitive deterrence.

Each of the four schools clearly recognizes the immense value of military space assets. Satellite imagery, three-dimensional radar maps of targets and terrain, GPSguided munitions, troop use of more than 100,000 lightweight GPS receivers, and a bevy of satellites for various uses were used in Operation Iraqi Freedom. This massive use of space assets “enabled military responses to occur in minutes rather Avoiding Thucydides’ trap 61 than hours, resulting in a dramatic reduction in the ‘kill-chain’”23—target identification, force dispatch to target, decision and order to attack the target, and target destruction. But if or when the speed of that kill chain becomes counterproductive, in terms of increasing the potential for mistakes or overreaction, must be considered as well.

The United States, Russia, China, India, Japan, Taiwan, and South Korea are all developing hypersonic missiles capable of traveling over Mach 5, which will reduce the kill chain time significantly. The US Conventional Prompt Global Strike (CPGS) effort aims to be able to deliver ordinance anywhere in the world within an hour. If, however, these weapons are suspected of carrying nuclear weapons, the potential for rapid escalation ensues.24

The fourth school is the sanctuary school, which in its purest form, seeks to maintain space as a sanctuary from military activity or at least to limit space to clearly passive rather than active programs. Dual-use technology, however, makes that differentiation difficult. Alternatively, space sanctuary has also been characterized as an alternative to the “inevitability” perspective,25 more in line with the arms control approach. Clearly, space offers military advantages on the ground through force enhancement that all countries seek, making the maintenance of space as a pristine, military-free domain unlikely.

Perhaps ironically, Oberg points out, “the popular view of space as a sanctuary, is one carefully crafted by the United States.”26 In doing so even while having a military space program that dwarfed the rest of the world, the United States ensured that actions taken against it by other countries would be viewed in terms of those countries violating this sanctuary. The 2016 CNAS report From Sanctuary to Battlefield seems to bear out Oberg’s view. There, it states that “US space assets enjoyed a degree of sanctuary for many years due to the significant technical challenges to being able to strike at or interfere with satellites.”27 Defense Secretary Ash Carter, in a March 2016 speech, reiterated the idea that the days of space sanctuary are gone, this being a rationale for why the Defense Department must now “prepare for, and seek to prevent, the possibility of a conflict that extends into space.”28 With other countries wanting the same rights to and advantages from space that the United States has enjoyed, they have worked assiduously to improve their technical capabilities.

An increasing number of countries are moving into or expanding their military space programs. In 2014, European Space Agency (ESA) Director Jean-Jacques Dordain commented on the likely future expansion of the military component of ESA activities.

As concerns military space activities, this represents so far the largest deficit of Europe as compared to other space powers. Space in Europe has been started as a civilian activity and military space activities are limited in size and scope so far. However there is an increasing number of programmes that, even though civilian may have military or security-related users – such as Galileo or Copernicus. The ESA itself is not a civilian agency. It is an agency 62 Avoiding Thucydides’ trap for peaceful purposes and may have programmes with a security component. If and when Europe needs space as an enabling tool for its security and defence policy, ESA will be prepared to develop the required programmes.29

Besides working together, European countries also have their own national space efforts, and it is there that a considerable amount of work on military space occurs. For example, French spending on military space programs increased by over $500 million in 2016, focused on next-generation optical imaging spacecraft, signals intelligence, and satellite communications.30 Even countries like Japan that once defined “the peaceful use of space” as meaning “nonmilitary” have now altered that definition to allow military use, simply as a reflection of reality. And perhaps most importantly, declaring space a sanctuary would, quite simply, not be in the best interests of the United States. But keeping space a sanctuary from violence has until recently been increasingly recognized as imperative.

Over time, there has also been more experience with the potentially deleterious and escalatory effects of space warfare through computer simulations and wargaming. Rarely, however, are these effects made known to the public in the same way that “The Battle Above” focused on revealing threats to the public. Since 2001, Air Force Space Command has been hosting the Schriever Wargames, named in honor of Air Force General Bernard Schriever. In 1961, Schriever was named the first commander of Air Force Systems Command, in charge of all missiles. The wargame began as a venue to examine the utility of advanced space technologies in various scenarios and evolved into an opportunity to consider policy and strategy issues as well as how diplomatic, economic, and information tools of power come into play. While originally focusing on issues related to space systems, cyber system challenges have been integrated into the game as well.31 While the specifics of the scenarios that trigger conflict are classified, the first Schriever wargame was generally known “to pit a friendly ‘Blue’ force against a near space-peer adversary known as the ‘Red’ force. ‘Red’ has been threatening a smaller, neighboring ‘Brown’ nation, and ‘Blue’ intervenes on ‘Brown’s’ behalf.”32 It would not be difficult for anyone, or any country, to imagine that Blue represented the United States, Red represented China, and Brown represented Taiwan.33 China certainly had no such difficulty.

Over the years, a plethora of issues and lessons learned have been identified. Perhaps key among them are the dangers of rapid escalation and the far-reaching consequences of space warfare. Military space assets are not the only assets that would become jeopardized in space warfare. Commercial space assets and military assets widely used by the civilian sector, such as GPS, are all put at risk. Writing after the Schriever V wargame, Congressional Representative Terry Everett, who played the US President in the game, wrote about the reach of space conflict in the midst of a still-deepening crisis.

I wondered how to explain to the American people that we had worked tirelessly with our coalition partners to defuse a crisis which had already resulted in the loss of global transport and communications services—services which deprived the people of the world the information they needed every day for national security, commerce, to transport goods, and maintain their way of life.34

The conditions on Earth which provide conflict “firebreaks”—borders, coastlines, mountain ranges, which cause troops and operations to pause—do not exist in space, making it an inherently unstable environment susceptible to rapid escalation. Further, there are no history books to pull from that provide “war-ending” lessons learned.35

Only recently, in the 2016 CNAS report, have the escalatory risks of space warfare, regularly noted in past analyses, been largely dismissed and assumptions made of “reasonable” responses to attacks—though few have been evidenced prior in wargames—or an anticipated “fog of war.”

Would the United States respond with a major strategic strike if China or Russia, in the context of a regional conflict with the United States, struck discriminately at implicated U.S. space assets in the attempt to defang U.S. power projection, all while leaving the broader U.S. space architecture alone? Not only does such a massive response seem unlikely – it would be positively foolish and irresponsible. Furthermore, would other nations regard attacks on assets the United States was actively employing for a local war as off limits to attack? Indeed, any reasonable observer would have to judge that such discriminate attacks on U.S. space assets would not necessarily be illegitimate, as, by the United States’ own admission, it relies greatly on its space architecture for conventional power projection.36

Assuming that an adversary, or even the United States, would be prudent and reasonable if one or more of its space assets were under attack is a dangerous gamble for both doctrinal and structural reasons.

Challenges regarding command and control of space assets and the need for integration and prior coordination with allies have also emerged from the Schriever games, with no easy answers. The ability for the military to protect valuable space assets, including by preemptive and even preventive strikes, may well rest on its ability to act quickly and decisively. Yet ceding authority to take rapid action to the military comes with risks as well. Ambassador Lincoln Bloomfield addressed that conundrum after Schriever V.

The question for the National Command Authority is, what if the worst-case characterization of the threat is incorrect? What if the first destructive action was an accident? Or a one-off demonstration intended as a political warning to the US relating to broader issues between the two adversaries? What if the attribution to a particular adversary was incorrect—perhaps even manipulated through offensive cyber operations by a third party provocateur? The point here is two-fold. As with any escalating crisis, the protagonists in a conflict are political actors, and the issues being contested are geopolitical; and thus the US management of the crisis must of necessity include the civilian as well as military leadership. Second, a hair-trigger kinetic response in space by the US confers more risk than advantage, and should be avoided as a matter of operational tradecraft, to allow a discrete period for better characterization of the intent of the adversary before irrevocably harmful escalation is undertaken.37

The risk of escalation has not abated but, instead, potentially increased with the advent of technology that increasingly cuts into decision-making time and kill chains as well as the increased potential for mistakes and miscalculation due to congestion and more actors. The potentially complicating considerations of more actors as stakeholders in space have come to light as well.

The need for international coordination was recognized and addressed in the first international version of the Schriever Wargame in 2012 (SW12I), conducted at Nellis Air Force Base in Nevada. The intent was to emulate a notional NATO operation with reliance on space-based capabilities provided by member countries. Nine NATO nations, Australia, six NATO groups, nine US organizations, and representatives of the commercial space industry participated. One of the takeaways from the game was a recognition of the need for all countries and organizations to develop coordination and cooperation mechanisms that set standards and guidelines in the area of Space Situational Awareness (SSA), which often means others adopting US Air Force standards. The post-game report noted that “[t]he challenges of developing the right channels of cooperation during an on-going operation is time sensitive and risky.”38 The competing needs of acting quickly in a high-risk environment while dealing with the multiple challenges of a fast-moving situation have become a recurring theme in even the unclassified space wargaming reports.

For the 2015 wargame, some 175 military and civilian experts from various US government agencies as well as representatives from Australia, Canada, and the United Kingdom participated. Though the results are classified, the annual press releases do provide insight.

As the wargame unfolded, a regional crisis quickly escalated, partly because of the interconnectedness of a multi-domain fight involving a capable adversary. The wargame participants emphasized the challenges in containing horizontal escalation once space control capabilities are employed to achieve limited national objectives.39

In other words, events spiraled rapidly.

Prudence requires that based on past analyses, simulations, and even statements by warfighters, it must be assumed events could and would likely escalate rapidly and dreadfully in space warfare. Alternatively, if it is to be assumed that limited space war is possible and adversaries would understand and agree to US expectations for non-escalatory responses, then taking steps to assure that other countries clearly understand and agree to those US assumptions is a necessary component of that approach. That requires dialogue and actions not currently being pursued with the same vigor as war plans. Yet the complications of space dialogue and space arms control are no less challenging than the complications of the inevitability school.

### Article IX ADV---1AC

#### Advantage two is ARTICLE IX.

#### Failure to invoke Article IX in response to Russian pre-positioning has created the perception that Article IX is dead letter.

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The second legal obligation and the legal right in Article IX are cojoined and have little or no precedent in the international arena.\* The second legal obligation in Article IX states: “If a State Party to the Treaty has reason to believe an activity or experiment planned by it or its nationals in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment.” This segment of Article IX creates a legal duty upon a state to consult with the international community, presumably through the United Nations and specifically the Committee on the Peaceful Uses of Outer Space (COPUOS), in the event a state believes its planned space activities, including those by nongovernment actors, could potentially cause harmful interference with the peaceful exploration or use of outer space by other state actors or their nationals.

Unlike the first legal obligation of Article IX, this legal obligation has never been invoked by any state preceding a potentially damaging outer space activity. This is the case even though there have been substantial outer space activities by both the United States, the Soviet Union/Russia, and the People’s Republic of China, which could have warranted its application—in particular the test of anti-satellite (ASAT) weapons. As Article IX was not invoked prior to these activities opens the question whether by not invoking the legal duty to consult for these activities a customary practice relating to Article IX has been created that reflects not when the duty to consult needs to be invoked but rather when it does not.\* \*\*\*FOOTNOTE BEGINS\*\*\* The original intent of Article IX to obligate states to consult prior to activities (presumably military activities) that could create “harmful interference” is for the most part nullified as no state wants to be the first to invoke the legal obligation and create a customary usage of not only what “harmful interference” is but when the legal duty to consult should be invoked. None of the Big Three have obligated themselves to the consultation duty in Article IX. This is not surprising because each of these states have sufficient prestige in outer space activities to establish by their own actions a customary practice of when the legal obligation to consult under Article IX is triggered. This in turn would create an international litmus test for the duty to consult under Article IX, which could expose national security activities in outer space to unwanted scrutiny. Likewise, the right to request a consultation is unlikely to be invoked by spacefaring nations for the simple fact it would invite abuse by geopolitical competitors who would question an activity merely to embarrass or harass a geopolitical competitor. \*\*\*FOOTNOTE ENDS\*\*\* The idea behind this is during national security/military activities in outer space, which could potentially require the Article IX duty to consult be invoked, the consistent state practice in not invoking the legal duty to consult and the intent to be legally bound to the practice not to consult on national security activities creates a state practice of Article IX that relates to national security/military activities. The result of this is not to disregard the duty to consult but rather create state practice that excludes national security activities.

It is notable the 2007 ASAT test performed by the People’s Republic of China (PRC) was claimed by Beijing to be consistent with international law, and likely so as Article IV would have permitted it. China also may have relied on the precedent created by the ASAT activities of the United States and the Soviet Union during the Cold War to justify not only its ASAT test but also its decision not to invoke the consultation requirement in Article IX.

To further illustrate this effect on Article IX, the United States prior to Operation Burnt Frost sent a representative from NASA’s Orbital Debris Office to brief COPUOS on the impending intercept attempt of USA-193. Significantly, the United States did not invoke the consultation requirement in Article IX when this consultation was made, which lends further support to a customary practice of when the legal duty to consult need not be invoked (but see Mineiro 2008, for an analysis of Article IX and its applicability to the FY-1C ASAT test and the USA-193 intercept.)

Consequently, while the military—in particular the Air Force—may have inadvertently instigated the creation of Article IX and its legal duty to consult through Project West Ford, its activities and the national security activities of other agencies and nations in orbit to include ASAT tests created an ad hoc rule of the legal duty through state practice that has legal recognition.

Notwithstanding the observance of the first legal duty by state space actors, the fact the second legal obligation has not been invoked gives Article IX the false reputation as a dead provision of the OST when in fact its applicability to military and national security activities has been refined by custom.

#### That’s causing a laundry list of existential regulatory failures stemming from institutional fragmentation---normalizing Article IX channels is key.

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8.2.2.7 Lack of Intent Clarification and Dispute Resolution Mechanisms

Under current international law, States can deploy weapons in outer space. While legal limitations exist on the type of weapons that may be deployed and the scope of such deployment, in some instances the extent of these limitations is unclear. This lack of clarity may lead to a dispute which threatens the peace and security of the international community. Such a dispute may occur if space weaponization activities are conducted within the lacunae of the current space law regime.

The current legal regime requires little, if any, transparency and provides no particular mechanisms for dispute resolution. The reporting requirements established under the Registration Convention provide very little transparency, allowing States to effectively conceal whether or not a registered object is a space weapon.59 The Outer Space Treaty does provide for the application of international law and the United Nations Charter. Thus, in case of a dispute relating to outer space weaponization, in accordance with article 2(3) of the Charter, States are obligated to negotiate in good faith under article 33 of the Charter.60 However, in the event that negotiations fail, few other methods of dispute resolution are available. While Article IX of the Outer Space Treaty calls for international consultations, it is unclear whether the deployment of a space weapon alone triggers this obligation and even if it does, to what extent such consultations are to be taken.61 \*\*\*FOOTNOTE BEGINS\*\*\* 61 See Michael Mineiro, “FY-1C and USA-197 ASAT Intercepts: An Assessment of Legal Obligations under Article 9 of the Outer Space Treaty” 34(2) Journal of Space Law 321 (2008). \*\*\*FOOTNOTE ENDS\*\*\*

8.3 The Maintenance of International Peace and Security

Up until this point in the chapter, we have examined how the current international regime of space technology trade and proliferation controls impact the ability of States to cooperate internationally on civil space endeavours, as well as the nexus between arms control, disarmament, proliferation and international cooperation. This examination has explicitly contended that the impact of the current international framework inhibits international civil space cooperation. To support this contention, specific examples were given of current international cooperative ventures, the limitations of these ventures, and also descriptions of the lacunae in international law that contribute to the international space security environment in which States operate. Notably absent has been the central question of whether or not the international community needs greater cooperation in outer space. While it has been implied that there is necessity for greater cooperation, it has not been articulated as to why.

Central to the challenge of determining a necessity is establishing an “objective” metric upon which the community can agree. In this section, it is proposed that one appropriate metric to assess the need for international space cooperation is the principle of “international peace and security.” On this basis, it is contended that international civil space cooperation is obligated in order facilitate collective measures that are necessary to maintain international peace and security.

8.3.1 General Duty to Maintain International Peace and Security

The maintenance of international peace and security is an issue without geospatial bounds and this principle is as applicable on Earth as it is in outer space. A fundamental legal principle in international space law is that States must undertake their activities in outer space in the interest of “maintaining international peace and security.” 62 Underlying this principle is a deeply rooted ideal that the maintenance of international peace and security is a priori to our collective human interests.

The general understanding of international peace and security derives from World War II and the United Nations Charter. Founded in the tumultuous years of World War II, the U.N.’s primary mission is to “maintain international peace and security.”63 To that end, the U.N. and her Member States undertake “collective action measures for the prevention and removal of threats to the peace, and for the suppression of acts and aggression or other breaches of the peace, and to bring about by peaceful means, and in conformity with the principles of justice and international law, adjustment or settlement of international disputes or situations which might lead to a breach of peace.”64

The errors of World War I and World War II, the historical use of armed conflict to resolve disputes, and the failure of the Kellogg-Briand Pact were the impetus behind this general understanding of international peace and security. But in the sixty-five years since the founding of the United Nations, the idea of international peace and security and its maintenance by the international community has evolved well-beyond the scope of inter-State conflict resolution. Under the auspices of maintaining international peace and security, the United Nations and her Member States engage in actions as diverse as intra-State humanitarian intervention,65 environmental protection,66 and international criminal tribunals.67 Through their actions, the international community is recognizing that the maintenance of international peace and security is a concept that should evolve over time to meet the challenges of the current generation and that breaches and threats to international peace and security need not necessarily take the form of inter-State armed conflict.68 Instead, the determination of what constitutes a breach and/or threat to peace and security has shifted to an assessment of the underlying impact and/or effects of the particular issue and/or event in question. State practice indicates that so long as it is determined that an issue threatens to destabilize the broader goal of international peace and security, the international community may exercise collective measures.69 This assessment holds true even if the issue and/or event only destabilizes peace and security at a local or regional level.70

8.3.2 Outer Space and International Peace and Security

Outer space is also experiencing an evolution in the conception of what constitutes a breach or threat of international peace and security and how the international community should respond. Traditionally the question of outer space and threats to international peace and security focused on possible issues of friction that may arise between space-faring States, in particular those related to territorial delimitation, claims of “outer space” appropriation, and the use of armed force.71 Today, new issues are emerging that support broadening the concept of peace and security beyond the traditional inter-State conflict model. These new issues incorporate environmental, security, and economic interests that transcend any particular State, issues that necessitate effective international collective measures for prevention, control, and removal.

8.3.3 Examples of Emergent Space-Based Threats to International Peace and Security

8.3.3.1 Outer Space Arms Race

The possibility of an outer space arms race has been declared a grave danger to international peace and security by the General Assembly of the United Nations.72 The danger of an outer space arms race represents an emergent threat to international peace and security. This threat is all the more acute because the current international legal regime applicable to outer space does not address the issue of development or deployment of outer-space and/or terrestrial based weapons whose targets are located in outer space.73

8.3.3.2 Space Debris (Space Environmental Degradation)

Space debris poses a danger to the sustainable and continued use of outer space within particular orbits around Earth. Projections of future space debris in outer space include the possibility of cascading debris fields and the complete destruction (e.g. the inability of spacecraft to operate within or through an orbit) of particularly important orbits (such as highly populated GEO and MEO).74 Given our significant terrestrial reliance on space-based applications (e.g. GPS, Remote Sensing, Telecommunications, Nuclear Verification Safeguards), space debris is an emerging threat to international peace and security to the extent that it has the potential to limit our future ability to use outer space.

8.3.3.3 Near Earth Objects (NEO)

NEOs have been identified as a threat to the health, wellbeing, and survival of the human species.75 International efforts to combat the threat of NEO collisions are developing.76 As the international community develops more accurate NEO Earth collision threat assessments, combating NEO threats may emerge as a necessity for the maintenance of international peace and security.

8.3.4 The Enhancement of Global Security

Related to the maintenance of international security is the emergent conception of global security, a conception of international security that identifies with the increased interconnectedness of the global community and the necessity of States to address transnational security threats. Within the discourse there are different opinions as to the nature and scope of global security commitments. Some advocate for a conception of global security to include human metrics, often termed “human security,” that are made of seven components: food security, environmental security, economic security, health security, personal security, community security and political security.77 Others call for global security to incorporate a post-Cold war approach of “cooperative” security that engenders WMD controls, proliferation controls, transparency, monitoring, and international supported concepts of effective and legitimate intervention.78 Regardless of the position taken, what is certain is that the international community of States has begun to recognize that traditional concepts of unilateral State security do not effectively function in the modern globalized community of States.

The facilitation of international civil space cooperation and collective utilization of space technologies can enhance global security through the use of space-based applications that advance human interests and combat transnational security threats. This is an important additional justification under the rubric of maintaining international security.79 Examples of space-based applications that enhance global security include: natural resource management and environmental monitoring80 information and communication applications,81 meteorology,82 risk reduction and disaster management.83

8.3.5 Space Technology and International Peace and Security

The needs to effectively combat the aforementioned emerging threats, as well as to enhance global security, will require the international community to engage in collective efforts that at certain times will include international technology sharing, exchange, co-development, transfer, and operation. Each case will have unique requirements as to the method, type, and extent of technology facilitation that should be taken. The following causal categories of technology facilitation are illustrative.

8.3.5.1 Harmonized Technology Standards

Certain issues will require all spacecraft and personnel to have harmonized technology. Implementing the standardization of technologies will include some degree of technological sharing, transfer, co-development, exchange, licensing, and/or sale. The need for harmonized technology standards will most likely initially arise to combat space debris84 and to support international crewed space operations.85

8.3.5.2 Verification and Compliance Monitoring

The outer space physical environment and the technical considerations of spacecraft will most likely require methods of arms control and disarmament verification and compliance monitoring that incorporate either into particular technologies directly in spacecraft or that require shared verification and safeguard technologies. Simply relying on independent “national means” of verification and compliance monitoring may not be sufficient due to technological impediments and/or monopolization of relevant monitoring technologies.86

8.3.5.3 Global Technology Development

Certain outer space endeavours will require levels of technological expertise and industrial capacity beyond the means of any one country.87 In such cases the collective technological resource potential of the global community will need to be tapped. The needs for global technology development will range from facilitating global security applications to combating specific space-based threats to international security.

8.3.6 Limitations of the Current International Technology Trade and Control Framework

As discussed supra, the current international framework governing space technology trade and controls is rooted in national control regimes and is designed first and foremost to protect the national security interests of individual States. The need for global technology sharing, exchange, co-development, transfer, and operation is not explicitly incorporated into the international framework. Notably absent is an international organization to facilitate outer space collective actions for either the maintenance of international peace and security, or more generally, for the peaceful development and use of outer space for all of mankind. Space technologies remain within the purview of national political and legal systems. In short, the current international framework is not designed to facilitate global space operations, nor the global development and use of technology. It is a framework rooted in the traditional model of space activity as a national activity.

For the time being, this means that technological facilitation of international collective actions to combat emergent outer space threats to international peace and security, and to enhance global security, will require ad-hoc case-by-case political and legal arrangements. States will enter in bilateral and multilateral agreements and/or arrangements as they deem necessary. But this approach carries with it several problems.

• Ad-hoc threat assessment may result in a response delay (a delay that could significantly increase the threat)

• Ad-hoc agreements and/or arrangements in which members of the international community can opt in or out without political and/or legal ramifications carry particular collective action problems.88 Because combating space-based threats to international peace and security, as well as the enhancement of global security, is a non-frivolous public good, States with the capability to contribute have an incentive to either “free-ride” or delay in participating in a response.

• Ad-hoc agreements and/or arrangements will exclude the global community from participation. This may result in several negative outcomes including:

(1) Political backlash from non-participating States89

(2) Economic costs that will not be distributed globally, burdening only those States who undertake action

(3) Technology that will not be pooled globally, potentially resulting in unnecessary duplication and/or a reduction in its development

(4) Non-participation of the global community may hinder the implementation of terrestrial elements to space-based operations (e.g. TT&C)

(5) Non-participating States may not have access to necessary technologies

• National space agencies must first and foremost satisfy their domestic political constituents. It is very likely that the interests of the global community will be secondary to the respective national interests of participating States absent an international organization to coordinate collective action.

8.4 Cooperation and Mutual Understanding

In addition to maintaining international peace and security, there are also legal justifications for reforming the current international framework in order to promote international cooperation and mutual understanding. In international law there is a general obligation to promote cooperation and mutual understanding. As proclaimed in the Declaration of Principles of International Law Concerning Friendly Relations and Cooperation Among States, “States have the duty to co-operate with one another, irrespective of the differences in their political, economic and social systems, in the various spheres of international relations, in order to maintain international peace and security and to promote international economic stability and progress, the general welfare of nations and international co-operation free from discrimination based on such differences.”90 This duty is reiterated in Article III of the Outer Space Treaty, obligating States to carry on activities in the exploration and use of outer space, in the interest of promoting international cooperation and mutual understanding.91 The term “international cooperation” is also found in Article 1(3),92 Article X,93 and Article XI94 of the Outer Space Treaty.

#### Invocation solves AND spills over to buttress US leadership on space governance.

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Ironically, the United States had an opportunity to strengthen the authority of Outer Space Treaty, in particular Article IX, when it announced its plan to intercept its crippled satellite USA 193. As part of its preparation to inform the general public and international community of the impending intercept, the United States, through NASA, briefed the UN’s Committee on the Peaceful Uses of Outer Space (COPUOS) concerning its plans for USA 193. However, instead of citing Article IX as its rationale for informing the international community, it took the position that the planned intercept of USA 193 did not trigger its obligations under Article IX. Arguably, the United States may have been correct in its legal assessment that the intercept did not trigger its Article IX obligations, but at the same time it missed an opportunity to set a precedent in international space law. Invoking Article IX would have set a precedent for future activities similar to the USA 193 intercept by other signatories to the Treaty, and it would have also bolstered the legitimacy Article IX as well as the general body of international outer space law.5

The above illustrations highlight only one of the problems faced by international space law. The remaining four treaties each designed to enhance the Outer Space Treaty also face similar problems in terms of interpretation and enforceability, with perhaps the Moon Treaty facing the greatest hurdles considering that neither the United States, the Russian Federation, nor China have recognized it as legally binding upon them. Given these inherent problems, how can a defunct research satellite that is falling to earth create an opportunity for the United States to reaffirm and strengthen international space law? The answer lies in the Liability Convention.

The Liability Convention and missed opportunities

The Liability Convention of 1972 expands upon the principles of liability for damage caused by space objects introduced in Article VII of the Outer Space Treaty. The Liability Convention envisions two scenarios where damage could be caused by a space object. The first scenario envisions a space object that causes damage to the surface of the earth or an aircraft in flight. The second scenario envisions an event where a space object causes damage someplace other than the surface of the earth, i.e. outer space or another celestial body.

For each scenario there is a separate standard of liability. In the first scenario a state is considered strictly liable for any damage caused by a space object launched even in the face of circumstances that are outside a state’s control. If more than one state is responsible for the launch of the space object in question those states then will be held jointly and severally liable for any damage caused. The second scenario under the Liability Convention holds a more burdensome standard of liability in that it employs fault liability. Under this standard, a state will be considered liable only if it can be shown that it was due to the fault of the state or states responsible for the launch of the space object, as the case may be.

The first and perhaps most infamous application of the first scenario envisioned under the Liability Convention was the reentry and subsequent crash of the RORSAT Cosmos 954 on January 24, 1978, in the Northwest Territories of Canada. The crash spread radioactive debris from the onboard nuclear reactor that powered Cosmos 954’s radar. The debris from the satellite, which was registered to the then Soviet Union, was located by Canadian authorities and initially identified as coming from Cosmos 954. Canada’s Department of External Affairs issued a diplomatic communiqué invoking Article V of the Rescue Agreement, whereby the Canadian government informed the Soviet Union that per its obligation under that Agreement it discovered what it believed to be the remnants of Cosmos 954. After the identity and origin of Cosmos 954 was confirmed, the Canadian government made its formal demand to the Soviet Union pursuant to the Liability Convention for costs associated with the cleanup of the debris and any resulting damage.

The diplomatic efforts of both governments led to an agreement for compensation, but despite the use of international space law as a means to resolve the incident, Cold War politics was likely the motivating factor. The resulting agreement and compensation actually paid by the Soviet Union is seen more as a punitive measure for the Soviet Union violating Canadian airspace than a means of compensation for the costs of cleanup and damages under the Liability Convention. The end result is that instead of enhancing the body of international space law, both Canada and the Soviet Union efforts may have done more harm to it than good.

A piece of Skylab debris on display at the 1979 Miss Universe contest held in Perth (Source: the Australian Government).

Another incident that could have implicated the Liability Convention and international space law occurred over a year later when Skylab fell from orbit on July 12, 1979. The United States assured the international community at the time that any debris from Skylab that survived reentry would likely fall in the Indian Ocean. Contrary to that assurance, several pieces of debris fell in the Australian town of Esperance, and authorities in Canberra were alerted.

Shortly thereafter, officials from NASA arrived to inspect and collect samples of the debris. The citizens of Esperance were encouraged to bring pieces of debris to the officials for which they were given a commemorative plaque and a model of Skylab. The officials from NASA did not collect all the debris, and in one case a piece of debris was turned over to the San Francisco Examiner, which was offering a $10,000 reward to the first person who could bring a piece of Skylab to the paper’s newsroom. Aside from the plaques and models, there was no official compensation for the debris falling on the town; however, a ticket was issued a year later by the president of the town council against the United States for littering, which the United States government has yet to pay.6

Otherwise, no formal claim was made by Canberra under the Liability Convention for the incident, and one can only speculate as to Canberra’s rationale for not doing so. It is noteworthy that it seems the United States never officially identified the debris as coming from Skylab, and the fact that the United States never collected all the debris seems to bear that out. Still, it is possible that the lack of appreciable damage or politics alone figured into Canberra’s decision not to press a formal claim for compensation against a Cold War ally. That a formal claim wasn’t filed represents another missed opportunity that could have otherwise set a legal precedent bolstering the legitimacy of international space law.

The Liability Convention and its implications for UARS

The potential for debris from UARS landing in a populated area creates the possibility that the Liability Convention may once again come into play. As noted earlier, an agent of the United States government publically stated that any debris from UARS remains the property of the United States government, thus if a claim for damages is made, it may be more difficult for the United States to shrug its shoulders and walk away as it appears to have done with Skylab.7

Per the Rescue Agreement, a claimant that found debris would be required to inform the United States of its discovery and facilitate the return of the debris to the United States. The claimant then would be in a position to file a claim for damages from the debris from UARS under the first scenario under the Liability Convention holding the United States strictly liable for those damages. At this juncture the United States would be left with two choices: Either present a legal rationale to ignore a legitimate request for compensation or admit liability and enter into good faith negotiations to address that request.

While the former may be difficult to achieve given the strict liability standard of the Liability Convention under the first scenario, it is not entirely insurmountable. Considerations of political rhetoric aside, denying liability would only serve to further weaken the authority of international space law. Furthermore, taking this path would certainly weaken the long-standing position by the United States that the existing in-force regime of international space law is sufficient to guarantee the right of all nations for access to, and operations in, space.8

While the legal arm of the United States might be loath to even consider the latter choice, the decision to do so would not be without its benefits. There is the inherent risk that the claimant would take advantage of an admission of liability and make a claim for damages far and above what actually occurred. There is also the risk that an admission of liability would be used by a claimant to get its fifteen minutes of fame on the world stage by parading the debris in front of the media and making a spectacle for all the world to see. However, the potential benefits of admitting liability would far outweigh the temporary inconvenience these risks would present.

The primary benefit to the United States in choosing to accept liability is that doing so would set a precedent that would strengthen the authority of the current body of international space law. Not only is this good for the legal regime in general, but it would also bolster the position by the United States that the current body of international space law is sufficient to guarantee the right of all nations of access to, and to operate in, space.

The United States could also find itself in a better position to go on the diplomatic offensive against those nations who prefer an expansion of the current legal regime, such as the Russian Federation and the People’s Republic of China. By accepting liability under international law, the United States could demonstrate that one of the solutions to the issues surrounding access to outer space is not to create more treaties, but rather for nations to abide by the current ones. The United States could find such leverage useful as it prepares to convince the international community that transparency and confidence-building measures (TCBMs) can be used to build upon the current body of international space law instead of creating new treaties to address old problems.9

Certainly not least of the possible benefits the United States could receive from fulfilling its obligations under the Liability Convention is the integrity that would allow it to stand up on the world stage and demonstrate that it not only supports support international space law through its word but through its actions as well. Standing such as this could silence or, at the very least, give pause to the political rhetoric of those who speak of their support to the precepts of international space law while at the same looking for opportunities to avoid it.

#### Controls responses to every risk.

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We live in “a time of profound transformations to our global context,” stressed Klaus Schwab, Founder and Executive Chairman of the World Economic Forum, during the presentation of the Global Risks Report 2015,4 in Davos, Switzerland. For him, mankind faces the accelerated effects of climate change and the increasing uncertainty about the global geopolitical context. Going further, the Bulletin of the Atomic Scientists Science and Security Board, in a recent analysis, pointed out that “ in 2015, unchecked climate change, global nuclear weapons modernization, and out-sized nuclear weapons arsenals pose extraordinary and undeniable threats to the continued existence of humanity.”5 That led its Doomsday Clock to be advanced by two minutes. Today it marks three minutes to midnight, the moment of the Earth's collapse.

There are many other reports and studies alerting to this catastrophe. Such an immeasurable disaster on Earth may affect all space activities, and their legal achievements. While focusing on outer space and space activities, international space law can be considered not only a probable victim of this disaster, but also an important instrument capable of preventing it. The fundamental 1967 Outer Space Treaty,6 as its Preamble points out, is inspired “ by the great prospects opening up for humanity as a result of man’s entry into outer space” and recognizes “ the common interest of all mankind in the progress of exploration and use of outer space for peaceful purposes.”

This obviously means that the fate of humanity is in the core of its attention. This paper attempts to demonstrate the ability and the need for international space law to face the critical situation of the Earth in extreme danger, including the legal examination and the use of juridical provisions presented in the recommendations of the main scientific documents already drawn up on this transcendental subject. In conclusion, some viable initiatives in the space law field are proposed as contributions to efforts to provide Earth with new guarantees of survival.

I. The Preventive Function of Law

The paper’s proposals raise the opportunity and the need to expand the scope and the objectives of international space law, including in it specific space issues of the Earth and of its life expressions. Furthermore, it is timely to underline that “ in today’s world, the preventive function of law is more vital than ever,” as observed Manfred Lachs (1914-1993) about 28 years ago. For him, it would be necessary for men around the world to feel this reality, “ in order to incite them to abandon something of the parish spirit and give them the feeling of the existence of a common interest, and of responsibility in application of law in the everyday life of nations, as well as to make them understand that, as usually is said, it is worth more act wisely together than commit follies separately,” At the same time, as a notable jurist and thinker, Lachs foresaw the dangers that the Earth is currently experiencing: “Today, it is required to work at a time when science and technology have placed in man’s hands weapons capable of creating a danger to life and even cause total destruction; when modern techniques create other dangers threatening the earth, water and air; when economic and political relations between the states require that a new order abolishes abyss between rich and hungry [...]” .7 If the world already was in great danger in the 1980s, what could be the magnitude of danger today?

II, Poly-Catastrophe

“Dark times [...] are not only not new, they are not a rarity in history,” as Hannah Arendt (1906-1975) observed.8 But today we are certainly living in often darker times. According to the Global Solidarity, Global Responsibility: An Appeal for World Governance - launched in Geneva, Switzerland, on 6 March 2012, and endorsed by the Collegium International members

"we are facing a conjunction of global crises that are unprecedented in history: depletion of natural resources, irreversible destruction of biodiversity, disruption of the global financial system, dehumanization of the international economic system, hunger and food shortages, viral pandemics and breakdown of political orders [...] none of these phenomena can be considered independently of the others. All are highly interconnected, constituting a single ‘poly-crisis’ that threatens the world with a ‘poly-catastrophe’ [...]”

The Appeal stresses that “ the great crises of the 21st century are planetary,” and that “ this is no butterfly effect, but the realization, grave and strong, that our common home is in danger of collapsing and that our salvation can only be collective.”9

III. Our World Today

The new Global Sustainable Development Goals - Transforming our World: the 2030 Agenda for Sustainable Development10 - have been adopted by Heads of State and Government and High Representatives, during the meeting at the United Nations (UN) Headquarters in New York from 25-27 September 2015 - with the UN celebrating its 70th anniversary. Paragraph 14 of this historic document presents the vision of the UN General Assembly (UNGA) on the world global situation today, as follows: “We are meeting at a time of immense challenges to sustainable development. Billions of our citizens continue to live in poverty and are denied a life of dignity. There are rising inequalities within and among countries. There are enormous disparities of opportunity, wealth and power. Gender inequality remains a key challenge. Unemployment, particularly youth unemployment, is a major concern. Global health threats, more frequent and intense natural disasters, spiraling conflict, violent extremism, terrorism and related humanitarian crises and forced displacement of people threaten to reverse much of the development progress made in recent decades. Natural resource depletion and adverse impacts of environmental degradation, including desertification, drought, land degradation, freshwater scarcity and loss of biodiversity, add to and exacerbate the list of challenges which humanity faces. Climate change is one of the greatest challenges of our time and its adverse impacts undermine the ability of all countries to achieve sustainable development. Increases in global temperature, sea level rise, ocean acidification and other climate change impacts are seriously affecting coastal areas and low-lying coastal countries, including many least developed countries and small island developing States. The survival of many societies, and of the biological support systems of the planet, are at risk.”

“ Climate change will amplify existing risks and create new risks for natural and human systems. Risks are unevenly distributed and are generally greater for disadvantaged people and communities in countries at all levels of development,” as Intergovernmental Panel on Climate Change (IPCC) says in Climate Change 2014 - Synthesis Report - Summary for Policymakers.11

IV. Care for Our Common Home

Pope Francis in his 2015 Encyclical Letter Laudato Si ~ On Care for Our Common Home - issued in 25 May - makes an “ urgent appeal for a new dialogue about how we are shaping the future of our planet.” According to Pope, “we require a new and universal solidarity,” as “ our present situation is in many ways unprecedented in the history of humanity.”

“ The Earth, our home,” - he stresses - “ is beginning to look more and more like an immense pile of filth,” because “ each year hundreds of millions of tons of waste are generated, much of it non-biodegradable, highly toxic and radioactive, from homes and businesses, from construction and demolition sites, from clinical, electronic and industrial sources.”

Pope Francis also warns:

“A very solid scientific consensus indicates that we are presently witnessing a disturbing warming of the climatic system [...} most of global warming in recent decades is due to the great concentration of greenhouse gases (carbon dioxide, methane, nitrogen oxides and others) released mainly as a result of human activity [...] The problem is aggravated by a model of development based on the intensive use of fossil fuels, which is at the heart of the worldwide energy system. Another determining factor has been an increase in changed uses of the soil, principally deforestation for agricultural purposes.”

“Warming has effects on the carbon cycle. It creates a vicious circle which aggravates the situation even more, affecting the availability of essential resources like drinking water, energy and agricultural production in warmer regions, and leading to the extinction of part of the planet’s biodiversity. If present trends continue, this century may well witness extraordinary climate change and an unprecedented destruction of ecosystems, with serious consequences for all of us,” as “ climate change is a global problem with grave implications: environmental, social, economic, political and for the distribution of goods.”

Moreover, Pope Francis remarks:

“We all know that it is not possible to sustain the present level of consumption in developed countries and wealthier sectors of society, where the habit of wasting and discarding has reached unprecedented levels. The exploitation of the planet has already exceeded acceptable limits and we still have not solved the problem of poverty. ”

“Caring for ecosystems demands far-sightedness, since no one looking for quick and easy profit is truly interested in their preservation. But the cost of the damage caused by such selfish lack of concern is much greater than the economic benefits to be obtained,” points out Pope Francis, And he adds that “ the alliance between the economy and technology ends up sidelining anything unrelated to its immediate interests.”

“The failure of global summits on the environment makes it plain that our politics are subject to technology and finance. There are too many special interests, and economic interests easily end up trumping the common good and manipulating information so that their own plans will not be affected.”

“ It is foreseeable that, once certain resources have been depleted, the scene will be set for new wars, albeit under the guise of noble claims. War always does grave harm to the environment and to the cultural riches of peoples, risks which are magnified when one considers nuclear arms and biological weapons [...] Politics must pay greater attention to foreseeing new conflicts and addressing the causes which can lead to them. But powerful financial interests prove most resistant to this effort, and political planning tends to lack breadth of vision.” 52

Wouldn’t these observations also applicable to outer space?

V. The Tragedy f Common Goods

To explain how we arrived to it at current bad situation of the common resources of Earth, Eduardo Felipe P. Matias recalls the article Tragedy of Common Goods, written in 1968 by American ecologist Garrett Hardin (1915-2003). Hardin recounts the case of a village of shepherds, whose sheep used a pasture in common. Each shepherd was engaged in putting more and more sheep in the pasture in order to increase his income. Over time, the pasture was saturated, and there was no pasture left to feed all the sheep. Most of them died. In sum, a tragedy. The shepherds abused the common good to increase their individual gains, ignoring the limits of nature. Although they gained more in short term, they lost out in long run. Already in 1999, it was recognized that “ a globalized world requires a theory of global public goods to achieve crucial goals such as financial stability, human security or the reduction of environmental pollution.” And that “many of today’s international crises have their roots in a serious under supply of global public goods.” 13

As to global human security as a public good, the 1994 Human Development Report has showed threats to world peace in transborder challenges: unchecked population growth, disparities in economic opportunities, environmental degradation, excessive international migration, narcotics production and trafficking and international terrorism,” It was equally said that the society would be “willing to pay for public goods that serve our common interest, be they shared systems of environmental controls, the destruction of nuclear weapons, the control of transmittable diseases such as malaria and HIV/AIDS, the preservation of ethnic conflicts or the reduction of refugee flows,” 14

Addressing the present question of common goods in his 2015 Encyclical Letter, Pope Francis points out:

“Whether believers or not, we are agreed today that the Earth is essentially a shared inheritance, whose fruits are meant to benefit everyone. Hence every ecological approach needs to incorporate a social perspective which takes into account the fundamental rights of the poor and the underprivileged. The principle of the subordination of private property to the universal destination of goods, and thus the right of everyone to their use, is a golden rule of social conduct He also notes that “ the natural environment is a collective good, the patrimony of all humanity and the responsibility of everyone. If we make something our own, it is only to administer it for the good of all. If we do not, we burden our consciences with the weight of having denied the existence of others.”

Antonio Cassese (1937-2011) commented that “ the concept of ‘common good’ is not yet felt by the members of the international society. Only state interests and their occasional convergence regulate international relations.” 15 The refugees tragedy in Europe today proves it.

VI. Uncertainty

According to Klaus Schwab, Executive Chairman of World Economic Forum, “ in the coming decade [...] our lives will be even more intensely shaped by transformative forces that are under way already. The effects of climate change are accelerating and the uncertainty about the global geopolitical context and the effects it will have on international collaboration will remain. At the same time, societies are increasingly under pressure from economic, political and social developments including rising income inequality, but also increasing national sentiment [...] [N]ew technologies, such as the Internet or emerging innovations will not bear fruit if regulatory mechanisms at the international and national levels cannot be agreed upon.”

The Global Risks Report 2015, in turn, stresses: “ 2015 differs markedly from the past, with rising technological risks, notably cyber-attacks, and new economic realities, which remind us that geopolitical tensions present themselves in a very different world from before. Information flows instantly around the globe and emerging technologies have boosted the influence of new players and new types of warfare [...] Past warnings of potential environmental catastrophes have begun to be borne out, yet insufficient progress has been made - as reflected in the high concerns about failure of climate-change adaptation and looming water crises in this year’s report.”

The Report sees three risk constellations that bear out its findings:

“ 1) The interconnections between geopolitics and economics are intensifying because States are making greater use of economic tools, from regional integration and trade treaties to protectionist policies and cross-border investments, to establish relative geopolitical power. This threatens to undermine the logic of global economic cooperation and potentially the entire international rulebased system;

2) The world is in the middle of a major transition from predominantly rural to urban living, with cities growing most rapidly in Asia and Africa. If managed well, this will help to incubate innovation and drive economic growth. However, our ability to address a range of global risks - including climate change, pandemics, social unrest, cyber threats and infrastructure development - will largely be determined by how well cities are governed; and

3) The pace of technological change is faster than ever. Disciplines such as synthetic biology and artificial intelligence are creating new fundamental capabilities, which offer tremendous potential for solving the world’s most pressing problems. At the same time, they present hard-to-foresee risks. Oversight mechanisms need to more effectively balance likely benefits and commercial demands with a deeper consideration of ethical questions and medium to long-term risks - ranging from economic to environmental and societal. Mitigating, preparing for and building resilience against global risks is long and complex, something often recognized in theory but difficult in practice.”

How to govern the emerging technologies and uncertainties?

VII. The Doomsday Clock

It is a symbolic clock face, marking countdown to doomsday. On 19 January 2015, it went on to score 23:57h, three minutes to midnight - the time of global catastrophe able to extinguish the human species inhabiting the Earth for many thousands of years. The decision to advance the clock by two minutes was taken after consultations with more than 20 scientists, including 17 Nobel laureates, among them famous physicists, such as the British Stephen Hawking, the Japanese Masatoshi Koshiba, pioneer in the study of neutrinos, and the American Leon Lederman. The clock has been maintained since 1947 - when the Cold War between the USA and the former USSR began - by the members of the Bulletin of the Atomic Scientists Science and Security Board. In 68 years, this sui generis indicator has been adjusted 22 times. Its worst moment came in 1953, triggered by American and Soviet tests with hydrogen weapons when the Clock scored 23:58h.

The Clock was conceived by the celebrated Chicago Atomic Scientists, that had actively participated in the Manhattan Project in the creation of the atomic bombs launched over Hiroshima and Nagasaki, Japan, in August 1945. Haunted with these bombings - that killed more than 100,000 people just on the first day, and many more in the following months - they started to publish a mimeographed warning newsletter and then the Bulletin. The closer they set the Clock to midnight, the closer the scientists believe the world is to a global disaster.

The Clock hangs on a wall in a Bulletin's office in the University of Chicago. Originally, it represented an analogy to the threat of global nuclear war. But since 2007 it has also reflected climate change, and new developments in the life sciences and technology that could inflict irrevocable harm to humanity.

The analysis of the Bulletin - addressed “to the leaders and citizens of the world” - says in sum: “ In 2015, unchecked climate change, global nuclear weapons modernizations, and out-sized nuclear weapons arsenals pose extraordinary and undeniable threats to the continued existence of humanity.” The group said in a statement: “ [Wjorld leaders have failed to act with the speed or on the scale required to protect citizens from potential catastrophe. These failures of political leadership endanger every person on Earth.” In 2014, with the Doomsday Clock at five minutes to midnight, the members of the Science and Security Board concluded their assessment of the world security situation by writing: “We can manage our technology, or become victims of it. The choice is ours, and the Clock is ticking.”

In 2015, with the Clock hand moved forward to three minutes to midnight, the Bulletin feels compelled to add, with a sense of great urgency: “The probability of global catastrophe is very high, and the actions needed to reduce the risks of disaster must be taken very soon.”

In face of the dangers affecting today civilization on a global scale, the Bulletin urges the citizens of the world to demand that their leaders, among other measures, "dramatically reduce proposed spending on nuclear weapons modernization programs” , as “ the USA and Russia have hatched plans to essentially rebuild their entire nuclear triads in coming decades, and other countries with nuclear weapons are following suit.”

At the start of 2015, nine States - the USA, Russia, the United Kingdom, France, China, India, Pakistan, Israel and Democratic People’s Republic of Korea (North Korea) - possessed about 15,850 nuclear weapons, of which 4,300 were deployed with operational forces. Roughly 1800 of these weapons are kept in a state of high operational alert, according to the Stockholm International Peace Research Institute (SIPRI). Launched on 15 June 2015, the SIPRI Yearbook 2015, which assesses the current state of armament, disarmament and international security, notes as one of its key findings that “ all the nuclear weapon-possessing states are working to develop new nuclear weapon systems and/or upgrade their existing ones.” 16

“There are too many nuclear weapons,” said Sharon Squassoni, an expert in nuclear weapons nonproliferation at the Center for Strategic and International Studies in Washington, USA. And she added: “The existence of these weapons takes a lot of time, effort, and money to keep them safe, and the bureaucracies are poised to keep these systems going indefinitely.” 17

For Hans M Kristensen, director of the Nuclear Information Project at the Federation of American Scientists, “ the projected costs of the nuclear weapons modernization program are indefensible, and they undermine the global disarmament regime.” 18

That is why another demand from Bulletin, addressed to world leaders, is to “ re-energize the disarmament process.” In practice it means that “ the USA and Russia, in particular, need to start negotiations on shrinking their strategic and tactical nuclear arsenals.”

The creation of “ institutions specifically assigned to explore and address potentially catastrophic misuses of new technologies,” is also a requirement proposed by the Bulletin.

The Bulletin’s appeals are also, to some extent, applicable to outer space, and some of its requirements can be objects of proper regulation by international space law.

VIII. Transparency and Confidence

The Earth being in danger, the transparency and confidence-building measures (TCBMs) are as vital as those of collective security. These actions are means by which Governments can share information aiming at creating mutual understanding and trust, reducing misconceptions and miscalculations and thereby helping both to prevent military confrontation and to foster regional and global stability. They played an important role during the Cold War, contributing to reducing the risk of armed conflict through mitigating misunderstandings on military actions, particularly in situations where States lacked clear and timely information.19 The need for such measures in outer space activities has increased significantly over the past 20 years, The world’s growing dependence on space-based systems and technologies and the information they provide requires collaborative efforts to address threats to the sustainability and security of outer space activities. TCBMs “ can reduce, or even eliminate, misunderstandings, mistrust and miscalculations with regard to the activities and intentions of States in outer space” , This is the conclusion of the Report of the Group of Governmental Experts on TCBMs in Outer Space Activities - a study adopted by consensus and issued on 29 July 2013.20

The Report adds that “ these measures can augment the safety, sustainability and security of day-to-day space operations and can contribute both to the development of mutual understanding and to the strengthening of friendly relations between States and peoples.”

It is acknowledged that “ the existing treaties on outer space contain several TCBMs of a mandatory nature. Non-legally binding measures for outer space activities should complement the existing international legal framework on space activities and should not undermine existing legal obligations or ham per the lawful use of outer space, particularly by emerging space actors.” The Group also discussed other measures, including those of a legally binding nature. The Group further agreed that “ such measures for outer space activities could contribute to, but not act as a substitute for, measures to monitor the implementation of arms limitation and disarmament agreements,” help States to enhance clarity of their peaceful intentions and create conditions for establishing a predictable strategic situation in both the economic and security arenas.

Similarly, included in the Report were "coordination and consultative mechanisms aimed at improving interaction between participants in outer space activities and clarifying information and ambiguous situations.” Likewise the Report recommended a coordination between the Office for Disarmament Affairs, the Office for Outer Space Affairs (OOSA) and other appropriate UN entities. Moreover, the Report drafted “ a series of measures for outer space activities, including exchange of information relating to national space policy such as major military expenditure in outer space, notifications of outer space activities aimed at risk reduction, and visits to space launch sites and facilities.”

The Group took note of the “Guidelines for appropriate types of confidencebuilding measures and for the implementation of such measures on a global or regional level” , as contained in the “ Study on the application of confidence- building measures in outer space”21

TCBMs for outer space activities are integrated in a broader context. The UN General Assembly endorsed, in its resolution 43/78 H, the guidelines on confidence- building measures adopted by the Disarmament Commission at its 1988 session. This resolution noted that “ confidence-building measures, while neither a substitute nor a precondition for arms limitation and disarmament measures, can be conducive to achieving progress in disarmament” .

The Report indicates the following categories of TCBMs for space activities as relevant: “ a) General transparency and confidence-building measures aimed at enhancing the availability of information on the space policy of States involved in outer space activities; b) Information exchange about development programs for new space systems, as well as information about operational space-based systems providing widely used services such as meteorological observations or global positioning, navigation and timing; c) The articulation of a State’s principles and goals relating to their exploration and use of outer space for peaceful purposes; d) Specific information-exchange measures aimed at expanding the availability of information on objects in outer space and their general function, particularly those objects in Earth orbits; e) Measures related to establishing norms of behavior for promoting spaceflight safety such as launch notifications and consultations that aim at avoiding potentially harmful interference, limiting orbital debris and mini mizing the risk of collisions with other space objects; f) International cooperation measures in outer space activities, including measures aimed at promoting capacity-building and disseminating data for sustainable economic and social development, that are consistent with existing international commitments and obligations.

In fact, some TCBMs for outer space activities have already been enacted at the multilateral and/or the national level. They include pre-launch notifications, space situational awareness data-sharing, notifications of hazards to spaceflight safety and other significant events, and the publication of national space policies. But they need to be further developed.

IX. Common Law of Mankind and Earth

More than ever, it is time to think big. International space law is usually defined as dealing with outer space, celestial bodies - Moon and asteroids, Mars and other planets as well as with the space activities which so far are carried out only by the human species from the planet Earth, However, the very specific situation of Earth as celestial body responsible for the creation and development of the international space law is not taken into the due consideration. Earth is not recognized as one of the main objectives of this branch of law.

Ironically, in this context, we could say that the international space law takes care of the solar system and the universe as a whole, minus of Earth, although it is the cradle of the exploration and use of outer space in general, and, therefore, of international space law.

Let’s take just two examples. “At its broadest, space law comprises all the law that may govern or apply to outer space and activities in and relating to outer space,” write Francis Lyall and Paul B. Larsen.22 In the same sense, the Education Curriculum of Space Law, adopted by United Nations Office For Outer Space Affairs (UNOOSA), on March, 2014, states that “ space law can be described as the body of law applicable to and governing space related activities.”23

Nevertheless, the Outer Space Treaty, of 1967, has, at least, two extremely important norms for the security of Earth and its inhabitants in Articles IV and IX, respectively: 1) “not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction,” and 2) to avoid “harmful contamination and adverse changes in the environment of the Earth resulting from introduction of extraterrestrial matter.” The sky always has played a crucial role in the evolution of mankind and all life manifestations on Earth. However, today the importance of outer space to our planet and its common life has increased as never before. The data coming from satellites are absolutely fundamental for any efforts to assure the sustainability of Earth and all its life expressions. In this global reality it is sheer recklessness to ignore the imperative of protecting our planet and its population, based on inclusive international space legislation. Hence the necessity of a Common Law of Mankind24 and Earth, specially related with international space law.

More and more, outer space protection25 must be seen as an indispensable factor to Earth protection, and vice-verse. As the globalization of Earth - with the interdependence of physical, social and political events - is more than ever recognized as an undeniable fact, the universalization of outer space {its cosmic reach), with the interconnection of everything with everything, cannot be bypassed, as it has been in the past. As Ervin Laszlo remarks, “ the reality we call universe is a seamless whole, evolving over eons of cosmic time and producing conditions where life, and then mind and consciousness can emerge.”26 Or, as Edgar Morin says, “we carry inside of us all the cosmos” and “we are all children of the sun.”27

X. It Is up to International Space Law

If we are really determined to avoid a likely apocalypse visible on the horizon, one of the main tasks of the international space law that we must trigger is to help save the Earth from space, using the powerful scientific and technological resources we have installed there.

Centuries ago Earth ceased to be the center of the universe, as our ancestors thought. But in face of unprecedented global dangers that threaten our planet today, its place cannot be other than the center of our universal concerns. Probably, a collapse of Earth would deprive the universe of a specie of intelligent life.

In reality, as Jonathan Schell (1943-2014) pointed out, “ the vision that counts is the view from Earth, from life,” as “ from our strategic position on Earth different view opens, bigger even than the one taken from space. It is the vision of our children and grandchildren, of all future generations of mankind, stretching ahead of us into the future.”28

The question, as posed by Antonio Cassese, is that “ international society is still grounded in the mere juxtaposition of its subjects - not in their solidarity, let alone in their integration.” 29

In any event, “ from the microbes inhabiting the earth beneath our feet to environments of the universe unknown to us now, the next 100 years of ecological discoveries will influence our lives. We enter a time when society is armed with the scientific knowledge and ability to make responsible decisions,” as a recent editorial of Science affirms.30 And with “ a new human consciousness ” , as says Edgar Morin.31

So, “ the choice is our: form a global partnership to care for Earth and one another or risk the destruction of ourselves and the diversity of life,” according to The Earth Charter.32

The current global situation seems to be so serious that the titanic work of saving mankind and our planet can be seen as a kind of utopia, maybe the major utopia of all times. A dream still far from having a general support. Coincidentally we’ll commemorate in 2016 the 500 years since the English humanist and statesman Thomas More (1478-1535) published his Utopia„ considered “ a playfully serious social critique to a social reality deadly and tragically grave.”33

In this context, it is urgent to build a positive agenda for the international space law.

#### Article IX’s a unique mechanism for closing inter-regime regulatory gaps---particularly for space-based nuclear power.

Gennady M. Danilenko 16. Institute of State and Law, USSR Academy of Sciences. 08/2016. “International Law-Making for Outer Space.” Space Policy, vol. 37, pp. 179–183.

Advances in space technology and the need for international cooperation in the exploration and use of outer space require more specific and detailed rules to govern new activities. One of the urgent issues is adequate regulation of the use of nuclear power sources in outer space. More generally, there is a growing need to agree on rules and procedures for the prevention of pollution of outer space and the Earth from space activities. The development of space military capabilities requires an adequate normative response from the international community concerned with the escalation of an arms race in outer space. The expanding space economic activities also require regulation. In addition, there are important issues, which, although already regulated by the relevant UN General Assembly resolutions, may call for treaty regulation at a later stage. These include the use of satellites for direct television broadcasting, covered by the 1982 Principles Governing Direct Television Broadcasting,3 and the use of satellites for remote sensing, governed by the 1986 Principles Relating to Remote Sensing.4

While the need for adequate space law-making may be as urgent as ever, the international community has discovered that today it is far more difficult to reach consensus on new legal rules. Although multilateral negotiations are being conducted in a number of forums, since the adoption of the Moon Treaty in 1979 there has been no agreement on a new multilateral space treaty. In view of this noticeable slowdown in the law-making process, the time may have come for a reassessment of existing legislative techniques. On both the political and doctrinal levels serious efforts seem to be required to formulate proposals aimed at improving the law-making process. This article raises some of the issues which may be of interest for the ongoing debate about the most suitable and effective techniques of law-making concerning space and space activities.

1. The search for a genuine consensus

The exploration and use of outer space is a global problem affecting the entire international community. This fact is recognized by the Outer Space Treaty, which stresses ‘the common interest of all mankind’ in the exploration and use of outer space for peaceful purposes. From a political legal perspective, this provision provides sufficient legal grounds for claims to full and effective participation by all members of the international community in the decision-making process relating to outer space. Realistically, then, viable solutions to outer space issues can be found only through multilateral negotiations leading to legal regimes of universal scope.

In view of the growing economic value of outer space an increasing number of states are making use of their right to equal participation in space law-making. As a result the membership of negotiating forums, especially UNCOPUOS, has expanded. With the arrival of a large number of developing countries as new participants of the negotiating process broad issues relating to the establishment of more equitable international economic relations have gradually surfaced in space law-making. The trend towards discussing space issues from the standpoint of the establishment of a new international economic order (NIEO) has become particularly evident in connection with the discussions on the status of the natural resources of the Moon as the common heritage of mankind. It also appears to be confirmed by the new item on the agenda of the UNCOPUOS relating to the distribution of benefits from space activities, adopted in 1988.5

The increase in membership of the negotiating forums and the emergence of NIEO problems, which place space issues in a confrontational context where the positions of different groups of states are radically opposed, creates additional difficulties in reaching substantive consensus on new legal rules. The search for consensus tends to result in settlements on the lowest common denominator which does not prejudice the positions of the states involved. Such a consensus often serves only as a disguise for continued disagreement. The disputes over the meaning of the common heritage of mankind principle incorporated into Article 11 of the Moon Treaty may serve as an illustration of this trend. Reservations expressed by a number of states in connection with the adoption of the 1986 Principles Relating to Remote Sensing are also a strong indication of the difficulties in reaching a genuine consensus on issues of economic importance.

The lack of genuine consensus becomes particularly apparent in cases where negotiated legal instruments require ratification. By 1984 the Moon Treaty had been ratified by five states and in accordance with its provisions had entered into force; however, although the treaty was negotiated by consensus it had not been ratified by the major space powers.6 It is beyond dispute that a treaty not ratified by states whose participation is crucial for the implementation of its provisions cannot be effective. The present signatories to the Moon Treaty who do not possess the necessary technical means to launch objects into outer space and to explore and exploit the resources of the Moon simply do not have the necessary effective power to bring this legislative project into operation.

The history of the ratification of the Moon Treaty clearly demonstrates that, contrary to a widely held view that consensus techniques provide ‘a guarantee for wide acceptance of the space treaties, ‘ 6a a simple consensus achieved in negotiating forums is insufficient for proposed space treaties to be brought into effect. Indeed, in the framework of negotiation consensus means no more than the absence of any formal objection to a particular decision. It does not imply the positive support which is necessary for subsequent approval of the treaty by the national bodies responsible for ratification. In the absence of such positive support, especially on the part of the space powers most directly affected, consensus may not lead to ratification when each state decides individually whether it is in its best interests to be bound by a particular treaty.

Although the positive support of the states who are most involved in the relevant space activities is a prerequisite for effective space legislation, in the foreseeable future such states will remain a small minority in any multilateral negotiating forum. This fact inevitably affects the negotiating process, where the majority tend to use their numerical strength by controlling the agenda and by pressing for solutions which satisfy their own interests. In extreme situations they may resort to use of the majority vote. The dramatic departure from the previously uninterrupted record of consensus decision-making in connection with the adoption of the 1982 Principles Governing Direct Television Broadcasting is an indication of this. It is doubtful, however, whether such an approach will lead to viable legal regimes, especially when the outvoted minority includes the most affected states.

In such a situation the influential minority may resort to a number of tactics which will eventually frustrate the multilateral law-making process. Diplomatic manoeuvring may prevent the inclusion of major new items in the agenda of broad multilateral forums or frustrate meaningful discussion of items already included. Effective law-making may be shifted to specialized bodies dealing with more technical issues. Finally, the dissatisfied minority may resort to limited international agreements negotiated within closed state groupings. In view of the unsatisfactory results of the multilateral negotiations on the Moon, proposals have already been made that a commercially acceptable legal regime for the exploitation of lunar resources should be elaborated outside the United Nations through agreement between ‘the space powers potentially capable of exploiting outer space natural resources’ 7

While limited agreements of this kind hardly offer a viable solution to problems calling for essentially global management, serious thought should be given to the need to secure the support of the most directly interested space powers for future space legislation on these and other matters. A realistic assessment of the situation should obviously proceed from the undeniable fact that not all states have the same level of interest in outer space. While many members of the international community may remain unaffected by a particular decision concerning outer space, others, on the contrary, are deeply concerned. Therefore it seems reasonable to suggest that the law-making process should reflect the various and differing levels of interest of the space powers and of other states.

There is no doubt that consensus is and will continue to be the most effective response to the problem of the discrepancy between the power of the numerical majority and the influence of the most affected space powers. However, as indicated earlier, a simple consensus does not guarantee the necessary positive support on the part of the space powers. Therefore, states could perhaps consider redefining consensus to give it a more positive interpretation. In view of the political realities prevailing in the international community, it may be difficult to obtain acceptance for the idea that rules of procedure should overtly reflect the differences in power and importance of various states in the decisionmaking process. As a formal matter, however, states could carefully consider whether it would not be advisable to provide for a qualitative criterion of participation in discussions on proposed space treaties, in addition to the quantitative criterion normally used in clauses dealing with the coming into force of treaties. Such a qualitative criterion would ensure that an agreement would take effect only if supported by a sufficient number of the most affected states. More specifically, a rule could be adopted providing that a particular space treaty would come into force only if ratified by a specified number of space powers. In addressing this issue, states could consider different criteria to identify the required qualitative representation, for instance the level of investment in the exploration and use of outer space or the number of space launchings per year.

In favour of the proposed approach it can be pointed out that there are precedents where states have expressly recognized that ratification by specified states, who are in the position to effectively implement the agreed rules, is a necessary precondition for the entry of a particular treaty into force. Thus the Outer Space Treaty provides that it will come into force only if ratified by three depository governments, namely the USSR, the UK and the USA (Article XIV, paras 2 and 3). Similar provision was included in the Agreement on the Rescue of Astronauts (Article VII, paras 2 and 3). The Partial Nuclear Test Ban Treaty8 provides that it will take effect only if three leading nuclear powers, the USSR, the UK and the USA, ratify it (Article III). There is also a well-established trend towards requiring qualitative participation in treaties elaborated in the framework of the International Maritime Organization. Thus treaties relating to shipping9 include requirements not only in terms of a fixed number of states but also of the amount of shipping tonnage they must possess.

The proposed approach would guarantee that after their coming into force new space treaties would have substantial control over the subject-matter covered by their provisions. Situations such as the difficulties surrounding the Moon Treaty will be precluded. Moreover, adoption of the proposed rule would also affect the negotiating process and the nature of the consensus emerging from such negotiations. The tested consensus procedure would lead to more realistic normative results and, therefore, more viable legal regimes in the future.

2. Anticipatory regulation

International space law is traditionally based on anticipatory regulation producing rules governing topics that might arise only in the future. This fact is often cited as the principal reason for earlier successes in space law-making. It is contended that it is easier to conduct negotiations and to reach compromises before the issues under discussion have acquired practical importance and states have fully realized their particular national interests.10 The argument is that in such a situation negotiating states proceed not from national but from common interest. Consequently, it has been suggested that early negotiations are a precondition for success in space lawmaking.

While anticipatory regulation may be useful for the establishment of a broad legal framework for future space activities, it is dangerous to rely on it too heavily in cases where detailed regulation of complex technical or economic issues is required. Early negotiations are usually carried out in the absence of substantial knowledge about the subject-matter under discussion. As a result the law-makers are forced to conduct negotiations on a number of assumptions about future technological developments, trends in practice and resulting national interests. Experience indicates, however, that at an early stage it is extremely difficult to foresee the content and impact of these and many other factors on international relations. Therefore there is a substantial risk that the proposed normative solutions may be unworkable from both the technical and political points of view. The resulting conflict between practical requirements and the negotiated legal rules will inevitably have an adverse effect on emerging space activities.

Notwithstanding claims to the contrary, actual experience does not support the view that early negotiations make the success of an agreement more likely. In the absence of adequate information about emerging space activities states may tend to put forward extreme and unrealistic demands. Such demands are usually modified only under pressure of reality. Thus a number of developing countries expressed serious concerns about the possible negative consequences of unrestricted remote sensing of their territories and free dissemination of satellite data concerning their natural resources. These concerns were reflected in far-reaching stipulations about prior consent for remote sensing of foreign territories and dissemination of data. However, actual practice has shown that these early concerns were largely exaggerated. Realization of this fact was a major factor contributing to the subsequent compromises reflected in the 1986 Principles Relating to Remote Sensing.

One should also bear in mind that doubts about the appropriateness and extent of anticipatory regulation may reduce the chances of early ratification of treaties using the anticipatory approach. Many states failed to ratify the Moon Treaty because they felt that it was simply premature. Indeed, one can hardly claim that at this stage there is a pressing need to adopt legal rules which purport to govern mining activities on the Moon and other celestial bodies. Such activities will take place only in the very distant future.

3. Proliferation of negotiating forums

The growing diversity of space-related activities means that the relevant legal issues may arise in many different international forums. Space law-making is no longer restricted to the UNCOPUOS although this remains the principal UN body concerned exclusively with legal questions arising from the exploration and use of outer space. Thus questions relating to the use of the geostationary orbit for space communications are being addressed by the International Telecommunication Union (ITU). Matters concerning the prevention of an arms race in outer space are being discussed in the framework of the Conference on Disarmament. Specific amendments to the Outer Space Treaty have been submitted in this forum,11 Important norms governing the early notification of nuclear accidents on space objects were adopted in 1986 by the General Conference of the International Atomic Energy Agency. Issues of international liability for damage caused by space objects are playing an important part in the deliberations of the International Law Commission on the topic of international liability for injurious consequences arising out of acts not prohibited by international law.

While the recent trend towards proliferation of space negotiating forums is primarily caused by the growing diversity of topics under discussion, political considerations also play an important part in this process. Difficulties in reaching consensus in broad multilateral bodies, especially in the UNCOPUOS, create pressure to transfer space negotiations to other institutions which are regarded as more suitable for dealing with a particular issue. Differences in the composition, decisionmaking procedures, working methods and other characteristics of various forums, which may influence the outcome of negotiations, are of major significance in this connection. Thus specialized institutions dealing with technical issues are generally regarded as more responsive to the preferences of the states most involved in relevant activities.

Arguments relating to competence may impose limits to diplomatic manoeuvring aimed at shifting space law-making from broad forums to specialized institutions. Thus, as a formal matter, the ITU deals only with the allocation of orbital positions for space communication. Its mandate does not allow it to regulate other possible uses of the geostationary orbit. It is not surprising, therefore, that the first session of the World Administrative Radio Conference on the Use of the Geostationary Orbit convened by the ITU declared itself not competent to deal with broad legal issues relating to the status of the orbit.12

Experience indicates, however, that even the partial solutions adopted by specialized institutions tend to affect discussions on broader issues. Analysis of negotiations in the framework of the UNCOPUOS shows that technical regulations established by the ITU concerning the equitable use of the geostationary orbit for space communications appear to exert a de facto influence on negotiations on the general rules governing access to the orbit. An indication of this tendency is the fact that the general concept of ‘equitable access’ to the orbit, proposed in the framework of the UNCOPUOS in 1988,13 is essentially based on the relevant provision of the ITU Convention.14

The proliferation of negotiating forums requires greater coherence and coordination of law-making activities at national and international levels. Lack of coordination at the national level results in inconsistent positions being taken by delegations from the same state in various international bodies. If there is no coordination at the international level, different legislative bodies may adopt conflicting rules on the same issue. Thus the 1986 Convention on Early Notification of a Nuclear Accident, elaborated under the auspices of the International Atomic Energy Agency, contains rules on nuclear power sources on space objects conflicting with the relevant provisions of the Draft Principles Relevant to the Use of Nuclear Power Sources in Outer Space currently under discussion in the UNCOPUOS.15

From a political-legal perspective such confusion may endanger the unity and coherence of space law. The existence of conflicting rules on the same issues could create serious legal and practical problems in terms of the interpretation and implementation of space treaties and other relevant international instruments.

4. Fragmentation of the legal regime

Lack of coordination among different legislative bodies is not the only factor leading to fragmentation of the legal regime applicable to space activities. The unity and coherence of space law may also be endangered by conflicting provisions elaborated in the same negotiating forum. Thus, although both the Outer Space Treaty and the Moon Treaty were adopted in the framework of the UNCOPUOS, the states which were parties to these treaties assumed different obligations in a number of areas.

A comparative analysis of Article IX of the Outer Space Treaty and of Article 7 of the Moon Treaty, for example, indicates that the content of obligations relating to the protection of the Earth and space environments of these treaties is different. As regards outer space Article IX of the Outer Space Treaty expressly limits the relevant environmental obligations to activities relating to the ‘study’ and ‘exploration’ of outer space. Other types of space activities, including such environmentally significant activities as the exploitation of the resources of outer space, do not seem to fall within the preview of Article IX. With respect to the Earth, Article IX requires only the avoidance of environmental hazards relating to the possible introduction of extraterrestrial matter. It does not contain a general environmental obligation applicable to all space activities. In contrast, the environmental protection rules of the Moon Treaty cover all possible kinds of adverse effects on the Moon's environment, as well as the Earth's, which may result from activities associated with the exploration and use of the Moon and other celestial bodies.

Another important area is the exploitation of the natural resources of outer space. While the Outer Space Treaty proclaims freedom in the use of outer space, which, as generally recognized, includes the freedom to exploit its resources, the Moon Treaty is regarded by many as imposing a moratorium on exploitation of the resources of the Moon and other celestial bodies. Even if there is no moratorium, the parties to the Moon Treaty have assumed a number of specific obligations relating to the exploitation of lunar resources, including the obligation to share equitably the derived benefits, which are absent from the Outer Space Treaty. Furthermore, according to Article 11 of the Moon Treaty the parties have an obligation to establish an international regime to govern the exploitation of the natural resources of the Moon. Further fragmentation of the applicable legal regime is possible in this case too, because not all parties to the Moon Treaty may be able to join the envisaged ‘international regime’. As a result, the exploitation of lunar resources may be governed by different rules contained in the Outer Space Treaty, the Moon Treaty and the future ‘international regime’ envisaged by the Moon Treaty. This could lead to considerable legal uncertainty and an increased danger of tension and conflicts between different groups of states.

The trend towards fragmentation of the applicable legal regime may intensify if states displaying divergent attitudes on controversial issues resort to limited agreements reflecting their preferences. An indication of this possibility is the regional Convention on the Transfer and Use of Data of the Remote Sensing of the Earth from Outer Space16 adopted by a group of socialist countries. While the 1986 Principles Relating to Remote Sensing and, arguably, emerging general customary law allow free dissemination of satellite data, the Convention restricts the dissemination of data with a spatial resolution finer than 50 m.

To some extent the trend towards fragmentation is limited by the fact that new space treaties generally repeat the general provisions which have already been endorsed by earlier treaties. Although this legislative technique may raise difficult questions about the relationship between the obligations created by different instruments, it enables the lawmakers to establish a legal system in which some basic rules are adopted by states which may not be bound by similar provisions in earlier treaties. As a result, the rules of space law acquire broader community support.

It could be argued, however, that inconsistencies and gaps in space law are inevitable as long as the law-making process continues to be limited to the adoption of different conventions dealing with particular space activities. From this perspective, the establishment of a harmonious body of space law would require the codification of space law in a single comprehensive convention governing all space activities.

5. A comprehensive convention?

Arguments for a comprehensive space convention governing all uses of outer space usually rely on existing experience in codification, especially of the law of the sea where serious attempts have been undertaken to establish an all-embracing legal regime for the oceans in a single UN Convention on the Law of the Sea.17 The proponents of such an approach to space law-making18 argue that it will result in a stable and coherent legal regime for outer space promoting international cooperation in its exploration and use.

It can be assumed that this proposal will find a certain amount of support not only on the doctrinal but also on the political level, especially among states pressing for a radical reform of existing space law. Relevant politicalelegal arguments were already being advanced in the 1970s. Thus the representative of Chile stated: ‘The 1967 Treaty, which had met the demands of what was essentially a period of exploration, should be superseded by a comprehensive international regime eventually covering the whole of outer space, duly delimited, and all its uses and resources.‘ 19

While as a technical matter the proposal to negotiate a comprehensive space convention may be attractive, there are grounds for believing that at this stage any legislative initiatives in this direction would be premature. Space law is still at an early stage of development. In a situation where technological transformations continue to create new politicalelegal problems, the tested method of step-by-step resolution of emerging issues through non-binding instruments which at a later stage are confirmed by limited agreements dealing with particular matters appears to be an essential prerequisite for successful law-making.

#### Extinction.

Margaret Morris 16. Inventor of the GEO-DMF System for robotically building virtually permanent automated solid rock outer space facilities, worked for decades as an assistant to Dr. Joseph Davidovits, the award-winning founder of the chemistry of geopolymerization, worked with the late Dr. Edward J. Zeller, Head of the former NASA-funded Radiation Physics Laboratory, at the Space Technology Center of the University of Kansas. 04-05-16. “Nuclear Waste Pollution is an Existential Risk that Threatens Global Health.” Institute for Ethics and Emerging Technologies. <https://ieet.org/index.php/IEET2/more/morris20160405>

Deadly environmental pollution has become an existential risk that threatens the prospect for the long-term survival of our species and a great many others. Here we will focus on the nuclear waste aspect of the problem and ways to mitigate it before there is a critical tipping point in our global ecosystem.

As philosopher Nick Bostrom said in his 2001 paper titled “Existential Risks,” published in the Journal of Evolution and Technology, “Our future, and whether we will have a future at all, may well be determined by how we deal with these challenges.”1

Unlike many radioactive materials that degrade fairly rapidly, some will remain intensely poisonous for incredibly long periods. Plutonium-240 (Pu-240) has a half-life of 6,560 years. The half-life is the time it takes for radioactive decay to decrease by half. But decay does not occur at an even pace, and radioactive isotopes are dangerous for much longer – typically 10 to 20 times the length of their half-life. Pu-238 has an 88-year half-life, and is used for space vehicles despite the frequency of rocket failures. Any exploding rocket including such cargo spreads pollution far and wide. Pu-239 has a half-life of over 24,000 years, and will remain radioactive for about a half a million years. But the situation is more complicated because as Pu-239 decays it transforms to uranium-235 (U- 235), which has a half life of 600 to 700 million years. Iodine-129 has a half-life of 16 million years. Pu-244 has a half-life of 80.8 million years. U-238 has a half- life of 4.5 billion years.2

When taken into the body, isotopes of radioactive plutonium are not fully eliminated and tend to accumulate. They are deadly when sufficiently accumulated. Pu-239 was described by its co-discoverer, chemist Glenn Seaborg, as “fiendishly toxic.” In addition to terrible chemical toxicity, plutonium emits ionizing radiation. Pu-239 emits alpha, beta and gamma particles. Gamma radiation can penetrate the entire body and kill cells. Pu-239 has a robust resonance energy of 0.2 96 electron-volts that can badly damage DNA and produce birth defects that carry over generations.3 The body repairs tissues and DNA, but becomes overwhelmed when plutonium concentrates too heavily.

According to a 1975 article in New Scientist Magazine, “But if it is inhaled, 10 micrograms of plutonium-239 is likely to cause fatal lung cancer.”4 Experts estimate that Pu-239 is so noxious that only one pound would be enough to kill everyone on our planet if it were so evenly dispersed in the air that everyone inhaled it.5

#### Formal consultation channel prevents moon commercialization from disrupting the lunar mass balance---that will EITHER crash it into earth, causing extinction

Monroe et al. 15. Heinrich Monroe is a space legal commentator; Michael J. Listner is Attorney and the founder/principal of Space Law and Policy Solutions, Vice-President of Legal Affairs for the International Space Safety Foundation, President and CEO (Interim) for the ISSF; Matula is an Associate Professor of Business Administration at Sul Ross State University - Rio Grande College whose research focus for the last 25 years has been on the economic development of space; Ken Murphy is former member of the Board of Directors of the National Space Society. 11-02-15. Comments on “Environmental liability on the Moon.” The Space Review. http://www.thespacereview.com/article/2855/1#IDComment1002383494

HEINRICH MONROE: Exactly. The threat of environmental disaster on Earth is measured in lives lost, whether human, animal, or plant life. Or decreased quality of life. The author states a definition pretty much identical to that. But none of that seems to pertain to the Moon. I guess you could disturb the regolith and leave trash all around, and the quality of life is impacted by making the view less pretty.

I guess one could define it on the Moon as changing the physical properties of a site in such a way as it infringes on the commercial capabilities of someone else using that site. I think the word "environmental" carries too much terrestrial baggage to be of relevance on the Moon.

MICHAEL J. LISTNER: The author appears to be articulating preservation of celestial bodies from contamination, defacement, significantly altering the lunar landscape etc. I'm surprised the author didn't mention Article IX of the OST specifically because that contains the legal duty of preventing the contamination of extraterrestrial environments.

THOMAS MATULA: Its a little late, the trash, including human waste, left from the Apollo missions has already set a lunar precedent :-)

Also its hard to see how you could deface the Moon, even that largest mines would be invisible except through large telescopes, and the astronomers using them wouldn't care as that very mining activity would likely provide them with far more information on those sites then they would ever get from Earth.

Now if you are assuming the proposed transformation of the Moon into an orbiting billboard, as Robert Heinlien wrote about in "The Man Who Sold the Moon" I could see some outrage. But that is just not practical.

For those not familiar with the story D.D. Harriman got a large amount of money from Coca-Cola for lunar advertising rights by suggesting that rival 7-UP was going to pay him to paint a large 7 on the Moon. The Coca-Cola president was outraged it would be defaced and bought the advertising rights on the spot to brag about how they saved the Moon from being defaced. Now there was a wheeler dealer...

KEN MURPHY: "Environmental damage could be defined as the adverse effects on protected species and natural habitats and on water and land."

There are no species, protected or otherwise, on the Moon. It is a habitat to nothing. Its 'environment' is a sterile dust bombarded by radiation and cosmic debris. While an interesting intellectual exercise, this article is still a null argument.

The main barrier thrown up when I'm selling Moon development is that if you mine too much of the Moon and transport it to Earth then you'll throw off the 'natural mass balance' and the Moon will be thrown off into deep space (or worse, into an orbit that will eventually intersect Earth), leaving the Earth an environmental disaster. Seriously, I get this over and over from folks. I've even heard it on The Space Show. It's only when I point out the actual masses of the Earth and the Moon that they start to get it.

The real legal issue is pointed out by Khannea below - there's no real forum to resolve disputes or torts between non-state actors in space activities. That's the real elephant in the room.

#### OR send it into deep space---extinction.

Jessica Orwig & Gene Kim 18. Orwig is a senior editor at Business Insider, has a Master of Science in science and technology journalism from Texas A&M University and a Bachelor of Science in astronomy and physics from The Ohio State University; Kim was an associate producer for Business Insider. 3-27-2018. "What living on Earth would be like without the moon." Business Insider. https://www.businessinsider.com/how-life-earth-would-change-without-moon-disappeared-2018-3

But by the next morning, you'd begin to realize just how important the moon is for life on Earth. To start, between the sun, Earth's rotation, and the moon, the moon has the largest influence on Earth's tides.

Without it, high and low tides would shrink by an estimated 75%. This would jeopardize the lives of many types of crabs, mussels, and sea snails that live in tidal zones and disrupt the diets of larger animals who rely on them for food, threatening entire coastal ecosystems in the process. Within a few decades, we would start to see mass population declines in the sea and on land.

One of the largest spawning events in the world occurs in the Great Barrier Reef. Each November in the days following the light of a full moon, coral colonies across the reef — spanning an area larger than the state of New Mexico — release millions of egg and sperm sacs within nearly minutes of one another. Scientists are certain that the full moon plays a role in the timing, but exactly how remains a mystery.

On land, animals like these Red Crabs also use lunar cues to reproduce. After living most of their lives in the mountains, millions of adult crabs migrate down to shore. And then, only during the last quarter of the moon, females release their eggs into the sea.

Now, the moon may not hold as much sway over human reproduction. But without it, something else we care equally about would change — the weather. Tides and tidal currents help mix cold arctic waters with warmer waters in the tropics. This balances temperatures and stabilizes the climate worldwide. Without the moon, weather forecasts would be practically impossible. The average difference between the hottest and coldest places on Earth could grow to life-threatening extremes.

But none of this compares to the biggest change that we would have coming over the next millennia. Right now, Earth tilts on its axis at 23.5º mostly due to the moon's gravity. If the moon disappeared, Earth's axis would wobble between anywhere from 10 to 45º.

Some experts estimate that Jupiter could help keep Earth's tilt from reeling completely out of control. But even just an extra 10º tilt could wreak havoc on the climate and seasons.

In the past, Earth's tilt has changed by about 1-2º, which scientists think could have caused Ice Ages in the past. It's hard to know what a 10º or 45º tilt would do but probably nothing good for most life on Earth.

The moon isn't just imperative for life on Earth today. Experts believe that it may also have played a key role in the formation of life more than 3.5 billion years ago. Turns out, the moon isn't just a beacon of light in the night sky. Its existence is crucial to the delicate balancing act that makes life here possible.

#### Article IX forces coordinated earth monitoring that enables disaster adaptation---satellites are key

Dionysia-Theodora Avgerinopoulou & Katerina Stolis 17. Avgerinopoulou is the Executive Director of the European Institute of Law, Science and Technology, also serves as the Vice Chair of the Steering Committee of the Global Water Partnership Organization, is the f. Chair of the Environment Committee and of the International Affairs and Public Defense Committee of the Hellenic Parliament; Stolis is a researcher of the European Institute of Law, Science and Technology and holds a Master’s Degree in Environmental Governance and Sustainable Development. 03-11-17. “Current Trends and Challenges in International Space Law.” http://www.essc.esf.org/fileadmin/user\_upload/essc/Article\_Current\_Trends\_and\_Challenges\_in\_Space\_Law.pdf \*\*\*“and” inserted for readability

Not less important than these principles is the Article IV which other than the peaceful use of outer space explicitly “forbids the Parties to place any objects carrying nuclear weapon or any other kinds of mass destruction in orbit around the Earth, install such weapons on celestial bodies or station such weapons in any other manner”. 21 Special attention should be drawn to Article IX, which, even though it incorporated the forward and backward environmental protection, 22 \*\*\*FOOTNOTE BEGINS\*\*\* 22 The environmental protection, as understood in Space Law, receives a dual form: the forward and the backward one. The forward environmental protection refers to the protection of outer space from any object coming from the Earth that may contaminate the outer space, [and] while the backward environmental protection concentrates on Earth’s protection from contamination by a space object. For more information see (Conley & Rettberg, 2011)Conley, C. & Rettberg, P., 2011. COSPAR Planetary Protection Policy - Present Status. In: M. Hofman, P. Rettberg & M. Williamson, eds. Protecting the Environment of Celestial Bodies. Paris: International Academy of Astronautics Cosmic Study (PECB), pp. 16-24. \*\*\*FOOTNOTE ENDS\*\*\* it also reflected the limits of the Treaty, when the consultations about a potentially harmful activity weren’t made obligatory.

Overall, the OST is one of the unique outstanding law-making treaties of Public International Law, where all major space countries are Signatory Parties to it. It also resemblances the legal regime governing Antarctica. It significantly contributed to the development of Article 13 of the UN Charter23 and served as a springboard in the subsequent treaties, which elaborated upon and amplified its contents. Since then, Space Law has been evolving accordingly to the space-related activities, in order to ensure that they are carried out in a peaceful manner.

In order to provide a holistic understanding of the outer space legal regime, a brief overview of the four subsequent treaties will follow, that is essential for acknowledging the issues covered by the existing framework and answering the question whether there is a need or not to reform it.

[[SHAPE 1 OMITTED]]

ii) Rescue Agreement, 1968

The 1968 Rescue Agreement specifies the Article V of the OST and deals almost exclusively with “the return of astronauts and space objects”, 24 the “assistance to astronauts” 25 and the “obligation to inform other states and the UN Secretary-General of any phenomena liable to constitute a danger to the life or health of astronauts”. 26 In space, astronauts have the obligation to help other astronauts, but for the countries it is not compulsory to render them assistance. Thus, the provisions of the Agreement explicitly integrate the issue of “assistance to astronauts in the territories under”27 and “beyond the jurisdiction of space parties”, 28 but they do not address the issue of assistance in space29 nor the expenditure concerning the rescue and return of astronauts. Overall the Agreement enshrines the immunity of astronauts and establishes rescue procedures in the event of an accident.

iii) Liability Convention, 1972

The Liability Convention is essentially an elaboration of Article VII of the OST and addresses the key issues that were previously left unanswered. The Convention provides definitions of key terms, in order to determine the extent of the issue. It establishes two versions of liability: on the one hand, the strict or absolute liability applies in case of “damage on the surface of the Earth or to aircraft in flight” by a space object,30 while on the other hand, the fault-based liability applies in the event of “damage being caused elsewhere than on the surface of the Earth”. 31 Under the strict liability provisions, “States are always liable for damage caused by their space objects”, without the need to prove that damage is the consequence of the fault of the launching state. In contrast, under the fault-based liability regime it is necessary to search for the fault, that is, whether it has been caused by “an act or omission done with intent to cause damage on the part of a claimant State, or negligent or from an accidental and unforeseeable event”. 32 Finally, liability lies even in the case of legitimate activities, while the term “space object” includes “the components of a space object, as well as the launch vehicle and its parts”. 33

iv) Registration Convention, 1975

Similarly, the Registration Convention has close ties with the 1967 OST and specifically in Article VIII with regard to the “obligation of the launching state to register the space object, when it is launched into Earth orbit or beyond and inform the Secretary-General of the UN of such a registration”. 34 Thus, the Convention establishes two different ways that a space object must be registered with specific information35 either in a “national registry” 36 or in a central “Register to be maintained by the UN Secretary-General”.37 The registration serves a two-fold purpose to contribute to the minimization of weapons being placed into orbit and the peaceful handle of outer space given the difficulty to identify a spacecraft otherwise. It is worth noting that according to Lyall and Larsen “registration establishes a link between a space object (and any personnel aboard) and a particular state for the purposes of jurisdiction, control and the return of astronauts set out in Arts V and VIII of the OST.”38 However, the implementation of the Convention is highly influenced by the reluctance of the states to disclose their real mission, especially in the case of military purposes, and this leads to widespread mistrust and insecurity. This ambiance is enhanced by the term “as soon as practicable” that refers to the responsibility of states to send particular information as to a space object which they have registered, which leaves a small “window” to send the information after the launch. 39

v) Moon Agreement, 1979

The Moon Agreement is the latest international space treaty that was adopted under the perception that the use of the Moon was imminent after the US Moon landing in 1969. 40 Unlike the other treaties, this Agreement came into force on 11 July 1984, but is not ratified by the decisive countries, 41 since they do not want to renounce their rights or to compel themselves to share technologies for exploitation activities, as the Moon Agreements provides. The Agreement is a result of a compromise between the developing countries and the space faring countries by accepting the principle of “common heritage of mankind” 42 along with the confirmation of “the freedom of scientific investigation, exploration and use of the Moon as a right of all states”. 43 The larger part of the Agreement is not controversial, since it reiterates the general rules and principles of the OST, such as the use of celestial bodies for exclusively peaceful purposes, the obligation to assist astronauts and international liability. The controversial part of the Convention is solely limited to “the establishment of an international regime to govern the exploitation of the natural resources”44 reflected by the concept of the “common heritage of mankind.”45 This concept refers to the common management of areas outside national jurisdiction with “an equitable sharing in the benefits derived from those resources, despite the level of participation in the exploitation activities.” 46 It is worth noting that the Agreement outlines the basic principles and purposes of the international regime,47 but without establishing it, which leaves upon the states to structure these rules after the “exploitation becomes feasible”. 48 All in all, given the paltry level of ratifications, the Agreement only binds its members, despite the fact that its content is reasonable.

The Moon Agreement heralded the end of an era of space law-making globally accepted, 49 so during the 1980s and 1990s the United Nations returned to the adoption of Resolutions by the General Assembly. In this way, the most prominent Resolutions are the “1986 Remote Sensing Principles”, 50 the “1992 Nuclear Power Sources Principles” 51 and the “1996 Space Benefits Declaration”. 52 The Resolutions, combined with the less active engagement of the UNCOPUOS regarding the development of new space law rules, reflect the “soft law” 53 approach. This approach promotes the adoption of legal documents, such as Declarations, that are not legally binding, but they have succeeded in formulating a common ground and understanding on controversial or difficult to handle issues among the international community. In addition, it facilitates the development of Space Law in line with the technological developments that have contributed to the expansion of the uses and application of space related technologies along with the increased capabilities of new states-actors becomes a necessity. Thus, the “soft law” approach is crucial to the development of Space Law, as well as other branches of law, since it may later constitute the first steps towards the creation of legally binding treaties.

Following the presentation of the outer space legal regime throughout the “preparatory stage”, the “law-making era” and the “soft law era,” 54 there is a clear need for an assessment of the existing legal regime in the light of the emerging issues and the consequent need, if any, for legal reform.

III. The Challenges Ahead

The OST, along with the Agreements and Conventions that shed light on particular aspects of the treaty, has been successful in establishing a legal regime that maintained peace and order in outer space. However, the adoption of the OST already counts several decades, which sets the emerging issues beyond the effective management of the current Space Law. The need for new Space Law rules, according to Tronchetti: “is driven by four main factors: (a) the technological developments, (b) the increased capabilities of specifically launching satellites into orbit, (c) the rise of new commercial space activities and (d) the emergence of new legal and technical issues that were not foreseen or considered relevant at the time of the drafting of the UN space treaties.” 55

A few of the current issues regarding Space Law, for instance, currently include: the increasing role of private sector in outer space, which calls for a review of current policies and legislation; the use of domestic laws, and the consequent need for their own legal reform, in order to encourage broader engagement with commercial space innovation; the adequacy of existing international liability regime to protect space tourists in the event of a space vehicle accidents; the increasing use of space for military activities; the challenges of scavenging space debris, with a focus on active remedial methods; the protection of space assets;56 and the legal regime pertaining to Anti-satellite weapon (ASAT). Also, it invites opinio juris from law scholars for ensuring the applicability of the Outer Space Treaty on all states without ratification and universal abidance with Space Law without demur. These indicative issues highlight the multi-level dimension of space-based legal issues.

The remainder of this article will discuss two key issues of the current space law namely: (1) the privatization and commercialization of outer space along with space tourism; and (2) the regulation of orbital space debris and environmental aspects, such as climate change.

i) Commercial Human Spaceflight – New Space

While exploitation of space is still in embryonic level, there are some new developments that gradually take place. Thus, we face a new era of Space Law during which the outer space operations that were traditionally conducted by government agencies are open to the public and the private sector. The rise of private spaceflight industry is directly related to the emerging term of “NewSpace”57 or alternatively “commercial” or “entrepreneurial space” or even “astropreneurship.”58 The Space Frontier Foundation defines “NewSpace” as “people, businesses and organizations working to open the space frontier to human settlement through economic development.”59 Likewise, the most appropriate definition of “private manned spaceflight”, according to Frans von der Dunk is the “flights of humans intended to enter outer space (a) at their own expense or that of another private person or private entity, (b) conducted by private entities, or (c) both.”60 Similarly, a commercial space activity, according to Tronchetti, can be defined “as one in which a private entity puts its own capital at risk and provides goods or services mostly to other private subjects or consumers rather than to the government.” 61 Despite the lack of a clear legally binding definition of NewSpace and “private manned spaceflight”, according to a NASA presentation: “We are at a turning point in the history of space exploration and development - new industries are being born that use space in many different ways. 62” More and more states are undertaking space activities themselves or are authorizing a private enterprise to do so, which increases the danger to take decisions that ignore or even contradict the international space agreements. This leads to a new approach to Space Law and highlights the need to reform the laws, in order to catch up to the new reality. Especially, if we take into account that soon all countries will be able to carry out exploitation missions, due to lower launch costs.

The rise of private sector’s involvement is space began in the 1990s due to technological maturity, significant benefits and decreasing costs along with the governmental need to reduce space expenditures. The benefits from the commercial use of technologies related to outer space are significant and they range from the field of telecommunications and remote sensing to space tourism and space navigation. The commercial private human access to outer space is one of the most imminent and hard to handle topics, which it is defined as “any commercial activity offering customers direct or indirect experience with space travel.” 63 Space tourism64 started as a concept after the launch of Dennis Tito to the Russian part of the International Space Station (ISS) in 2001, 65 while the launch of Scaled Composites’ SpaceShipOne in 200466 marked the begging of re-usable spaceships. Since then, the commercial use of space has evolved and has subsequently risen major legal questions. This new reality requires regulation by both private and public sectors of legislation, in order to address central issues, such as launch permits and restrictions which a state may impose for reasons of national security. Countries are begging to adopt national legislation for outer space activities67 with the pioneers being the US68 and Australia. Until today, most space activities are conducted by governmental space agencies like the US National Auronautics and Space Association (NASA), 69 the Russian State Space Corporation: Roscosmos,70 the European Space Agency (ESA) 71 or the Japan Aerospace Exploration Agency (JAXA), 72 in collaboration with private companies. 73

The outer space legal regime was drafted at a time that space activities where purely scientific and the only actors in the exploration and exploitation where the governments, hence all space treaties address only states. Nevertheless, entrepreneurs operating in space are subject to international, regional (e.g. European Union Space Law) and national legal regulations. 74 Thus, commercial operations are concerned with the principles of the OST along with the Liability Convention. According to the provisions of the OST: “Outer space is not subject to national appropriation by claim of sovereignty, by means of use or occupation or by any other means”.75 The most important regulation about private actors is Art. VI of the OST, which states that “States Parties to the Treaty shall bear international responsibility for national activities in outer space, whether such activities are carried on by governmental agencies or by non-governmental entities”. It also clarifies that the “appropriate state bears the responsibility for authorization and supervision of all activities of non-governmental entities”. 76 This Article establishes a dual system, where private activities are permissible, but at the same time the responsibility lies with the states as a result of finding consensus between the conflicting claims of the Soviet Union and the United States. Correlatively by Art. VII a “launching state is internationally liable for damages its object may cause to another state party” of the OST, as well as “it retains jurisdiction and control over a space object and its personnel” based on Art. VIII. From these Articles it is clear that the current legal regime outlines the main core for the commercial activities, but it is up to interpretation and national legislation of each State to clarify the details.77 The most prevailing view is that states remain legally responsible in the case of activities by their national private commercial entrepreneurs. The access to space is controlled by states and therefore they should take the appropriate measuresfor licensing and supervision of the private users acting within their own territory either per case or on a more general basis.

The approach to the legal aspect of liability in the light of private entrepreneurs is a demanding one. As discussed above, the Liability Convention distinguishes between strict and fault-based liability, but it does not address the issue of who is the “owner” of and who is “responsible for” the space object causing the incident. According to the Convention, the “launching state is held liable for any damage caused by its space object”, but in the light of private involvement, the issue is not so simple. There are many uncertainties regarding the terms that define the “launching state,” such as who is undertaking the launch and what is the liability if it is a private launch operator. The “territory”78 that is used for the launch is an exclusively reserved right for the states, 79 but what if the launch takes place outside the territory of any states, such as at the high seas? Nevertheless, since the treaties address only states, states are the only ones that carry the full burden of international liability according to the state the space object is registered. Such an assumption leaves the countries exposed to the risk of high compensations, unless national space legislation provides specific regulations, such as the obligation for a liability insurance in an effort to guard themselves against liability.

In a more specific context, the issue of space tourism also raises challenging questions about liability issues, since the space treaties refer only at issues including astronauts. According to Article V of the OST astronauts are “envoys of mankind”, which allots them special rights.80 The Rescue Agreement also focuses on the return of the personnel and the assistance to astronauts, who conduct “activities for the benefit and in the interest of all countries”. In this context it is unclear if space tourists81 fall under the right of rescue. Even though there is no explicit provision, it is considered that it covers whoever is in the outer space. The Article 31 of the Vienna Convention regarding the interpretation of treaties leads to this conclusion.82 According to this article: “a treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose,”83 which essentially prohibits the unreasonable results and highlights the elementary considerations of humanity. But on the other hand, the ISS Partner States84 and the US legislation85 make an explicit distinction between professional astronauts and spaceflight participants, which reinforces the view that the Rescue Agreement should not apply to spaceflight participants. 86 Even though there is a remarkable difference of opinion, the prevailing theory is that humanitarian considerations entail the applicability of the Agreement and the existing general humanitarian obligations to assist humans in distress are sufficient without the qualifications as “envoys of mankind”.87 However, it will be extremely useful for the international community to elucidate the status of “space-flight participants” and their relationships with the Rescue Agreement, which will lead to the clarification of the provisions and the elimination of conflicting laws and practices.

At the regional level the main regulations for space activities lay within the EU legal framework, notably provisions regarding data protection and general economic rules. Its main concern is to “prevent outer space from becoming an area of conflict” and in this process the EU issued a “Draft Code of Conduct for Outer Space Activities” 88 in 2008. On a national level the adoption of a national space legislation is directly linked to the demand of private space commerce and it is mainly concerned with issues of liability and supervision of private actors. The US, UK, Australia and the USSR have developed national space legislation, while China, India, Indonesia and Thailand are in the process. For instance, the US have adopted the Commercial Space Launch Act, 89 which establishes the licensing regime and addresses the authorization, supervision and liability of commercial operations. The “Spurring Private Aerospace Competitiveness and Entrepreneurship (SPACE) Act” of 2015 constitutes an update of commercial space legislation, which allows US citizens to “engage in the commercial exploration and exploitation of space resources”,90 even though there is a debate whether the recognition of ownership of space resources is an act of sovereignty that violates the OST or not.

Due to the legal vacuum left by the treaties about commercial space activities there is still an ongoing debate on whether these activities operate within a lawless or not business environment. 91 The fact that space has been acknowledged as part of the “common heritage of man” raises the question whether space should continue to be defined as that or whether its definition should be changed to allow private property in space. The “principle of non-appropriation” is said to pose a barrier in the way of a thriving space economy, since the absence of explicitly guaranteed proprietary rights deters investors, especially in the case of celestial bodies where mining is possible. 92 The need to devise rules to regulate intellectual property93 in the light of the increasing commercialization of outer space and the emerging need to determine whether existing copyright law should be applicable to satellite activities are additional issues. Oosterlinck held the view that there was need for a legal framework about intellectual property relating to the outer space activities, but with “minimum conflict and maximum progress.”94 On the other hand, Balsano and Smith highlight that the “present framework for use of IPR (Intellectual Property Rights) in space activities suffers from several inadequacies, inequalities, and ultimately from potential conflicts with the founding principles both of national IPR law and of international law.” 95 Either way, the OST provision that “a state shall retain jurisdiction and control over an object on its registry” 96 fine-tunes the issue and allows for a creative interpretation through the extension of the national intellectual property rights to encompass space activities and inventions, especially in the fields of pattern and copyrights.97 However, the different point of views and interpretations in national laws hamper the applicability of intellectual property rights. The main issues continue to be the lack of legally binding definitions of the “appropriate state” and “space object” in the light of commercialization of outer space along with the concerns about the applicability of Space Law, Air Law or both, especially within the liability context. A positive step could be the adoption of a multilateral agreement to cover the transfer of supervisory duties and authority between states in the event of a change of ownership of a space object in space. 98 Also, an improvement would be the adoption of a space traffic management system under the Registration Convention regime along with need for a formal relationship between space traffic and air traffic control. According to Lyall and Larsen, 99 the establishment of a boundary between air-space and outer space100 alongside with the need to harmonization between the use of air-space and transit to and from outer space would also be remarkable.

In the years to come, the international community, the space companies and the legislatures will have to play a crucial role in handling the complicated legal issues that will raise from the increased commercial human spaceflight and the subsequent questions of liability in the event of accidents. 101 The private entrepreneurs are anticipated to increase their share in space operations in cooperation with the government agencies, but it cannot be expected to take over space in the medium term. There are several factors that play an essential role in this assumption, such as more the costs of such trips and less the inadequacy of the legal framework, since it is still unclear where space legislation applies. Nevertheless, the space business will continue to evolve, especially if we take into account Walter’s comment that “the past has shown that cut-throat competition and legal uncertainty have seldom discouraged entrepreneurs from trying something new.”102 In the light of these developments it is an absolute necessity for International Law to establish the balance between respect for the main principles of Space Law and the need to support private imitative. 103

ii) Environmental Aspects of Space Law - Space Debris

Space presents a variety of environmental issues to which law must respond, of which the most severe are those that might take place after the launch. Faced with the environmental risk, the states, according to Article IX of the OST, have the obligation to “avoid harmful contamination of outer space (forward contamination), as well as adverse changes in the Earth resulting from the introduction of extraterrestrial matter”104 (backward contamination). This Article is the basis on which states have the obligation to “adopt appropriate measures” and therefore act to prevent changes in the space environment. Article IX along with Articles I (1), III, IV and VIII outlines the core environmental protection. The importance of maintaining the space environment is, among other things, directly linked to its contributions in solving environmental issues of the Earth. Thus, for the scope of the current analysis the crucial role of the space observations for the protection of the environment along with the most imminent environmental space issue, the space debris, will be discussed. Of course, space debris are by no means the only environmental issues related to space exploration, since, other issues, such as nuclear contamination and forward and backward contamination are of equal importance.

It is commonly known that numerous space-related activities can serve as an effective tool for the protection of the environment, such as satellites that monitor the earth environment providing data about the complicated global changes of the Earth system and early warning systems for natural disasters. These systems are able to mitigate the consequences of natural disasters through coordination and technological space capacities. 105 Thus, satellite observations play a crucial role filling the gap in the data sparse regions and assist in understanding the functions of our natural environment. The collection of global data through atmospheric, climate, hydrological and ecological applications106 is undeniably a significant contribution to developing and implementing means to solve environmental or human problems. Apart from the data, space technologies play a crucial role in sustaining the Earth’s resources. For example space observations help in securing freshwater resources, 107 as well as in forest management, climate change and disaster and risk management. 108 For instance, one of the most important initiatives for earth monitoring is the Global Monitoring for Environment and Security (GMES), 109 which collect data and provides information that enhances the areas of climate change (adaptation and mitigation policies), emergency response services, land and marine monitoring services and atmosphere services. 110 These space applications are only indicative of the importance of space technology for improving life on Earth.

#### Unmitigated disasters cause extinction---advance warning enables adaptation.

Anders Sandberg 18. Future of Humanity Institute, University of Oxford. 02/26/2018. “Human Extinction from Natural Hazard Events.” Oxford Research Encyclopedia of Natural Hazard Science. oxfordre.com, doi:10.1093/acrefore/9780199389407.013.293.

Systemic Risks

Localized disasters or slow-moving risks are unlikely on their own to spell doom for H. sapiens. It may appear that an unlikely intense global event or confluence of disasters need to occur in order to cause extinction. However, many risks are potentially systemic: a sequence or combination of disasters may reduce resiliency and the ability to recover, especially when interacting with the human systems.

A model of how compound risks can act is the synchronous failure model of Homer-Dixon et al. (2015). Multiple stresses (such as climate change, resource shortages, or conflicts) can interact and accumulate in a social-ecological system, pushing it toward a state where its coping capacity is diminished. Different subsystems become coupled because they require support from each other to function in the stressed state. When a crisis occurs (either externally triggered or because an internal component finally fails) it rapidly cascades through the system, spreading between subsystems and causing the whole to fail. Simultaneous damage is often multiplicative in severity.

Many human systems such as food, energy, finance and communications are global, densely interconnected systems where failures can cascade rapidly (Helbing, 2013). They have developed in a locally rational way: the gains in efficiency and reliability have been significant. However, the probability of global failures also has increased compared to more local, modular and redundant systems (Goldin & Vogel, 2010). While societal collapse does not imply extinction, humans are dependent on complex societies and their high productivity, and any long-term collapse would reduce the human carrying capacity significantly.

A stressor such as climate change may increase the probability and severity of global failure, and once this occurs vulnerability to further risks increases. Various example scenarios can be constructed where plausible events produce gradual deterioration of the human system before it can recover; see, for example, Tonn and MacGregor (2009) and other papers in the same issue.

Another example is sudden geoengineering cessation. If, as a response to climate change, solar radiation management geoengineering is used to maintain temperature, this will require ongoing technological maintenance. If a global disaster disrupts civilization, besides the damage from the primary disaster there would also be a rapid temperature change to close to what the un-modified climate would have been. This will likely produce massive disruptions of agriculture and other human systems at the time when vulnerability is maximal (Baum, Maher, & Haqq-Misra, 2013). In this case a risk mitigation effort adds to systemic risk.

Systemic effects are hard to predict (trade can both strengthen human societies by providing an adaptive system of distribution, prosperity, and incentives for innovation as well as destabilize them due to market bubbles, dependencies, and spread of pathogens). Taking uncertainty into account is possible but tends to lead to conservative policies (Weitzman, 2009). Another approach is to engineer human systems so they are naturally redundant, modular, and otherwise resilient to systemic stresses (Helbing, 2013).

Probabilities

Estimating existential risks can be done in many ways, each with their own merits and drawbacks; see (Tonn & Stiefel, 2013) for a review.

It is possible to place upper bounds on extinction risks due to natural disasters by considering the fossil record. This can be done in several ways; the following will be based on the work of Toby Ord (2017). The simplest bound is based on the observation that H. sapiens has existed for 200,000 years: this observation would be unlikely if the extinction risk was higher than about 1 in 3,000 per century. One can say that an extinction rate of 0.15% or higher per century is ruled out at a 95% confidence level.

Another bound uses now-extinct related hominin species as a reference class, producing estimates in the range 0.001% to 0.05% per century. This is in line with survival times for mammalian species, which typically is 1–2 million years (Raup, 1978) but shorter than for the entire fossil record where lifetimes of 5–10 million years are typical (Raup, 1986; May, Lawton, & Stork, 1995).

H. sapiens is an unusually populous, well-dispersed, and adaptable large mammal species. However, it also has high food requirements and a long generation time. It may then be that the most likely risk to lead to extinction would be a mass-extinction level risk. Large mass extinctions occur at a rate of about 1 in 100 million years, producing a risk estimate of 0.0001% per century.

One issue is that we are still discovering new kinds of existential risks. As noted above, supernovas have been recognized as a risk since the 1950s but gamma ray bursts were recognized as a risk first in the 1990s. High-energy physics risks were suggested in 1970s and later. Recognition of supervolcanism as a risk dates to the 1990s, in turn based on the models of nuclear winter in the 1980s. “Big rip” early endings of the universe were noticed in 2003 (Caldwell, Kamionkowski, & Weinberg, 2003). Since the rate of discovery does not seem to have slacked off, it is plausible that more natural hazards exist that we are unaware of, yet could pose a threat. At the same time, the above estimates bound the total risk: we are merely refining our understanding of what hazard categories exist.

It should be noted that using past geological or fossil records to estimate risks that could have influenced the emergence of the species doing the risk estimation requires some care: risks that would have precluded the emergence of the species would naturally be underrepresented (Ćirković, Sandberg, & Bostrom, 2010). It is also clear that the peculiarities of the current situation may exacerbate some risks (e.g., pandemics) while reducing others (e.g., local disasters); these estimates merely show the risk magnitude for the earlier stages of the species’ history. The current probability is dynamically changing depending on human action.

Probability estimates are on their own irrelevant: the point of risk assessment is to motivate rational risk management. This includes prioritizing mitigation efforts (typically toward the largest, most urgent, and most controllable risks) and research to reduce uncertainty and find more options.

Mitigation

Human extinction is an unusual risk since it can only occur once. Mitigation efforts need to succeed every time.

Mitigating extinction risk can be done by reducing the probability of sufficiently severe hazards occurring, improving resilience mechanisms to reduce the damage, and endurance mechanisms to ensure that survivors can rebuild and repopulate.

Many astrophysical extinction risks, supervolcanism and the emergence of new diseases are likely impossible to prevent, requiring resilience strategies. Impacts from near earth objects or comets can in principle be prevented given enough lead time and the right technological level (NRC, 2010). The amount of impulse needed to avoid an earth collision scales inversely with the lead time and proportional to the impactor mass: with enough time, even a high-precision weak intervention can move large objects. Managing atmospheric emissions and possibly intervening with geoengineering can influence climate risks (Wigley, 2006; Moreno-Cruz & Keith, 2013). Human systems can be designed to be resistant to various forms of systemic risks (Helbing, 2013).

Prediction of extreme events is often impossible since they are the outcome of cascades in noisy, chaotic systems with hidden variables, and past data of less extreme cases often does not constrain models of phenomena of this magnitude. This requires using robust strategies taking large uncertainty into account (Weitzman, 2009). Although exact prediction may not be possible, rapid and improved response is possible and can enhance the resiliency against many of the listed threats. This includes better risk surveillance, preparation of responses and resources, as well as intergovernmental coordination.

Many extinction risks have joint pathways. For example, supervolcanism, large meteor impacts, and nuclear winters (not discussed in this article) do most of their harm by precluding agricultural/fishing over a span of years leading to widespread starvation (Engvild, 2003). While they also cause other harms this particular shared pathway can be dealt with by emergency food stores or alternative food sources (Denkenberger & Pearce, 2014). Shielding in space against radiation sources could in principle mitigate the risk from supernovas, GRBs, superflares, and similar risks (Ćirković & Vukotić, 2016). Improved resiliency against particular damage pathways can hence improve chances against a large set of risks.

Endurance mechanisms aim at ensuring survival, adaptation, and eventual recovery after a near-extinction disaster (Maher & Baum, 2013). An occasionally suggested endurance mechanism against extinction risks is the deliberate construction of refuges where people can survive (or the encouragement of natural refuges in isolated regions, nuclear submarines etc.). Ideally such refuges would be self-sufficient and independent of the earth’s surface (Baum, Denkenberger, & Haqq-Misra, 2015; Jebari, 2015). However, refuges only help against certain categories of disasters and their cost-effectiveness depends on the relative value of current and future generations (Beckstead, 2015).

Undersupply of Mitigation

Preventing extinction is important; at least as important as saving the lives of 7.2 billion people, and quite possibly far more important when taking future generations and their value into account (Parfit, 1984; Bostrom, 2003; Bostrom, 2013; Häggström, 2016).

Mitigating extinction risk is an undersupplied global public good. For example, traditional statistical life valuations suggest that a $16–$32 billion annual investment in asteroid defense would be cost-effective yet U.S. government spending on asteroid detection (with no mitigation) is around $4 million per year, orders of magnitude smaller than funding for hazardous waste sites per unit of risk (Gerrard, 2000; Matheny, 2007). The annual cost to the world due to pandemic influenza has been estimated to $570 billion per year or 0.7% of global income, comparable to estimates of the long-term costs of climate change (Fan, Jamison, & Summers, 2016): the global influenza vaccine market has been estimated to less than $4 billion per year (Kaddar, 2013). These estimates merely take lives saved into account, not the value of future generations.

Since existential risk mitigation is non-excludable and non-rivalrous there is a free-rider problem (non-participants gain the benefit without having to pay) and each producer of risk reduction would only gain a fraction of the total benefit. This is amplified by the transgenerational nature of risk reduction: most of the benefit will accrue to future generations. In principle the value to them of our present preventing extinction is near-infinite, but they cannot pay us any compensation (Matheny, 2007; Bostrom, 2013).

Beside the normal logic of undersupply and lack of global coordination mechanisms there are also cognitive and cultural factors making existential risk mitigation rare. Part of the problem may be discomfort with the topic leading to willful denial or ignorance (Epstein & Zhao, 2009). Part of the problem is the difficulty to fit the topic with human cognitive biases (Yudkowsky, 2008; Wiener, 2016). Humans have heuristics that provide quick and adequate answers for many situations but lead to systematic biases in many situations removed from our ancestral everyday ones. For example, since extinction has not occurred in the past, the availability heuristic (“probabilities of events are roughly proportional to how easy examples of past events come to mind”) will underestimate likelihood. Scope neglect makes us relatively insensitive to the number of lives affected, making the willingness to make an effort scale sublinearly with the size of the problem. In general, without rich context information people are generally bad at judging differences between low probability events (Kunreuther, Novemsky, & Kahneman, 2001).

Risks are judged not just by probability and severity but also by psychological aspects such as outrage and dread (Slovic, 1987). This can sometimes support efforts to mitigate global risks (since they tend to score highly on dread) but makes the focus strongly dependent on what is and is not discussed in public (Yudkowsky, 2008). This makes constructing risk management strategies that are resistant to behavioral biases vitally important for extreme risks (Kunreuther & Heal, 2012; Wiener, 2016).

Conclusion

There is clear evidence that natural events could cause the extinction of H. sapiens. While astronomical risks may be the most dramatic, geophysical risks to food security and pathogenic risks appear to be more significant. It is unlikely that a single disaster will be severe enough to directly cause extinction, but it is plausible that it could place the species in a vulnerable situation for a long time, during which other risks could lead to further vulnerability and extinction.

### Plan---1AC

#### The United States federal government should propose an Article IX consultation with the government of Russia over positional information concerning satellite interactions between NORAD 40258 and INTELSATs 7 and 901 between June 25th and September 25th, 2015.

### Solvency---1AC

#### The final contention is SOLVENCY

#### The NORAD 40258 satellite is a unique test case---US invocation clarifies when consulting is necessary and what procedures should be utilized, even without a Russian disclosure.

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Article IX contains two specific legal obligations and one legal right. The first legal obligation, as previously discussed, deals with contamination of extraterrestrial environments and preventing the contamination of Earth’s biosphere by extraterrestrial material introduced via the space activities of a State Party. This segment of Article IX has been borne out in State practice with protocols such as those developed by NASA’s Office of Planetary Protection, and therefore it is an accepted international practice.

The Legal Duty to Consult

The second legal obligation and the legal right in Article IX are co-joined and have little or no customary precedent in the international arena. The second legal obligation is found in the second segment of Article IX whereby:

If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment.

This segment of Article IX creates a legal duty upon a State to consult with the international community, presumably through the United Nations and specifically the Committee on the Peaceful Uses of Outer Space (COPUOS), in the event a State believes its planned space activities, including those by non-government actors, will potentially cause harmful interference with the peaceful exploration or use of outer space by other State actors or their nationals. Unlike the first legal obligation of Article IX, this legal obligation has never been invoked by any State outer space actor, although there have been substantial activities could have warranted its application.

For instance, both the United States and the Soviet performed numerous national activities space activities subsequent to the signing of the Outer Space Treaty and during the Cold War to include both direct-ascent and co-orbital anti-satellite (ASAT) tests, but neither side felt the legal duty to consult was triggered, which was influenced by the classified nature of these activities. Moreover, during the last decade there were two highly-publicized events that may or may not have implicated this legal duty under Article IX.

First, is Operation Burnt Frost, where the United States used an ancillary capability to its ship-based anti-ballistic missile system to intercept its derelict satellite, USA-193, on February 20, 2008 out of concern the intelligence satellite’s hydrazine fuel might survive reentry and cause contamination, which the United States would be liable for under international law. The United States concluded prior to the intercept because the satellite was in such a low orbit any debris from a successful intercept would reenter shortly after and not pose harmful interference to the space activities of other States, which would not rigger the duty to consult in Article IX. Notwithstanding, COPUOS was informally briefed on the planned intercept by Dr. Nicholas Johnson, formerly of the NASA’s Orbital Debris Program Office, just hours prior to the intercept.

A second more serious event occurred prior to Operation Burnt Frost when on January 11, 2007 the People’s Republic of China destroyed FY-1C, an aging Chinese weather satellite, with a direct-ascent ASAT. The resulting hard-kill created a substantial debris field in polar orbit, which has increased in the orbital space it encompasses. As a result, the debris field intersects the orbits of many functioning satellites belonging to several States and requires monitoring to prevent interference and collisions. Several days after the test, the international community expressed its concern to the PRC, including why the PRC did not inform the international community of the impending test whether informally or via Article IX. Plausibly, it is this type of event that would trigger the second legal obligation in Article IX, yet the PRC did obligate itself.

As demonstrated, none of the Big Three have obligated themselves to the consultation duty in Article IX. This is not surprising because each of these States have sufficient prestige in outer space activities to establish by their own actions a customary practice of when the legal obligation to consult under Article IX is triggered. This in turn would create an international litmus test for the duty to consult under Article IX, which could expose national security activities in outer space to unwanted scrutiny. In effect, this is likely the rationale why the United States and the Soviet Union never obligated themselves to consult via Article IX during the Cold War.

Conversely, by not obligating themselves to Article IX for these activities, both the United States and the Soviet Union created a customary international norm for not when the legal obligation to consult in Article IX is triggered but instead when it is not triggered. Notably, the PRC claimed its 2007 ASAT test conformed with international law, which suggests it was alluding to this customary practice, i.e. the PRC felt prior to the test the customary practice created by the United States and the Soviet Union allowed it [the PRC] to destroy one of its satellites with a direct-ascent ASAT without triggering the legal obligation to consult in Article IX.

Furthermore, it is clear the Russian Federation did not consider itself obligated to consult per Article IX prior to the launch of NORAD 40258 nor before its maneuvers between INTELSAT 7 & INTELSAT 901, which suggest the Russian Federation is relying on the customary practice regarding when the legal obligation to consult in Article IX is not triggered. Moreover, the Russian Federation may be subjectively relying on what it perceives to be customary law created by the United States through its national security activities in geosynchronous orbit, which in turn affects the legal obligation to consult in Article IX.

The Legal Right to Request a Consultation

The legal right to request a consultation in Article IX dove-tails the legal obligation to consult. The right is created in Article IX whereby:

A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, including the moon and other celestial bodies, may request consultation concerning the activity or experiment.

The legal right to request a consultation occurs before a State performs a space activity. Unlike the duty to consult, the right to request a consultation was invoked by Japan following the PRC’s 2007 ASAT test. The question is whether Japan’s use of this right under Article IX creates a binding customary practice. There are two reasons it may not create a customary usage. First, the right to request a consultation is for an activity being planned by another State Party in outer space, but Japan claimed the right to request a consultation after the test occurred. The second and most persuasive reason for denying a customary practice was created is because Japan, although a noteworthy State actor in outer space, simply lacks the level of standing for a customary norm to be created. That is to say, even though Japan’s use of the right to request a consultation is indicative of a state practice, which Japan appeared to hold itself legally obligated to, no other State has since similarly invoked the right to request a consultation in Article IX. Simply put, Japan lacks the level of prestige in outer space activities to create a customary norm on its own.

Additionally, Japan’s use of the right to request a consultation though technically incorrect and lacking the standing to create a customary practice on its own pales in comparison to the inaction of the United States in the matter. Reportedly, Western intelligence organs had foreknowledge the PRC was planning an ASAT test, although it is unclear how much detail they knew and whether that detail would have been enough to trigger the right to request a consultation. Nevertheless, there is an argument the failure of the United States to request the right of consultation creates a similar conundrum to the legal obligation of consultation in that the failure to use either creates a customary norm of when it is not applicable.

So herein lies the impasse for the United States. NORAD 40258 has positioned itself in proximity to INTELSAT 7 and INTELSAT 901. Because NORAD 40258 is a Russian military satellite, INTELSAT has no legal recourse to address the situation nor do they have the authority to open a dialogue with the Russian Federation. Therefore, because INTELSAT 7 and INTELSAT 901 are registered to and under the jurisdiction of the United States per Article VIII of the Outer Space Treaty, INTELSAT’s only recourse is to turn to the United States government for assistance. As noted before, the diplomatic environment between the United States and the Russian Federation is chilly and tense at best, and whether diplomatic overtures will even be acknowledged is questionable.

This bears the question whether the time may be ripe for the United States to make a formal request for consultation under Article IX. Making a formal request before the United Nations could work to the soft-power advantage of the United States because it would not only put significant political pressure on the Russian Federation to respond to the United States’ request, but also given the prestige of the United States in outer space activities would create a customary practice of under what circumstances the duty to consult is triggered, which would give new significance to Article IX.

[[OPTIONAL]]

#### Extensive coop now AND planned projects thump

Vladimir Isachenkov 18, Defense News Reporter for the Associated Press, “Russian, US officials Say Space Cooperation Remains Strong”, AP News, 11/19/2018, https://www.apnews.com/9687d0640d9d4c8d8e2f9eaa1352e49f

Russian and U.S. space officials hailed the joint work of their programs Monday and said cooperation remains strong despite political tensions between their countries. Roscosmos director Dmitry Rogozin and Bill Gerstenmaier, head of NASA’s human explorations and operations, said after a conference marking the 20th anniversary of the International Space Station that their agencies plan to collaborate on developing a moon orbiting outpost. Russia is working on a heavy booster rocket and a new spacecraft to complement American projects intended for a future moon mission, Rogozin said. “We absolutely trust each other, and political winds haven’t touched us,” he said. Gerstenmaier spoke in kind, noting that space exploration “has driven us together” as effective partners that could “be an example to the outside world. “It has been a blessing that our governments have both seen the wisdom of what we are doing and both our governments have avoided placing sanctions on us or getting us caught up in the political things,” the NASA official said. Ties between Washington and Moscow have been strained by allegations of Russian meddling in the 2016 U.S. presidential election, as well as by Russia’s military role in Ukraine and Syria.